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TEXAS ARCHEOLOGICAL SOCIETY

The Society was organized and chartered in pursuit of a literary and scientific undertaking: the study of man's past in Texas and contiguous areas. The *Bulletin* offers an outlet for the publication of serious research on prehistory, archeological theory, and history. In line with the goals of the Society, it encourages the scientific collection, study, and publication of archeological data.

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CONTENTS

PART I

PART II

COMMENTS

BOOK REVIEWS

J. C. Harrington Medal in Historical Archaeology: Kathleen Kirk Gilmore, 1995

Edward B. Jelks

ABSTRACT

In January 1995 at the annual meeting of the Society for Historical Archaeology, held in Washington, D.C., former Texas Archeological Society president Kathleen Gilmore was awarded the J. C. Harrington Medal for Significant Contributions to Historical Archaeology, the Society for Historical Archaeology's most prestigious award. The presentation of the Harrington Medal was made by Edward B. Jelks, also a former Texas Archeological Society president and a Harrington Medalist.

Ed's presentation contained some vignettes that deserved being recorded in the annals of Texas archeology, but which were deleted from the published version of the award that appeared in the Society for Historical Archaeology's journal, *Historical Archaeology*. So the entire presentation is printed here, with the permission of the Society for Historical Archaeology.

June 1962 was unusually hot and stifling, even for Texas, in the densely wooded valley of the upper Sabine River, where I was directing excavations at the Gilbert site, an eighteenth century village of the Tawakoni, one of the southern Wichita tribes. Labor for the project was contributed voluntarily by members of the Texas Archeological Society, who received training in field methods and techniques in exchange for providing the muscle to excavate an important site.

One morning a Cadillac about a block long came weaving through the trees, stopped at the edge of the site, and disgorged three women of youngish middle-age appearance, all togged out in what looked like Neiman-Marcus field garb. "Heaven protect me," I thought. "A bunch of bored Dallas socialites out to get their hands dirty in the name of science." They introduced themselves as Kathleen Gilmore, Norma Hoffrichter, and Dessamae Lorrain, and said that they all were interested in archeology and had come out to help on our dig. I assigned each of them to one of the crews that were working on various features.

It was not more than 15 minutes before Kathleen appeared with her very first find: a beautifully engraved brass butt plate from a French trade gun. She asked me what it was. I replied in a matter-of-fact tone of voice that it was a butt plate.

I could see the wheels turning in Kathleen's head as, transparently, she was weighing the possibility that it really was a butt plate (whatever that might be) against the possibility that I was pulling her leg with the archeological equivalent of sending a novice on a snipe hunt. Skepticism won the day, and with flashing eyes she retorted, "Like hell it is," with heavy accent on the "hell."

I did not know it then, but I was fated to hear her utter the same expression many times in the future. I then described what a trade gun looked like, with the brass plate at the butt end of its stock. But she still was not convinced until she had confirmed that the thing really was a butt plate by showing it to R. King Harris, the other person on the site familiar with trade gun hardware.

The fierce skepticism that Kathleen showed in the butt plate incident is one of the qualities that has served her well over the years. It underlies her refusal to make premature judgments without sufficient data in hand—a hallmark of her research.

Kathleen Kirk Gilmore was born in Altus, Oklahoma, moved to Tulsa as a child, and graduated from high school there. She got her first job while a junior in high school as switchboard operator at the Tulsa Bone and Joint Clinic, where she received the munificent salary, by Great Depression standards, of 25 cents an hour. Saving her money for a couple of years, she was barely able to finance her freshman year at the University of Tulsa.

But she needed to find a part-time job if she was going to continue at the university after that first year, and all the campus jobs at that time normally went to male students. Never one to be intimidated by protocol, Kathleen showed her feminist tendencies for the first time—but by no means for the last time—when she badgered the university library into giving her a job.

She had had a long-standing interest in archeology, sparked by reading about the "lost cities of the Maya" at the age of 13; when she discovered a collection of ethnographic artifacts on the library's fourth floor she was strongly tempted to major in archeology. However, upon reflection, she decided that such a course was impractical because the cost was beyond her means. Besides, her main interest was American prehistory, and the only brand of archeology available at most universities at the time was classical. Furthermore, most jobs for female archeologists were in museums and Kathleen wanted to get out and DIG.

So she followed a more practical course. With a $250 loan from the Tulsa Town Club she transferred to the University of Oklahoma where she earned a B.S. degree in the university's prestigious geology department.

But who would hire a female geologist with a B.S. degree when all the jobs for geologists were in the field, prospecting for likely formations, drilling wells, and the like? This was considered man's work where women would be out of place, and superstitious oilworkers considered it very bad luck for a female even to step on a derrick floor.

Stifling her feminist resentment, Kathleen learned to type and take shorthand, after which she landed a job in Tulsa with a small independent oil operator. There she got to do a bit of geology, drew maps, plotted well logs, and even was permitted to visit a drilling rig or two.

But her employer soon went broke, after which Kathleen found a job with the American Association of Petroleum Geologists as editorial assistant for their *Bulletin*. This was too tame for her, however, so she quit her job and moved to Houston—center of the oil business—to seek something better. After a month or so of pounding the pavement, she got several offers, mainly because she could type, the degree in geology being only of incidental importance. Still, it was nice to have options to choose from, so she decided to accept an offer from the Superior Oil Company of California to type field reports in their Corpus Christi office.

After nine months in Corpus Christi, she was offered, and took, a job back in Houston with the Standard Oil Company of Kansas. In 1940 she married Bob Gilmore, a former classmate at the University of Tulsa, and a year later they moved to Dallas where Bob was hired as a petroleum engineer with DeGoyler and MacNaughton.

During World War II there was a demand for women to replace male geologists who were called to the war effort, so Kathleen went to work for Atlantic Oil Company, doing well log analysis and running the sample lab. With the end of the war, and the birth of the first of four girls, she quit her job and devoted her energies to raising her daughters.

When I joined the faculty at Southern Methodist University (SMU) in 1965, guess who showed up in my seminar in historical archeology?: Kathleen, Norma, and Dessamae. When an archeology curriculum had been initiated at SMU the previous year, they were first in line to register.

I could not have been more wrong in my first impression of this dynamic trio: they all worked like Trojans at the Gilbert site, and all three went on to earn graduate degrees in archeology and to make substantial contributions to the field. Kathleen stayed on at SMU to earn her doctorate in anthropology in 1973.

A major field project of my historical archeology seminar at SMU in 1967 was an effort to locate the sites of the three San Xavier missions, established and operated for a few years in the mid-eighteenth century by Spanish missionaries in East Central Texas. After abandonment, their exact locations had become lost to memory, but surviving documents indicated with virtual certainty that they were located a short distance from one another along the modern-day San Gabriel River.

After putting together a model of what we should expect to find at the mission sites (eighteenth century Hispanic ceramics, etc.), we sallied forth to the San Gabriel and broke up into teams, each of which was assigned to examine likely places. When the teams regrouped several hours later, Kathleen produced a sack of sherds her team had found in a vegetable garden behind a farmhouse. Most of the sherds were recent, but among them were several good eighteenth century Puebla Blue-on-white majolica sherds—precisely the kind of indicators we were looking for.

Thinking that I would test her to see how well she had learned the ceramic types we had examined in class, I said as matter-of-factly as I could, "This is just a bunch of recent Woolworth stuff." Kathleen picked the majolica out of the lot and replied, "But what about these?" I said they were modern too. But she knew better this time and retorted indignantly, "Like HELL they are."

In 1969, with funding from the Texas State Historical Commission (now the Texas Historical Commission), she got down to serious fieldwork and returned to the San Xavier missions. There she found archeological evidence to verify the locations of all three missions and the associated military garrison. This project became the topic of her M.A. thesis.

San Xavier was representative of an abiding passion that Kathleen pursued over the years: establishing the locations of "lost" historic sites by discovering their archeological remains. In addition to the San Xavier complex, she has worked with colleagues in their successful search for the Santa Cruz de San Sabá mission. Other Spanish Colonial sites in Texas where she has conducted fieldwork include Rosario Mission, Nasoni Mission, Amarillas Presidio, and Loreto Presidio, the latter built on the ruins of La Salle's ill-fated Fort St. Louis of 1685.

Talk about your late bloomers! It would be hard to find anyone who has blossomed more spectacularly than Kathleen. In 1974, she became a research archeologist and adjunct professor in the Institute of Applied Sciences at the University of North Texas in Denton, Texas, embarked on two decades of research and teaching, and earned national recognition as an authority on Spanish Colonial archeology, as well as a leading light in Texas archeology, both historical and prehistorical.

During her 16 years at the University of North Texas (she took early retirement in 1990), Kathleen trained a generation of students, both in the classroom and in the field. Her feminist instincts bore fruit during this time and she became a greatly admired role model to her female students, a number of whom were inspired to follow her example to successful careers in archeology.

Kathleen has published extensively on her Spanish Colonial fieldwork and documentary research, including site reports on the San Xavier, Rosario, Santa Cruz de San Sabá, and Dolores de los Ais missions; also on the Presidio San Luis de las Amarillas and Fort St. Leon. Her synthetic publications on French-Spanish-Indian interactions, and on Caddoan prehistory, are widely recognized as major contributions to the discipline.

In addition to her research and teaching, Kathleen has made substantial contributions to her profession through service to archeological and historical associations. She has been president of the Society for Historical Archaeology (SHA), president of the Texas Archeological Society, and president of the Council of Texas Archeologists. She has served on the Texas Board of Review (which reviews and recommends nominations to the National Register of Historic Places), and on the board of directors of the Texas Historical Foundation. She has been on too many committees to mention here.

Kathleen played an important role in the birth of the SHA. This happened in January 1967, when Arnold Pilling and I organized a meeting of 15 people we considered to be among the leading historical archeologists to consider the possibility of establishing a society devoted to historical archeology. SMU sponsored the meeting, and Kathleen, a graduate student at the time, made most of the local arrangements for the meeting, as well as for a concurrent conference at which two days of formal papers on historical archeology were presented. It was at this conference that the SHA was founded. Especially memorable was a party that she and Bob hosted at a private club atop a Dallas skyscraper.

After retirement, Kathleen and Bob have divided their time between their homes in Dallas and Santa Fe, and in traveling the world. Kathleen also finds time to continue her research interests in Spanish Colonial archeology.

An incident that captures the essence of Kathleen's more charming qualities took place one evening about 20 years ago at a Caddoan Conference in Natchitoches, Louisiana. A small group in someone's hotel room were engaged in fierce debate about matters archeological—and prudently refueling their wits from time to time by imbibing invigorating stimulants.

About 2:00 a.m., during a brief pause in the interminable arguments, Kathleen captured everyone's attention by announcing, "De Mézières died in Natchitoches." After we had puzzled over this startling news for a moment, someone asked, "So what?" "Well," replied Kathleen, "if he died here he must be buried here; so let's go out to the cemetery, find his grave, and pay him our respects." All agreed that this was a capital idea, so without further ado we climbed into Kathleen's car and headed for the cemetery. (In case someone doesn't know, Athanase De Mézières was an eighteenth century French explorer and French and Spanish government official whose records Kathleen and colleagues had frequently used in trying to locate the sites of early Spanish and French settlements and Indian villages in Texas.)

We found the cemetery, and Kathleen fished a flashlight out of the glove compartment. We were in the middle of a systematic search for De Mézières' gravestone when, without warning, we suddenly were caught in the beam of a searchlight. Peering against the glare, we saw that the searchlight was mounted on a police car, from which two huge policemen emerged.

Approaching and playing their flashlights over our faces, they asked suspiciously what we were doing. Without hesitation, Kathleen explained, "We are looking for De Mézières' grave."

The policemen looked at each other and shrugged their shoulders. One said, "We never heard of him. Anyway, don't you know there is a curfew on, and no one is supposed to be on the streets after 11:00 p.m.?"

Kathleen turned on her sweetest smile and replied in a dulcet Texas drawl, "We are from out of town and didn't know about the curfew. But if you will let us keep looking for another 30 minutes, we promise to go back to our hotel and stay there until daylight."

The policemen whispered together for a while, looking at us out of the corners of their eyes from time to time, while Kathleen kept smiling and the rest of us shuffled from one foot to the other, hoping we would not have to take sobriety tests or be arrested. Finally, one of the policemen decided: "Well if De Mezi —what's his name?— was a friend of yours, we guess it's O.K., but be sure to be off the streets in half an hour." Then they left, shaking their heads.

It is altogether fitting that the signal honor of being the first woman to receive the prestigious Harrington Medal falls to an outstanding researcher, teacher, and mentor, a staunch supporter of feminine rights, truly a lady and a scholar: Dr. Kathleen Gilmore.

Foreword

Edward B. Jelks

The papers in this volume of the *Bulletin of the Texas Archeological Society* constitute an excellent overview of current knowledge about Texas prehistory. They also evoke many personal memories about the growth of Texas archeology over the past half century and about some of the archeologists who contributed to that growth. I beg your indulgence while I reminisce.

After almost four years in the Navy, I returned to Austin at the end of World War II in 1945 and re-entered The University of Texas (UT), where I had dropped out in the middle of my junior year to go to war. Casting about for a suitable major, I became hooked on anthropology—especially archeology—after taking courses from Tom Campbell, Charles Kelley, George Engerrand, and Gilbert McAllister.

At that time there were four archeologists in Texas who could be termed professionals by virtue of job title and advanced degrees in archeology/anthropology: Tom Campbell and Charles Kelley, both on the teaching faculty of the Department of Anthropology at UT; Alex Krieger, a non-teaching research scientist at UT; and Bob Stephenson, director of the Texas division of the Smithsonian's River Basin Surveys (RBS) program. Several geologists had been doing scientific field archeology for years, especially at Paleoindian sites: notably E. H. Sellards and Glen Evans at the Texas Memorial Museum, and Grayson Meade at Texas Tech. Historians Curry Holden at Texas Tech and Victor Smith at Sul Ross also were competent archeologists. To the best of my knowledge, the only university in Texas offering a degree in archeology was UT.

We archeology students at UT became aware that in the minds of at least some of the professionals, Texas had been divided, like ancient Gaul, into three parts, with one archeologist having proprietary rights to each part. Krieger's primary domain was East Texas, and he also held rights in the Panhandle because of his publications on the Antelope Creek phase; Campbell focused on the coastal region; Kelley claimed a broad area encompassing Central Texas and the Trans-Pecos region. I recall an occasion when one proprietor was outraged because another professional was alleged to have trespassed on his territory.

Paleoindian sites, few and far between, were viewed as a special case and were pretty much up for grabs for whomever could find one. However, it was generally recognized that the team of Sellards and Evans had some priority on Paleoindian sites because of their previous work at Plainview, Miami, Berclair Terrace, and other early sites. Krieger also had a long-standing involvement in Paleoindian research.

In addition to these professional scholars, there were a number of avocational archeologists with various backgrounds who had made important contributions to knowledge of Texas archeology by publishing descriptions of their fieldwork and, sometimes, synthetic interpretations. Osteopath Cyrus Ray, was the best known of these. A founder of the Texas Archeological Society, he served as the society's president for its first 20 years, during which time he published extensively about the prehistory of the Abilene region. Other prominent avocational archeologists included printer Frank Watt of Waco, leading light of the Central Texas Archeological Society; railroad engineer R. K. Harris of the Dallas Archeological Society; businessman Richard Worthington of the Houston Archeological Society; and attorney O. L. Sims of Paint Rock, who was instrumental in protecting the nearby spectacular pictographs. They, along with many others all over the state, maintained a close working relationship with professionals.

By the fall of 1949, having completed the classroom requirements for an M.A., I was hired by Bob Stephenson as his assistant at the RBS office and laboratory, then housed in the old "nut lab" on the southeast corner of Red River and 19th (now Martin Luther King Drive) in UT's Little Campus complex. A large collection of artifacts and fieldnotes—largely from WPA archeology projects in Central and eastern Texas, but including eclectic accumulations from various sources—were housed in the nut lab. When Bob left in 1951 for graduate work at the University of Michigan, I inherited the directorship of the Texas RBS program.

By the mid-1950s, the tripartite archeological segmentation of Texas had disintegrated, largely because RBS archeologists were working pretty much all over the state. Also, two of the proprietors pulled up stakes: Kelley joined the faculty at Southern Illinois University about 1950, and Krieger moved to California to become director of the Riverside Museum about 1956.

As of the early 1950s, regional chronologies and definitions of culture units had been advanced by several researchers. Krieger had organized post-Archaic East Texas cultures into a number of foci, grouped into two aspects, following the Midwestern, or McKern, nomenclature of cultural classification. But Krieger arranged his aspects in chronological sequence, in contrast to the assumption underlying the Midwestern system that cultural units in the system were atemporal.

Campbell also had used Midwestern nomenclature in defining Archaic and post-Archaic foci and aspects for the Texas coastal area, again ascribing them temporal values within a regional chronology. Kelley had followed the same plan in identifying foci, aspects, and phases for the Central Texas region, arranging them in chronological sequence.

Since those days, new types have been recognized and new phases have been defined, of course; and the old types and phases have been redefined. But it is noteworthy that many elements of the archeological classifications developed and promulgated by Campbell, Kelley, and Krieger are still current, including names for important types and culture units (generally phases now instead of foci). These three pioneers are due a lot of credit for limning the broad outlines of several major prehistoric cultural patterns in Texas that have served archeologists well over the years.

Between the mid-1950s and the time I left Texas for Illinois in 1968, the amount of archeological fieldwork expanded dramatically. This was primarily due to the RBS program and the contract programs that it spawned at Texas universities and museums, fueled by ever-increasing funding for archeological fieldwork by federal and state agencies as a series of conservation bills was passed by Congress and state legislatures. As a result, a great need for skilled field and laboratory archeologists arose, which led to the establishment of archeology curricula in a number of Texas universities, including Southern Methodist University, The University of Texas at San Antonio, Rice University, and Texas A&M University, and to the expansion of existing programs at UT and Texas Tech.

By the 1970s, each field season saw scores of field crews from a dozen or more institutions and private firms conducting contract archeology in Texas. In contrast to the four professional archeologists in Texas in 1950, the Council of Texas Archeologists currently lists some 200 members, all with professional credentials. The largely avocational membership of the Texas Archeological Society, about 200 in 1950, now numbers well over 1,400.

The way that archeological research is done has changed significantly since the late 1940s. New methods (radiocarbon, thermoluminescence, archeomagnetic alignment, etc.) have made it possible to date field data with confidence in many cases. Computers have made it simple for archeologists to perform statistical computations, make neat and accurate maps and drawings, store vast quantities of readily accessible data, and produce prettily printed papers with few misspellings and typographical errors. Advanced collecting methods (for example, flotation and statistically based sampling) have added new dimensions to the study of the archeological record.

Until the 1960s, almost every American archeologists collected only artifacts, discarding the byproducts of the artifacts' manufacture. But then experiments in stone working techniques opened the door to the study of flakes, cores, and other residue of flintknapping. The Texas Archeological Society can be proud that one of their members, J. B. Sollberger, is widely recognized as a pioneer and leading authority on knapping.

I recall a time about 35 years ago when Jerry Epstein announced that he had found burins in Centipede and Damp Caves at Amistad Reservoir. No one had ever recognized burins in Texas before, and Jerry had to do some tall talking to convince us. But eventually he did, and now every field archeologist looks for burins along with other chipped stone artifacts. Such examples point up the many changes in how archeology is done in Texas and elsewhere, *almost* all of them for the better.

Looking back to a time several decades ago when a few underfunded archeologists—flying pretty much by the seats of their pants—scrambled to salvage a tiny fraction of the archeological record that was about to be destroyed by construction projects, I am tempted to contend that those were better times: that things were simpler then, and we could devote our energies to doing *archeology*, without the frustrations and distractions imposed on today's researchers by layers of bureaucracy and tangles of red tape. And it can reasonably be argued that some desirable skills practiced by the typical dirt archeologist of yesteryear now are rarely seen in the high-tech enterprise that it is today.

But upon full reflection, nostalgia succumbs to reason, and the superiority of today's archeology—with its advanced scientific techniques, rigorous methodology, political support, large body of practitioners, and reasonably ample funding—is evident.

This volume of the *Bulletin of the Texas Archeological Society* is the third comprehensive effort to summarize knowledge of Texas archeology on a state-wide basis under a single cover. E. B. Sayles's *An Archaeological Survey of Texas*, published in 1935 was first; second was the 1954 *Handbook of Texas Archeology*, largely the work of Dee Ann Suhm (Story), with help from Alex Krieger and myself. The demographics of the archeological community noted above are reflected in the respective authorship's of the three summaries: one author in 1935, three authors in 1954, and more than 20 in 1995.

The phenomenal growth of Texas archeology, along with archeology all over the United States, since the late 1940s bodes well for the discipline's future. Some problems have accompanied this phenomenal growth: for example, the current Native American repatriation issue, and temporary aberrations that flowed from over zealously scientistic applications of the "New Archeology" by some archeologists in the 1970s and 1980s. However, despite such problems and vagaries, the trend toward better archeology, conservation of archeological resources, and wide appreciation of archeology by the public continue on a progressive track.

The papers in this volume constitute clear proof that Texas archeology is alive and well and continuing to move ahead.

PART I

THE PRESENT AND FUTURE,
AND
THE "NUTS AND BOLTS"

The Present and Future of Texas Prehistoric Archeology: An Introduction to the 1995 BTAS

Timothy K. Perttula

ABSTRACT

The structure and content of this special collection of papers on the prehistoric archeology of Texas is summarized. The purpose of the 1995 *Bulletin of the Texas Archeological Society* is to communicate to interested members of the public, Native Americans, and professional and avocational archeologists what has been learned about Texas' prehistoric archeological heritage from 1950 to today, and discuss trends for the future study of the state's rich store of archeological resources.

INTRODUCTION AND PURPOSE OF THE VOLUME

Our understanding of the prehistoric archeology of Texas has come a long way since Dee Ann Suhm (now Story), Alex D. Krieger, and Edward B. Jelks (1954) published the now classic "An Introductory Handbook to Texas Archeology" as Volume 25 of the *Bulletin of the Texas Archeological Society*. This book presented current knowledge of the archeology of Texas, as well as an illustrated compendium of the known pottery and projectile point types in the state (the latter compendium was separately republished by the Texas Archeological Society and the Texas Memorial Museum in Suhm and Jelks [1962]).

Since that time, a multitude of archeological investigations have occurred in Texas—by both avocational and professional archeologist alike—and the pace of archeological work has especially quickened in the last 15-25 years with the passage of Federal (principally the National Historic Preservation Act of 1966, and most recently amended in 1992) and State (the 1969 Antiquities Code of Texas, as amended in 1995) laws and regulations concerning historic preservation and the conduct of archeological projects when important sites are to be impacted by development projects. Recent archeological overview volumes commissioned by the U.S. Army Corps of Engineers, Southwest Division (COE-SWD), provide a good sense of the scope of the archeological data base in Texas (with more than 50,000 sites recorded to date) and surrounding states, the types of investigations conducted across the state, and the kinds of research problems and questions that have been, and continue to be, the subject of inquiry (Hester et al. 1989; Hofman et al. 1989; Jeter et al. 1989; Sabo et al. 1988; Simmons et al. 1989; Story et al. 1990). While these volumes are extremely valuable research documents, they are not broadly accessible to all those interested in the prehistoric archeology of Texas. Nor are the many hundreds, if not thousands, of cultural resource management technical documents of surveys and excavations prepared by contract archeological firms for clients, permit applicants, regulatory agencies, and other government consumers; few copies are produced, few see the light of day, and few are written to be read by more than the jargon-bound professional archeologist and cultural resource manager (Fagan 1995; see also commentary in Bruseth and Perttula [1995:1-2] about Texas archeology). Nevertheless, truly exciting and interesting archeological research is being conducted in this sometimes bleak forum, and innovative ways must be found to share this knowledge with the public and the interested avocational archeologist!

The Texas Archeological Society (TAS) has contributed more than its fair share to the stock of archeological knowledge by conducting annual Field Schools across the state (see Richmond et al. 1985), with the results of the field school investigations being published on a regular basis in the *Bulletin of the Texas Archeological Society* (see Mueggenborg 1994; Smith 1993; Turpin and Davis 1993; Houk and Lohse 1993 for recent publications of the results of TAS field schools). The TAS also has helped sponsor regional field schools held by affiliated avocational archeological societies in Texas (such as the South Texas Archaeological Association's annual September field school).

Foremost, though, among the important roles of the TAS in communicating the results of archeological research to those interested in the prehistory and early history of Texas, has been the compilation and publication of some 65 years of archeological research in Texas that documents man's past in the state (Perttula 1994). In particular, from time to time, the *BTAS* has taken stock of our understanding of the archeology of particular parts of Texas by publishing in a single volume a number of important articles that focus on one of the prehistoric cultural regions of Texas. Since 1958, papers summarizing the regional archeology of Texas have been published in the *BTAS*: East Texas, Central Texas, Trans-Pecos Texas, and the central and southern parts of the Gulf Coast (Volume 29); the southern Texas Coast (Volume 58, 1987); the Lower Pecos and Eastern Trans-Pecos (Volume 59, 1988); Texas Panhandle and Southern Plains (Volume 60, 1989); North Central Texas (Volume 64, 1993); and Northeast Texas (Volume 65, 1994).

The time seems propitious to again take stock of current knowledge of Texas archeology. Thus, the 1995 *BTAS* provides a summary collection of papers on the archeology of many different cultural regions of Texas—from the Caddo mounds of Northeast Texas, the shell middens of the Gulf Coast, the burned rock middens of Central Texas, the slab houses of Plains farmers and bison hunters, to the Puebloan villages of the Hueco Bolson and the Rio Grande (for various reasons, not all regions of the state are discussed in volume 66 of the *BTAS*). The goal of this publication is to communicate to interested members of the public, Native Americans, and professional and avocational archeologists alike what has been learned (and what we still do not know) about Texas archeology from 1950 to today. In taking a broad and synthetic view of the prehistoric archeology of the state of Texas, the 1995 *BTAS* is a long overdue followup to the classic 1954 *BTAS*.

ORGANIZATION OF THE VOLUME

The first paper in the volume explicitly considers the present status of Texas archeology and its players, while also looking at the aims of archeology, and how archeologists over the last 40 odd years have attempted to learn about the prehistoric archeological record in the state. Steve Black, well-known of late for casting a critical eye on the state of Texas archeology (e.g., Black 1993; Black and Shafer 1994), takes a hard look at the political realities of archeology, as well as the approaches, assumptions, and methodological and theoretical underpinnings of the discipline, and offers a vision concerning the future of Texas archeology.

The next two papers concern the "nuts and bolts" of Texas prehistoric archeology: the material culture record as seen in the documentation of projectile point and ceramic types and styles, ages, and spatial distributions. Elton Prewitt presents a unique data set compiled over many years on the distributions of some 160 projectile point styles and types in Texas, while Perttula, Miller, Ricklis, Prikryl and Lintz discuss the character of the distinctive regionally-based prehistoric ceramic assemblages that have been defined across the state, focusing on temporal frameworks, ceramic styles, and changes in ceramic technology and function.

Next is David Meltzer and Michael Bever's final summary of the results of the Texas Clovis Fluted Point Survey project (cf. Meltzer 1987). Much of the archeological data on the distribution of Clovis points in this paper was provided by Texas Archeological Society members who have documented and/or collected these distinctive lanceolate points across the state.

The remaining papers in this BTAS volume are summaries of the current state of archeological knowledge in different cultural-ecological regions of Texas (Figure 1); the regions are broadly defined following the divisions recognized in the COE-SWD overviews, and there are inevitable overlaps in coverage and presentation. The papers, for the most part, are cultural-historical in nature, but stay strongly focused on which of the important and current research problems recognized in each of the regions hold particular promise for achieving a better understanding and explanation of Native American adaptations in Texas. Of course, the emphases of the papers vary depending upon the state of archeological knowledge in a particular region of the state—ranging from the discussion of one or a few particular research problems and perspectives, temporal periods, and cultural manifestations to broad syntheses —and our current understanding of long

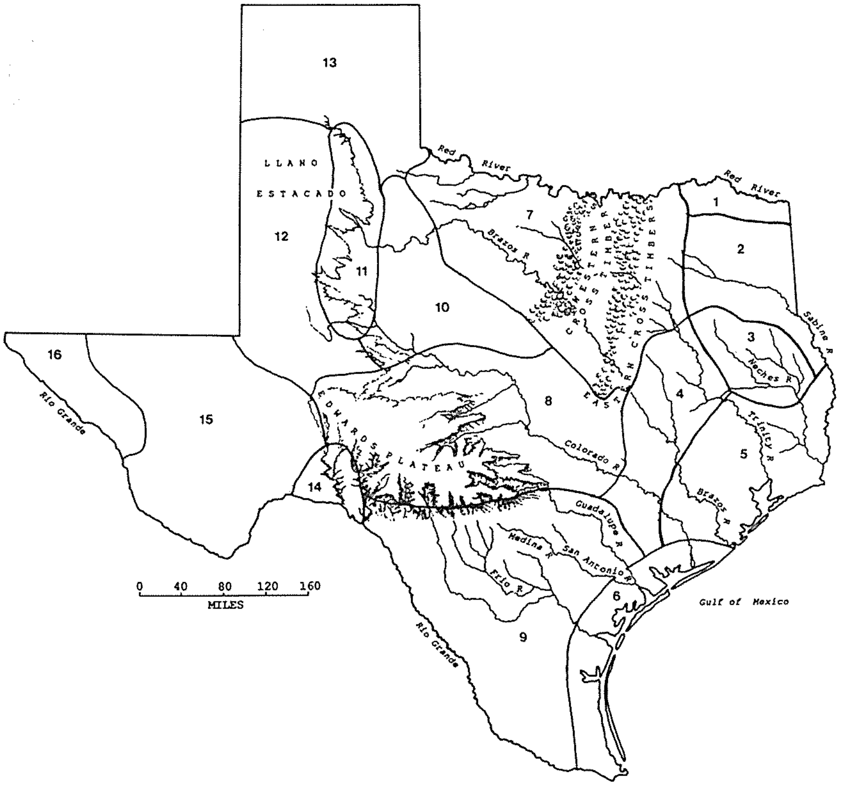

Figure 1. Archeological Regions in the State of Texas: (1) Red River; (2) Northeast Texas; (3) Deep East Texas; (4) Savannah and Prairie; (5) Southeast Texas; (6) Coastal Texas; (7) North Central Texas; (8) Central Texas; (9) South Texas; (10) West Central Texas; (11) Caprock Canyonlands; (12) Southern High Plains; (13) Panhandle; (14) Lower Pecos; (15) Trans-Pecos; and (16) El Paso/Hueco Bolson. Base Map drawn by Kathy Roemer, and redrawn by Sergio Iruegas.

and short-term cultural change across the state. Thus, the various papers promise to present through the careful consideration of the Texas archeological (and paleoenvironmental) record, a new, vital, and innovative means of understanding the past.

While all regions of the state are not considered in this volume, important and innovative archeological research is producing exciting and interesting results about prehistoric lifeways and paleoenvironmental conditions throughout Texas. Therefore, a short bibliography of some of the more significant recent published reports for those regions is also included in this paper.

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REFERENCES CITED

Black, S. L.

1993 Nailing the Coffin Shut on the Traditional Approach to Prehistoric Archeology in Texas: An Epitaph and Inquiry into the Afterlife. *CRM News & Views* 5(1):16-19.

Black, S. L. and H. J. Shafer
1994 Archeology by the Numbers? A Dissenting and Trenchant Viewpoint on DAP Survey Guidelines. *CRM News & Views* 6(2):16-18.

Bruseth, J. E. and T. K. Perttula (editors)
1995 *Advances in Texas Archeology: Contributions from Cultural Resource Management, Volume I.* Cultural Resource Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

Fagan, B. M.
1995 Perhaps We May Hear Voices.... In *Save the Past for the Future II: Report of the Working Conference*, pp. 25-30. Special Report, Society for American Archaeology, Washington, D.C.

Hester, T. R., S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement
1989 *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos, Texas.* Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

Hofman, J. L., R. L. Brooks, J. S. Hays, D. W. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manheim
1989 *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains.* Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Houk, B. A. and J. C. Lohse
1993 Archeological Investigations at the Mingo Site, Bandera County, Texas. *Bulletin of the Texas Archeological Society* 61:193-247.

Jeter, M. D., J. C. Rose, G. I. Williams, Jr., and A. M. Harmon
1989 *Archeology and Bioarcheology of the Lower Mississippi Valley and Trans-Mississippi South in Arkansas and Louisiana.* Research Series No. 37. Arkansas Archeological Survey, Fayetteville.

Meltzer, D. J.
1987 The Clovis Paleoindian Occupation of Texas: Results of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archeological Survey* 57:27-68.

Mueggenborg, H. E.
1994 Excavations at the Blue Hole Site, Uvalde County, Texas. *Bulletin of the Texas Archeological Society* 62:1-74.

Perttula, T. K.
1994 65 Years of Publishing Excellence: The Bulletin of the Texas Archeological Society. *Heritage* 12(4):20-22. Texas Historical Foundation, Austin.

Richmond, J. A., W. L. Richmond, and J. W. Greer
1985 Texas Archeological Society Field Schools, 1962-1982. *Bulletin of the Texas Archeological Society* 54:105-184.

Sabo, G. III, A. M. Early, J. C. Rose, B. A. Burnett, L. Vogele, Jr., and J. P. Harcourt
1988 *Human Adaptation in the Ozark and Ouachita Mountains.* Research Series No. 31. Arkansas Archeological Survey, Fayetteville.

Simmons, A. H., A. L. W. Stodder, D. D. Dykeman, and P. A. Hicks
1989 *Human Adaptations and Cultural Change in the Greater Southwest.* Research Series No. 32. Arkansas Archeological Survey, Fayetteville.

Smith, J. E., II
1993 The Vinson Site: A Norteño Focus Village in Limestone County, Texas. *Bulletin of the Texas Archeological Society* 64:65-162.

Story, D. A., J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard
1990 *The Archeology and Bioarcheology of the Gulf Coastal Plain.* Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Suhm, D. A. and E. B. Jelks
1962 *Handbook of Texas Archeology: Type Descriptions.* Texas Archeological Society Special Publication No. 1 and Texas Memorial Museum Special Publication No. 4. Austin.

Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Turpin, S. A. and M. W. Davis
1993 The 1989 TAS Field School: Devils River State Natural Area. *Bulletin of the Texas Archeological Society* 61:1-58.

BIBLIOGRAPHY OF RECENT REGIONAL LITERATURE

Ackerly, N. W.
1990 *Playa Margin Adaptation in the Southern Jornada del Muerto.* Center for Anthropological Research, New Mexico State University, Las Cruces.

Amick, D. S.
1995 Patterns of Technological Variation among Folsom and Midland Projectile Points in the American Southwest. *Plains Anthropologist* 40(151):23-38.

Anthony, D. and D. O. Brown (editors)
1994 *Archeological Investigations in the Denton Creek Floodplain: Data Recovery Excavations at 41DL270, Denton and Dallas Counties, Texas*. Archeology Series 37. Hicks & Company, Austin.

Baugh, T. G.
1994 Holocene Adaptations in the Southern High Plains. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by K. H. Schlesier, pp. 264-289. University of Oklahoma Press, Norman.

Bement, L. C.
1991 The Thunder Valley Burial Cache: Group Investment in a Central Texas Sinkhole Cemetery. *Plains Anthropologist* 36(135):97-109.
1994 *Hunter-Gatherer Mortuary Practices during the Central Texas Archaic*. University of Texas Press, Austin.

Bentley, M. T.
1993 Hot Well Village and Reservoir: A Preliminary Overview. *The Artifact* 32(1):1-32.

Brooks, R. L.
1994a Southern Plains Cultural Complexes. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 33-50. Smithsonian Institution Press, Washington, D.C.
1994b Warfare on the Southern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 317-323. Smithsonian Institution Press, Washington, D.C.

Brown, D. O. and J. A. Peterson (editors)
1992 *El Valle Bajo: The Culture History of the Lower Rio Grande Valley of El Paso, Volume I: The Prehistory of the Lower Valley of El Paso*. Archaeological Research, Inc. and Hicks and Company, El Paso and Austin.

Bruseth, J. E., D. E. McGregor, and W. A. Martin
1995 Hunter-Gatherer Adaptations along Richland Creek, North-Central Texas. In *Advances in Texas Archeology: Contributions from Cultural Resource Management*, edited by J. E. Bruseth and T. K. Perttula, pp. 5-50. Cultural Resourc Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

Bruseth, J. E., D. E. Wilson, and T. K. Perttula
1995 The Sanders Site: A Spiroan Entrepot in Texas? *Plains Anthropologist* 40(153):223-236.

Camilli, E. L. Wandsnider, and J. I. Ebert
1988 *Distributional Survey and Excavation of Archaeological Landscapes in the Vicinity of El Paso, Texas*. Bureau of Land Management, Las Cruces.

Carmichael, D. L.
1990 Patterns of Residential Mobility and Sedentism in the Jornada Mogollon Area. In *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 122-134. Westview Press, Boulder.

Cloud, W. A., R. J. Mallouf, P. A. Mercado-Allinger, C. A. Hoyt, N. A. Kenmotsu, J. M. Sanchez, and E. R. Madrid
1994 *Archeological Testing at the Polvo Site, Presidio County, Texas*. Office of the State Archeologist Report 39. Texas Historical Commission and U.S. Department of Agriculture, Soil Conservation Service, Austin.

Creel, D.
1991 Bison Hides in Late Prehistoric Exchange in the Southern Plains. *American Antiquity* 56:40-49.

Dean, J. S., W. H. Doelle, and J. D. Orcutt
1994 Adaptive Stress, Environment, and Demography. In *Themes in Southwest Prehistory*, edited by G. J. Gumerman, pp. 53-86. School of American Research Press, Santa Fe.

Ferring, C. R.
1990 Archaeological Geology of the Southern Plains. In *Archaeological Geology of North America*, edited by J. Donahue and N. Lasca, pp. 253-266. Geological Society of America, Centennial Special Volume, Boulder, Colorado.
1995a The Late Quaternary Geology and Archaeology of the Aubrey Clovis Site, Texas. In *Ancient Peoples and Landscapes*, edited by E. Johnson, pp. 273-281. Museum of Texas Tech University, Lubbock.
1995b Middle Holocene environments, geology, and archaeology in the Southern Plains. In *Archaeological Geology of the Archaic Period in North America*, edited by E. A. Bettis, pp. 21-35. Special Paper 297. Geological Society of America, Boulder.

Fish, P. R. and S. K. Fish
1994 Southwest and Northwest: Recent Research at the Juncture of the United States and Mexico. *Journal of Archaeological Research* 2(1):3-44.

Fish, P. R., S. K. Fish, G. J. Gumerman, and J. J. Reid
1994 Toward an Explanation for Southwestern "Abandonments." In *Themes in Southwest Prehistory*, edited by G. J. Gumerman, pp. 135-163. School of American Research Press, Santa Fe.

Frederick, C. D., M. D. Glascock, H. Neff, and C. M. Stevenson
1994 *Evaluation of Chert Patination as a Dating Technique: A Case Study from Fort Hood, Texas*. Research Report No. 32, Archeological Resource Management Series. United States Army, Fort Hood.

Gerald, R. E.
1990 Collected Papers. *The Artifact* 28(3). El Paso Archaeological Society, El Paso.

Habicht-Mauche, J. A.
1991 Evidence for the Manufacture of Southwestern-Style Culinary Ceramics on the Southern Plains. In *Farmers, Hunters, and Colonists: Interaction between the Southwest and the Southern Plains*, edited by K. A. Spielmann, pp. 51-70. University of Arizona Press, Tucson.

1992 Coronado's Querechos and Teyas in the Archaeological Record of the Texas Panhandle. *Plains Anthropologist* 37(140):247-259.

Habicht-Mauche, J. A., A. A. Levendosky, and M. J. Schoeninger
1994 Antelope Creek Phase Subsistence: The Bone Chemistry Evidence. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 291-304. Smithsonian Institution Press, Washington, D.C.

Hindes, V. K., M. R. Wolf, G. D. Hall, and K. K. Gilmore
1995 *The Rediscovery of Santa Cruz de San Sabá, a Mission for the Apache in Spanish Texas*. San Saba Regional Survey Report 1, Archaeology Laboratory, Texas Tech University. Texas Historical Foundation and Texas Tech University, Austin and Lubbock.

Hines, M. H., S. A. Tomka, and K. W. Kibler
1994 *Data Recovery Excavations at the Wind Canyon Site, 41HZ119, Hudspeth County, Texas*. Reports of Investigations, Number 99. Prewitt and Associates, Inc., Austin.

Hofman, J. L.
1992 Recognition and Interpretation of Folsom Technological Variability on the Southern Plains. In *Ice Age Hunters of the Rockies*, edited by D. J. Stanford and J. S. Day, pp. 193-224. Denver Museum of Natural History and University Press of Colorado, Niwot.

Hofman, J. L., D. S. Amick, and R. O. Rose
1990 Shifting Sands: A Folsom-Midland Assemblage from a Campsite in Western Texas. *Plains Anthropologist* 35(129):221-254.

Hofman, J. L., L. C. Todd, and M. B. Collins
1991 Identification of Central Texas Edwards Chert at the Folsom and Lindenmeier Sites. *Plains Anthropologist* 36(137):297-308.

Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343-358.

Ing, J. D., W. A. Cloud, S. Smith-Savage, and R. J. Mallouf
1995 *Archeological Reconnaissance on Big Bend Ranch State Park, Presidio and Brewster Counties, Texas: 1988-1994*. Texas Parks and Wildlife Department and Office of the State Archeologist, Texas Historical Commission, Austin.

Jelks, E. B.
1993 Observations on the Distributions of Certain Arrow-Point Types in Texas and Adjoining Regions. *Lithic Technology* 18 (no. 1&2):9-15.

Johnson, L.
1995 *Past Cultures and Climates at the Jonas Terrace Site, 41ME29, of Medina County, Texas*. Texas Department of Transportation, in press.

Kelley, J. C.
1990 The Rio Conchos Drainage: History, Archaeology, Significance. *Journal of Big Bend Studies* 2:29-41.

Largent, F. B., Jr., M. R. Waters, and D. L. Carlson
1991 The Spatiotemporal Distribution of Folsom Projectile Points in the State of Texas. *Plains Anthropologist* 36(137):323-341.

Lintz, C.
1991 Texas Panhandle-Pueblo Interactions from the Thirteenth Through the Sixteenth Century. In *Farmers, Hunters, and Colonsits: Interaction between the Southwest and the Southern Plains*, edited by K. A. Spielmann, pp. 89-106. University of Arizona Press, Tucson.

Lintz, C., A. C. Treece, F. M. Oglesby, K. Kibler, P. O'Neill, W. N. Trierweiler, C. Frederick, J. M. Quigg, and A. J. Taylor
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume II: Test Excavations at Prehistoric Sites and Assessment of Rock Cairn Features*. Technical Report 346-II. Mariah Associates, Inc., Austin.

Lintz, C., W. N. Trierweiler, A. C. Earls, F. M. Oglesby, M. Blum, P. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume I: Project Introduction, Setting and Methods.* Technical Report 346-I. Mariah Associates, Inc., Austin.

MacNeish, R. S. (editor)
1993 *Preliminary Investigations of the Archaic in the Region of Las Cruces, New Mexico.* Historic and Natural Resources Report No. 9. Cultural Resources Management Program, Directorate of Environment, United States Army Air Defense Artillery Center, Fort Bliss, Texas.

Mallouf, R. J.
1992 A Commentary on the Prehistory of Far Northeastern Chihuahua, the La Junta District, and the Cielo Complex. English translation of La Prehistoria del Noreste de Chihuahua: Complejo Cielo y Distrito La Junta. In *Historia General de Chihuahua I: Geologia Geografia y Arqueologia*, edited by A. Marquez-Alameda, pp. 137-162. Universidad Autonoma de Ciudad Juarez, Gobierno del Estado de Chihuahua, Juarez, Mexico.
1993 Archaeology in the Cienega Mountains of Presidio County, Texas. *The Artifact* 31(1):1-44. El Paso Archaeological Society, El Paso.
1995 Arroyo de las Burras: Preliminary Findings from the 1992 SRSU Archeological Field School. *Journal of Big Bend Studies* 7.

Martin, W. A.
1995 Prehistoric Subsistence Strategies in North-Central Texas: Evidence from Joe Pool Lake and Richland/Chambers Reservoir. In *Advances in Texas Archeology: Contributions from Cultural Resource Management*, edited by J. E. Bruseth and T. K. Perttula, pp. 203-256. Cultural Resource Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

Mauldin, R. P.
1993 *The Divad Archaeological Project.* Historic and Natural Resources Report No. 8. Directorate of Environment, Fort Bliss, Texas.

McGregor, D. E.
1995 Lithic Resource Availability in the Upper Trinity River Region: The Evidence from Joe Pool Lake. In *Advances in Texas Archeology: Contributions from Cultural Resource Management*, edited by J. E. Bruseth and T. K. Perttula, pp. 187-202. Cultural Resource Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

McGuire, R. H., E. C. Adams, B. A. Nelson, and K. A. Spielmann
1994 Perspectives on Macroregional Relations. In *Themes in Southwest Prehistory*, edited by G. J. Gumerman, pp. 239-265. School of American Research Press, Santa Fe.

Meltzer, D. J.
1991 Altithermal Archaeology and Paleoecology at Mustang Springs, on the Southern High Plains of Texas. *American Antiquity* 56(2):236-267.
1995 Modelling the Prehistoric Response to Altithermal Climates on the Southern High Plains. In *Ancient Peoples and Ancient Landscapes*, edited by E. Johnson, pp. 349-368. Museum of Texas Tech University, Lubbock.

Middlebrook, T.
1994 An Update of Archaeological Investigations at the Tyson Site (41SY92). *Journal of Northeast Texas Archaeology*, No. 3:1-36.

Miller, M. R. and B. L. O'Leary
1992 *The Ysleta Clinic Site: A Spanish Colonial Period Native American Settlement in the Lower Valley of El Paso, Texas.* Cultural Resources Research Report Number 2. Batcho & Kauffman Associates, El Paso.

Nash, M. A., E. Roemer, Jr., E. R. Foster, S. C. Caran, and E. A. Skokan
1995 *Excavations at the Kingsland Site, 41BT215, Burnet County, Texas.* Cultural Resources Report No. 2. Environmental Protection Division, Lower Colorado River Authority, Austin.

O'Laughlin, T. C. and D. L. Martin
1990 *Loop 375 Archaeological Project, El Paso County, Texas: An Interim Report for Phase III Data Recovery.* Archaeological Studies Program, The University of Texas at El Paso.

Perino, G.
1994 Archaeological Research at the Rowland Clark Site (41RR77), Red River County, Texas. *Journal of Northeast Texas Archaeology*, No. 4:3-42.

Perttula, T. K.
1993 Kee-Oh-Na-Wah'-Wah: The Effects of European Contact on the Caddoan Indians of Texas, Louisiana, Arkansas, and Oklahoma. In *Ethnohistory and Archaeology: Approaches to Postcontact Change in the Americas*, edited by J. D. Rogers and S. M. Wilson, pp. 89-109. Plenum Press, New York.

1995 Early Ceramic Settlement in Northeast Texas: Archeological Investigations of the Hurricane Hill Site (41HP106), Cooper Lake. In *Advances in Texas Archeology: Contributions from Cultural Resource Management*, edited by J. E. Bruseth and T. K. Perttula, pp. 131-154. Cultural Resource Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

Powell, J. F. and D. G. Steele
1994 Diet and Health of Paleoindians: An Examination of Early Holocene Human Dental Remains. In *Paleonutrition: The Diet and Health of Prehistoric Americans*, edited by K. D. Sobolik, pp. 178-194. Occasional Paper No. 22. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Prikryl, D. J.
1990 *Lower Elm Fork Prehistory: A Redefinition of Cultural Concepts and Chronologies along the Trinity River, North-Central Texas*. Office of the State Archeologist Report No. 37. Texas Historical Commission, Austin.

Quigg, J. M., C. Lintz, F. M. Oglesby, A. C. Earls, C. D. Frederick, W. N. Trierweiler, D. Owsley, and K. W. Kibler
1993 *Historic and Prehistoric Data Recovery at Palo Duro Reservoir, Hansford County, Texas*. Technical Report No. 485. Mariah Associates, Inc., Austin.

Scarborough, V. L.
1992 Ceramics, Sedentism, and Agricultural Dependency at a Late Pithouse/Early Pueblo Period Village. In *Long-Term Subsistence Change in Prehistoric North America*, edited by D. R. Croes, pp. 307-333. Research in Economic Anthropology, Supplement 6. JAI Press, Greenwich, Connecticut.

Schambach, F. F.
1993a Some New Interpretations of Spiroan Culture History. In *Archaeology of Eastern North America: Papers in Honor of Stephen Williams*, edited by J. B. Stoltman, pp. 187-230. Archaeological Report No. 25. Mississippi Department of Archives and History, Jackson.

1993b Spiroan Entrepots at and Beyond the Western Border of the Trans-Mississippi South. *Caddoan Archeology Newsletter* IV(2):11-26.

1995 A Probable Spiroan Entrepot in the Red River Valley in Northeast Texas. *Caddoan Archeology Newsletter* 6(1):9-25.

Schroeder, A. H.
1994 Development in the Southwest and Relations with the Plains. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by K. H. Schlesier, pp. 290-307. University of Oklahoma Press, Norman.

Sobolik, K. D.
1994 Paleonutrition of the Lower Pecos Region of the Chihuahuan Desert. In *Paleonutrition: The Diet and Health of Prehistoric Americans*, edited by K. D. Sobolik, pp. 247-264. Occasional Paper No. 22. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Staley, D. P. and C. A. Turnbow
1995 *Archaeological Test Excavations at Eight Sites on the Proposed Samalayuca Natural Gas Pipeline, El Paso and Hudspeth Counties, Texas*. Technical Report 1163. Mariah Associates, Inc., Albuquerque.

Thoms, A. V.
1993 Knocking Sense from Old Rocks: Typologies and the Narrow Perspective of the Angostura Point Type. *Lithic Technology* 18 (no. 1&2):16-27.

Thoms, A. V. (editor)
1994 *The Valley Branch Archaeological Project: Excavations at an Archaic Site (41MU55) in the Cross Timbers Uplands, North-Central Texas*. Reports of Investigations No. 15. Archaeological Research Laboratory, Texas A&M University, College Station.

Thoms, A. V. and S. W. Ahr
1995 The Pampopa-Talon Crossings and Heermann Ranch Sites: Preliminary Results of the 1994 Southern Texas Archaeological Association Field School. *La Tierra* 22(2):34-67.

Tomka, S. A. and E. R. Prewitt
1993 "What Do I Call Thee?" Projectile Point Types and Archaeological Interpretations: Perspectives from Texas. Lit*hic Technology* 18 (no. 1&2):49-58.

Treece, A. C., C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller
1993a *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume III: Data Recovery Results from Non-Ceramic Sites*. Technical Report 346-III. Mariah Associates, Inc., Austin.

1993b *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume IV Data Recovery Results from Ceramic Sites*. Technical Report 346-IV. Mariah Associates, Inc., Austin.

Trierweiler, W. N. (editor)
1994 *Archeological Investigations on 571 Prehistoric Sites at Fort Hood, Bell and Coryell Counties, Texas*. Research Report No. 31, Archeological Resource Management Series. United States Army, Fort Hood.

Vehik, S. C.
1992 Wichita Culture History. *Plains Anthropologist* 37:311-332.

1994 Cultural Continuity and Discontinuity in the Southern Prairies and Cross Timbers. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by K. H. Schlesier, pp. 239-263. University of Oklahoma Press, Norman.

Whalen, M. E.
1990 Sampling Versus Full-Coverage Survey: An Example from Western Texas. In *The Archaeology of Regions: A Case for Full-Coverage Survey*, edited by S. K. Fish and S. A. Kowalewski, pp. 219-236. Smithsonian Institution Press, Washington, D.C.

Whalen, M. E. *(Continued)*
1993 El Paso Plain Brown Rims as Chronological Markers? New data on an Old Question. *Kiva* 58(4):475-486.

1994 *Turquoise Ridge and Late Prehistoric Residential Mobility in the Desert Mogollon Region.* Anthropological Papers Number 118. University of Utah Press, Salt Lake City.

Wilson, D. E.
1995 Dental Paleopathology in the Sanders Site (41LR2) Population from Lamar County, Texas. *Journal of Northeast Texas Archaeology*, No. 5:29-59.

(Texas) Archeology 1995

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INTRODUCTION

As the 20th century comes to a close, it is appropriate that archeologists find time to take stock of our discipline and begin to think long and hard about its future. Ideally, archeology of the 21st century should be structured so that it combines the best of our present traditions with new ideas, methods, and technologies. However, before the headlong course of any discipline such as archeology can be (re)directed, the intimate workings of that field of research need to be revealed. The discipline's organization and formal nature have to be explained, as well as its methods of financing. The nature of the relationships among the players must be understood and the human behavior that transpires has to be disclosed.

In this essay I advocate and attempt to stimulate positive improvement by contrasting the good things about Texas archeology 1995 with the bad. When I look at Texas archeology, I see great promise along with grievous problems, colored black, white, and a thousand shades of gray. I see more money and time being spent in the name of archeology than ever before. I see ethical and capable individuals and organizations that are devoted to realizing the wonderful archeological opportunities afforded by the in-the-ground archeological record that yet survives in this state. Yet, I also see the very same opportunities being dashed by greed, incompetence, and malfeasance. I wonder if this perplexing mismatch is inevitable or if the (Texas) archeology of the future will be a marked improvement on what we have today.

I will begin by explaining my motivation and reviewing certain general aspects of the discipline of archeology in North America, and then go on to treat the practices of Texas archeology in particular. Wishing to avoid the hemlock proffered Socrates, criticisms and faults are accompanied by possible remedies, and are usually not personalized. In fact, a number of recommendations for improvement appear throughout this essay and, near the paper's end, the reader will find specific notions about needed changes and the expected evolution of Texas archeology. Beyond the turn of the century, (Texas) archeology will surely differ from what it is today. Changing technology, improvements in data-recording and information-sharing methods, shifts in social values, and perhaps major changes in governmental support and regulation (control) are all to be expected.

Many changes will occur automatically in the new milieu, as American social structure, educational systems, and bureaucracies, as well as world technologies, evolve (and occasionally devolve). However that might be, Texas arche-ologists of all stripes will not be trapped in an evolutionary cycle entirely beyond our control. Techniques of research can be chosen or rejected, and used wisely or foolishly. Organizational formats of a bureaucratic nature can be altered and redirected, and ethical professional and personal values can be inculcated. As we approach the 21st century, Texas archeologists, professional and avocational alike, will need to reaffirm our commitment to basic principles and responsibilities.

THE AUTHOR

The reader may wonder, rightly, about my background and motivation as author of an article that presumes to assess the state of the archeology of the "great state." I offer a somewhat lengthy accounting of my "archeological lineage" because I am convinced that the historical connections (mentors, colleagues, education, field experiences, etc.) that form one's archeological background largely determine one's contributions, for better or worse, to the discipline (see Black 1990a). I first developed an uninformed interest in archeology as a suburban teenager who loved reading adventure and historical novels; these fostered an unabidding curiosity about the cultural world and the human past. The first site I knowingly saw was a burned rock midden a few miles from my north Austin home that was in the process of being obliterated by relic collectors in advance of urban development. Later, as a student at the University of Texas at Austin, I decided to major in Archeological Studies after taking my first courses from Professors E. Mott Davis, T. N. Campbell, and Dee Ann Story. My undergraduate education and some minor field experience gave me a decent appreciation of basic archeological principles. However, upon graduation in 1976 I could not write competently and truly did not appreciate the difficulties involved in meaningfully relating the static past (what archeologists find) to the once-living people who created that human past. I also had little clue as to how I might make a career out of archeology.

On the verge of reading employment ads, a phone call from Thomas R. Hester, Director of the Center for Archaeological Research (CAR) at the University of Texas at San Antonio (UTSA) led to a one-week job surveying in Karnes County with the inimitable Col. Thomas C. Kelly. My one week evolved into a nine-year stint doing "contract" archeology at UTSA, during which I climbed the ladder of archeological responsibility from crew member, to crew chief, to assistant project director, to project director. I worked on surveys, testing programs, and excavations at many prehistoric and a few historic sites from the Balcones Escarpment southward. This experience, particularly the endless year spent working under Grant D. Hall in what would become Choke Canyon Reservoir, gave me a more solid connection to the natural landscape than city life ever had. From my first real mentor, Tom Hester, I learned to view contract archeology as an opportunity to do basic research while performing a needed service for federal agencies, small town governments, and mining companies. As I assumed greater responsibility, I gradually learned to organize archeological data and express my understandings in writing, especially while following through with the excavations at the Panther Springs Creek site (Black and McGraw 1985) and the Hinojosa site (Black 1986). Most importantly, however, I made many friends among the fluid ranks of contract archeology crews and the earnest members of the Southern Texas Archaeological Association (STAA). Along the way I earned a Master of arts degree in anthropology from UTSA and was introduced to archeology in the land of the Maya, which seemed far more appealing than digging test pits in Live Oak County.

I left Texas and went to Harvard University in 1984, to study Middle American archeology under Gordon R. Willey, and to continue fieldwork near the Maya center of Río Azul in northern Petèn, Guatemala under Richard E. W. Adams of UTSA (himself a former student of Willey). However, I soon found myself learning more about sociocultural and biological (physical) anthropology and archeology, as it is conceived and practiced across the wide human world beyond and before North America. Surprisingly, I learned more while "teaching" discussion sections than I did from most of my professors. The students asked the most obvious and the most obscure questions—the former by far the more challenging to address. This training combined with the vivid cultural experience of living in Cambridge, Massachusetts, convinced me of two "big" ideas that I had not adequately appreciated. One was that modern human cultures were so vastly varied and complex that even trained observers-in-the-flesh were often reduced to gross abstractions or trivial pursuits. Social anthropologists, I learned, were almost inescapably ethnocentric despite genuine effort to be otherwise, forcing me to understand that the same had to be true of archeologists as well. The other big idea was that for any archeological region or topic there were many alternative approaches and radically different ideas to be considered when planning archeological strategies (such as how and what to dig). In this regard, being one of the last two of Gordon Willey's long line of students (Grant Hall was the other) was instrumental. The Bowditch Professor Emeritus of Central American Archaeology and Ethnology was very reflective about roads he had taken and those he had not. Also thought-provoking were conversations with Rosemary A. Joyce, an untenured faculty member who challenged many of my favorite ideas. For my doctoral thesis I studied the historical development of field methods and methodologies in lowland Maya archeology (Black 1990b). Mayanists, I discovered, tended to follow the tracks of their predecessors rather narrowly, walking right by, so to speak, unimagined temples of the past hidden not by forest veil, but by archeological tradition.

After my final graduation, I taught and advised students at Harvard for a year while seeking the tenure-track teaching job I trained for. Such jobs are scarce and highly competitive (200 or more applicants for every solid position). Happily, in 1991 I moved back to Austin and began working as a Research Associate at the Texas Archeological Research Laboratory (TARL). There, working once again under Tom Hester, I have been directing and administering CRM projects sponsored by the Texas Department of Transportation. Beyond the need for employment, I came back to Texas because of family, archeological friends, and my love for the land and its waters, but I came back with a different outlook on archeology as it is practiced in the 28th state.

My break from contract archeology, time spent doing archeology in Mesoamerica and studying and teaching anthropology in Cambridge, gave me a perspective on Texas archeology that I would not possibly have gained if I had stayed put. Back home, the change from the archeological frontier of San Antonio to the longtime hotbed of Austin opened my eyes on Texas archeology as I had never seen it before. For self-serving reasons, I developed an intense interest in the workings of CRM archeology as I realized my career would be centered in Texas instead of Mesoamerica. I asked questions, developed and renewed contacts, and paid more attention to what people did than to what they said. I was able to see more clearly the opportunities and the limitations, as well as the admirable and the senseless aspects of archeology. I now feel compelled to speak out (Black 1993; Black and Shafer 1994), try different approaches (Black et al. 1993), and participate more actively in community-wide organizations such as the Texas Archeological Society and the Council of Texas Archeologists.

This essay, then, reflects my archeological path, and those of my mentors and colleagues, as I seek to describe how I think (Texas) archeology works, for better and for worse, and where I hope the discipline might go. Throughout, I try to personify archeology by mentioning positive examples of the colleagues and organizations that I know best, knowing that I must omit mention of many who should be lauded, particularly those who work in areas of the state where I have not. As the reader will have guessed, I put Texas in parentheses from time to time to reinforce the point that much of (North American) archeology knows no political boundaries. I begin by explaining my understanding of what archeology the discipline is all about.

THE ARCHEOLOGISTS

Today as never before, archeology means many different things to the many different individuals who consider themselves archeologists. Most American archeologists fall into one of three broad groups: academic archeologists, cultural resource management (CRM) archeologists, and avocational archeologists. Keep in mind that many individuals participate in more than one group during their archeological careers, and that finer distinctions can and will be made.

Academic archeologists are the formally trained holders of advanced degrees who teach, theorize, and conduct scholarly research from the bastions of the University. Academic faculty are paid on a long-term basis (through the tenure system) to teach and to do scholarly research, although most research funds except salary and basic infrastructure are obtained from outside sources (mostly federal granting agencies, private foundations, and private benefactors). Historically, it has been the academic archeologists in North America who have held the scholarly high road, written most of the books and articles, trained the next generation of archeologists, and done (or at least supervised) most of the excavations. While at the present time there are perhaps 30 to 40 tenured archeologists teaching in universities and colleges in Texas, fewer than 10 are active in Texas archeology, as most have research interests elsewhere in the world. Academic archeologists have contributed greatly (and not-so-greatly) to the development of Texas archeology. In my view, the late Alex D. Krieger was one of the finest scholars that has yet concentrated on the state, although he did not hold a faculty position and left Texas precipitously in 1956 because of what he felt was a lack of support from UT-Austin (Story 1993).

There are also smaller numbers of academically trained archeologists who have research and curatorial duties at regional and local museums. The holders of such positions often operate in isolation, preoccupied with the survival of the professional niches they have found and the direction of their institutions, more than research. For example, Anna J. Taylor (of Quitaque, Texas) has returned to her geographic roots at the Panhandle-Plains Museum at Canyon. As Curator of Archeological Collections, A. J. is helping the museum deal with repatriation issues (see below) and hoping to win a permanent position. Others, such as Alex Barker, Curator of Archaeology at the Dallas Museum of Natural History, are less isolated and are able to interact with academics at major schools (SMU, in Alex's case). The premier example of a museum-based academic position in Texas archeology is the one Eileen Johnson has carved out at the Lubbock Lake Landmark.

Since the early 1970s, the balance of archeological power (as reflected by funding) in North America has increasingly shifted to the burgeoning CRM subfield. Cultural Resource Management is the preferred term today for what I previously labeled as contract archeology and which earlier generations called salvage archeology. The term CRM comes from the 1960s and 1970s federal laws and regulations which strengthened government commitments to the preservation of cultural resources (including prehistoric and historic sites). The profound change in emphasis from salvaging information to "complying" with government regulation is one that American archeology is still struggling to come to grips with. Paradoxically, CRM funding has been both boon and boondoggle.

CRM archeologists include researchers, bureaucrats, businessmen, and technicians that collectively comprise a majority of the membership of the Society for American Archaeology (SAA), the major national organization of professional archeologists. A much smaller number of these also belong to the Society of Professional Archeologists (SOPA), an organization whose members are sworn to uphold an ethical code and standards of performance. Today, almost all CRM archeologists, except for a few technicians, hold at least a B.A., with many having a master's degree, and some a Ph.D. Broadly, the CRM archeologists can be sorted into two piles, government and non-government.

The first includes those employed by the federal and state governments or, less commonly, local and regional governments and quasi-governmental entities (like the Lower Colorado River Authority, or LCRA). Most CRM archeologists employed in government are paid on a long-term basis to regulate and administer CRM archeology and, to a lesser extent, to actually do archeological research. For example, Erwin Roemer (of Elgin, Texas) works for the U.S. Army Corps of Engineers in Vicksburg, Mississippi. His job is to make sure that the Corps complies with federal and state archeological regulations as it builds and maintains the nation's reservoirs and waterways. He travels often and coordinates research, but rarely gets to participate directly in fieldwork. At the state level, Margaret Howard Hines of Austin works for the Texas Parks and Wildlife Department, planning and conducting archeological surveys to help individual state parks protect and manage the many obvious and not-so-obvious archeological sites they contain. She spends more time than most state government archeologists doing fieldwork, but her work is limited to survey and testing projects.

Erwin and Margaret are two of many fine archeologists who have joined the governmental branch of CRM archeology and have continued to contribute to archeological research. However, as is typical of all bureaucracies, there are many government archeologists who do not advance archeological research in any demonstrable way. Regardless, over the last thirty years or so government has been a steadily growing and secure source of employment, although this may soon be changing, especially at the federal level.

The growth in the number of non-government CRM archeologists has been even more explosive, and the highs and lows even more profound. In the history of Texas archeology, most organized research was connected with the University of Texas at Austin until the early 1970s. The establishment of anthropology departments at other universities in Texas, coupled with strengthened CRM laws, led to the creation of organized archeological research units at Texas A&M University (TAMU), Texas Tech University, Southern Methodist University (SMU), the University of North Texas (UNT), UTSA, the University of Texas at El Paso, and Stephen F. Austin University. While many of these organized research units have operated mainly within the regions in which they are located, others sought contracts wherever opportunity has arisen. However, the demand for CRM archeology has been more than the universities could effectively handle, and by the 1980s private consulting firms brought American archeology into the free enterprise system both for better and for worse.

Firms such as Prewitt and Associates, Inc., of Austin have been able to make a viable business of complying with archeological regulations while accomplishing quality research, at the same time providing many up and coming archeologists with training and research opportunities (Margaret, for one). With such firms, the archeology seems to come before profit. However, there are competing organizations where the driving motive is clearly profit and, as I perceive it, the quality of archeological research has often suffered as a direct consequence. One could cite unfavorable examples of small firms run by Texas-bred archeologists, as well as larger corporations in which Texas archeology is only a convenient aspect of a wider portfolio of endeavors intended strictly to garner profit. Despite the setting, the quality of CRM archeology depends on the integrity of the individual archeologists and managers as much or more than that of the organization; if the archeological integrity of either is compromised, the quality of research suffers.

Today, private firms compete with the universities that still have contract programs, such as the one at TARL. Some organized research units that were active in the 1970s and 1980s, such as those at SMU and Texas Tech, no longer exist. While as a university-affiliated archeologist, I wish I were able to assure the reader that the quasi-academic setting always insures that quality research is the top priority; any archeological organization, however, is only as good as its people. I use the term "quasi-academic" because, as organized research units, university CRM operations are typically housed separately from, and are not effectively integrated with, the teaching faculty. The Center for Environmental Archaeology (CEA) at TAMU is an important exception to this characterization, as it is reasonably well-integrated with TAMU's Department of Anthropology. While I can point to many examples of excellent research projects that have been conducted by university CRM organizations, it is also the case that some of the most egregious examples of wasted archeological opportunities in Texas can be laid at the feet of organized research units connected with public and private universities. Thankfully, not many of these horror stories are recent ones. The history of CRM archeology, on whatever level one wishes to discuss, is replete with examples of the good, the bad, and the downright ugly.

Part of the difficulty is the uncertainty of funding, which for any given organization can vary widely from one year to the next. Almost all nongovernmental CRM positions are only as "permanent" as the funding. This means there is often a high turnover rate, especially at the positions of lower responsibility. Most private firms employ a relatively small number of archeologists who hold "permanent" staff positions. These serve as administrators, principal investigators, and project directors, and fill other positions of primary responsibility. Most field and laboratory workers are hired and laid off seasonally as business comes and goes, and they are seldom offered fringe benefits. Many would-be archeologists, including some of the brightest and most promising I have known, leave archeology because of the uncertainties and difficulties of CRM employment. For those that survive the initial years and are capable of, and interested in, assuming greater levels of responsibility, the employment picture improves, although it is still subject to irregular cycles of feast and famine. Many CRM archeologists migrate back and forth across the country as regional economies and mega-projects boom and bust.

The final group, the avocational archeologists, includes those from many walks of life who participate in archeology without earning a salary from it. Texas has a long and justifiably proud tradition of public participation in archeology, a tradition that is exemplified by the history of the Texas Archeological Society (see Davis 1979). The Texas Archeological and Paleontological Society was founded in 1929 with the idea that anyone with an abiding interest in past peoples, things, and fossils could participate. Among its founding members were the few professional archeologists of the day and the somewhat more numerous serious avocationals. As time went on the paleontologists went their separate way, and the members of the Society agreed to adhere to a code of ethics that said among other things that members would not buy and sell artifacts and would not dig irresponsibly. As the profession of archeology grew so did the TAS, as well as regional and local societies and associations such as the STAA and the Travis County Archeological Society, the two that I belong to. It is interesting to note that the TAS and the regional and local societies have only partially overlapping memberships; more people, it seems, will participate in regional and local societies than in the statewide society.

Initially, most avocational archeologists do not have any formal education in archeology. They usually gain field experience and training by participating in field schools and digs sponsored by societies, and by working on volunteer projects in the field and laboratory. Many go on to take college courses in archeology and to participate in university field schools and research projects. In the earlier years of

Texas archeology it was common for professional archeologists to invite avocational archeologists to participate in digs. Unfortunately, because of the growing professionalization of archeology and, in part, because of liability laws and other restrictions placed on archeological organizations by governmental and private sponsors, this practice is generally uncommon today. In fact, some CRM archeologists complain when a competing CRM firm uses volunteers in lieu of paid help, out of a belief that the practice confers an unfair competitive advantage. This situation is one of many highly regrettable aspects of compliance archeology.

Avocational archeologists present the discipline with much enthusiasm and varying levels of archeological expertise. Some of the very best excavators that I have been privileged to dig with have been avocational archeologists. For instance, E. Thomas Miller of Kerrville, Texas, is retired and has gone on to make archeology a part-time occupation and serious avocation. Tom worked with me at the Panther Springs Creek and Hinojosa sites, and on the Higgins Experiment, and is an active member of the STAA and TAS. As I write this, the archeological grapevine reports that, while participating in the fall 1995 STAA field school, Tom has excavated the first complete Angostura point found at the deeply-stratified Richard Beene site in southern Bexar County. Knowing the man, I am certain that he carefully exposed the artifact in place and documented his find as skillfully as any professional archeologist. Tom is one of many avocational archeologists of the first water.

Avocationals often bring to archeology skills and specialized knowledge that most archeologists do not have. For instance, Donald Lewis of San Antonio, a retired research chemist, has taught at UTSA and made many contributions to South Texas archeology, as well as to the field of archeometry, the application of hard science methods to archeological problems (e.g., Lewis 1978). Lewis has trained several students, such as Jeff Huebner, who have gone on to put archeometric techniques to good use in Texas archeology (e.g., Huebner 1991). Pam Wheat, formerly of Houston, was a school teacher who melded her profession with her avocational interest in archeology to great effect (e.g., Wheat and Wharton 1990). Pam is currently the educational coordinator for the Crow Canyon Archeological Center in Colorado. Many other avocationals develop specialized skills out of their interest in archeology, although I'll cite only three. The late R. King Harris of Dallas was a world authority on glass trade beads (e.g., Harris and Harris 1967). Jay C. Blaine of Dallas has become an expert in early historic weaponry and metal artifact conservation (e.g., Blaine 1993). Bill McClure of Houston is an acknowledged expert zooarcheologist, one who analyses animal bones from archeological sites (e.g., McClure 1990).

INVESTIGATING THE HUMAN PAST

Archaeo: from Greek *arkhaio*, meaning ancient

-Logy: from Greek *logos*, meaning word/speech/discourse

Archaeology (Archeology): discourse about the human past as informed by the systematic study of ancient material remains.

What is it about archeology that the members of the three groups of archeologists, academic, CRM, and avocational, have in common? **What is the central goal of archeology?** We will not find a consensus answer from the scholarly discipline of archeology, which over the past half century increasingly has become a field of inquiry that lacks a unifying theoretical vision (Dunnell 1986). Today among the "hothouse theoretical elite" (Watson 1991:273), there are literally dozens of label-bearing brands of archeology: processualism, post-processualism, Marxism, realism, feminism, evolutionism, and so on (see Preucel 1991). While each has its proponents, adherents, and critics, most academic archeologists tread the abstract waters without wholly subscribing to any one theoretical pathway. And as Watson (1991:272) points out, "beyond the brightly lit arena of theory in North America, there are thousands of people doing archaeology every day who do not participate in the debates or even follow them very closely." She sees the very large CRM group as "almost an archaeological proletariat" who do "most of [the] field and laboratory work carried out in this country."

Like many members of the "dirt" archeology proletariat, I see the nature and aims of archeology in more concrete terms. To me, archeology is about trying to understand what it means to be the only ape (member of the superfamily Hominoidea) that can reach in his pocket, pull out the key to a Toyota, and drive to the store for a bunch of bananas. Put differently, the archeologist's fascination with the human past is part of mankind's never ending efforts to understand the nature and history of our own species, *Homo sapiens sapiens*, "doubly-wise man." We archeologists study the material remains of the human past, a past that is dimly and not-so-dimly reflected by ancient things, artifacts and site deposits: ancient remains that, when carefully and cleverly studied, can reveal something of mankind's past, which is to say something of our present and future selves as well. To me, archeology is both history and science; by using the diverse methods and tools of both the historian and the scientist, we can help tell the unfolding narrative of humankind's unique history on earth as well as help identify and explain the processes and mechanisms by which our species and its cultures have evolved since our distant ancestors began to use tools some two to three million years ago.

Like most, I chose to become an archeologist because it seemed fascinating and fun. While in the field as an archeologist, I have the opportunity to sweat and shiver, ache and chaff, swat and stumble, and otherwise savor the pleasures and pains of working with my hands in the dirt searching for ancient things connected to the human past. The thrill of archeological discovery is a powerful shared human experience. When a remarkable artifact, for instance a Guadalupe gouge (Brown 1985), comes back from the past to make itself known to us in the present, the feeling of connectedness is hard to shake. As my hand grasps the curiously shaped object and pulls it to my eyes, my mind's eye flashes with the realization that this very artifact was last held by another human in this very place some 5500 years ago, a veritable warp in the time-space continuum. And naturally, my second impulse is to holler out to my field companions of the moment: "come look at this." We gather around trying to find a name for it, a time for it, an action for it. We want to understand who made this thing, what was it used for, how it looked in life, where was it created, when was it left behind, and why was it abandoned. We try to imagine the faces of its maker and her (his?) companions. We recognize larger patterns that this thing fits and fits not; what do these patterns mean? What was life in the past like? Why was it that earlier humans came to this very spot? These questions, and the discoveries that bring them to mind, are the timeless and universal essence and excitement of archeology. Yet, definitive answers can be exceedingly difficult to come by and we archeologists often become dissatisfied with those that we do propose.

Throughout the 20th century, archeologists have come to realize that the human past is infinitely more complex and less accessible than was previously imagined. The *Tales that Dead Men Tell* through the "father of Texas archeology," James E. Pearce, in 1935 seem quaint and narrow-minded today. Similarly, site reports written in archeology's recent youth often seem painfully naive as the archeologist of the day reads with what she/he regards as a more sophisticated understanding of the nature of the archeological record. The past is a distant place inhabited by people we can never meet, whose tongues are forever silent, whose thoughts we can never directly fathom, and whose mundane habits remain quite a challenge to comprehend. Today the materials remains of the human past are static, lifeless things; the past will never exist again and cannot possibly be recreated (Binford 1986). We archeologists study the archeological record and create present day understandings of the past. Yet, despite the abundant evidence of our inevitable failings as interpreters, we continue to gain understandings of the human past. In doing so, we are coming to appreciate a bit more about what it means to be the members of the only species with pockets containing car keys.

The material record of mankind's past is entombed skin-deep within the ever-changing face of the planet Earth. To develop improved understandings of our unwritten cultural past, we archeologists must also study the earth's natural history. Archeology is inescapably linked to the earth and natural sciences, geology, geography, biology, botany, zoology, and so forth. Those who study the archeological record must also tread some of the same intellectual and methodological turf as certain of the social sciences and humanities, including sociocultural anthropology, history, architecture, art history, linguistics, sociology, psychology, and even philosophy, among others. Archeologists look to these many interrelated disciplines to borrow ideas, methods, and knowledge; occasionally we reciprocate.

To be an archeologist, then, is to be engaged in an ongoing discussion about the human and natural past as informed by the systematic study of ancient material remains and many other avenues of learning. This discourse is potentially carried on at many levels with many other humans. For each of us there is first the internal dialogue; trying to convince yourself that some observation is of potential relevance for understanding the human past. Outwardly, we communicate our understandings and questions by the written and spoken word, as well as by images, that find expression in excavation records, informal discussions, site reports, journal articles, presentations at archeological meetings, visits to public schools, public lectures, and, increasingly, through the electronic media. Today, our audience can be as narrow as our immediate colleagues, or as wide as interest in the human past and our own skills as communicators will allow.

In communicating what we think about the past we archeologists hope to strike a cord in another's mind, for unless we can provoke response we have failed to communicate. The main lure of the discipline for the serious archeologist lies not in the discovery of some great or perfect thing, but in the intellectual and emotional interaction that follows. We attempt to learn about the human past so that we can share our discoveries, our ideas, our words, with each other and, perhaps, with a few of those who will follow. Archeology is creative human interaction or it is nothing. As detectivistic-historians we try to weave the bits and clues into narrative accounts of the behaviors, events, and relations of human prehistory. As scientists, we try to link the patterns we detect in the archeological record to convincing explanations of the long-term processes of cultural transformation. Archeologists create ideas based on our preconceived notions tempered with our systematic observations about ancient remains, so that informed dialogue about the human past and about the human present can thrive among present and future humans.

At the heart of the archeologist's responsibility is the ethical principle that we share what we learn. To do this, one's field data must be inventoried and organized coherently in the process of analyzing one's findings and writing down an honest (methodological warts and all) and adequate accounting of what one did and found. Once these steps are properly done and the materials turned over to a proper curation facility, then any archeological researcher wishing to use the data or examine the collections will be able to do so toward whatever research goals they might have. Unfortunately, the process of analysis and reporting is often long delayed, sometimes for good reason.

A regrettable (and all too common) cost of delay between field work and publication is that often the latter never happens and the artifacts, records, and other random data languish in messy boxes. Untold hundreds of boxes have been dumped at TARL and other repositories, places where the tiny, overworked records and curation staffs never have time to properly sort out most of the messes. Every ethical archeologist fully intends to publish the backlog of reports and sites that often accrue during a career, but being opportunistic, we often take on much more than we can successfully bring to publication. Yet we know we have the responsibility, so we maintain the illusion that some day we will make things right. All the while, the data we collected is sitting, often in an incoherent and unusable condition, sometimes hidden and forgotten. This problem is even worse among unethical archeologists and organizations that do not even intend to carry through with their obligations to finish projects and properly curate data and collections. A better solution, in my opinion, would be to take the interim step of properly preparing a coherent data set and brief accounting of what was done, as well as properly curating the materials. This step done, the data and artifacts would be available for other researchers to access. If the original researcher found time to publish the information, so much the better, but if not, the primary ethical responsibility (to make one's data accessible) has been accomplished.

I think that the failure to publish one's research also points to a very harmful misunderstanding held by many about archeology: the perception that a single correct interpretation of any artifact, feature, or site can (or should) exist. No interesting idea or understanding about the human past is complete or beyond dispute and improvement, no matter what the credentials of its author. We do not dig up facts, we dig up things and groups of things about which, potentially, a great many observations and explanations can be advanced, many different questions posed, and many stories told. Ultimately, most published archeological explanations are either ignored or are shown to be flawed or otherwise incomplete. While some explanations are ignored because they are set forth in obscure sources or because they are not understood, most simply fail to capture the reader's mind as an interesting notion.

(A cynic might also add that many fine ideas are ignored simply because few archeologists actually bother to read the CRM reports lining their shelves.) Our best interpretations are carefully structured arguments that account for as many of the relevant facts and observations as we can muster, given our preconceptions at the time. Since we are constantly enlarging the written archeological record, continually finding ways to apply new (or borrowed) analytical techniques, and even occasionally able to come up with improved explanatory frameworks, most interpretations are destined to be revisited. That so little about the human past can be definitively known is, depending on one's perspective, either the greatest frustration about archeology or its greatest opportunity.

Perhaps it is the frustration with the uncertainties of archeological inquiry that causes many of us to cling to previously expressed notions so tightly that we close our minds to new ideas. Sometimes we become so afraid of being wrong that we are unwilling (or unable) to commit our ideas and our data to the printed word. Maybe it is just a lack of imagination? Whatever the motive, archeologists often mimic and recycle prevailing notions as if reiteration strengthens veracity. In my view, the idea that 'what is written must be right' is absurd, especially in a revisionistic field like archeology. Archeological interpretations and presentations should live for their moment. I see the most successful archeological idea as one that inspires others to challenge it and, in so doing, push archeological understanding to the next level or in a new direction. Similarly, the successful presentation of archeological data provides reliable information that others find useful or stimulating. Truly unsuccessful archeological ideas and data presentations are not those that fail to provide the end all and be all; they are the ones that are ignored.

(TEXAS) ARCHEOLOGY

The political entity we call Texas (from the Caddo word *taysha*, meaning friend) has existed for less than two centuries, a blink in humankind's past. Most of the boundaries of the oddly-shaped 28th state are completely meaningless in the context of the past. The straight lines that separate Texas from other states are transparently artificial. Our rivers have been effective cultural barriers but for brief moments of their existence. Only the Gulf of Mexico served as a natural barrier, and even it seems to have been penetrated by water-borne visitors from Mesoamerica and Mississippian America long before Alvar Núñez Cabeza de Vaca washed up on Galveston Island in 1528.

The landforms, plants, and animals that make up Texas are aspects of geographic patterns that dwarf the "everything is bigger" state. The oak and juniper savanna in the central part of the state form the tale end of vast forests that stretch eastward for thousands of miles as well as the tail end of easterly critters like the pine vole and the swamp rabbit. Likewise the grassy prairies that meet their salty demise on the beaches of South Texas can be followed for an even greater distance to the north. And the parched, thorny evergreen woodlands and brushlands of southwest Texas can be tracked southward for hundreds of miles up, down, and over the parched and rocky Sierra Madre of northern Mexico. And so on.

The wider natural landscape provided the stage upon which the dramas of the human past played themselves out. The Native American cultures that left their dim and unmistakable marks upon the stage we call Texas often can be traced far beyond the confines of our provincial state. Paleoindian hunters carried distinctive spear tips and knives made from Texas Panhandle (Alibates) flint hundreds of miles northward, following the migrations of the Pleistocene beasts to and fro across the inland grassy sea. Archaic plant gatherers and deer hunters performed hallucinogen-induced shamanistic rituals and depicted these on the walls of rockshelters on both sides of the Rio Grande. The dryland farming Mogollon villagers of the Hueco Bolson shared culture and bloodlines with their relatives further west, and turquoise, pottery, and ideas with Chichimecs far to the south. The forest farming ancient Caddo participated in far-flung interaction spheres which moved cultigens, cult items, and social ideals back and forth across the Red River. These examples are evoked to drive home the point that modern political bounds of Texas need not confine the minds of its archeologists.

The impressive archeological record of ancient and not-so-ancient Texas exists in two great bodies of potential and realized information, in-the-ground and on-the-shelf. The buried archeological record includes all that remains in context of the 54,000 officially recorded sites, as well as the hundreds of thousands of other localities bearing cultural remains that have not yet been added to the list. All of us know that with each passing day this archeological record suffers depredation and attrition as the human (and natural) remodeling of the planet continues apace. A relentlessly expanding human population begets more concrete and less unaltered terrain. More and more people find the lure of ancient human artifacts irresistible. And who can blame them?

Serious archeologists have as our credo that things from the past are important and interesting because of their informational content. While most of us will certainly pause to appreciate the beauty and craftsmanship of a well made dart point or pottery vessel, we recognize that without good provenience (where something comes from) and full context (the circumstances within which something occurs), artifacts lose most of their archeological meaning. Therefore, it is hardly surprising that we archeologists often condemn pothunters and relic collectors who seek things for things sake.

We who call ourselves archeologists need to realize that we do not have an exclusive right to study or possess archeological remains. As much as we might desire control, the fact is that many people other than archeologists are interested in the past and purposefully (and not-so-purposefully) go about finding artifacts. Landowners and their guests ordinarily have every right under current Texas law to do what they please with artifacts and entire sites found on private property. In the near future, both archeologists and collectors will probably have less say-so regarding the ownership of certain archeological remains. For many Native Americans, whose direct and not-so-direct ancestors created much of the in-the-ground archeological record in Texas (as elsewhere in North America), the ownership and disposition of human remains, grave goods, and other cultural items represents civil and political rights issues.

Under the 1990 Native American Graves Protection and Repatriation Act (NAGPRA), federal agencies and all museums and repositories that receive federal funds must create inventories of all Native American human remains and associated funerary objects. Currently, these institutions are in the process of providing inventories to the appropriate "culturally-affiliated" tribes, after which time the tribes can demand the return of human remains and associated grave goods. There are many circumstances where tribal groups have demonstrable and direct cultural links to the bones of their ancestors; in these cases, few conscientious archeologists would deny their rights to demand repatriation. However, political and bureaucratic decisions already have been made that will almost certainly result in the reburial of much more than the bones and grave goods that can reasonably be linked to specific tribes. Prehistoric burials and grave goods that cannot be confidently attributed to the direct ancestors of any modern tribe are being assigned to designated tribal groups. For instance, in Texas this could conceivably result in all unmarked burials from the Southern Plains being assigned either to the Comanches or one of the Apache groups. Ironically, archeological repositories soon may be turning over the last direct remains of the Late Prehistoric Southern Plains peoples (and their likely Archaic ancestors) to the descendants of the very peoples who drove them from their homeland.

I suspect that many may not be aware that this process is already well underway here in Texas. In most of the museums and other repositories like TARL, NAGPRA inventories (accounting for and assessing the cultural affiliation of all human remains and grave goods) are nearing completion. Repatriations already have begun. For instance, in the *Federal Register* issued on Monday, August 14, 1995 (60(156):41898-41899), the National Park Service posted a "Notice of Inventory Completion" in compliance with NAGPRA involving human remains recovered from five sites in Bell County, from within or near Fort Hood. This brief notice also summarizes actions already taken since 1991 by Jack Jackson, staff archeologist at Fort Hood whose expertise is primarily in the realm of historic archeology (e.g., Jackson 1986). Jackson appears to be operating on his own as his actions did not follow the federal government's stated NAGPRA policy. Among other things, the policy specifies that formal notice of intent to repatriate will appear prior to an action, not after-the-fact. Far worse from my perspective is the way alleged tribal affiliations were justified.

As stated in the notice, Jackson repatriated the bones of 48 individuals vandalized from Javalina Shelter to the Comanches. The determination of the affiliated tribal group was based on the "abnormal number of juvenile remains, suggesting a historical disease epidemic" and "evidence of access to obsidian." A single obsidian flake was found in pothunter's backdirt (along with most of the bones), and may or may not have been interred with the burials. It does not take much archeological knowledge to realize that these constitute precariously thin grounds for linking the bones to the Comanche (or any other modern group). Obsidian artifacts, although generally rare, are known from Paleoindian times onward in the prehistoric archeological record in Texas (see Hester 1991). Apparently, Jackson did not employ the routine archeological method of obtaining radiocarbon dates from the archeological deposits containing the bones or directly from a small sample of the bones, to find out if indeed these remains could plausibly be those of the Comanche.

The notice says that on another occasion, Jackson turned over human remains from three other sites to the Tonkawa of Oklahoma because they were recovered from sites "occupied by peoples of the Toyah and Austin Foci, acknowledged as ancestral to the Tonkawa Tribe." The knowledgeable reader will know that this assertion flies in the face of recent archeological and historical thinking and abundant contrary evidence (see Johnson 1994:271-281; Newcomb 1993:26-29; Newcomb and Campbell 1982; Ricklis 1992). The Tonkawa were latecomers to Texas who did not arrive until the 17th century, and could not possibly have been responsible for the vast majority of the archeological manifestations known as the Austin and Toyah foci or phases (cf. Jelks 1962; Prewitt 1981, 1985).

I consider it extremely unlikely that the bones from Fort Hood that were returned to the Comanche and Tonkawa were, in fact, those of their ancestors. Sadly, the hasty and, in my opinion, ill-considered actions in these cases will probably be used to establish legal precedent. Within a very few years (months?), it is likely that human remains, grave goods, and possibly even obsidian flakes and other artifacts from the Waco area will be turned over to the Comanche, Tonkawa, and other tribes based on equally dubious evidence of ancestral connection. I doubt that knowledgeable archeological researchers will be allowed any say in the matter.

If NAGPRA and the Archeological Resources Protection Act of 1979, an oddly-written law which contains sweeping provisions that partially belie its apparent benign intent, are any indication, the federal government will continue to attempt to exert greater control over archeological remains in Texas, as elsewhere. Although there are indications that some Native American groups, such as the Caddo, appreciate the information that can be gained from responsible archeological research (Carter 1995:10-19), the archeological community can expect years of turmoil during which archeological repositories will lose significant portions of their collections. While some tribes may elect to maintain their own curatorial facilities, most grave goods will probably be reinterred along with the human remains. I predict that future generations of archeological researchers will wonder why the archeologists of the 20th century were so slow to acknowledge and to take into consideration Native American interests. Future Texas archeologists will also wonder why the archeological community did not take a strong stance to oppose repatriation to inappropriate groups, and why more analyses were not done before archeological collections were repatriated. Our answers will seem hollow.

My view is that, in principle, the human past belongs to all humankind. Since ultimately all living humans are genetically related to one another, often much less distantly than most realize, on some level we can all claim past remains as part of our cultural heritage. Human remains from whatever time period or cultural affiliation should be treated with care and dignity. When our archeological work intrudes on the human remains and sacred places that are historically linked to specific living peoples (i.e, lineal descendants), archeologists should take into consideration their wishes. However, the idea that all present-day Americans with Native blood should determine the fate of all prehistoric remains in North America is as preposterous as the notion that I, Stephen Louis Black, as an individual of Anglo-Saxon descent, should have a say so concerning what might be dug up on the grounds of Buckingham Palace, much less what is excavated in the Caucasus Mountains. Cultural heritage has many competing interests, and we archeologists should make sure that the right to investigate the archeological record scientifically is not dealt away by politicians, bureaucrats, lawyers, and our own politically correct colleagues.

We North American archeologists need to realize that we must accord extraordinary respect and sensitivity to Native American peoples and groups, out of appreciation for the prehistoric archeological record, which is the historical record of Native American life. We must also acknowledge that among earlier and present generations of archeologists there are many who have shown little respect for living Native Americans. These realizations and acknowledgments are not, however, grounds for accepting without question any statement or claim by a person who identifies himself as a Native American. Last year, I listened respectfully while an older Hispanic man from San Antonio who considers himself a Coahuiltecan intently described how his ancestors made stone tools by trickling hot water onto flint rocks. I said nothing, but I recognized his explanation as a bit of popular folklore that has no basis in reality. Perhaps he has a trace of Coahuiltecan blood coursing through his veins, but Coahuilteco-speaking cultures have long since gone to ground. Is tribal identity acquired by biological ancestry or through the generation to generation sharing of history, place, language, and custom? Should newly formed groups such as "The Coahuiltecan Nation" be given control of the archeological collections they are now coming forth to claim? What happens when more than one group of reborn "Coahuiltecans" emerge? These issues will be revisited many times in the next few years as bones and grave goods are pulled in many directions, and as more and more urban Texans acknowledge and celebrate their Native American ancestors (England 1995).

We archeologists must also acknowledge that Native Americans, casual and serious collectors, and other members of society have understandable and often legitimate interests in the past, even in cases where these competing interests are antithetical to the goals of archeology. I advocate this position, not out of any desire whatsoever to encourage collecting, site destruction, and wholesale repatriation, but simply because I think it foolish to deny reality. Rather than react to the many challenges to the in-the-ground and on-the-shelf archeological record with condemnation, condescension, and denial, we must make better use of our most effective tools: education, negotiated science-based compromise, and the dissemination of what we have learned from the archeological record.

The on-the-shelf archeological record is the sum total of the archeological data that has been salvaged from the ground and preserved for posterity. This data exists as site notes, photographs, maps, drawings, data bases, manuscripts, and published reports, much of it stored at a relatively small number of permanent curation facilities like the one where I work. The things (artifacts) themselves, are not, to my way of thinking, archeological data, per se. This is because the actual items have little meaning until and unless meaningful observations are made about them. A meaningful observation might be as simple as a basic description, but without such a record the artifacts might as well not exist. Without provenience and proper archeological documentation, the artifacts collected by the archeologist are just plain old things that have comparatively little to say about the past.

All archeological pathways share at least one common set of needs: to establish when, where, and how ancient human traces came to rest in the places we call sites. The universal need for establishing context is critical to all but the artifact idolaters among us, and even they would like to hang a time and place on their goodies now and again. This means that all archeologists (and even non-archeologists interested in relics of the past) share a common need. The contextual pieces that allow each archeological puzzle-solver to gain an understanding of how his/her site or artifact fits into the human past are virtually meaningless in and of themselves. In archeological research, as in the assembly of a jigsaw puzzle or a detective's chain of evidence, each fitted piece (say an archeological deposit linked to a time period) opens a larger picture. The chances of finding the fit(s) for any particular piece are proportional to the number of well-fitted pieces. In other words, the more that is known about the archeological record, the more likely it is that any single site or deposit or artifact can be linked to another, and wider cultural patterns can be discerned. Let's take a concrete example involving the two archeological manifestations I mentioned earlier, the Austin and Toyah foci.

In 1959 and 1960, the Texas Archeological Salvage Project (as TARL was then known) undertook the excavation of the Kyle Rockshelter in what is now Whitney Reservoir, about 35 miles northeast of Waco. Members of the Dallas Archeological Society (many of whom were TAS members as well) assisted in the work. Edward B. Jelks, then a professional salvage archeologist (see Jelks' Foreword, this volume), directed the excavations and wrote a fine report (Jelks 1962) which many subsequent archeological researchers, including me, have found very useful. The study's main contribution was to begin to flesh out the definition of that portion of the archeological record in the central part of the state that dates to the latter part of the prehistoric sequence, now known to date from about A.D. 800 to A.D. 1500, or perhaps a bit later. Jelks found that the shelter's earlier cultural deposits formed during what was called the Austin focus (with Scallorn arrow points as its main marker) and that these deposits were overlain by those attributed to the Toyah focus (with Perdiz points). In doing so, he succeeded in finally putting to rest J. Charles Kelly's long-lingering notion that Scallorn and Perdiz arrow points were contemporaneous, and showed that their periods of use of the Kyle rockshelter were characterized by different artifact assemblages and peculiar human behaviors.

However, lacking adequate comparative data, Jelks could not fully evaluate his findings. For instance, when he assembled what would be one of the first published sets of radiocarbon dates in Texas archeology, he mistakenly concluded that the Austin and Toyah foci were separated in time by a gap of several hundred years. Subsequent researchers have shown that the makers of Perdiz points (i.e., Toyah peoples) followed directly on the heels of those who made Scallorn points (i.e., Austin peoples) and probably even partially overlapped in time (Prewitt 1985). Today, as archeologists are continuing to try to understand the timing and nature of the cultural relationships among Late Prehistoric cultural manifestations, the archeological data excavated and presented by Jelks over 30 years ago are used time and again as comparative points of reference (Black 1986:249; Johnson 1994:246-248; Prewitt 1981:82-84; Quigg and Peck 1995:176; Ricklis and Collins 1994:298-304). While it is likely that Toyah culture was in part shared by peoples who were present in earliest historic times, such as the Mayeye (Newcomb 1993) and perhaps the Sanans (Johnson and Campbell 1992), these were the very groups that were displaced by the mounted aboriginal raiders who moved into the region in the 17th and 18th centuries (see Newcomb 1993).

As this example shows, the written archeological record of prehistoric Texas is a dynamic and constantly changing set of documents in which archeologists attempt to record and preserve the results of our research. As research opportunities arise, we go back to the field and sample more of the in-the-ground record, giving rise to new, improved, but never perfect understandings as archeologists fulfill their ethical obligation to publish and make available the results of their research. Academic scholars have traditionally published in peer-reviewed academic journals, such as *American Antiquity*, in scholarly volumes published by university presses, and in regional journals such as the *Bulletin of the Texas Archeological Society*. Effective scholarly publication is a time-consuming, expensive task because the intended result is a polished, carefully reasoned, tightly edited, well-illustrated, well-produced volume.

CRM archeology generally moves at a much faster pace and, unfortunately, generally has much lower standards. In Texas, the growth of CRM archeology has led to an overwhelming quantity of printed information: letter reports, survey reports, testing reports, and mitigation volumes. While there are fine studies among these, the average report is hastily produced, minimally edited, poorly illustrated, and crudely printed. Further, there is much duplication of effort, because CRM archeologists feel obligated to provide the background and basic explanations that the sponsors of research often do not have (but rarely care to learn). The cost of producing badly done reports is one of the major ones associated with CRM archeology. The problem is well known to anyone who has actually looked at the stacks and stacks of reports that CRM archeology generates. Aside the relatively small, but crucially important, fraction of substantive reports, most CRM reports are, in my opinion, remarkably free of meaningful content. In fact, most ordinary reports look and sound alike, because they basically contain the same things written in the same dull, technical style. If the common claim is true, that we CRM archeologists write only for each other, much of our published record would seem to suggest that we hold each other in exceptionally low regard.

I often find more interesting reading in the journals produced by the most dedicated of the volunteers who comprise the regional and local societies. There, one finds timely articles by professional, avocational, and student archeologists on a range of archeological and historical subjects. The one I regularly receive and enjoy is *La Tierra*, the quarterly journal of the STAA, now in its 22nd year. Even longer traditions are maintained by the El Paso Archaeological Society (*The Artifact*) and the Dallas Archeological Society (*The Record*). Although the quality of articles and the production of the regional journals is highly varied, much good data are reported nowhere else.

HOW TEXAS ARCHEOLOGY 1995 WORKS

To explain more clearly how archeology works today, I need to discuss the roles of key groups of "players," some of whom have already been mentioned. The many individuals and organizations that play a role in current Texas archeology have diverse interests and involvements, roles which are sometimes adversarial to one another. Some players do archeology, while others sponsor, regulate, manage, legislate, consume, preserve, encourage, allow, protect, destroy, or do their best to avoid archeology. This sketch is of necessity incomplete and perhaps not entirely objective, as I am sometimes in the thick of things. Like most attempts to fit people or archeological things into neat piles, there are gaps and overlaps. I shall begin by taking a closer look at how each of three groups of North American archeologists—academic, CRM, and avocational—are involved in Texas archeology.

There are academic archeologists at all of the major public and private universities in the state and some of the smaller colleges as well. Many academics have little direct involvement in Texas archeology, but may have considerable impact through their scholarly contributions. For example, the man many consider the most influential modern archeological thinker in North America, Lewis D. Binford, is presently on the faculty of SMU. Binford was the acknowledged intellectual leader of the New Archeology, a reactionary movement in North American archeology in the 1960s and 1970s. The New Archeologists, most of whom were among the younger academic archeologists of the day, wrenched the prevailing research agenda of North American archeologists away from its traditional concentration on chronology and culture history and toward what they considered more explicitly scientific approaches and a primary concern with cultural processes (see Dunnell 1986; Trigger 1989). While Texas archeology remained on the sidelines during much of the upheaval and debate, its research goals and methods have changed somewhat in response to wider intellectual trends, as many of the articles in this volume attest.

Resident academic archeologists also contribute to Texas archeology by training undergraduate and graduate students and by participating directly in archeological research. With the exception of a small number of mostly Old World archeologists who are connected with Classics, Art History, and Middle Eastern Studies, academic archeologists in Texas are faculty members in anthropology (or sometimes geography) departments. They teach courses on many aspects of archeology and often involve graduate students (and sometimes undergraduates) in their research projects. This is directly reflected in the comparatively small number of Ph.D. dissertations that have been written on Texas archeology. Most advanced students are encouraged to work toward their mentor's goals in other areas of the world. From the present perspective, this is highly regrettable, because doctoral research often contributes very importantly to the archeology of any region. Interesting, among the small number of examples that can be cited of such energizing studies, about as many were accomplished by Texas archeologists who left the state to study elsewhere (e.g., Weir 1976; Creel 1986) as were done locally (e.g., Shafer 1973; Ricklis 1990).

Most of the academics who actively participate in Texas archeology periodically teach summer field schools. In any given summer there may be as many as 4-5 field schools going on in different places in Texas. For instance, in late June of each of the last four years I have enjoyed visiting the Texas Tech University (TTU) field school near San Saba in Central Texas that is directed by my long-time friend and colleague, Grant Hall. As is typical of university field schools, most of the students are undergraduates getting their first exposure to hands-on archeology. While relatively few will make a career of archeology, many will remember the experience fondly and may participate in archeology again on an avocational basis. I know of a half dozen of Grant's former field school students who are employed in CRM archeology in Texas and elsewhere, as well as several who are now in graduate school. As the students at the TTU field school learn about the basics and logistics of survey and test excavation, they contribute to long-term regional research. Hall has identified the San Saba area as one that, because of its concentration of native pecan trees and permanent springs, would have been an important resource area for Archaic hunter-gatherers. Over the next several decades, Hall hopes to continue working in the area (with anyone who will join him) to gain the kind of in-depth understanding of the cultural and natural history of the region that can only come from experience. As I see it, most archeological research efforts in Texas would be more effective if they were conceived and coordinated on a regional basis.

For me the most disheartening aspect of academic archeology in Texas is the present gulf between theoretical/methodological ideals and the realities of CRM archeology. Most academic programs continue to prepare more and more students to become academic archeologists despite the fact that only a small fraction of those graduating with advanced degrees will obtain academic positions (see Schuldenrein 1995). In the real world of archeological employment, the vast majority of all the jobs are CRM-related. To succeed in the CRM world, archeological students need training and exposure to such aspects of modern archeology as situational ethics, CRM law and the regulatory process, government- and private-sector employment opportunities, and even business administration. To my knowledge, the only academic program in Texas archeology that regularly offers formal courses in CRM or "applied" archeology is TAMU. Other anthropology departments, such as the largest one in the state at UT-Austin, continue to act as though an academically-oriented education will best serve their students. While UT-Austin and other universities have organized research branches (such as TARL) that provide some students with employment opportunities and firsthand experience in CRM archeology, far less integration exists than should and could (Blanton 1995).

I find it fascinating and encouraging that so many undergraduate and graduate students take an interest in Texas archeology. While many of these students are young, a surprising number are older people who have followed other paths through life and have returned to school to pursue an interest in the human past. They do not study, knowingly, to prepare themselves to be management or business types; they study to become archeological researchers. Longtime readers of the *Bulletin* and the regional journals have seen many examples of the potential revealed by student research articles, but must wonder what happens to all those whose names never surface again. As they progress through the educational system, students encounter many of the same promises and problems that I describe in this article and they, too, wonder if they will find employment that satisfies both their need for a steady income and their desire to contribute to meaningful research. While some find that they have no real aptitude for painstaking research, many become disheartened because of the mismatch they encounter between academic promise and CRM reality, and they leave archeology never to return. However, others persist. Some go on to make significant contributions to archeology in Texas or elsewhere, but others seem to bow their once-promising heads to what I see as the darker side of CRM reality and become part of the problem.

I have made the basic distinctions among private-sector, university-affiliated, and government archeologists. About a third of the 300-400 CRM archeologists in the state belong to the Council of Texas Archeologists (CTA), a professional organization that meets twice a year to discuss shared issues. The CTA also provides a listing of archeological contractors. The May 1995 list reveals that in the private-sector there are at least 40 firms that periodically employ archeologists in Texas, although at least a third of these are essentially one-person operations. The private firms include those like Prewitt and Associates, Inc. of Austin and Moore Archaeological Consulting of Houston that focus exclusively on archeology, as well as larger consulting companies like Espey, Huston and Associates, Inc. of Austin, Sandra Hicks and Company of Austin, and Geo-Marine, Inc. of Plano that provide a variety of environmental and cultural services. Among the multi-service companies, there are still larger consulting firms like TRC Mariah Associates Inc. and SWCA Environmental Consultants that have offices in Austin, but are headquartered in other states. Further, consulting firms in adjacent states and elsewhere in the country sometimes do archeological work in Texas. The private archeological consulting business is fluid and difficult to track as companies expand and contract in step with business.

I have mentioned the larger university-affiliated research organizations, TARL at UT-Austin, CEA at TAMU, and CAR at UTSA. There are smaller contract programs at the University of Texas at El Paso, Stephen F. Austin University (Nacogdoches), and UNT (Denton). The major federal agencies that have archeologists in Texas include the Corps of Engineers with offices in Ft. Worth and Galveston, the U.S. Forest Service, and the U.S. Army at Ft. Hood and Ft. Bliss. Other federal archeologists in the state work for the U.S. Air Force and the National Park Service (NPS). At the state level, the largest archeological employer is the Texas Historical Commission, followed by the Texas Department of Transportation, the Texas Parks and Wildlife Department, the Texas Water Development Board, the Adjutant General's Office (Army National Guard of Texas) and, finally, the Texas General Land Office (GLO) who has a single archeologist, Bob Skiles. Bob's career is an interesting example of how CRM archeologists often move from one group to the next. He got his start with university contract outfits at SMU and UNT, then worked for the U.S. Forest Service in East Texas, and now works for the GLO in Austin.

Among the CRM archeologists and organizations that actually do compliance fieldwork, I see a basic distinction between those which I will call "reactive" and others who may be said to be "proactive" with regard to archeological research. While there are many shades of gray, the end members, at least, are accurately described by my caricatures. Proactive archeologists attempt to carry out compliance work in a conscientious way, generally doing average or above-average work with whatever archeological task falls their way. When given a choice, these individuals generally do the archeologically ethical thing to the best of their training and ability, within the constraints of the situation. In contrast, reactive "archeologists" seem to care about archeology only when it is particularly exciting or falls within their favored area of the state, or when forced to. Many are just lazy, but some are downright dishonest. They cut corners whenever possible. Ironically, reactive archeologists sometimes piously claim the high road of archeological righteousness and justify their professional irresponsibility on the nature of the archeological record. Only "good" sites deserve good work, they say (thereby acknowledging that they ordinarily do bad or cursory work). Unfortunately, despite not having the respect of most of their colleagues, a fair number of these individuals end up in positions of authority and responsibility, often undermining or thwarting the efforts of the proactive archeologists who work under them. Since the principals of any organization usually determine the nature of its contributions to, and attitudes about, archeological research, one can ordinarily distinguish between reactive and proactive organizations. I will use this admittedly overdrawn proactive vs. reactive distinction to help illustrate certain tensions in Texas archeology.

CRM archeology is driven by federal and state laws, regulations, and rules. These include laws such as the National Historic Preservation Act of 1966 and the Antiquities Code of Texas (written in 1969 and amended several times since, most recently in 1995), as well as regulations such 36 CFR 60, Department of the Interior Regulations concerning the National Register of Historic Places. Leaving aside the many technicalities, the obvious intent of this extensive body of laws and regulations is to offer some protection to cultural resources (such as archeological sites) by insuring that when federal- or state-funded, permitted, or approved land-altering actions take place, steps are taken to avoid or mitigate the impact of these actions on the resources. All Federally permitted, funded, or approved "undertakings" (land-altering actions) must follow what is known as the Section 106 process (of the National Historic Preservation Act of 1966). Examples of such undertakings include the state's building of interstate and state highways with federal moneys, the building of recreational facilities on NPS land at Lake Amistad, and the issuing of discharge permits by the Environmental Protection Agency for lignite mines in East Texas. The Section 106 process involves the determination of whether affected archeological sites are eligible for inclusion in the National Register of Historic Places (i.e., are important), and, if so, what actions should be taken to protect the sites or salvage a reasonable part of the information that they contain. The complex federal process is administered and enforced through the State Historic Preservation Office, the Texas Historical Commission (THC). The THC also administers and enforces the Antiquities Code, which requires permits (under certain conditions) when land-altering actions are carried out on property that is owned or controlled by a state agency or any of the state's political subdivision (counties, municipalities, etc.). While there are important differences, the federal and state processes are broadly equivalent.

Like most areas of government, what began as a well-intentioned and straightforward aim—to protect archeological sites and preserve the information that they contain—has become a complex, time-consuming, and very expensive process. Simplified, it works more or less as follows. The archeological regulators at the THC and among various federal agencies attempt to encourage, cajole, and coerce "sponsors," governmental agencies, political subdivisions, and private concerns who need governmental approval, to determine if they have responsibilities under these laws and if their actions will have an adverse impact on "culturally or scientifically-significant" archeological sites. Sponsors do this by hiring or employing CRM archeologists to survey a given property and evaluate the encountered sites, usually by probing or testing with hand and mechanized methods. CRM archeologists usually find sites for the simple reason that prehistoric and historic sites abound in the state. While the proactive archeologists generally find more sites and answer "yes" or "maybe" more often to the question of site significance than reactive archeologists, initial work rarely suffices when the area to be affected is sizable and/or situated along permanent water. This is because little is actually known about the hundreds of thousands of archeological sites present in Texas; hence most sites have some theoretical (or actual) potential to yield scientifically useful information. A "yes" or "maybe" answer means, of course, that more investigation time (which means money) is needed to further test to determine if a site is important enough to be excavated. If it is, and the site cannot be avoided or protected from the action, even more time/money will be needed.

CRM archeology, like purely academic research, is costly for many reasons, such as the not-unreasonable desire for profitability among private contractors. Most reasons, however, have to do with the changing nature of archeological research and the cost of life in late 20th century America. Sticking to the former, modern archeological research is expensive for two reasons, time and technicality. The process of intelligently and thoroughly investigating informative archeological sites is extremely time consuming (and in professional life, time equals money). While there are ways to speed things up, to focus more narrowly, and to extrapolate from smallish samples, thorough field archeology requires a great deal of human effort. While earlier generations of Texas archeologists dug fast and saved only the "goodies" (intact or well-shaped artifacts), today we recognize that the answers to much of what we want to know about aboriginal life can only come from recording the crucial observations that document the patterning of artifacts, features, and natural deposits before the archeological context is shoveled away. We also understand that often we must closely scrutinize the minutiae, the fragments as well as the good stuff, the tiny charred pieces of animal bone and plants, the very grains of the soil which envelop archeological deposits. Increasingly important and informative are technical studies such as the identification of animal bones and plants, radiocarbon dating, pollen and phytolith (plant crystals) identification, soil chemistry, petrographic examination of pottery thin sections, and forensic studies of human bone. These specialized studies are part and parcel of modern archeological research and the developing subfields such as archeometry, zooarcheology, paleobotany, and geomorphology.

Many millions of dollars are spent each year in Texas as part of CRM work. No one really knows how much is spent because the funds are dispersed by many different public and private organizations. My educated guess is that at least 10 million dollars will be expended in 1995 on contracted CRM archeological research in Texas. Since this does not include the cost of work done by the 60-70 archeologists who are on government payrolls, add another roughly 2 million for federal and state archeologists headquartered in Texas. Conservatively, then, I estimate that at least 12 million dollars will be spent on archeology in Texas during 1995, although the true figure could be twice that. The reader might find this figure astonishing and might wonder what is being learned for all this money; so do I. (Many of the data summarized and presented in the other articles in this Bulletin were gathered during CRM work, and provide a partial answer.)

The sponsoring organizations who distribute these monies include state and federal agencies, regional and local utilities, land developers, and other private businesses. In Texas, the federal agencies who directly sponsor research include all those previously listed as employers of archeologists, as well as the Bureau of Reclamation, the Department of Energy, and various others. Certain state organizations, such as the Texas Department of Transportation (TxDOT) sponsor or administer archeology on behalf of federal agencies, in this case the Federal Highways Administration, as well as for the state. In addition to TxDOT, the sponsoring agencies at the state level include the Texas Water Development Board and the Texas Parks and Wildlife Department. As mentioned, some of these federal and state agencies have archeologists on their staffs who carry out or contract out archeological research work. Beyond the strictly governmental realm, regional quasi-governmental agencies such as the

LCRA sponsor archeology, as do many municipalities and towns. The other major group of sponsors are private land developers, such as mining companies, who contract archeological services as part of the federal and state environmental review and permitting process.

Few of these sponsoring agencies and organizations are motivated to become seriously involved in archeology because of a primary concern with the impact their activities might have on archeological sites and other types of cultural resources. They sponsor research and contract archeological services because federal and state regulations require them to do so and because archeologists working for federal and state agencies force them to meet these requirements. In Texas, most of this responsibility falls to (or involves) the Texas Historical Commission, a small state agency that has the unenviable burden of attempting to balance the many conflicting interests involved in archeology.

The daily workings of the THC are in the hands of its Executive Director, Curtis D. Tunnell (himself an archeologist), who runs the agency on behalf of 18 commissioners who are private citizens (usually politically connected) appointed for 3-year terms by the Governor. Rose Treviño, historic preservationist, TAS member, and avocational from Laredo, Texas, is the only archeologist who has ever served as a commissioner. Fortunately, due to recent changes mandated by the 74th Legislature, in the future, one of the commissioners will always be a professional archeologist. Also new is a seven-person Antiquities Advisory Board (which includes five archeologists) which will advise the Commissioners on archeological matters related to the Antiquities Code. The Commission meets four times a year, and rules on certain preservation issues such as the occasionally hotly contested designation of State Archeological Landmarks (a protective designation that is somewhat confusingly applied more often to historic buildings than archeological sites). However, the day-to-day decisions are made by agency staff, who have a mission to encourage the preservation and protection of historically important cultural resources, including buildings and other types of historical properties, as well as archeological sites. Two THC departments deal with archeology, the Department of Antiquities Protection (DAP), headed currently by Dr. James Bruseth, and the Office of the State Archeologist (OSA), headed by Pat Mercado-Allinger, the acting State Archeologist.

The Office of the State Archeologist is funded primarily by the state, and is charged with working with private landowners and citizens to protect and preserve archeological sites on private land. They have a staff of four archeologists (including Mercado-Allinger) and several support people, including a publications editor. OSA does some research, particularly in rescue situations when private funds can be raised, but focuses its efforts on education and on working with avocational archeologists. Since 1984, one of the most important projects of the OSA has been its Archeological Stewardship Network, composed of about 50 avocational archeologists across the state who serve as the eyes and ears of the THC. Among their duties, the stewards try to monitor land-altering activities in their corners of the state, and to alert OSA and DAP when archeological opportunities and problems come to their attention. Stewards record sites, salvage important finds and document collections, and generally try to stay on top of the archeology in their local areas, tasks that the small Austin-based staff of the THC cannot possibly do. Along with the TAS and CTA, the OSA also cosponsors Texas Archeology Awareness week (now month) in April of each year. This highly successful program provides archeological speakers and literature to public groups and schools around the state. The OSA also publishes well-produced archeological reports and educational brochures. While OSA gets drawn into various archeologically related conflicts, these generally pale by comparison to those facing DAP.

The Department of Antiquities Protection is charged with making sure that the federal Section 106 process is followed by federal agencies and project sponsors, as well as overseeing the provisions of the Antiquities Code of Texas that deal with archeological sites. Because DAP administers, on behalf of the state of Texas, the Section 106 review process, it receives a substantial portion of its funding from federal sources. DAP has a regular staff of eight archeologists (including Bruseth) and three support people. In addition, four other staff members (two of whom are also archeologists) are working on the Texas Historic Sites Atlas Project, a sizable, federally funded project to create a statewide electronic database of historic and prehistoric site information. The regular staff archeologists spend most of their time reviewing the small mountains of paperwork that flow through DAP week-in, week-out. Their task is to sort through the notices of federal, state, and local actions to find the relatively small number of activities that may adversely affect (impact) archeological sites. Project reviewing is a difficult and largely thankless task even in the best of times, a process that virtually the entire CRM community in Texas depends on for its livelihood. In spite of this, or perhaps because of it, DAP is the lightning rod for criticism and controversy concerning archeological problems in the state of Texas.

The Department of Antiquities Protection lies at the nexus of sponsors, CRM archeologists, Texas politicians, and federal regulatory agencies, groups which often have competing and conflicting interests and priorities. Understandably, most of the sponsors want to be done with archeology as quickly and as cheaply as possible so they can accomplish their larger construction goal. However, relatively few sponsors understand how CRM archeology works. Sometimes out of ignorance, sponsors at times contract with the more reactive CRM organizations and archeologists, who care more about serving their business client, the sponsor, than they do about doing good archeology. While keeping the sponsors happy and doing good archeology need not be an either-or situation, it all too often is. With profit as their primary motive, reactive CRM firms bid as high as they can (but as low as needed to get the work), and then do as little archeology as they think they can get away with. Naturally, DAP should deal with reactive CRM archeologists with a heavy hand, double-checking their claims and often demanding that a more thorough job be done. Yet, what would be judged "shoddy" or substandard work by most competent archeologists regularly goes unchallenged because DAP reviewers do not have the resources, the motivation, and/or the mandate to investigate every suspect case. However, sometimes the reported work is blatantly inadequate or misrepresented (such as one archeologist's claim that he had single-handedly dug, screened, and recorded some 90-100 shovel tests in a single day!). On other occasions, an OSA Steward or other archeologist blows the whistle on problems by alerting DAP to the existence of additional sites within the affected area or to the potential significance of sites that a CRM firm (or governmental agency) has judged insignificant.

When shoddy work is called into question, the reactionary archeologist always blames the need for more work on DAP, sometimes causing the sponsor to complain to DAP. In extreme cases, usually involving large tracts and costly archeological investigations, sponsors have been known to call friendly politicians who themselves do not understand archeology. "We have already spent nearly a million dollars" they might say (omitting mention that the costs often reflect the incompetence and greed of their archeological contractor more than the amount of archeology done), "we just can't afford any more." The sponsors or their politicians demand explanation and reprieve from DAP (or from the THC's Executive Director). In Section 106 cases, the THC truthfully responds that they are merely insuring that federal laws and regulations relating to archeology are met by project sponsors and federal agencies. Still, the THC is vulnerable to political pressure because its state funding and the Antiquities Code is in the powerful and capricious hands of the Texas Legislature. While many such calls can be handled by calm explanations of the process, the political pressure results, more often than DAP admits, in a decision to "back off" from its demands that reactive CRM archeologists do a competent job. Regrettably, it is the archeological record that suffers, not the unethical archeologists.

With most proactive CRM archeologists, DAP does not need a heavy hand because they know that conscientious archeologists make good-faith archeological evaluations and attempt to do an adequate amount of work. Even so, differences can arise between the sponsor, the CRM contractor, and DAP as archeological significance, costs, and timing, are weighed and debated. Project sponsors often find the costs of archeology more than what they had initially budgeted (usually without benefit of consultation with archeologically knowledgeable individuals), especially when they delay archeological decisions until late in the process. Zealous contractors are sometimes unwilling to do less than what they see as the archeologically correct thing to do, irrespective of costs and political realities. DAP tries to steer a neutral road by seeming to side with both, and often ends up making everybody unhappy and suspicious. Further, in their usual attempt to be impartial, DAP reviewers have been known to scrutinize proactive work more carefully than reactive work (i.e., trivial problems are pointed out and small decisions are questioned). Although such actions and differences cause resentment and sometimes delay, the proactive archeologists usually take their complaints directly to DAP and ultimately achieve some kind of workable compromise.

In sum, sponsors perceive themselves to be at the mercy of archeologists, who always blame the problems on DAP, who blame the federal agencies and regulations. Few sponsors have the knowledge of the CRM archeological world to be able to realize that a higher initial bid from a competent, proactive firm may end up costing them less in the long run, especially if they use the occasion to gain the positive publicity that can be garnered by sponsoring important research. The reactive firms often submit unrealistic initial bids, knowing that DAP will force them to do more work, which they can bill the client for, blaming added costs on DAP. The proactive archeologists get upset when they see DAP caving in to real and perceived political pressures and letting reactive archeologists (their competitors) get away with inadequate work. The result is a vicious circle that, at times, has all sides distrusting and resenting DAP.

Doubtlessly, many sponsors and CRM archeologists do not see the CRM world the way I do. Having served on DAP's 1992-1994 CRM Advisory Board, a small, diverse group of CRM and avocational archeologists, I appreciate the extremely important and unavoidably difficult nature of DAP's role. On the balance, I think that DAP usually does a commendable job. However, I do not agree with the way political pressure is often handled. As I perceive it, DAP makes archeologically unfavorable deals and caves in to perceived and real political pressure out of a belief that this will stave off the powerful sponsors, business groups, and bought politicians who want to see archeological laws and rules weakened (e.g., Ivanovich 1995). I think that just the opposite happens: When the power players see that DAP will bend to pressure, they are encouraged to lean even more heavily. DAP claims that this behind-the-scenes political bargaining saves the archeological day by "keeping the preservation tools intact" (a euphemism which apparently means "preserve the bureaucracy at any cost"). I think the only right thing for DAP to do is to address such matters openly, and to consistently argue in favor of doing what is best for the archeological record (i.e., to protect the state's antiquities).

The reader may find this seamy underside of CRM archeology disturbing; so do I and so do most conscientious professional archeologists. Many of my colleagues feel powerless to do anything about the situation and some fear, not without reason, that speaking up might make their professional lives more difficult. Others fear that if we draw attention to our problems, we will provide ammunition for archeology's foes. I feel strongly that cleaning up the CRM process is a responsibility that we cannot postpone or conceal, although I realize all too well that the road to a better CRM tomorrow will not be an easy one.

Let me now turn to the more pleasant task of mentioning recent examples of some of the quality research that CRM archeologists in Texas are producing before I discuss the roles of other players in Texas archeology. By focusing attention on the troubles of CRM archeology, I run the risk of making it seem as though nothing good ever happens. This is far from the case, as demonstrated by four recent studies that have provided outstanding data, as well as stimulating ideas. The need for a large water pipeline in Tom Green County brought about the 1993 discovery and partial excavation of an unusually well-stratified and preserved Toyah campsite (Quigg and Peck 1995). This important report's major strengths are its data presentation and timely publication. Many years earlier, the construction of IH 10 in Kimble County occasioned the excavation of an interestingly different Toyah campsite. After long delay, the results were studied and a lively comparative study was published in a volume that is quite well-produced by CRM standards (Johnson 1994). At about the same time far to the south in Live Oak County, the building of IH 37 was scheduled to obliterate a large prehistoric cemetery containing the bones and grave goods of Archaic peoples who lived in the region some 2,500 years ago. Fortunately, TxDOT archeologists were able to carry out a major excavation, and eventually the results were analyzed and a fine report produced that is jam-packed with very useful and well-presented data (Taylor and Highley 1995). My final recent example is a project done on Galveston Island, where a civic-minded developer funded the study of a cemetery and campsite that dates to the latest prehistoric era and early historic period (Ricklis 1994). This report is exemplary because of its data presentation and the skillful integration of archeological and ethnohistorical data. These are but a few of many examples that could be cited where CRM monies result in the salvaging of important information in advance of land-altering activities.

Having taken Jack Jackson to task for how he has handled reburial issues, it is only fair that I acknowledge his contributions as a manager of cultural resources. Since the late 1980s, Jackson has overseen the archeological resources at Fort Hood, a huge expanse of land in Bell and Coryell counties controlled by the U.S. Army. Jackson and his predecessor, Frederick Briuer, have managed the Army's efforts for almost 20 years to fulfill its obligations under the National Historic Preservation Act. Work by TAMU, TRC Mariah Associates, and now Prewitt and Associates, has been aimed at inventorying and evaluating the archeological record that the Army manages. While this work has been time consuming and costly, over 30 published studies have documented a huge research base of dated site deposits, many of which are not immediately threatened. In the 21st century, this data base may prove very important to archeologists as a conserved, well-documented archeological record that may be made available for focused research efforts.

The many avocational archeologists in the state contribute in diverse ways, many of which I have mentioned. The regional and local societies regularly undertake survey and excavation work, sometimes assisting professional archeologists. Although avocational archeologists usually do not receive much recognition, the Society for American Archaeology's Crabtree Award for lifelong avocational contributions has been awarded to three individuals who have worked in Texas since the award was established in 1985. In that year, the first recipient was the late Clarence Webb, who was recognized for his contributions to Caddo archeology in Texas and Louisiana. In 1989, the late J. B. Sollberger (formerly of Dallas) was acknowledged for his experimental lithic research. Most recently in 1994, Leland W. Patterson of Houston was recognized for his prolific and wide-ranging contributions to archeology.

I have cited other examples of particularly dedicated avocationals who specialize, like many professionals do, on some topic or area and, over time, become respected experts. Other avocationals work with relic collectors and landowners to document sites and artifact collections. For instance, longtime STAA and TAS member and Steward C. K. Chandler of San Antonio has labored tirelessly for many years to record sites and bring important collections and finds to printed light (e.g., Chandler 1995). Some professional archeologists are opposed to having anything to do with poorly provenienced and improperly excavated artifacts, reasoning that by cooperating, archeologists will lend an air of legitimacy to collecting and looting. While I agree in cases that involve antiquities buying, selling, or trading, I believe that there is much more to be gained by documenting the collections of recreational collectors than by chastising these people. Most collectors are ordinary citizens motivated by a genuine, if uninformed, interest in the human past. I know of many examples where such collectors have become involved in archeology through avocational societies, and then have contributed to archeology. In fact, many of the leading professional archeologists in this state were first introduced to archeology through collecting. It is usually through contact with avocational and professional archeologists that collectors become more informed and responsible about archeology.

The final two players, private landowners and the general public, are potentially the most important players of all. Since most land in Texas is held in private hands, and since the state's laws allow most private landowners to do what they please with archeological sites, landowners hold one of the most important keys to archeology's future. I have found that most ranchers, farmers, and other landowners (including some developers), have a genuine interest in the natural and cultural history of their land. Some of archeology's most tireless and effective workers have come from the ranks of rural landowners; historian and avocational archeologist Kay D. Hindes of Charlotte, springs immediately to mind (e.g., Hindes et al. 1995) as does Wharton County rancher and avocational Joe D. Hudgins (e.g., Hudgins 1993). When archeologists earn landowners' respect, we often find them willing and interested in protecting important archeological sites. However, developing such relationships takes a commitment on the part of the archeologist to respect the rights and wishes of the landowner. Obtaining permission to enter private land, leaving gates as you find them, crossing fences through gates, obeying landowner rules, and keeping one's promises are essential behaviors for the responsible archeologist.

Recently, though, I have become troubled by the more reactionary forces involved in the property rights movement, as I have encountered several landowners who have refused me access, when only a few years before they were willing and cooperative. "Why," I ask, "did I break my word?" "No, it's just that this 'environmental' thing has me upset," one banker in West Central Texas told me. Apparently he had been persuaded that unnamed "environmentalists" would use any excuse (including archeology) to obtain access to private land for untoward purposes. I think such scare tactics are ludicrous, but the banker was quite sincere and unmoved by my lengthy letter explaining exactly what I wanted to do (a minor reconnaissance while collecting ochre and chert samples for comparative analyses). I mention this in hopes that archeologists will be aware of the heightened sensitivity of landowners and will keep archeological issues separate from environmental issues and property rights. We archeologists already have our hands full in educating landowners and other members of the public about the value and long-term potential of important archeological sites.

Archeology's biggest potential audience is the general public. I cannot count the times that, when introduced to a stranger as an archeologist, I have heard "I always wanted to be an archeologist" or "archeology is so-o-o fascinating." Average people are interested in archeology because they understand, often more clearly than archeologists, that we all have a share in the human past. They want to know many of the same things that archeologists want to know, although most are uninterested in technicalities and the painstaking research process. They want to know who did what in the past and why. Unthinkingly, we archeologists often reply in our normal dry, jargon-laden, and overly qualified archeo-speak. As my wife put it, after sitting through what I had thought was a very public-oriented, well-illustrated talk, "most people are not as interested in [burned] rocks as you are." I believe that to insure a bright future for (Texas) archeology, we must concentrate on building and maintaining "audience share." We need to give back to the public that directly and indirectly supports archeological work more of what they want to learn (Lintz 1994). Through education and increased public participation, I am convinced that more people will want to hear about the fascinating implications of the lowly burned rock and other sorts of mundane, but potentially revealing archeological evidence.

(TEXAS) ARCHEOLOGY IN THE 21ST CENTURY?

While earlier generations of archeologists in Texas and elsewhere in North America shared a world view of how archeology was to be done and what archeology was after (Dunnell 1986), 21st century archeologists will continue to diversify. Interest will proliferate in different: periods of the past, cultures, theoretical perspectives, methods, research specialties, and motivations for doing archeology. This diversification will continue simply because of the growing numbers of people who live in the state and take part in archeological research, because there are so many ways that the past can be explored, and because there are many uses to which the past can be put. As we increasingly recognize the complexities of the past, we realize that there is no one true path to knowledge, but many pathways which can and should be explored.

It is equally apparent that certain unproductive trails should be avoided. An obvious example is the one that led archeologists to excavate Caddo cemetery sites as recently as two years ago in Northeast Texas without taking into consideration the views of the modern Caddo people. Other unproductive pathways are commingled with productive ones in the tangled mess of laws, bureaucracy, "research" by low-bid, and good archeology that is subsumed under the shingle of CRM. Where is (Texas) archeology to go?

The shape of the archeological future in Texas will be closely tied to social, technological, and political changes. We are witnessing a period during which politicians and the public are struggling with social issues and the nature of government involvement. Those who are taking aim at the enormous federal government and its seemingly voracious spending have gone after historic preservation funding and the budgets of many agencies (such as the Corps of Engineers) that play important roles in Texas archeology. So far, the cuts in most of the areas that affect CRM funding seem to be relatively minor, but these decreases may very well constitute the first wave of many to come, I suspect. Perhaps this is because I see up close plenty of examples of needless waste, well-intentioned but hopelessly cumbersome regulations, and misdirected effort in the federal and state CRM process. However, all things are relative, and the magnitude of archeological spending pales by comparison with that of many other areas of government. Some of my colleagues believe that the federal and state CRM processes are too firmly ingrained to be done away with, and point to continued public support for historic preservation.

The problems of CRM archeology are certainly not unique to Texas (or to archeology) and are currently being chronicled and debated elsewhere in the country (e.g., Pape 1995). While I think it is increasingly clear that the whole process needs to be reconsidered, few participant observers see a safe path to achieving meaningful reform. In cynical moments, I am convinced that major improvements will not come about until the regulations are gutted and the present system collapses. However it happens, catastrophically or gradually, CRM archeology must change. Too much power and control is concentrated in the hands of too few well-intentioned, but entrenched bureaucrats in Austin and Washington. Those of us on the contractor side of the CRM coin, proactive and reactive alike, have vested interests in that our own needs and goals often take priority over objective assessments of archeological significance. To keep our organizations and careers afloat, we play the system to our own advantage, justifying our own excesses more easily than we do those of our competitors.

Texas archeologists of good heart and thick hide need to push the state's CRM agencies toward profound reform. Archeological bureaucrats, like academics, tend to stay put for too long, becoming inured to shortcomings, and well-practiced at rationalizing the status quo. Experience needs to be tempered with the idealism borne by fresh faces who do not yet conceive most problems as intractable. To effectively manage the cultural resources of our vast and geographically diverse state, we need to move toward regionally based systems of planning, review, and research where the important decisions are shared by a broader spectrum of archeologically knowledgeable individuals. Our vested interests need to be openly disclosed and balanced against objective measures of research significance, need, and value. And we CRM archeologists need to consistently serve the needs of the archeological record at least as well as we do those of our sponsors, and ourselves.

During the CRM boom of recent decades, the traditional bonds among the relatively few professional archeologists and the relatively many avocational archeologists have weakened. Today many of the professional archeologists in the state do their work with comparatively little interaction with avocationals. This trend is one that I think is particularly harmful, though perhaps understandable. Archeology as a business operates at a hurried pace that often does not allow time for developing and cultivating relationships between paid and unpaid archeologist. The increasingly technical nature of archeological research and writing is also to blame as fewer and fewer people find archeological reports interesting and readable.

However, from my perspective it will be absolutely crucial to the survival of archeology in the 21st century that professional and avocational archeology be reunited. Here is why. The archeological record is disappearing at an ever-increasing pace. There will never be enough money and time for professionals to salvage or investigate the disappearing record fully. The efforts, skills, and enthusiasm of avocational archeologists can help increase the odds that any single site or deposit is at least partially sampled before it is gone. Besides, the fun of archeology is the process of discovery, and sharing that discovery with people who care. What is the point of spending great chunks of archeological research time and effort in our all-too-short lives to learn things that nobody gives a tinker's spring about? For me, more good archeological data and more good archeological participants means more fun, more stimulation, and more meaningful interaction about the archeological record.

How do we achieve this reunification, or rather, improved integration? I think the lion's share of the responsibility here falls to the professional archeologists. Too many paid archeologists do not participate in the societies, Archeology Awareness Week, or any after-hours activities in archeology. Professionals need to realize that we are part of a wider archeological community and that cooperation with avocational archeologists and the archeologically interested public is part of our responsibilities as members of the discipline. All CRM organizations and agencies should encourage staff members to participate in the events of archeological societies and organizations as part of their professional obligation to share knowledge.

Texas archeology of the next century will operate in an increasingly different technological and social environment from what we have now. On the social side, more and more people will live in the state and they will have more and more diverse interests, if less and less free time. Thus, there will be an ever larger pool of possible participants and consumers of Texas archeology. Clever archeologists among us will harness this potential by devising imaginative ways of involving avocationals and non-archeologists more meaningfully in the potentially creative human interaction that is archeology. I think the primary means for involving more people in archeology will come from the rapidly changing technological world.

It is estimated that by the end of 1995, 40 percent of American households will have personal computers. I would guess that this percentage is much higher among most professional archeologists in Texas and probably among avocationals as well. I bought my first one in 1982, and have relied on computers ever since, primarily as writing tools, but increasingly as the means of organizing, collecting, and analyzing data, as well as a communication device. From my house in Austin I can participate nightly in debates and exchanges with archeologists across North America and the world. Information, trivial and substantive, travels almost instantaneously. For instance, last July I sent a message to Al Wesolowsky, former Texan archeologist who is the managing editor of the *Journal for Field Archaeology* at Boston University, telling him of the news that underwater archeologist J. Barto Arnold of the THC had apparently discovered one of La Salle's ships in Matagorda Bay. Not surprisingly, Al had already seen digital rumor of this as-yet-unannounced discovery, and was keen to know details. The world is truly becoming a global village for those of us with access to technology.

In the early 21st century, the computer will be integrated with the television and telephone to fundamentally change communication and information exchange. While late 20th century archeologists have been generally slow to harness the technology, computers offer us the very means we have long lacked to effectively manage, store, compare, and exchange the astonishingly voluminous amount of archeological data that has been pried from the in-the-ground archeological record. Resistance to doing this has come from the cost of technology and the technological phobias that some archeologists seem to have. Ironically, archeological tradition is sometimes seen as threatened by the very thing, technological change, that archeologists often study. The considerable costs of adopting technology must be weighed against the considerable cost of doing things by hand. Computers will not replace archeologists; they are simply tools that, when used effectively, will allow us to concentrate more on the fun parts of archeology: investigation, analysis, and communication. In the 21st century, new generations of computer-literate archeologists will be able to help transform and convert data collected by traditional methods to the newer technologies. The information age will offer many challenges and opportunities to Texas archeologists.

Those interested in archeology in the 21st century should, I think, take a keen interest in where the professional archeological money goes and how it is spent. Since most professional archeologists are being paid directly or indirectly to serve the public, to educate the public, to preserve cultural resources for the public future, or to fulfill public (governmental) regulations and responsibilities, the public has the right to demand accountability and participation. Taxpayers and citizens ultimately pay for most of the archeology that is done in Texas as elsewhere in this country. The archeologically motivated citizenry can and should demand accountability and participation.

What is being learned by public-sponsored digs? Why are taxpayers paying millions of dollars for what amounts to, in some cases, shoddy research and abysmal archeological records? Why can't taxpayers go to public libraries and find readable accounts of every major archeological research project? Why can't taxpayers see and even handle the artifacts that are collected by public servants and housed by public institutions? Why can't they visit digs on public lands and lend a hand? Why aren't the laws and regulations written to insure that public moneys are wisely spent (in archeology)? Why don't more local and regional museums hire an archeologist? Why don't state-funded universities train archeological students to do public-sponsored archeology? Ask and ask again.

I am encouraged by the positive steps currently being taken to keep building on the successes of the Archeological Stewards Network. However, we other archeologists need to recognize that such stewardship is within our power. That is, each of us can and should serve as archeological stewards by working locally to do what we can to rescue the rapidly vanishing in-the-ground archeological record. We need to put greater emphasis on what earlier generations called "salvage" archeology; it is hard to "manage" cultural resources that are being destroyed at ever-faster rates. The crisis of a disappearing archeological record is one that every introductory text emphasizes and one that every conscientious archeologist calls attention to whenever opportunity presents itself, but I'll make it real and recent.

In Corps of Engineers lakes in Northeast Texas, Caddo villages, graves, and houses are being relentlessly destroyed, day-in, day-out, by the actions of winds and artificial waters and by the artifact-seeking collectors and pothunters. Far to the south and west the same is happening to the remains of Coahuilteco speakers (and other ethnic groups who passed without leaving their name): cemeteries, camps, and rockshelters along both sides of the Mexican border in Falcon and Amistad reservoirs. Near El Paso, all-terrain vehicles wreck much havoc and provide ready access to Mogollon villages, houses, and graves, things that lay scarcely buried beneath the shifting sands. In the Pandhandle, collectors with metal detectors are striping away the meager traces of early Spanish visitors and potting some of the few documented historic Indian village locations. Meanwhile honest farmers plow through the playas ringed with habitation traces dating back to Clovis times, year by year.

As more and more people populate Texas and the world at large, the traces of past humans are progressively destroyed by intent, by accident, by neglect, and by the passage of time. Here in Texas, the buried archeological record is continuously and rapidly dwindling, and it is our responsibility as conscientious archeologists to act wherever and whenever we can to rescue (a term preferred by the British) what we can. Of course many of us are doing just that, but we can do more if we would coordinate and focus our actions more effectively. In my view, one of the most important missions any archeological society can aspire to is that of rescue archeology. While there are countless sites, features, and artifacts in need of rescue, we should, I think, marshall our efforts where it can be best put to use. For urban and suburban archeologists the major battlefields should be on the edges of the metropolis. As the cities relentlessly sprawl, it is in those places that the largest number of sites are threatened by construction and by the wave of uncontrolled digging that accompanies the urban expansion. The most recent session of the Texas Legislature has provided a special incentive (through a brokered deal of the sort I mentioned earlier) by exempting municipalities from following the Antiquities Code when their actions involve less than 5 acres and no sites are known before construction. Thus, by making sure that the cultural resources within and around municipalities are known and properly recorded, we can prevent undue harm to the archeological record.

I conclude this article by sketching a vision of a Texas archeology of the 21st century, an idealistic blend of the best of what we have now and what might and could be. As you read it, try not to think about the reasons why such a Texas archeology can never exist, or even the many difficult steps that achieving such a vision would require. Instead, join me in imagining (Texas) archeology as it could be in the tomorrow of the next century. The sketch touches on many elements that I think we, who are sincerely and even passionately interested in archeological scholarship, research, and interaction, should work to achieve. As I have tried to indicate throughout this essay, there are already many encouraging recent examples of the kinds of positive archeological effort and common-sense integration that I seek. The seeds of a productive archeological future for Texas are already sown, but our seedlings need coddling and protection from the tenaciously weedy and often harsh climate that is Texas archeology in 1995. Doubtlessly, my fellow archeologists present and future will create a 21st century different from what I envision, but perhaps some ideals will be shared and realized.

A Vision of (Texas) Archeology of Tomorrow

For I dipt into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that would be;

Alfred, Lord Tennyson, 1842

Texas archeology could be a place where academic, avocational, and CRM archeologists work cooperatively: sharing mutual goals whenever feasible, sharing ideas, data, and scholarly arguments freely, and taking advantage of diverse skills and interests by channeling opportunity toward the peoples and organizations that can best accomplish individual pieces of the archeological pie. Academic and contract branches of a single university would be effectively integrated, with students and teachers moving back and forth from classroom to apply method and theory hands-on. University-based researchers and specialists would also work with private compliance-oriented firms that offered efficient, competent service tailored to meet the needs of both sponsors and archeological research. CRM archeologists would have a professional guild whose members were sworn to promote ethical, competent research.

CRM funds would be generated based on fair appraisals of land-altering project impacts. These moneys would be distributed according to research and development priorities, as well as scientific and educational potential. Regionally based funding and compliance approval boards made up of rotating groups of regional experts (including CRM researchers, avocationals and academics, as well as archeologically-educated private citizens and government managers), would set reasonable standards, research priorities, and effectively administer the money. University-based archeologists and private firms would compete to win contracts to carry out specific archeolological rescue tasks and basic research, based on the quality of research designs, innovation, and delivery efficiency. Professional research organizations would be expected to accommodate capable avocational volunteers and the interested public whenever possible.

Professional and avocational archeologists would work within loosely organized research groups to monitor and steward the archeological resources of a region, and work cooperatively to share in the process and results of archeological interaction. They would also help channel and encourage citizen involvement through educational programs, field and laboratory participation, archeological experiments, and public museums. Local and regional museums would employ archeologists that helped coordinate and focus avocational and public participation. Community colleges would offer courses and training in archeology to extend that provided in the universities to a wider segment of the citizenry. Landowners would receive recognition and tax incentives for protecting and preserving important archeological resources.

The Texas Archeological Society and its regional and local counterparts would work with professional research organizations to accomplish long-term research. The annual field school would be one component of a year-around commitment to follow research through to completion. TAS members, guided by professional principal investigators, would participate in the planning of research, the execution of field research (the field school), laboratory processing, analyses, and publications. The data generated from the Society's research efforts would be quickly made available for all interested members to ponder and work with. This would be accomplished through widely-available digital technologies, technologies that would allow TAS members to communicate at any time from any spot in the state, sharing ideas, rumors, finds, and bad puns. The Society would foster many new archeological activities. The annual meeting would include sessions geared toward the general public, hands-on work, and regional problems, as well as conventional talks.

State and Federal agencies would coordinate their planning and development programs with the regional research groups and funding boards. Research would be scheduled to mutual advantage, usually well in advance of land-altering activities. Business and government would pay their fair share, but would be assured that their monies were wisely spent. The physical remains of our past would be treated with respect and concern for both cultural and scientific needs. When land-altered activities and archeological investigations encountered human remains of any time or culture, these would be handled according to protocols worked out by agreements negotiated in advance by living ethnic descendants, if such can be accurately traced, and with scientific and cultural advisors.

Information about the basic archeological record would be filed, stored, and retrieved electronically from any location in the state (and world), with proper safeguards for locationally and personally sensitive information. Routine reports of most investigations would appear only in electronic form, retrievable from any home or office. These would competently describe what was done and what was found, and furnish an overview (and locational guide) of properly archived and safeguarded data. Much comparative research could be done remotely by accessing data from regional clearing houses and repositories. When necessary, researchers would be able to examine artifacts, ecofacts, and records first hand, by scheduling visits with curation facilities jointly supported by universities and government funds. Major research efforts, general and technological syntheses, and special studies would be published both electronically and conventionally to high standards of scholarship and production.

Technological advances would permit "virtual digs," where excavations in remote areas of Texas, such as the canyons of the Lower Pecos, would be linked via satellite communication and the Internet to the wider world. These interactive demonstration projects would feature rotating teams of professional, student, and volunteer archeologists working together to close the loop between discovery and dissemination of the archeological findings. Specialists and analysts would attempt to stay current with the excavation, providing immediate feedback to the excavators and to the watching world. Links to schools would allow 7th grade Texas history classes to follow the dig, ask questions, and actually examine and work with the archeological data. The project's corporate sponsors might fund a contest enabling school kids, who come up with winning solutions to real archeological problems, to visit the dig first hand. Through such virtual digs, Texas archeology could move to the forefront of innovation and public participation in the 21st century.

Blink, blink. Back to the Texas archeology of 1995, where darker professional moments send nightmarishly pessimistic visions flickering through my mind's eye. The great promise and the grievous problems compel me to see the end of this century as a major turning point and a time for action. Although certain changes in 21st century archeology will be automatic (and a consequence of social change), the members of the Texas Archeological Society and all other archeologists in the state will have many opportunities to use our voices, talents, and resources to help shape the archeological future. Whether and how we make use of these opportunities is up to each one of us. Think of tomorrow, do it today.

REFERENCES CITED

Binford, L. R.
1986 In Pursuit of the Future. In *American Archaeology Past and Future*, edited by D. J. Meltzer, D. D. Fowler, and J. A. Sabloff, pp. 459-479. Smithsonian Institution Press, Washington, D.C..

Black, S. L.
1986 *The Clemente and Herminia Hinojosa Site, 41JW8: A Toyah Horizon Campsite in Southern Texas*. Special Report 18. Center for Archaeological Research, The University of Texas at San Antonio.
1990a The Carnegie Uaxactun Project and the Development of Maya Archaeology. *Ancient Mesoamerica* 1:257-276.
1990b Unearthing the Ancient Maya: Field Methods and Methodologies in Lowland Maya Archaeology. Unpublished Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge, Massachusetts.
1993 Nailing the Coffin Shut on the Traditional Approach to Prehistoric Archeology in Texas: An Epitaph and Inquiry into the Afterlife. *CRM News and Views* 5(1):16-19.

Black, S. L., K. Jolly, and D. R. Potter
1993 *The Higgins Experiment Field Report*. Wurzbach Project Working Papers. Texas Archeological Research Laboratory, The University of Texas at Austin.

Black, S. L. and A. J. McGraw
1985 *The Panther Springs Creek Site: Cultural Change and Continuity within the Upper Salado Creek Watershed, South-Central Texas*. Archaeological Survey Report 100. Center for Archaeological Research, The University of Texas at San Antonio.

Black, S. L. and H. J. Shafer
1994 Archeology by the Numbers? A Dissenting and Trenchant Viewpoint on DAP Survey Guidelines. *CRM News and Views* 6(2):16-18.

Blaine, J. C.
1993 Firearms and Related Artifacts from the Vinson Site. *Bulletin of the Texas Archeological Society* 64:163-186.

Blanton, D. B.
1995 The Case for CRM Training in Academic Institutions. SAA *Bulletin* 13(4):40-41.

Brown, K. M.
1985 Three Caches of Guadalupe Tools from South Texas. *Bulletin of the Texas Archeological Society* 56:75-125.

Carter, C. E.
1995 *Caddo Indians: Where We Come From*. University of Oklahoma Press, Norman.

Chandler, C.K.
1995 Stone Pipes from Bexar County, Texas. *La Tierra* 22(1):6-11.

Creel, D. G.
1986 A Study of Prehistoric Burned Rock Middens in West Central Texas. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Davis, E.M.
1979 The First Quarter Century of the Texas Archeological Society. *Bulletin of the Texas Archeological Society* 50:159-194.

Dunnell, R. C
1986 Five Decades of American Archaeology. In *American Archaeology Past and Future*, edited by D. J. Meltzer, D. D. Fowler, and J. A. Sabloff, pp. 23-49. Smithsonian Institution Press, Washington, D.C.

England, N.
1995 Urban Indians: Trails of Hope. *Texas Highways*, October, pp. 32-41.

Harris, R. K. and I. M. Harris
1967 Trade Beads, Projectile Points, and Knives. In *A Pilot Study of Wichita Indian Archeology and Ethnohistory*, assembled by R. E. Bell, E. B. Jelks, and W. W. Newcomb, pp. 129-162. Final Report for Grant GS-964. National Science Foundation, Washington, D.C.

Hester, T. R.
1991 Notes on South Texas Archeology: 1991-1, An Overview of the Results of the Texas Obsidian Project. *La Tierra* 18(1):4-7.

Hindes, V. K., M. R. Wolf, G. D. Hall, and K. K. Gilmore
1995 *The Rediscovery of Santa Cruz de San Sabá, A Mission for the Apache in Spanish Texas*. San Saba Regional Survey Report 1. Archeology Laboratory, Texas Tech University, Lubbock.

Hudgins, J. D.
1993 Cooking with Clay Balls. Th*e Cache* 1:47-52.

Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343-358.

Ivanovich, D.
1995 When Oil Firms Drill into the Past. *Houston Chronicle*, June 25th, Section D:1-3.

Jackson, J. M.
1986 Archeological Investigations at the Little Campus Restoration Project, Austin, Texas. *Bulletin of the Texas Archeological Society* 55:1-27.

Jelks, E. B.
1962 *The Kyle Site*. Archeology Series 5. Department of Anthropology, University of Texas, Austin.

Johnson, L.
1994 *The Life and Times of Toyah-Culture Folk: The Buckhollow Encampment, Site 41KM16, Kimble County, Texas*. Office of the State Archeologist Report 38. Texas Department of Transportation and Texas Historical Commission, Austin.

Johnson, L. and T.N. Campbell
1992 Sanan: Traces of a Previously Unknown Aboriginal Language in Colonial Coahuila and Texas. *Plains Anthropologist* 37(140):185-212.

Lewis, D. R.
1978 Use of Phosphate Analysis for Determining Land Use Patterns. *Bulletin of the Texas Archeological Society* 49:309-317.

Lintz, C.
1994 What Are We Giving Back to the Public? *CRM News and Views* 6(2):19-21

McClure W. L.
1990 A Snake "Necklace" from the Morhiss Site. *La Tierra* 17(1):9-12.

Newcomb, W.W., Jr.
1993 Historic Indians of Central Texas. *Bulletin of the Texas Archeological Society* 64:1-63.

Newcomb, W.W., Jr. and T.N. Campbell
1982 Southern Plains Ethnohistory: A Re-Examination of the Escanjaques, Ahijados, and Cuitoas. In *Pathways to Plains Prehistory: Anthropological Perspectives of Plains Natives and their Pasts,* edited by D. G. Wyckoff and J. L. Hofman, pp. 29-43. Oklahoma Anthropological Society, Memoir 3. Duncan, Oklahoma.

Pape, W. K.
1995 Emerging Crises in CRM Archaeology. *SAA Bulletin* 13(2):24-26.

Pearce, J. E.
1935 *Tales That Dead Men Tell*. Bulletin No. 3537, Anthropological Papers 1(1). The University of Texas at Austin.

Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201-238.

Preucel, R. W. (editor)
1991 *Processual and Postprocessual Archaeologies*. Occasional Paper No. 10. Center for Archaeological Investigations, Southern Illinois University at Carbondale.

Ricklis, R. A.

1990 A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Coast: A Case Study in the Roots of Adaptive Change. Unpublished Ph.D. Dissertation, Department of Geography, the University of Texas at Austin.

1992 The Spread of a Late Prehistoric Bison Hunting Complex: Evidence from the South-Central Coastal Prairie of Texas. *Plains Anthropologist* 37(140):261-273.

1994 *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island*. Coastal Archaeological Research, Inc., Corpus Christi.

Ricklis, R. A. and M. B. Collins

1994 *Archaic and Late Prehistoric Human Ecology in The Middle Onion Creek Valley, Hays County, Texas*. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Quigg, J. M. and J. Peck

1995 *The Rush Site (41TG346): A Stratified Late Prehistoric Locale in Tom Green County, Texas*. Technical Report No. 816C. Mariah Associates, Inc., Austin.

Schuldenrein, J.

1995 The Care and Feeding of Archaeologists: A Plea for Pragmatic Training in the 21st Century. *SAA Bulletin* 13(3):22-24.

Shafer, H. J.

1973 Lithic Technology at the George C. Davis Site, Cherokee County, Texas. Unpublished Ph.D. dissertation, Department of Anthropology, the University of Texas at Austin.

Story, D. A.

1993 Alex D. Krieger: 1911-1991. *American Antiquity* 58(4):614-621.

Taylor, A. J. and C. L. Highley

1995 *Archeological Investigations at the Loma Sandia Site (41LK28): A Prehistoric Cemetery and Campsite in Live Oak County, Texas*. Studies in Archeology 20. 2 Vols. Texas Archeological Research Laboratory, The University of Texas at Austin.

Trigger, B. G.

1989 *A History of Archaeological Thought*. Cambridge University Press, Cambridge.

Watson, P. J.

1991 A Parochial Primer: The New Dissonance As Seen from the Midcontinental United States. In *Processual and Postprocessual Archaeologies*, edited by R. W. Preucel, pp. 265-274. Occasional Paper No. 10. Center for Archaeological Investigations, Southern Illinois University at Carbondale.

Weir, F. A.

1976 The Central Texas Archaic. Unpublished Ph.D dissertation, Department of Anthropology, Washington State University, Pullman.

Wheat, P. and B. Whorton (editors)

1990 *Clues from the Past*. Hendrick-Long Publishing Co., Dallas.

Paleoindians of Texas: An Update on the Texas Clovis Fluted Point Survey

David J. Meltzer and Michael R. Bever

ABSTRACT

Since the initial report of a statewide survey of 205 Texas Clovis fluted points (Meltzer 1986, 1987), an additional 201 Clovis points have been recorded. These additional records come from 33 counties not previously represented in the survey; they enhance, but do not appreciably change, the spatial distributional patterns observed earlier with the smaller sample. The density of these points vary across the state and by region. Most of these Clovis points occur in surface scatters with archeological materials of later age; many are otherwise Clovis isolates; a relatively few occur in sites. These contextual patterns vary by region, and suggest differences in land use. The majority of the points are made of Edwards formation chert; the minority are fashioned of Alibates agatized dolomite and Tecovas jasper; rare specimens occur made of Dakota quartzite, and a few other materials. Raw material use varies by region as well. Texas Clovis fluted points vary in their morphology and along certain dimensions—notably length and width—but that variation is attributable to reworking and breakage. Other dimensions (basal width and fluting thickness) in contrast are tightly constrained, indicating considerable standardization in the manufacture of these points, perhaps to fit pre-existing hafts. These and other morphometric data shed some light on the technology of fluted point manufacture. Most of the Clovis points in the sample are whole, but over 100 show distinct breakage or reworking patterns, which cluster to a degree by region, and provide clues to point function and life histories. Data on Texas Clovis fluted points continue to yield insight into Clovis adaptations.

INTRODUCTION

Some 15 years ago, Story (1981:142) observed that our views of the Clovis occupation of Texas were based more on speculation than substance. It was partly in an effort to put our understanding of Clovis on firmer ground that Meltzer (1986, 1987, 1989a) subsequently undertook the Texas Clovis Fluted Point Survey (hereafter, TCFPS), a systematic survey aimed at determining the number, density, distribution, and variability of Clovis fluted points across the state.

That survey was not the first of its kind. In the 1960s Thomas Hester and in the early 1980s, Elton Prewitt, each initiated similar efforts; their examination of published and unpublished reports and collections netted information on some 50 Clovis points scattered in 31 counties (Meltzer 1987:34), but unfortunately neither study was published. However, both Hester and Prewitt graciously provided their results to Meltzer, and his TCFPS built on their foundation by updating records on all known and published Clovis fluted point occurrences, and then by actively seeking data from individuals and collections (public and private) across the state—much of which came as a result of a questionnaire sent to the membership of the Texas Archeological Society (Meltzer 1987:29).

The initial results of the TCFPS were considerable: 205 Clovis fluted points were recorded from 95 counties across the state. Those data provided a measure of the density and distribution of Clovis points across the state, insight into Clovis land use, fluted point technology and function, and some measure of Clovis subsistence, settlement, and adaptation.

After the initial results of the TCFPS were published (Meltzer 1986, 1987), more records of Texas Clovis fluted points accumulated. A very brief update was published a few years later (Meltzer 1989a), but nothing has appeared since then, despite the fact that the sample is nearly double what it was in 1986 (Table 1), thanks to the continued interest and cooperation of individuals across the

Table 1. Tally of Texas Clovis fluted points by county, original tally, points added, and current tally (TCFPS indicates the source of the data was the Texas Clovis Fluted Point Survey. Data from other sources is listed by reference).

County (Site[s])	Original tally	Points added	Current tally	Reference
Anderson	0	1	1	TCFPS
Andrews	2	1	3	TCFPS
Angelina	1	6	7	Brown 1994; TCFPS
Armstrong	1	0	1	TCFPS
Atascosa	1	7	8	Hester 1974:Figure 1j; TCFPS
Bailey	1	0	1	TCFPS
Bandera	1	0	1	TCFPS
Bee	1	0	1	Sellards 1940
Bell (Gault)	1	2	3	Collins et al. 1991, 1992; TCFPS
Bexar (41BX52)	2	1	3	Henderson and Goode 1991; TCFPS
Blanco	1	0	1	Orchard & Campbell 1954; TCFPS
Borden	1	0	1	TCFPS
Bosque	1	0	1	TCFPS
Bowie	0	1	1	Story 1990:Table 44:8
Brazos	1	1	2	TCFPS
Brazoria	0	1	1	Chandler and Rogers 1995
Brewster	2	1	3	Enlow & Campbell 1955; Hester n.d.; TCFPS
Briscoe	0	8	8	TCFPS
Brown	4	1	5	TCFPS
Burnet	0	1	1	TCFPS
Calhoun	2	1	3	Suhm and Jelks 1962:Plate 89A, G; Hester 1988
Callahan	1	0	1	TCFPS
Cameron	1	0	1	Hester n.d.
Camp	1	0	1	TCFPS
Cass	0	1	1	TCFPS
Cherokee	1	0	1	Hester n.d.; TCFPS
Coke	2	2	4	TCFPS
Comal	0	1	1	TCFPS
Comanche	2	5	7	TCFPS
Concho	1	0	1	EHA 1981
Cooke	1	0	1	Jensen 1968
Coryell	0	4	4	TCFPS
Crosby	12	0	12	TCFPS
Dallam	3	0	3	TCFPS
Dallas	3	3	6	Crook & Harris 1955; Suhm and Jelks 1962:Plate 89C; TCFPS
Dawson	0	6	6	TCFPS
Deaf Smith	1	0	1	Suhm and Jelks 1962:Plate 89C
Denton (Lewisville, Aubrey)	1	3	4	Crook and Harris 1957; Ferring 1990; TCFPS
DeWitt	1	0	1	Prewitt unpublished
Dimmit	6	0	6	Hester n.d., 1974:Figure 1a, c, f, g
Donley	0	1	1	TCFPS

Table 1 (Continued)

County (Site[s])	Original tally	Points added	Current tally	Reference
Duval	1	0	1	Hester n.d., 1974:Figure 1b
Ellis	2	1	3	TCFPS
El Paso	0	1	1	TCFPS
Erath	3	2	5	TCFPS
Falls	0	2	2	TCFPS
Fayette	3	0	3	Meier and Hester 1972, 1976; Wilson 1979
Floyd	1	0	1	TCFPS
Foard	1	0	1	Etchieson et al. 1979
Gaines	16	7	23	TCFPS
Galveston	0	1	1	TCFPS
Garza	1	0	1	TCFPS
Gonzales	1	0	1	Hester n.d.
Gray	2	0	2	TCFPS
Grayson	1	0	1	TCFPS
Hall	0	1	1	TCFPS
Hamilton	1	2	3	TCFPS
Harris	2	4	6	TCFPS; Hester 1980; Patterson 1986; Patterson et al. 1992a, 1992b; Suhm & Jelks 1962:Plate 89B; Wheat 1953
Harrison	5	1	6	Hayner 1955, Hester n.d.; TCFPS
Hartley	0	1	1	TCFPS
Hays	4	1	5	Hester n.d.; Takac 1991; TCFPS
Henderson	1	3	4	Story 1990:Table 44:29; TCFPS
Hill	2	4	6	TCFPS
Hockley (Poverty Hill)	1	1	2	Walter 1990; TCFPS
Hood	1	0	1	Skinner and Rash 1969
Howard	3	1	4	TCFPS
Hunt	0	1	1	TCFPS
Jasper	2	0	2	TCFPS
Jefferson	10	60	70	Long 1977; Turner and Tanner 1994; TCFPS
Johnson	2	0	2	TCFPS
Jones	1	0	1	TCFPS
Kaufman	0	1	1	TCFPS
Kendall	1	2	3	Chandler 1983; TCFPS
Kerr	1	1	2	TCFPS; Saner 1995
Kimble	0	1	1	TCFPS
Lamar	2	2	4	TCFPS
Lampasas	0	1	1	TCFPS
Live Oak	0	1	1	House 1974
Lubbock (Lubbock Lake)	1	1	2	Johnson 1983; TCFPS
Marion	4	0	4	Hayner 1955; Story 1990:Table 44:20; TCFPS
Martin	2	0	2	TCFPS
McLennan	3	0	3	TCFPS
McMullen	2	1	3	Cooper 1974; Kelly 1983; TCFPS
Medina	1	2	3	TCFPS
Midland	5	0	5	TCFPS
Milam	0	1	1	TCFPS
Mills	0	1	1	TCFPS

Table 1 (Continued)

County (Site[s])	Original tally	Points added	Current tally	Reference
Montague	1	0	1	TCFPS
Montgomery	0	4	4	Chandler and Rogers 1995
Moore	6	0	6	TCFPS
Navarro	1	2	3	Story 1990:Table 44:33; TCFPS
Nolan	2	0	2	TCFPS
Oldham	2	0	2	TCFPS
Panola	1	0	1	Scurlock and Davis 1962
Parker	1	0	1	TCFPS
Pecos	1	0	1	Hester n.d.
Polk	0	1	1	TCFPS
Potter	0	3	3	TCFPS
Red River	0	1	1	Skinner and Rash 1969
Roberts (Miami)	3	0	3	Sellards 1952; Holliday et al. 1994
Robertson	1	0	1	TCFPS
Runnels	2	1	3	EHA 1981; TCFPS
San Augustine	1	1	2	Brown 1994; TCFPS
San Patricio	2	0	2	Chandler 1982; Hester 1980
San Saba	0	1	1	TCFPS
Schleicher	2	0	2	TCFPS
Shackleford	1	0	1	TCFPS
Starr	1	0	1	Weir 1956
Swisher	1	0	1	TCFPS
Taylor (McLean, Yellow Hawk)	5	1	6	Mallouf 1989; Ray 1930; Sellards 1952; TCFPS
Terry	0	4	4	TCFPS
Titus	1	1	2	Story 1990:Table 44:33; TCFPS
Tom Green	0	1	1	TCFPS
Travis	4	0	4	Alexander 1963; Hester n.d.
Tyler	1	0	1	Suhm and Jelks 1962:Plate 89E
Uvalde (Kincaid)	1	6	7	Hester n.d.; Collins et al. 1989
Val Verde	1	0	1	Greer 1968
Van Zandt	2	0	2	Johnson 1961
Victoria	1	0	1	Hester 1974:Figure 1i
Ward	3	0	3	TCFPS
Webb	0	1	1	Mitchell and Winsch 1974
Williamson (Wilson-Leonard)	2	0	2	Collins et al. 1993; Hays 1982; TCFPS
Wilson	0	1	1	TCFPS
Winkler	2	0	2	TCFPS
Wise	0	1	1	TCFPS
Wood	0	2	2	Story 1990:Table 44:19
Yoakum	1	1	2	TCFPS
Zavala	2	0	2	Hester 1974:Figure 1d, e
Unknown	1	0	1	TCFPS
Totals	205	201	406	

Note: The designation of a site does not indicate all points in that county were found at that site.

state. Now, as nearly a decade has passed since the initial report was published, it is time to present a detailed update of the TCFPS.

As before, this discussion will cover several areas: the spatial distribution of Texas Clovis fluted points; patterns in raw material use; their technology, form, and function; and what these data reveal of Clovis adaptations and land use patterns. In addition, now that a survey of Texas Folsom points has appeared (Largent et al. 1991; Largent 1995), we will take the opportunity to examine to what degree, if any, the distribution and patterning of Clovis and Folsom differed, and what changes that might reveal in Paleoindian adaptive strategies.

PARAMETERS OF THE TCFPS DATA

Boundaries, sources, and analytical units

We open with the caveat—the reminder, really—that there is an element of arbitrariness in examining the distribution of fluted points within the *state* of Texas. The state's borders are not entirely "natural." And even those portions that are (the Red River on the north, the Sabine River on the east, and the Rio Grande on the south) were unlikely to have been significant barriers to Clovis hunter-gatherers, wide-ranging and mobile as they were.

Complicating the picture further is the great diversity of environments across the state, not all of which are contained within the state (in effect, several ecological zones intersect, but are not isomorphic with, the boundaries of Texas). We now know not all Clovis was alike: it varied, and not just on a continental scale, but regionally as well (Meltzer 1993a). Moreover, because Clovis land use was likely tied to particular ecological niches (and not, obviously, to modern state lines), groups occupying those niches might on the face of it be expected to have very different adaptive strategies than those in other niches.

In effect, we must anticipate the possibility that not all Texas Clovis points in all regions of the state look alike or were alike. The Clovis record on, say, the High Plains of Texas almost surely had more in common with Clovis on the High Plains generally, than with Clovis in the East Texas forests. Such would be true of any state in North America, but seems especially true of one as large and varied as Texas. A pan-regional approach is clearly needed to truly understand the potential Clovis Paleoindian occupations of Texas, but so far comparable data are not readily available for the adjoining states and regions (they are starting to become available [Faught et al. 1994; Hofman and Wyckoff 1991]). So we start with Texas, but within the state also recognize, and use, the major geographical provinces of the state: the Plains/Panhandle, North Central, East, Coast, Southwest, Trans-Pecos, and Central Texas regions. This partitioning follows Suhm et al. (1954), with modifications from Arbingast et al. (1976) and Brown et al. (1982), and is in keeping with the divisions used in the original report and with other studies (e.g., Largent et al. 1991; Largent 1995). However, in order to incorporate site distributional data from Biesaart et al. (1985), their finer-scale regional divisions will also on occasion be used (as noted below).

The bulk of the data in the TCFPS comes from individual and institutional collections; the remainder is from published sources. In all instances, a form (Appendix A) was used to record information on fluted point size and shape and other attributes that might inform on point function, technology, and style (Figure 1). Data was also recorded on point location, the context in which it was found (and what kinds of archeological material of what ages was found with it), and the raw material of which it was made. As before, many of those forms were completed with the help and cooperation of scores of interested individuals (see Acknowledgments).

In some cases, particularly among the published sources, the morphological, metrical, and technological data sought for this analysis were not available, and hence it might have only been possible to record, for instance, that a fluted point was present in a particular county, and little beyond that. Still, even knowing fluted points were present in a county is very useful for helping fill in the statewide distribution map. It means, of course, we know of more fluted point occurrences than we have specific attribute data for those points.

The study of Clovis point distribution is based largely on the presence and/or number of points by county. The county serves as the basic mapping unit since it is almost always known and recorded; often, more precise location information is unavailable or unknown. Because the county is the most common spatial denominator used in recording Clovis finds, using it ensures that uneven details in available locational data do not unduly influence the analysis (Meltzer 1987:31). Counties also have the virtue of being easily mapped, clustered into

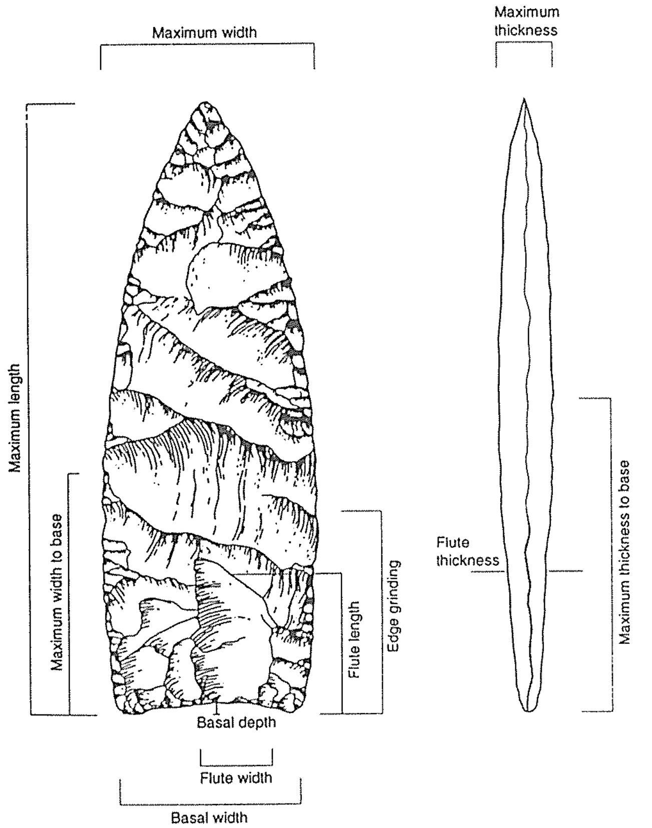

Figure 1. Schematic diagram showing attributes recorded on Texas Clovis fluted points.

larger geographic regions, and, given the statewide scale of this study, can be used without sacrificing much information. Obviously, were this a study of a smaller area (the distribution of fluted points along Blackwater Draw, say, or in the Pedernales River valley), knowing only that points were found in a particular county would not be as informative as knowing where within that county they occurred. But since we are interested in the distribution of fluted points across the state, the county is a useful spatial unit.

Potential biases

There are several potential biases regarding this data set (see also Meltzer 1987:29-31, 36-40). For one, to what degree do these data accurately reflect the range and variation of Texas Clovis points? In general, quite accurately. We infer this is so because, despite the near-doubling of the number of points in the TCFPS sample, the overall statistical patterns in size, shape, and other characteristics evident in the original TCFPS data remain largely unchanged (as we discuss in detail below). Such congruence would be unlikely were this sample unrepresentative of the underlying population of Texas Clovis points.

We would hasten to add, however, there is one obvious bias in the sample, in that it has disproportionately more complete points and point bases than point tips. This comes as little surprise: Clovis point tips, as well as medial blade fragments or other broken point sections lacking the diagnostic flute scars or the other distinctive Clovis attributes (Bradley 1993:253-254), will not always be recognized as having come from Clovis fluted points. While this bias may reduce the overall total of recorded Clovis points, and give a somewhat skewed picture of morphometric and breakage patterns in those points, it should not otherwise unduly influence the analysis. Except, perhaps, in one regard: if it appears that point attrition and breakage is more frequent in certain regions of the state, it may be that the tendency to collect and record whole points could underestimate the number of points from that region.

Another matter of potential bias is whether the spatial distribution of these points provides a reliable glimpse into Clovis land use, as opposed to revealing modern surveying and collecting patterns. In effect, were areas well represented by Clovis points intensively occupied by Clovis groups or have they just been more intensively surveyed by archeologists (and the reverse: does Clovis point scarcity indicate a scarcity of Clovis activity or a lack of archeological survey)? Certainly archeological visibility varies across the state, as does the degree of archeological scrutiny of the various regions (Meltzer 1987:30). Obviously, such matters will have to be considered (and will be considered below) in discussing specific regions, especially where Clovis points are rare or altogether absent.

Even so, it seems reasonable to suppose that, in general, the presence of Clovis points across the state is not simply a function of the distribution of collectors, either TAS members or the general populace. Previously, it was shown there was no statistically significant correlation between numbers of Clovis points and TAS members per county: there were counties with large numbers of fluted points but few TAS members and vice versa (Meltzer 1987:37-38). Since then, new Clovis finds and changes in TAS membership have produced different tallies of each category, but not enough to bring about a correlation between the two. Moreover, there is not a significant correlation between numbers of Clovis points and people per county.[1] Whatever the distribution of Clovis points may reflect, it is not merely an artifact of the present distribution of people in Texas. We will comment on other matters of potential bias below.

SPATIAL PATTERNS IN TEXAS CLOVIS FLUTED POINT DISTRIBUTIONS

Current Totals and Changes since 1986 by County and Region

We have now recorded 406 Clovis fluted points for the state of Texas (see Table 1), representing nearly a two-fold increase over the 205 points reported in the original TCFPS (Meltzer 1987:Table 1). The additional 201 Clovis points come from 70 counties, 33 of which were not represented in the original survey. Presently, Clovis points are known from 128 of Texas' 254 counties (Figure 2; previously, only 95 counties were represented).

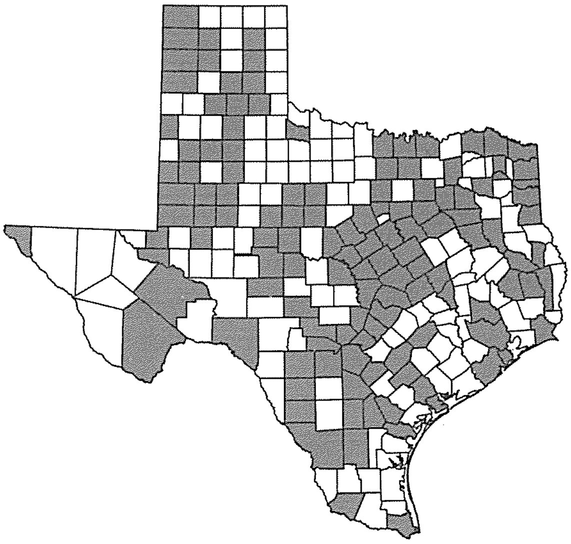

Figure 2. Occurrence of Texas Clovis fluted points by county.

Almost 30 percent (60/201) of the increase in the number of fluted points between 1986 and 1995 comes from the McFaddin Beach locality in Jefferson County on the central Gulf Coast. McFaddin Beach is a lengthy (ca. 35 km) stretch of the central Gulf Coast regularly littered by Clovis points and Pleistocene fossils that have washed ashore over decades from a source or sources apparently near the present coastline (but which during the Pleistocene were inland areas some 80 km from the coast [Long 1977; Turner and Tanner 1994:323]). This locality has lately been the subject of considerable interest and yield (Hester et al. 1992), and at present 70 Clovis points are known from it (Turner and Tanner 1994:324). This is a seven-fold increase over the previous total of 10 (Meltzer 1987:Table 1), and an increase far larger in relative and absolute terms than in any other county.

Atascosa, Briscoe, and Dawson counties had comparable relative increases, however. In fact, excluding the Jefferson County total, the average gain per county between 1986 and 1995 was 1.11; including Jefferson County, the average gain per county over that same period is 1.57.

In the current TCFPS sample, the average number of points per county is 3.16 (data from Table 1). For reasons just noted, and as was evident in the original TCFPS report (Meltzer 1987:36), using an average value is somewhat misleading, inflated as it is by the high numbers of points in just a few counties. As can be seen in Table 2, the modal distribution—the number of Clovis fluted points by county—is more meaningful, revealing as it does that the majority of Texas counties have just one or two Clovis points.

The changes in county tallies between the 1986 and 1995 TCFPS samples are mirrored in changes in point frequencies in the larger geographical regions (Table 3). All seven of those regions showed an increase in the number of Clovis points between 1986 and 1995. However, in most regions the increase, although substantial, generally resulted in no more than a doubling of the recorded occurrences of Clovis points.

Naturally, in the Coast region the increase from 1986 to 1995 was considerably greater (over three times larger than in any other region). Again, this spike is attributable to the singular contribution of

[1]The analysis used 1990 county population data provided in Kingston (1993:331-336). Because these data are on a ratio scale it was possible to derive a Pearson's correlation coefficient between the numbers of Clovis points and Log^{10} population, and the resulting value was .1648, with a significance of .051.

Table 2. Modal distribution of Clovis fluted points by county, 1995

(total number of counties with occurrences = 124)

	Number of occurrences of Clovis points								
	1	2	3	4	5	6	7	8	>10
Number of counties	59	21	18	10	4	8	3	2	3

McFaddin Beach, which makes it appear there was a more extensive Clovis record in this region than actually exists.

The Regional Density of Clovis Points

Just how extensive that effect is can be seen more clearly in the density of points in this and the other regions. The overall density of Clovis fluted points across the state is just over 15 per 10,000 square miles (Table 4). In four of the separate regions of the state, the Plains/Panhandle, East Texas, Southwest Texas, and Central Texas, density values are roughly comparable, ranging from 12-17 points per 10,000 mi^2 (Table 4). In two regions—North Central Texas and the Trans-Pecos—the densities of Clovis materials are considerably lower, while in the Texas Coast densities are considerably higher (39 points per 10,000 mi^2), for reasons already detailed.

To assess whether Clovis points are distributed evenly among the regions, we can calculate the degree of difference between the actual number of points in a given region and the number of points expected in that region were that number proportional to the region's area (that is, test the proposition that larger regions have more points, and smaller regions, fewer points [see Largent et al. 1991:Table 4]). Expected frequencies are derived by multiplying each region's percentage of the state's total area with the total number of points. Thus, as the Plains/Panhandle represents 25 percent of the total area of the state of Texas, it is expected to have 25 percent of the total number of the state's Clovis fluted points (in this case, roughly 100 points [0.25 x 406 points]).

Table 3. Tally of Texas Clovis fluted points by region, 1986 and 1995

Region		Number of Clovis points: Original (1986) tally	Number of Clovis points: Current (1995) tally	Percent increase 1986 to 1995
1	Plains/Panhandle	73	109	49.3%
2	North Central	12	21	75.0%
3	East	22	47	113.6%
4	Coast	19	86	352.6%
5	Southwest	13	27	107.7%
6	Trans-Pecos	4	6	50.0%
7	Central	61	109	78.6%
	Unknown	1	1	-0-
		205	406	98.0%

Table 4. Distribution and density of Clovis fluted points by region against model of expected point frequency by area (data on area from Arbingast et al. 1976:78-79)

Region	No. of points	Area in mi^2	Density $10{,}000mi^2$	% total area	Expected no. points[1]	Standard residuals
1 Plains/Panhandle	109	65,388	16.67	.249	100.84	1.054
2 North Central	21	24,719	8.49	.094	38.07	-2.662
3 East	47	26,765	17.56	.102	41.31	0.105
4 Coast	86	21,527	39.94	.082	33.21	9.052
5 Southwest	27	21,683	12.45	.083	33.62	-0.991
6 Trans-Pecos	6	34,797	1.72	.133	53.87	-6.412
7 Central	109	67,235	16.21	.256	103.68	0.564
Total	405	262,114	15.45	.999	404.60	

Chi square = 132.5665, df = 6, significant at 0.0000

[1] Obtained by multiplying the regional percent of the total area by the total number of points (405) from all the known regions

The calculated chi-square[2] statistic in Table 4 indicates the expected and observed values are significantly different, showing that indeed fluted point densities across the state are not uniform. The standardized residuals provide a measure of just how far the observed and expected values diverge from each other. In some regions of the state, most especially the Coast, the density of fluted points is far higher than expected for a region of that size.

Statewide Frequency Distribution of Clovis Fluted Points

Not surprisingly, then, the statewide map of the frequency of Clovis fluted points by county (Figure 3) is rather uneven: just as it was in 1986 (compare Figure 3 here with Figure 2 in Meltzer [1987]). The 1986 and 1995 maps are also somewhat alike, largely because, as noted, Clovis points added to the TCFPS since 1986 were distributed across the state roughly proportional to their abundance in the original sample (with the exceptions noted). Given this, it is appropriate to frame our discussion in terms of the six broad spatial patterns noted previously (Meltzer 1987:41-42), to assess whether and how those have changed, remained the same, or been enhanced by the additional data.

(1) **There is an apparent concentration of Clovis points in the Plains/Panhandle region, and specifically in the High Plains region** (Meltzer 1987:41). In the current TCFPS map, there is still a high frequency of Clovis points on the High Plains. Indeed, eight of the High Plains counties that did not previously have records of Clovis points have them now. Overall, adjusting for the McFaddin Beach Effect, the Plains has the greatest density of Clovis material of any area of

[2] The chi-square statistic measures the degree of difference between an observed and an expected value. In the case of this 1 x 7 cell table, the expected values are derived from data beyond that contained in the table itself (as noted in the text). More typically, and this is true of the 2 x 2 and larger (r x c) tables below, expected values are derived by multiplying row and column totals, then dividing the product by the overall total. This provides a probabilistic "best estimate" of the number that ought to be in that particular cell, based on the data within the table. The chi-square statistic then measures the magnitude of the difference between the observed and expected values, and whether that difference is more than would be expected by chance (Everitt 1977:7).

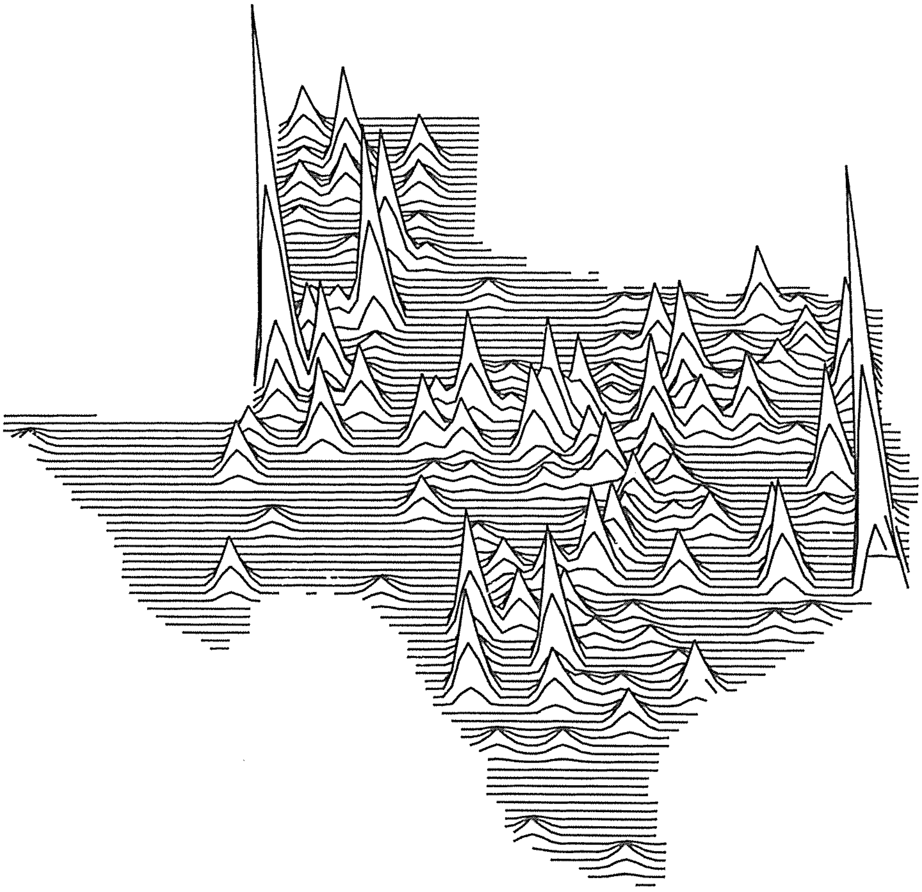

Figure 3. Frequency map of Texas Clovis fluted points by county. The spikes on the map represent the number of points recorded per county, except in the case of Jefferson County (the high spike on the Texas Gulf Coast). Were the 70 Clovis points from Jefferson County plotted, the resulting peak would proportionately reduce all the other county peaks, thus making the statewide patterns difficult to discern. For this figure, then, the Jefferson County total was arbitrarily set at 25. All other values represent the actual recorded totals.

the state (see Table 4).

The high frequency of Clovis material on the Plains was earlier attributed to brisk archeological attention (owing to the early recognition of several important Clovis sites on this landscape), and to the high surface visibility of archeological remains (owing to this being a largely treeless landscape where current land use practices regularly expose subsurface archeological material). It seems just as likely, however, that the abundance of Clovis age material here is no sampling fluke: this area was intensely occupied by Clovis groups. The Plains in Late Pleistocene times overall was wetter and cooler than today (effective precipitation was higher, whether because of increased precipitation, decreased evaporation, changes in seasonality or some combination thereof is unknown), and mantled by grasses, composites, chenopods, as well as some artemisia (sage) and *Ephedra* (Mormon tea) in the uplands, and open forest or wooded parkland in low-lying and wetter areas (Bryant and Holloway 1985). Antelope and bison grazed the landscape alongside the occasional mammoth. The abundant freshwater lakes that dotted the landscape (Sabin and Holliday 1995), and the spring-fed ponds (like the Clovis type site and Lubbock Lake), would have been a prime attraction to human foragers, and many Clovis points are found alongside these now dry features (Meltzer, unpublished). Haynes (1991) raises the possibility these features may also have been dry in Clovis times—that there was a Clovis-age drought. However, Holliday's extensive sediment coring and stratigraphic study on the High Plains of West Texas and eastern New Mexico has not found evidence to support the hypothesis of a Clovis drought (Holliday 1995). Regardless, the conclusion that Clovis groups more intensely occupied this area, as opposed to other regions of the state, must remain tentative until such time as those other regions have been as thoroughly searched for Clovis remains.

2) **There is a relative absence of Clovis points on the Lower or Rolling Plains (Brown et al. 1982), with Clovis points scarce in a 60 mile wide and nearly 400 mile long north-south swath just to the east and down off of the Llano Estacado or High Plains** (Meltzer 1987:41). Despite the large increase in the TCFPS sample since the original survey, the Rolling Plains remains an archeological "empty corridor," at least in regard to Clovis remains (for that matter, Folsom points occur in relatively fewer numbers in this region as well [Largent et al. 1991:324]). There may be several reasons for this. As earlier suggested (Meltzer 1987:43), aeolian and fluvial deposition off the High Plains deeply buried, and thus rendered invisible, any Late Pleistocene surfaces and associated archeological records in this region, though further work was needed on surface ages and the amount of deposition in this region. Several papers have since appeared that corroborate this suggestion (Blum et al. 1992; Blum and Valastro 1992; Ferring 1995a). A particularly striking illustration of the phenomenon is Baumgardner's report of a surface just 2000 years old buried beneath seven meters of sediment on the Rolling Plains (Baumgardner 1986:20). Any Paleoindian-age occupational surfaces below such thick deposits will not be readily visible archeologically (Meltzer 1987:43), assuming, that is, Paleoindian occupations preserve. The uplands and drainages of the Rolling Plains have also been subject (especially in certain settings) to high erosion and geomorphic removal (Blum et al. 1992:362), which, with the deep burial of preserved Clovis age surfaces, conspire to obscure if not destroy the archeological record (Ferring 1995a; Holliday, 1995 personal communication).

But the scarcity of Paleoindian material in this region may not be wholly attributable to natural formation processes preventing our access to the archeological record. As Gustavson has observed, the water in this region is only marginally potable: the rivers that traverse the area carry large amounts of salt (dissolved from Permian halite beds), and have since long before Clovis groups arrived (Gustavson et al. 1980:3-9, 33-35). The extremely poor quality of the water may have influenced, if not discouraged Clovis occupation in so far as good water, and animals, may have been more accessible elsewhere.

Still, current land use practices in the Rolling Plains (large and relatively inaccessible ranches covered with plains and mesquite savanna) do not provide good exposures of Late Pleistocene surfaces or opportunities for survey. Hence, it would be premature to conclude Clovis groups did *not* occupy this area. Until such time as deep testing shows the deeply buried Pleistocene surfaces lack Clovis remains, it is better to conclude on the side of cautzion that this empty corridor in the Clovis record results from inadequate exposures or insufficient samples of surfaces of the proper age.

3) **The Trans-Pecos region has the lowest abundance and density of Clovis points in the state** (Meltzer 1987:42). That was true in 1986, and it remains so today. Indeed, as evident in Table 4, the density of fluted points in the Trans-Pecos is far lower than would be expected for a region that size. Again, the question of sampling adequacy arises: will the region appear to have been peopled by Clovis groups, once it has been thoroughly peopled by archeologists? That's a reasonable possibility, in part because the Big Bend National Park and the large size of ranches in the area have tended to restrict access to the area.

Even so, there was an extensive surface survey of a 3500 km^2 area of the Trans-Pecos around Van Horn by Hedrick, which included an examination of several private projectile point collections, and the only Paleoindian material recorded was a single Folsom point (Hedrick 1989:149). No Clovis remains were noted (see also Collins 1976; Mallouf 1981, 1985); later Paleoindian occupations are also only "scattered thinly" throughout the region (Mallouf 1985:100). For that matter, Clovis remains are equally rare in the Mexican states of Chihuahua and Coahuila south of the international border (MacNeish and Nelken-Terner 1983). Thus, it may be the scarcity of Clovis remains in the Trans-Pecos is real, possibly a result of harsh environmental circumstances (Mallouf 1985; Meltzer 1987:44). In this regard, it would be useful to know whether there is evidence in this region for Haynes' posited Clovis-age drought (Haynes 1991).

4) **Clovis points occur with some frequency and are rather evenly distributed in a slightly elliptical trend of contiguous counties through Central Texas, beginning in Uvalde County in the southwest, and extending up to Bell county in Central Texas** (Meltzer 1987:42). This distributional pattern remains largely unchanged with the presently available data. If anything, the arc now extends farther to the north. For most of its length, that elliptical distribution conforms to the eastern edge of the Edwards Plateau (the Balcones Fault line), along which were freshwater springs and extensive outcrops of Cretaceous age, chert-bearing, limestone of the Fredericksburg (Edwards) Group. These resources were likely a prime attraction to Clovis groups and, as important, the exploitation of the chert sources resulted in a dense and well-marked archeological record (Meltzer 1987:44).

5) **Clovis points appear, at first glance, to be relatively scarce in the Coastal region; however, there are concentrations of this material, and some apparent areas of high versus low densities of point materials** (Meltzer 1987:42). That observation is corroborated statistically: analysis of residuals in a plot of Clovis points by Paleoindian sites indicates there are significantly more isolates in this region than would be expected.

The Clovis points from Southeast Texas nearly all occur as surface finds along the Gulf Coast shoreline (but mostly on McFaddin Beach). At the time of the Clovis occupation, sea levels were still lower than at present (although by then, post-Pleistocene sea level rise had begun), the coast was under what is now Gulf waters, and McFaddin Beach was well inland. The materials that wash ashore on McFaddin Beach today are from now-submerged source(s) on the continental shelf, which in Clovis times were coastal plain or down-stream river drainages (Meltzer 1987:35; Hester et al. 1992; Turner and Tanner 1994). Since McFaddin Beach is a secondary deposit of material washing ashore, and not the primary source of the material, its point tally may underrepresent the offshore record, in so far as some of the Clovis points from the offshore source(s) almost certainly have failed to make it to shore.

It may be the extraordinarily high numbers of Clovis points from McFaddin Beach derive from no more than a single, rich Clovis site or cache offshore. On the face of it, however, several sources would seem more likely, given the variation evident in the morphology of these points; perhaps some of the apparent clusters of a few, highly similar points found close to one another (Turner and Tanner 1994:324) represent a single source. As to the nature of the source, whether a camp site, kill site, or cache, little can be said. It is perhaps worth noting that the few known Clovis caches tend to comprise not just finished points, but a wide technological range of forms from large preforms down to points (e.g., Frison 1991). Ultimately, determining the extent and nature of the McFaddin Beach source will have to wait more extensive work, possibly including underwater survey (geophysical sounding techniques might prove useful here). McFaddin Beach aside, Patterson (1993:262) notes that Clovis materials are relatively rare in this region.

6) **There is an apparent abundance of Clovis points recorded from East Texas** (Meltzer 1987:42). In the earlier TCFPS, the abundance of Clovis points from East and Northeast Texas was referred to as "apparent" in light of the fact that two-thirds of the recorded points had only minimal documentation, and there seemed reason to doubt that all the forms said to be Clovis were Clovis (Meltzer 1987:46). It was suggested then the data ought to be used with caution, until such time as further work in the region corroborated the apparently high numbers of Clovis points.

That has now happened: several reports (Brown 1994; Perttula 1989; Story 1990) document in detail the presence and distribution of Clovis groups in the region. That distribution is concentrated along and near the Red River and in the Upper Trinity drainage, as well as the North and South Sulphur drainages (Perttula 1989:20; Story 1990:Figure 26). The distribution may in part be attributable to the active collecting of avocational groups (Perttula 1989:19; Story 1990:178), and to deep incision of (and exposure of Pleistocene age deposits in) the Sulphur River channel since the 1930s (Ferring, personal communication, 1995). Because Clovis-age surfaces in these large river valleys are now deeply buried or removed by erosion, the Clovis material tends to occur as isolates (rather than sites) in upland and tributary settings (Perttula 1989:20; Story 1990:182).

Both Story (1990:182) and Perttula (1989:21) see Clovis groups in this region as having a broad-based diet, and foraging widely over this forested area. There is tantalizing, but unfortunately not well documented, evidence that the Clovis point from the multi-component Murphey site (Marion County, Texas) was associated with mastodon bones (Story 1990:185). If that was the case, it would make this locality one of the few in all of North America in which Clovis was associated with mastodon (as opposed to mammoth).

Moving slightly west into North Central Texas, the Aubrey Clovis site (Ferring 1989, 1990; Humphrey and Ferring 1994)—along with the Lewisville site (Crook and Harris 1957, 1958; Stanford et al. 1995)—are now filling in vital gaps in the Clovis occupation of an area, an occupation that is otherwise not well represented in the TCFPS. The scarcity of Clovis age material in this area, as in others, may be attributable to geologic processes obscuring the archeological record, rather than an absence of Clovis occupations.

Distribution of Clovis and Folsom in Texas

Clovis, Folsom, and later Paleoindian occupations were traditionally thought to be similarly adapted, and represented a continuous tradition of big-game hunting that began with a focus on the Pleistocene megafauna (mammoth and mastodon) in Clovis times, and shifted to bison in Folsom and later periods. In recent years, however, it has become clear the adaptive picture is far more complex, and that Clovis adaptations not only varied across their range, but perhaps differed from those of the Paleoindians who followed (Meltzer 1993a, 1993b).

Moreover, there is ample reason to doubt Clovis groups were big-game hunters (of mastodon *or* mammoth). More likely, they were generalized hunter-gatherers who occasionally pursued big-game, but more often exploited smaller, less risky prey. Like turtles. Turtle remains (and other small game) appear with surprising regularity and abundance in Clovis sites (Meltzer 1993b), including several in Texas such as Lewisville (Crook and Harris 1958; Stanford et al. 1995) and Aubrey (Ferring 1990, 1995b). Our romantic image of specialized Clovis hunters moving in for the kill on a trumpeting, rearing mammoth, may have to be replaced by one of Clovis foragers roasting turtles on the half-shell, after a more leisurely and far less dangerous hunt.

In contrast to Clovis, Folsom and later Paleoindians (especially those on the Plains), were more specialized hunter-gatherers, focusing on bison, although theirs was not wholly a bison-diet (see Hofman 1996). Given that contrast in adaptation and the differences in land use that ought to follow from that contrast, we would not expect a strong correlation in the distribution of Clovis and later Paleoindian localities. By and large, that proves to be the case. Table 5 shows the correlation between the numbers of Clovis and Folsom occurrences, all Paleoindian sites, and all archeological sites (data on Folsom occurrences are from Largent et al. [1991:Table 1]; data on Paleoindian and all sites are from Biesaart et al. [1985]).

These results indicate that the distribution by county of Clovis points is unrelated to the distribution of later Paleoindian sites: there is no correlation between the two (Spearman's rho, r_s = .1508, significance = .074, and even less between Clovis points and all archeological sites). However, there was a strong correlation between the number of Paleoindian sites and the total number of sites by county (r_s = .6621, significance = .000). Granting biases in the collection and reporting of Clovis points versus Paleoindian sites, one might attribute the lack of correlation between the two to differential intensity of land use on the part of Clovis groups (Meltzer 1987:36).

Yet, it is important to note this lack of correlation is partly an artifact of scale. Reanalysis of the data using fewer and larger spatial units, namely the environmental and geographic regions defined by Biesaart et al. (1985:9, and Figure 15), shows there is a significant correlation between the number of Clovis isolates and Paleoindian sites by such regions (r_s = .6999, significance = .008). This means, in effect, that at a coarser spatial scale the Paleoindian archeological record (and this includes Clovis) is more generally homogeneous, as perhaps might be expected given regions are larger and more archeologically meaningful units than counties. From this one might speculate that intra-state, inter-regional Paleoindian land use patterns were similar.

Taking the analysis a step further, what of the relationship between Clovis and Folsom? After examining the correlation of Folsom localities with several variables (including county population, area, number of TAS members, and number of available publications), Largent et al. (1991:330) conclude the "best way to predict Folsom localities is to

Table 5. Spearman (r_s) rank order correlations of Clovis and later Paleoindian materials, by county and region.

a) **By county**	Clovis points	Folsom points	Paleoindian sites
Folsom points	-.0445 sig = .600	-	-
Paleoindian sites	.1508 sig = .074	.2870 sig = .001	-
All sites	.1219 sig = .150	.0214 sig = .801	.6621 sig = .000
b) **By region**[1]	Clovis points	Folsom points	Paleoindian sites
Folsom points	.3269 sig = .276	-	-
Paleoindian sites	.6999 sig = .008	.6138 sig = .026	-
All sites	.4972 sig = .084	.1515 sig = .621	.5447 sig = .054

[1] Region designations follow Biesaart et al. 1985

know the number of Clovis points in a county." Relative to the other measures they included in their analysis, this may be so.

Yet, analyzing the correlation between Clovis and Folsom points, using the updated TCFPS data, reveals the relationship is, at best, a very weak one (r_s = -.0445, significance = .622; the correlation measured by Kendall's Tau-B [to allow comparison with Largent et al.'s 1991 results] is -.0375, significance = .593). In fact, unlike the Clovis distribution, the Folsom data do correlate, albeit weakly, with the number of Paleoindian sites per county (Table 5). Our analysis differs somewhat from that of Largent et al. (1991), in so far as we examined the correlation between the number of Clovis and Folsom points per county, not the number of localities per county (as was apparently done by Largent et al. 1991). Still, since there is a very strong correlation between Folsom points and Folsom localities by county (r_s = .9648, significance = .000), the difference between our approaches may be more apparent than real (cf. Largent et al. 1991:328). It seems, then, the Clovis and Folsom records are not significantly alike, at least in their frequency and spatial patterning.

THE ARCHEOLOGICAL CONTEXT OF TEXAS CLOVIS FLUTED POINTS

Clovis fluted points recorded by the TCFPS were found in several contexts (Table 6): as isolated surface occurrences (*isolates*); in well defined (and perhaps sealed) Clovis *site* contexts; and, in the clear majority of those where the context was known, in *surface scatters* amidst archeological material of many different types and ages, including Clovis, other Paleoindian, Archaic, Late Prehistoric, and even Historic material. Note that Table 6 shows the number of individual points as well as number of localities within which those points occur (the latter is included to offset the statistical effects of a single locality having an inordinate number of points, and will always be equal to or less than the number of points). For nearly a third of the points, the context was unknown, or at least insufficient information was provided to make a secure judgment, and we always preferred to err on the side of caution, perhaps unduly so: TCFPS respondents generally noted if other material was present with a fluted point; the absence of such a note provides some warrant to speculate that many "unknown" points are, therefore, isolates. We did not assume so in our analysis, however.

There are a number of observations that might be made of these data. For one, they highlight the fact that discrete and well-defined Clovis sites are rare, a point noted previously (Meltzer 1987:27-28), and also observed in later Paleoindian occupations elsewhere (e.g., Hofman 1996). Even counting the surprising number of sites discovered or reported since the initial TCFPS, notably Aubrey (Ferring 1989, 1990; Humphrey and Ferring 1994), Pavo Real (Henderson and Goode 1991), Gault (Collins et al. 1991, 1992), Poverty Hill (Meltzer, unpublished; Parker 1983; Walter 1990), and Yellow Hawk (Mallouf 1988, 1989), as well as the Clovis sites already known—some of which were recently subject to reinvestigation (e.g., Miami [Holliday et al. 1994] and Wilson-Leonard [Collins et al. 1993])—the essential fact that Texas Clovis sites are rare remains unchanged. Which itself reaffirms the importance of examining the distribution of individual Clovis fluted points (and not just sites) across the state.

But is that scarcity of sites itself meaningful, perhaps suggestive of Clovis settlement activities (Meltzer 1987:27-28), or is it simply an artifact of an archeological record that has somehow made it difficult to see once-intact Clovis sites? The latter possibility might seem supported by the large number of Clovis points that occur within surface scatters, if one assumes those scatters also include the debitage and tools from Clovis assemblages that, unlike fluted points, are difficult to recognize as Clovis.

However, the occurrence of Clovis points within those larger surface scatters could result from one of several causes, but precisely which causes can be difficult to determine, especially from a distance. For example, the occurrence of a Clovis fluted point in a large surface scatter might indicate, as above, that a larger Clovis component was once present at the locality, but by virtue of a heavy artifact rain of later occupations and only light sedimentation, just the fluted point (and not the tools and debitage that were part of the same assemblage and are still present at the site) is recognized as Clovis (while the occurrence ought to be tallied as a site). Alternatively, that Clovis point might be no

Table 6. Context in which Texas Clovis fluted points are found, by region[1]

Context	Number by region[2] 1	2	3	4	5	6	7	Totals
Clovis site	6/3	2/2	0	0	0	0	14/6	22/11
Surface scatter	29/25	3/3	18/17	75/6	7/7	1/1	57/52	190/111
Isolate	15/15	5/5	6/6	0	5/5	1/1	8/8	40/40
Unknown	59	11	23	11	15	4	30	154
Totals	109/43	21/10	47/23	86/6	27/12	6/2	109/66	406/162

[1] Region designations follow Table 3
[2] Figures are Numbers of points / Numbers of sites or localities in which points are found

more than a single isolate left at that locality by earlier Clovis groups (and should be counted as an isolate, and not as a site). Finally, the Clovis point might have been picked up elsewhere by later groups and brought into the site by them for their use (its present context therefore providing few clues as to whether its original context was as an isolate or in a site).

These several possibilities, especially the first two, are likely in areas where key resources, freshwater or stone, for instance, long attracted human occupation, while the third would be likely (but not necessarily restricted) to stone-poor areas. And unless the Clovis point was re-fashioned into a later style (notched, say), its post-Clovis life history might not be easily traced. Examples of Clovis points apparently recycled by later groups would include the fluted points at Ryan's site (Hartwell et al. 1989), Crockett Gardens (Hays 1982), the Doering site (Wheat 1953), 41SP69 (Chandler 1982), the Fred Yarbrough site (Johnson 1961), La Perdida (Weir 1956), the Meier site (Meier and Hester 1972, 1976), and the Obshner site (Crook and Harris 1955).

Sorting these and other possibilities (the ones listed are just the few that come readily to mind) is mostly a methodological problem: how can we differentiate Clovis versus later debitage, for example? Resolving that problem will also require detailed information on the archeological, geological, hydrological, and paleoenvironmental context of the occurrence, information that unfortunately rarely accompanies the points in the TCFPS. Thus, while "surface scatter" is presently the most common context in which Clovis points occur, we cannot conclude that they represent scattered Clovis components or, for that matter, Clovis isolates.

A related matter bears mention: as seems evident elsewhere in Clovis times, and particularly in comparison to later, post-Paleoindian occupations, Clovis groups did not always participate in the highly structured spatial behavior that produces sites. As highly mobile hunter-gatherers, whose movements were virtually unrestricted across the very thinly inhabited and relatively rich Late Pleistocene landscape, Clovis groups were not forced to use the same localities repeatedly, and hence would not necessarily build up a visible archeological record at any one. Indeed, most of the known Texas Clovis sites represent single, very short-term events (the Aubrey site [Ferring 1989, 1990, 1995b] being a particularly well-documented example).

The exception to this pattern would be those areas in which key resources were relatively rare and spatially restricted (so-called point resources): like the freshwater springs and ponds on the High Plains. Such point resources would lend themselves to repeated and perhaps cyclical Clovis exploitation and use, which in turn would lead to the build-up of spatially concentrated debris (sites). Given that many of the springs and ponds on the High Plains dried in the Early Holocene (Holliday 1989, 1995), these localities would not necessarily be targets of later groups, and hence would not become palimpsests of different occupations (surface scatters).

Conversely, where the point resources were unaffected by changing climates or environments (high-quality stone outcrops, for example), use by Clovis and later groups would ultimately result in large surface scatters. Again, however, unless there was active sedimentation on site, discrete Clovis components may not be separable. The intensive use of the Edwards chert outcrops along the Balcones Escarpment provides a good illustration of this. It is appropriate to add that the resultant concentration of Clovis material need not arise, as Shiner (1983) suggested, from sedentary Clovis occupations, but simply from the build-up of assemblages over repeated visits (Meltzer 1987:44).

To a degree, these inferences are supported by the analysis in Table 7, which provides the chi-square and adjusted residuals[3] values for the *locality* data in Table 6 (which of course excludes tallies on the Clovis points for which the context was "unknown"). The significant chi-square result indicates that site context and region are not independent: there are regions in which points occur in certain contexts more often than would be expected by chance. The adjusted residuals help pinpoint which of the cells (region by context) contributed most to the chi square.

In Central Texas, as inferred, surface scatters occur significantly more often than would be expected by chance, while isolates are significantly

[3] Adjusted residuals help identify which cells are responsible for a significant chi-square value (Everitt 1977:46-47). Adjusted residuals are read as standard normal deviates; values greater than 1.96 (or -1.96) mark cells in which the observed values are significant—hence, have observed values greater (or lesser) than would expected (and thus drive the chi-square value).

Table 7. Chi square and adjusted residuals analysis of the context in which Texas Clovis fluted points are found, by region (data are from Table 4, excluding the "unknown" row).

	Adjusted residuals by region[1]						
Context	1	2	3	4	5	6	7
Clovis site	.06	1.71	-1.40	- .67	-.97	-.38	.97
Surface scatter	-1.71	-2.71	.60	1.69	-.79	-.57	2.33
Isolate	1.81	1.92	.17	-1.43	1.42	.84	-3.08

Chi square = 23.156, df = 12, significant at 0.026

[1] Region designations follow Table 3

under-represented (adjusted residuals values of 2.33 and -3.08, respectively). A similar pattern seems to characterize the Coast region. For lack of other information, McFaddin Beach is currently designated as a surface scatter, given that it has also yielded other Paleoindian points, as well as those of Archaic and Late Prehistoric age (Turner and Tanner 1994:324). Were the McFaddin Beach materials derived from one or more discrete site contexts, the results would almost certainly change. In the Plains/Panhandle and in North Central Texas, the pattern is just the reverse: Clovis points found as isolates are more common, surface scatters less so.

These results open a window into Clovis settlement strategies, suggesting as they do that such strategies differ across the state. Perhaps, following the earlier line of argument, resource exploitation in Central Texas entailed the kind of highly structured spatial behavior that produces sites: camping at springs and refurbishing tool kits from locally abundant supplies of chert, for example. We might speculate, therefore, that Clovis points occurring within surface scatters at localities with such key, point resources might represent palimpsests of sites, more so than a record of isolates (after all, if the locality attracted repeated use throughout prehistory, then it may equally have attracted repeated occupations by Clovis groups).

In contrast, in North Central Texas and on the Plains/Panhandle it would appear more non-point resources were utilized. On the Plains, point resources that were visited repeatedly, such as the freshwater springs and lakes around which many of the isolates were found, were not otherwise used in ways that produced a significant archeological record. Such speculations, however, are limited by the lack of more fine-grained data in the TCFPS on the precise contexts of Clovis points.

VARIATION AND PATTERN IN TEXAS CLOVIS FLUTED POINTS

There is additional information to be gleaned from the points themselves which sheds light on this and other aspects of Clovis adaptations. To explore these issues, we sought through the TCFPS data on the kinds of lithic raw material used in the manufacture of the points (which may reveal something of Clovis settlement strategies), patterns in fluted point size and shape (which might bear on technology, function, and possibly style), and information on fluted point life-histories.

Raw material sources and usage

The analysis of lithic raw materials used in the production of Texas fluted points was limited by the fact that correspondents were generally able to identify the stone to type (chert as opposed to quartzite, say), but less often to specific outcrops or even sources; this is a difficulty hardly limited to TCFPS correspondents, given the well-known complexity of raw material sourcing (Banks 1990:6-7; Hofman et al. 1991). Even so, enough raw material types were identified to make some statements about the sources of raw material used by Clovis groups in the manufacture of their points or, short of that, at least the general rock type used (Table 8).

Not surprisingly, the majority of the 137 Clovis points across the state identifiable to raw material type were manufactured of Edwards Formation (Cretaceous) cherts, which crop out over a large area of Central Texas (Banks 1990:Figure 3.1; Frederick and Ringstaff 1994:Figures 6.3-6.5). Based on those data, and the descriptions that accompany many of the reports, we would speculate that a majority of the 269 "unknowns" in Table 8 are also made of Edwards chert. In those instances where uncertainty existed, however, we tallied the stone type as unknown.

Far fewer Clovis points statewide are manufactured of Alibates agatized dolomite and Tecovas jasper, which crop out in relatively smaller areas of the Plains/Panhandle and escarpment (Banks 1990:91-92). Less common still are points made of quartzite (those that were fashioned of Morrison or Dakota quartzite, which crops out discontinuously across the High Plains [Banks 1990:90]). Individual Clovis specimens were also fashioned of petrified wood (source locality unknown), Manning fused glass (Brown 1976,1994; this material outcrops in eastern Texas [Banks 1990:53]), and obsidian.

An interesting pattern emerges in the data on Edwards, Alibates, and Tecovas materials that comprise the bulk of the identified sources. If one collapses the data in Table 8 to show only the number of Clovis points fashioned of Edwards chert by region, arrayed against the number of Clovis points fashioned of either Alibates or Tecovas by region (combining the Alibates and Tecovas stone sources on the rationale that together they represent a "High Plains" source), as in Table 9, it becomes clear there is a distinct asymmetry in Clovis stone usage.

Clovis points fashioned of Edwards chert were commonly found in Central Texas as well as on the High Plains (although as the adjusted residuals indicate, Edwards is still significantly under-represented on the High Plains). Yet, Clovis points made from the High Plains sources were common on the High Plains, but rarely were carried east into Central Texas (and given the cautions of Goode [cited in Banks 1990:61], there is a possibility the few that do occur in that region are not actually Alibates or Tecovas, but an anomalous local Edwards variety). The easternmost occurrence of a point manufactured of Alibates "flint" is from the McFaddin Beach locality (Long 1977:7), but as noted previously, it exhibits little of the attrition that often occurs on points so far from their source, and thus

Table 8. Raw material types identified in the TCFPS, by region

Source/type	Number by region[1] 1	2	3	4	5	6	7	Unk	Totals
Edwards chert	37	7	3	0	7	0	39	0	93
Tecovas jasper	6	1	0	0	0	0	0	0	7
Alibates dolomite	18	2	0	0	0	0	4	1	25
Alibates or Tecovas?	2	0	0	0	0	0	0	0	2
Quartzite	4	1	0	1	0	0	0	0	6
Petrified wood	0	0	2	0	0	0	0	0	2
Obsidian	0	0	0	1	0	0	1	0	2
Manning fused glass	0	0	1	0	0	0	0	0	1
Unknown	42	10	41	84	20	6	65	0	268

[1] Region designations follow Table 3

Table 9. Clovis fluted points made of Edwards versus Alibates & Tecovas, grouped by region

Source/type	Number by region[1] 1	2	3	4	5	6	7	Totals
Edwards chert	37	7	3	0	7	0	39	93
Adjusted residuals	-3.84	-.28	1.04	0	1.62	0	3.10	
Alibates & Tecovas	26	3	0	0	0	0	4	33
Adjusted residuals	3.84	.28	-1.04	0	-1.62	0	-3.10	
Totals	63	10	3	0	7	0	43	126

[1]Region designations follow Table 3

seems oddly out of place on the Texas Gulf coast (Meltzer 1987:45). Points made from Alibates and Tecovas, however, were often carried onto the High Plains far to the north and west of their source, as seen most notably in their occurrence in the Drake Cache in North Central Colorado, some 485 km from the Alibates outcrops (Stanford and Jodry 1988).

What this pattern of stone use might indicate is that the Clovis High Plains settlement system tracked predominantly to the north and west of that region (and then back), more so than to the south and east, although, of course, High Plains groups did utilize Edwards chert (Meltzer 1989b). Unless the Edwards chert on the High Plains marks Clovis groups from Central Texas moving onto the High Plains, it suggests as well that they cycled back to Central Texas without procuring or using to any significant degree the stone local to the High Plains. Such speculations, however, must be taken with the caveat that the raw material evidence is saying no more than that certain stone sources were being used, and is not directly tracking whether Clovis settlement systems did not extend in certain directions or in specific regions. Still, it does highlight the fact that in order to truly understand the movements of hunter-gatherers as wide-ranging as these Clovis groups clearly were, one must attack the problem on a very large scale, and (reinforcing the point made at the outset) pay no attention to modern political boundaries.

Perhaps shedding additional light on Clovis settlement systems is an intriguing bit of largely negative evidence, which naturally must be taken with great caution. No artifact-quality obsidian occurs in Texas (Hester 1988); hence, any obsidian in or near the state is exotic and was imported. For reasons outlined in Meltzer (1989b), it is suspected that where exotic stone comprises the bulk of a group's stone supply, then it most likely was obtained by the group directly at the distant outcrop. Cases where exotic stone is extremely rare open the possibility that either direct procurement or exchange might have been the mechanism by which the stone was moved from source to site. In general, most lithic raw material used in Clovis sites (and perhaps Folsom as well [Hofman 1992:198]), appears to have been directly procured. But obsidian—rare as it is and distant as its sources—may prove the exception to that rule.

One obsidian Clovis point occurs on the High Plains at Blackwater Locality No. 1 (the Clovis type site) in New Mexico, just across the Texas border. It was made of obsidian from the Valles Caldera in the central Rio Grande Valley of New Mexico, some 350 km west of the site (Johnson et al. 1985:52). No other obsidian Clovis points from this or any other central Rio Grande source have been found on the High Plains. This indicates that in Clovis times at least there was only infrequent traffic between the two regions, which may reveal something of the direction of Clovis settlement systems, backhanded support for the supposition that Plains Clovis groups were moving south to north, or perhaps some evidence of the scale of these systems.

In regard to the latter, one might observe that obsidian Clovis points tend to be infrequent in North America, occurring most often and in the greatest abundance in what we might term "Clovis-proximity" to major obsidian sources (e.g., the Dietz site in Oregon [Willig 1988]). "Clovis proximity" is about 300 km, the figure that turns up repeatedly in measures of the distances these groups are known to have traveled from their stone sources (Haynes 1982:392; Meltzer 1993a:305). It may well be that if groups cycling through the central Rio Grande were heading towards the Plains, they did not do so often or extend very far onto the Plains (it being beyond Clovis proximity), or interact with groups that were on the Plains. It would be most interesting, although well beyond the scope of the present paper, to determine the relative frequency of Clovis points made of Alibates or Tecovas in the central Rio Grande Valley, in order to see the degree to which the pattern evident in the use of obsidian in Texas was mirrored in the other direction by the use of Texas cherts Judge (1973:248) notes that 21 percent of a sample of 26 Clovis points from the central Rio Grande are made of "chert and obsidian," but does not specify the chert in question. Judge adds that 43 percent of the points are made of chalcedony, which appears at the Aubrey site (Ferring, personal communication, 1995) as well; it was not distinguished in the TCFPS analysis, but does occur in this sample.

Only two obsidian Clovis points have been found within Texas. One was reported by Hester (1988) from the Port Lavaca area of Calhoun County on the central Gulf Coast (41CL72), and had been heavily abraded by wave action. The precise source of the obsidian could not be determined by laboratory analysis: however, it did not match the known New Mexico sources, nor did it match sources known from old Mexico (each at least 1000 km to the west and south, respectively) (Hester 1988:28). In this instance, knowing the context of the discovery is crucial (notably, whether the point was picked up and moved by post-Clovis groups), for if that context is securely Clovis and its source can be located it may be possible to infer something of the scale and direction of Clovis movements across the landscape or Clovis exchange.

In that regard, the obsidian Clovis point from Kincaid Shelter is of some interest. This point, originally described by Hester et al. (1985:150-151) as an indeterminate (possibly Angostura-like) Paleoindian point, has subsequently been identified by Collins et al. (1989) on the basis of the point's morphology and context as Clovis. The point was fashioned of obsidian derived from a Valley of Mexico source (Queretaro) some 1000 km south of Kincaid. It is a heavily ground basal fragment, which Collins (personal communication, 1995), believes represents a re-tooling discard. Point manufacture was taking place at Kincaid, and not surprisingly the Clovis preforms from the site are made of locally available chert; the obsidian point was one of the very few exotics in the Kincaid Clovis assemblage. If this obsidian specimen was acquired directly at the source by highly mobile Clovis groups, as opposed to obtained via exchange, its presence in Central Texas would imply a considerable settlement range. Taking this evidence a step further, if Clovis groups were the first Americans and were generally trending southward through the hemisphere (in addition to their more "local" settlement moves), then this evidence would also indicate that the migratory process was not unidirectional, and that even after travelling some distance south of the Rio Grande, these groups cycled back north as well. This is in keeping with recent models of the peopling of the Americas, which anticipate "reverse migrations" in the long process of colonizing the continent (Meltzer 1995), but again it assumes that Clovis groups were the first Americans—which may or may not be the case.

Texas Clovis Morphometrics

Of the 201 points added to the data set since 1986, morphological and metric data are available on 132 of them (Table 10). Measurements on all variables were not always available for all specimens, however; hence, the different values for *n* in Table 10. Adding those data to the analysis is revealing in several ways, not the least of which is that despite substantially increasing the number of points from the original sample, the overall size and shape patterns remain largely unchanged (compare Table 10 with Meltzer 1987:Table 9). That there was so little change between the two samples demonstrates that the original data set was indeed a reasonably representative one in terms of point morphology. Were the original sample not representative, the additional data would have significantly changed the statistical patterning.

The data from the TCFPS indicate that the "average" Texas Clovis fluted point is just over 6 cm long, and 2.75 cm wide at its widest spot (generally, the base is narrower, only 2.36 cm wide). The widest spot occurs partly up the blade, 2.88 cm up from the base, just a few mm beyond where the haft ended. The haft area in Clovis points is marked by edge grinding, which on average extends upwards from the base 2.59 cm, and is present on virtually all of the points in the TCFPS. The *maximum thickness* of these points averages 7.3 mm, and generally the points are thickest on the blade portion well beyond the haft (3.5 cm from the base) and beyond the point of maximum width. In effect, these points are "front heavy." All of which means they have a slight taper, in both plan and longitudinal section. Flute scars generally do not extend beyond the haft area, are centered over the point axis, and are sufficiently narrow (on average, 1.29 cm wide) that they rarely extend to the lateral edges of the point.

Further, the points in this sample tend to scale by size in a relatively straightforward manner: longer points are generally thicker and wider (at both their maximum and at their base), and the spots in which they are widest and thickest are farther from the base (correlations of *length* with *maximum width to base* and *maximum thickness to base* are *rp* = .7090 and .8681, respectively, with both significant at the .000 level). Longer points also tend to have longer flute scars although their length does not correlate as strongly with overall length (*rp* = .3562, p = .000). As might be expected, the extent of the *edge grinding* does not correlate with length (*rp* = .0878, p = .149); the size of the haft was apparently relatively constant regardless of point size (see below, as well). To highlight the obvious: the length of *edge grinding* can also be more tightly controlled than flute scar length, which is also part of the haft. The number of flute scars does not correlate at all with point length (r_s= -.0432, significance = .475, and -.0754, significance = .215, for flute scars on the obverse and reverse faces, respectively).

At least those are the statistical averages and trends. Of course, it is highly unlikely that all (or even most) of the 406 points in the TCFPS conform precisely to the averages in Table 10. But these statistics do show that in certain attributes there is considerable conformance to the mean, while in others there is more variance about the mean (as measured by, for example, *kurtosis*, which indicates the shape of the distribution of cases about a mean: normal distributions have a kurtosis value of zero, positive kurtosis values result where most of the individual cases cluster tightly around the average value for all cases, while negative values occur where cases are scattered widely around the mean). While we obviously cannot describe each point individually, we can use such measures to help gain insight into how and in what attributes the "average" values are representative (or not), and from that perhaps draw some general inferences about Texas Clovis fluted point morphology, technology, and function.

As was true in the original survey, a measure that shows considerable variation is the *maximum length* of the fluted point, which in the original sample had a kurtosis value of -.28; the value is currently .05, indicating a very slight "tightening" of the distribution about the mean in this larger sample. The relative scatter of *length* values is easily understandable: *length* varied considerably over the life history of a Clovis fluted point as a result of use, breakage, and reworking (Meltzer 1987:56). Because the data in Table 10 come from all the cases in the TCFPS, including whole, reworked, and broken points, the values naturally vary. Accordingly, the subsample of only the whole and completely unbroken points in the TCFPS is longer and much less varied (mean = 7.81 cm; kurtosis = .81), than the subsample of only the reworked points (mean = 5.38 cm; kurtosis = .50). In fact, there is a statistically significant difference in the lengths of whole versus reworked points (t-value = 6.49, significant at .000 level) (see also Meltzer 1987:49).

In general, it appears points were reworked while still mounted in their haft (Meltzer 1987:49), based on the "shouldering" just beyond the haft that occurs in many cases, and the fact that flute scars and edge grinding were rarely removed by subsequent flaking or retouch. Thus, reworking mostly affected the blade portion of the fluted point, and because reworking did not just make the points shorter, but narrower too (by moving the blade edges in), the *maximum width to base* measure is significantly reduced in reworked points as well (the mean for whole points is 3.33 cm, for reworked points it is 2.26 cm, producing a t-value of 4.97, significance = .000).

Table 10. Descriptive statistics for Texas Clove fluted points, 1986 and current samples (in centimeters)

Variable	n in sample	Mean	Minimum	Maximum	Standard Deviation	Kurtosis
1986 data only[1]						
Maximum length	155	5.75	1.10	13.04	2.69	-.28
Maximum width	155	2.73	1.71	4.80	0.49	1.46
Distance from maximum width to base	130	2.78	.00	6.50	1.28	-.01
Base width	144	2.34	1.38	4.50	0.46	2.43
Maximum thickness	137	0.72	.30	1.20	0.15	.36
Average flute length[2]	106	2.42	.95	5.20	.83	.41
Average flute width[3]	111	1.28	.65	2.30	.35	-.27
Basal depth	124	.21	.00	.80	.17	.24
Average length edge grinding[4]	87	2.51	1.07	4.88	.79	-.30
All data						
Maximum length	285	6.14	1.10	16.40	2.78	.05
Maximum width	287	2.75	1.71	4.89	0.49	1.60
Distance from maximum width to base	235	2.88	.00	8.13	1.39	1.03
Base Width	260	2.36	1.38	4.50	0.46	1.82
Maximum thickness	269	0.73	0.30	1.20	0.15	0.23
Distance from maximum thickness to base	17	3.50	1.50	5.63	1.20	-.39
Average flute length	138	2.42	.95	5.20	.81	.36
Average flute width	146	1.29	.65	2.30	.33	-.11
Flute thickness	18	.57	.42	.88	.11	2.21
Basal depth	177	.28	.00	.80	.17	.10
Average length edge grinding	140	2.59	.97	5.72	.78	1.18

[1]There were several discrepancies in the original published version of this table (Meltzer 1987:Table 9)—the most glaring of which was maximum fluted point thickness erroneously listed as 2.80 cm, far thicker than any fluted point in this or perhaps any other sample. We present the corrected data here. Certain measurements were not taken in the original survey, hence the difference in the variable list between the 1986 and current samples.

[2] These values are derived by first calculating the average flute length on an individual fluted point (by summing flute length on the obverse and reverse faces of the point, then dividing by two), then averaging those values for all points.

[3] The calculation for average flute width was done in the same manner as the calculation for average flute length.

[4] The calculation for average length of edge grinding was done in a similar manner as average flute length and width, only in this instance the length of the left and right edge grinding was averaged for each individual point.

If reworking also made the blade thinner, then there should be a difference in *maximum thickness to base* between whole and reworked points. However, if reworking was of the sort that characterized Dalton points, in which the blade was narrowed and its edges steepened, but the blade was not thinned. In that case, there would be no significant difference between whole and reworked points. Unfortunately, we have measurements of *maximum thickness to base* on only nine of the whole and reworked points in the TCFPS, so a test of that proposition would not be statistically meaningful at present.

But perhaps we can explore this issue another way: by looking at the values for *maximum thickness*. These were normally distributed about the mean, and showed approximately the same dispersion as maximum length values (see Table 10). That variability might result from reworking and/or use, or perhaps other factors. In a recent discussion, Tankersley (1994) argued that variation in fluted point thickness results from variation in the lithic raw material selected for use, and as a byproduct of the use of a percussion-based bifacial reduction strategy. He assumed that percussion flaking yields less precise and more variable thinning flakes than that resulting from the controlled pressure-flake fluting of Folsom times (Tankersley 1994:506). Unfortunately, Tankersley's paper proposes, but by no means demonstrates, that the relationship between thickness and raw material/technology occurs, and the proposition is weakened on several counts, not least that the site (Williamson) in Tankersley's sample with the most raw material variability is not the one with the greatest variation in point thickness (see Tankersley 1994:Tables 2 and 10). Still, the proposition makes intuitive sense, so it is appropriate to ask, is there such variation in the thickness of fluted points in the TCFPS sample, and can that variation be correlated with raw material types?

A histogram of the distribution of fluted point *maximum thickness* reveals a bimodality in the TCFPS sample: one mode centers around 0.63 cm, the other around 0.81 cm. Obviously, if Tankersley's supposition is correct, then that bimodality ought to represent two distinct lithic raw material subgroups within the sample. Our data do not support this, however. These two modes do not correspond with raw material types. Instead, the *maximum thickness* of points made of Edwards chert and Alibates agatized dolomite is quite similar (average thickness for Edwards points [n=86] is 0.742 cm; average thickness for Alibates points [n=22] is 0.756 cm), and statistically indistinguishable (t-value = -.35, significance = .727). While Tankersley's proposition is not supported by this particular data set, there is always the possibility that raw material differences might emerge in the use of other, more contrasting lithic raw materials than Edwards and Alibates: it would be useful, therefore, to compare points made of, say, Edwards, and those made of Dakota quartzite, but unfortunately, sample sizes of quartzite and other non-chert materials in the TCFPS are currently too small to make statistically meaningful comparisons. Thus, it remains to be demonstrated that fluted point thickness varies with raw material type (see also the comments in Amick 1995:34).

As to what does explain the observed variation and bimodality in fluted point thickness, we explored whether it might sort by region, reworking, and many other possibilities, ultimately concluding that point thickness appears to sort by *breakage* types. Specifically, whole points tend to be significantly thicker than points that have snapped in half: the average *thickness* for whole points (n=135) is 0.752 cm; the average *thickness* for laterally snapped point bases (n=42) is 0.654 cm; the two means are significantly different (t-value = 3.72, significance = .000). That, of course, brings us back to the observation earlier made that the spot of *maximum thickness* generally occurs on the blade beyond the haft. Since lateral snaps usually occur along the upper edge of the haft (also Meltzer 1987:49), that effectively removes the thickest portions of the point, and thus gives us the observed bimodality. In effect, then, it does not appear there is any significant variation in fluted point thickness, at least none that is not explained by the overall size of the points in the TCFPS sample.

The fact that reworking was generally done outside the haft helps explain the relatively higher kurtosis values for variables within the haft area, such as *flute thickness* and *basal width*, as well as why the averages for the latter changed less than 0.2 mm between the 1986 and current samples. It is worth noting, as well, that the average value of *basal width* in the TCFPS sample is within 0.2 and 0.6 mm of the averages for 305 Clovis points from the Midwest, and 57 Clovis points from Oklahoma (see Hofman and Wyckoff 1991:30; Tankersley 1994:Table 3).

In turn, these relatively high kurtosis values suggest that since the attributes most directly associated with the haft vary the least, there was a degree of "standardization" in point manufacture. Were these artifacts all intended for use as spear points, one might suggest the standardization reflects the critical size range necessary for maximum penetrating efficiency (e.g., Sollberger 1988:2, 11). However, that argument may not hold, as many of these points (by their wear and retouch patterns, lack of impact fractures, and distinctive breakage) were almost certainly also used as hafted knives (see Meltzer 1987:46-54).

Alternatively, the standardization may reflect hafting demands, and those required of maintaining composite (tool, haft, and foreshaft) artifacts (for a further discussion along these lines, see Bleed [1986]). Judge (1973), and others (e.g., Amick 1995; Keeley 1982; Meltzer 1987:56; Odell 1994:54-55; Shott 1986:43) have inferred that hafted tools were made to fit their hafts, and not vice versa, and that the hafts themselves were maintained and curated through the lifetimes of several points (hence, the standardization in attributes such as *basal width*). Perhaps this implies that the raw materials for hafting (bone, wood, or ivory) were scarcer or by some other measure (perhaps the labor involved in manufacture or the scarcity of suitable materials) more "costly" than the stone to make the points. Or perhaps it indicates that stone points simply had a much shorter use life than the non-stone hafts. In any case, making a new point was likely more efficient and less costly than making a new haft, and thus the point became the most readily expendable and interchangeable part in this artifact system.

This conclusion may seem somewhat counterintuitive, given the time involved in point production, and especially the potential for failure in the very last stages of point manufacture—the fluting itself (Bradley 1993; Sollberger 1988:13). Still, Clovis fluting may have been less prone to failure than fluting the thinner Folsom points (Bradley 1993:255), although it nonetheless always involved a degree of risk of errant flutes ending in reverse hinge or step fractures that broke the preforms (Sollberger 1988:9). But stone was, relatively speaking, a reasonably inexpensive commodity, and perhaps the risks of fluting were less than they appear some 11,000 years after the fact.

The specific technological process by which Clovis fluting was accomplished—whether direct or indirect percussion, pressure, or levered pressure—is still a matter of discussion and debate (e.g., Bradley 1993; Collins 1990, unpublished; Henderson and Goode 1991; Mallouf 1989; Sollberger 1988). There is little in the TCFPS data that will resolve that issue, since it is difficult to tease technological information from morphological data on a group of finished and primarily isolated fluted points. The TCFPS data do, however, shed some light on the fluting process, at least on a statewide scale.

For one, it was a remarkably exact process. The tight distribution of *flute thickness* is evidence of that, indicating as it does that there was a narrow range of thickness tolerances, perhaps driven by the requirements of the haft. The fluting process most often involved a single flute on each face, and only occasionally multiple flutes (flutes side by side and sometimes overlapping); roughly 30 percent of the 285 points for which data are available have two or more flutes. Multiple flutes were in some cases struck to provide guide ridges for a main flute.

Basal preparation in advance of fluting is not always obvious in the finished products, especially when the base was retouched afterwards. However, it is of interest to observe that the *basal concavity* in these points is on average rather shallow (less than 3 mm), much smaller than the average for Clovis points in other parts of North America, notably in the northeast U.S. and on the northern Plains (e.g., Colby points), and considerably smaller than the average in some forms that have basal concavities upwards of 8 mm deep (Gramly 1982:Table 2; Tankersley 1994:Table 3). The depth of the *basal concavity* may be a stylistic feature and/or a technological one, and in the case of the latter may represent one (or more) of several possibilities: a by-product of pre-flute platform preparation (whether bevelling or preparation of nipple platforms) and platform remodeling (e.g., Sollberger 1988:12); the result of fluting; or a consequence of post-fluting trimming and retouch (possibly by pressure flaking) (Collins 1990:74). One fact seems clear: the depth of the *basal concavity* is unrelated to *flute length* (rp = -.1306, p = .145), *flute width* (rp = -.0266, p = .763), and the number of flutes, so does not appear to be a direct correlate of the fluting process itself.

Flute length, as noted, seems to scale with overall point length, but only weakly, which suggests that beyond a certain minimum length the extent of the flute did not particularly matter. In fact, while the overall range of *flute length* extends up to a maximum of 5.2 cm, that maximum value is an anomaly, much longer than the next longest flute scar (4.5 cm). Plotting the distribution of average flute lengths reveals that in the large majority (77 percent) of the cases, *flute length* falls between 1.5 and 3 cm. There was clearly little effort, at least in this sample of Clovis points, to create flutes that ran much past the haft, let alone the full length of the point, as they do in Folsom points, and in some eastern fluted styles (e.g., Barnes, Cumberland). As an aside, the empirical observation that longer flutes occur on later point styles (Sollberger 1988:11) seems correct on a continental scale, but that does not mean the reverse is true: that is, shorter flutes are not necessarily earlier. In fact, some of the later eastern varieties, like Holcombe, have short flutes (for a useful discussion of stylistic change in eastern and some western fluted points, see Deller and Ellis [1992:125-133]). Nor is it yet clear that full-length fluting can be used as a chronological marker independent of radiocarbon dating, or that *flute length* increased over time as a result of technological improvements which yielded greater hunting efficiency (Sollberger 1988:3, 7).

There is in the TCFPS sample evidence for a *regional* difference in *flute length*: points from Central Texas tend to have longer flutes than those on the High Plains (the means are 2.68 and 2.28 cm respectively, producing a t-value of 2.61, significance =.01). But as points on the High Plains also show a higher incidence of reworking (see below), often obscuring the distal portion of the flute scars (a practice that, in general, was avoided by Clovis knappers [Bradley 1993:254]), these differences in *flute length* are likely not technological or stylistic. In fact, when only whole points are considered, *flute length* does not differ between the two areas.

Clovis Life-histories

As is evident, Clovis fluted points in the TCFPS vary considerably in their condition. The numbers of whole and broken points are tallied in Table 11. The tally is obviously biased toward whole points and points in which at least a portion of the base remains. The reason for that is twofold: first, whole points are more likely to be collected and reported; and, second, only points in which the flute is visible are likely to be recognized as Clovis. There are in the TCFPS sample some 55 fluted point bases (categories 2 and 5), most of which snapped off at the haft line. Just as many distal ends were once attached to those bases, and at least some of them ought to be present in the archeological record, but if they lack any evidence of a flute their Clovis affinities might not be obvious (and as flutes tend not to extend much beyond the haft, they were likely absent on many of those distal ends).

The frequency of whole points is actually higher than it appears in Table 11, for several of the other categories (4, 6 and 7) are points that are virtually intact, and have only minor breaks that likely took place *after* the points had been discarded or lost (it is common for points lying on a surface, for example, to lose a tip or corner). In fact, 169 of the points in Table 11 (the sum of categories 1, 4, 6, and 7) can be counted having been discarded or lost while still essentially intact. While that is a large number for the size of the sample, it is not unexpected, given the manner in which points are recognized and collected.

Of the remainder of the points in Table 11, breakage likely took place while the points were in use; perhaps this was the reason the points were discarded. As before (cf. Meltzer 1987:Table 6), lateral snaps are the most common break in the TCFPS sample (categories 2 and 5, n = 55). For a variety of reasons (Meltzer 1987:48-49), lateral snaps may indicate points broken while being levered in the haft. That action hints at the additional use of these points as knives, a suggestion corroborated in some instances by patterns of retouch and utilization.

Reworking (categories 3 and 10) is evident on 58 of the points, and is responsible for some of the morphometric patterns seen in the sample (as just noted). Furthermore, reworked points are not distributed evenly among the regions; rather, the incidence of reworking is significantly higher than would be expected in the Plains/Panhandle region (Table 12). Lithic raw material was, of course, relatively scarce there (above, see also Johnson and Holliday 1984:67; Meltzer 1987:43), which led Paleoindians (and, for that matter, later groups) to conserve their raw material through judicious reworking and reuse of points and tools (see also Amick 1995; Hofman 1992).

Table 11. Breakage patterns for Texas Clovis fluted points (breakage patterns are unknown for 99 specimens)

Source/type	Distribution by region								Totals
	1	2	3	4	5	6	7	Unk	
1 Whole points (no breaks)	31	5	14	21	8	1	34	0	114
2 Base only (lateral snap)	19	5	4	2	2	1	15	0	48
3 Reworked (distal end)	21	5	4	1	9	0	12	0	52
4 Distal tip broken	11	1	1	5	2	1	7	0	28
5 Base only (lateral snap) with broken corners	2	0	1	0	1	0	3	0	7
6 Broken corners	2	1	3	1	2	1	7	0	17
7 Distal tip broken, broken corners	2	0	0	1	1	0	5	1	10
8 Broken base	2	0	1	1	0	0	4	0	8
9 Distal tip broken, broken base	1	2	2	1	0	0	2	0	8
10 Reworked (distal end), impact fracture	5	0	0	0	0	0	1	0	6
11 Edge damage	0	0	0	2	0	0	1	0	3
12 Failed preform	0	0	0	0	0	0	6	0	6
Total	96	19	30	35	25	4	97	1	307

Overall, reworked points tend to be the same length regardless of region and regardless of raw material type, which indicates that there may have been a threshold size beyond which a point was no longer useful in that form, and reworking ceased. There is a further, interesting pattern bearing on reworking hinted at when these data are partitioned by the major raw material types: whole and reworked points made of Edwards chert tend be slightly longer (by 0.27 cm) in Central Texas (their source areas) than on the High Plains (where they had to be imported). The difference is not statistically significant. And yet whole and reworked points of Alibates and Tecovas also tend to be slightly longer (this time, by 1.32 cm) in Central Texas and not the Plains, where the raw material occurs. Again, the difference is not statistically significant, and the sample sizes make any conclusions premature (there are 16 points for which data are available). Still, these data raise the possibility that reworking of Alibates and Tecovas was more extensive on the High Plains where the distance (in time and space) to stone sources enhanced efforts to prolong point use-life through resharpening and reworking; reworking was less extensive in Central Texas where there was an ample supply of raw material to replace the points long before they reached the threshold beyond which they were unusable or exhausted.

Impact fractures (n = 6) remain extremely rare in Texas Clovis fluted points, and occur mostly (5/6) on points from the Plains/Panhandle. Whether that regional difference bespeaks different uses of the points is uncertain, especially given the small sample size, and the fact that reworking may have masked impact fractures that were once on other points. Reworked points, as noted earlier, are shorter and narrower than whole points, but whether some of those represent impact damaged-projectiles that

Table 12. Whole point (categories 1, 4, 6 and 7) versus reworked points (categories 3 and 10), by region.

	Number by region[1]							
Condition	1	2	3	4	5	6	7	Totals
Whole points	46	7	18	28	13	3	54	169
Adjusted residuals	-2.57	-1.34	.80	2.89	-1.78	1.01	1.56	
Reworked points	26	5	4	1	9	0	12	57
Adjusted residuals	2.57	1.34	-.80	-2.89	1.78	-1.01	-1.56	
Totals	72	12	22	29	22	3	66	226

[1] Region designations follow Table 3
Chi square = 19.73, df = 6, significant at .00309

were repaired, as opposed to points that were simply resharpened, is unknown. Taking this low figure at face value, however, does highlight the contrast between Clovis and later Paleoindian assemblages, especially those from Plains bison kills, in which impact features are common damage on points used to bring down large game. The low incidence of impact fractures in this large sample of Clovis points, including the one from the Murphey site apparently associated with mastodon remains (Story 1990:185), raises the question of whether these points were regularly used as the tips of spears (also Meltzer 1987:50-51).

Preforms (broken and whole) are equally rare in the TCFPS sample (n = 6), although this is partly a definitional matter: only later stage preforms in which the flute was present (and hence recognizable as Clovis) were recorded in the survey. Earlier stage preforms and reduction debris are present at a few sites in Texas, notably Aubrey (Ferring, personal communication, 1995), Kincaid Shelter (Collins et al. 1989), Spring Lake (Takac 1991), and Yellow Hawk (Mallouf 1989), and ultimately it is this evidence that will yield the most precise information on Clovis technology.

SUMMARY AND CONCLUSIONS

The salient facts that emerge from this update of the TCFPS are as follows: the sample (n = 406) is now nearly double what it was originally, and in most respects is a representative one. The sample is not biased by modern population density, and its statistical similarity to the original data set suggests it provides a valid profile of Texas Clovis material (with exceptions as noted).

In this updated sample, points were added to 33 counties where Clovis records had not previously been reported, raising the total number of Texas counties with Clovis points to 128. The vast majority of counties have less than two Clovis points, though a few (Crosby, Gaines, and Jefferson), have more than 10. The average density of Clovis points by region is 15 per 10,000 square miles, although some regions (such as the Trans-Pecos) have far lower densities, while in other regions (the Coast) the densities are much greater.

These patterns are also reflected in finer-grained statewide maps, which also show a considerable density of Clovis material on the High Plains and on a crescent-shaped arc through Central Texas, but lower densities in East Texas, and a near absence of Clovis material on the Lower Plains. In some areas (such as the Trans-Pecos, Central Texas, and the High Plains), those patterns may accurately represent the relative intensity of Clovis land use. In other areas, the patterns may be skewed by geological processes which either mask Clovis age surfaces and remains (the Lower Plains), or prevent us from understanding the context from which Clovis remains are derived (McFaddin Beach on the Coast).

One pattern does seem clear, which is that the Clovis distribution is not coincident with the distribution of later Paleoindian remains (including Folsom), except at a very coarse spatial scale. This contrast may imply differences in land use strategies, and is in keeping with independent evidence that the adaptations of Clovis groups may be quite different than those of the Paleoindians who followed.

A further expression of Clovis land use patterns is in the context in which Clovis materials occur. Most are found within surface scatters of material of later age; the remainder occur as true isolates; only a few occur in discrete Clovis sites. Such patterns, which to a degree vary by region, bespeak adaptations which did not always involve the redundant use of space, except perhaps in those instances where fixed, point resources occur, such as freshwater springs on the Plains or chert in Central Texas.

The majority of Texas Clovis fluted points are made of Edwards Group chert from Central Texas; a significant minority are fashioned of Alibates agatized dolomite and Tecovas jasper from the High Plains/Panhandle region; a few specimens are made of Dakota quartzite; individual points occur on a sprinkling of rare materials. There are regional differences in raw material use: Edwards cherts are common throughout the state, while the High Plains raw materials tend to drop off sharply in frequency moving east off the Plains, though stone from these same sources was routinely carried north on the Plains. Such patterns, and the extreme scarcity of material such as obsidian, reveal something of the scale and direction of Clovis settlement mobility.

Texas Clovis fluted points are generally 6 cm long, around 2.5 cm wide, are less than a cm thick, taper in both plan and longitudinal section, were fluted only once on each face, and generally were fluted only within the haft area (as defined by the extent of lateral grinding). As a group, however, they also vary in their morphology and along certain dimensions (notably *length* and *thickness*), but that variation is attributable to reworking and breakage, and not raw material differences or technological strategies. In contrast, other dimensions of the points, such as *basal width* and *fluting thickness*, are tightly constrained, indicating considerable standardization in the manufacture of these points. That standardization appears to be related to the demands of fitting the points to pre-existing hafts.

Reworking of these points generally took place while the points were still in the haft, and one of the most common breakage patterns (lateral snaps) also occurred while the points were in their hafts. Reworking and breakage patterns varied by region, with point attrition being especially pronounced on the Plains, where raw material was scarcest and where, perhaps not coincidentally, the few points with impact fractures were mostly recovered. Patterns in the use, reworking, and breakage of these points generally suggest they were multifunctional: not simply projectile points, but hafted knives as well.

In the end, much as there is to gain from this enhanced sample of 406 fluted points, we can only surmise that even more information will come as additional records of Texas Clovis are compiled. Certainly, more is still needed. We should continue to seek more (and more precise) data on Clovis occurrences; greater information on the paleoenvironmental stage which Clovis groups inhabited; data on raw material use and the context in which these points are found; and information on the technology, form, and function of these points.

We have little doubt that additional records will be forthcoming, since we believe that the current tally remains just a sample (of size yet unknown) of the Clovis fluted points of Texas. More will surely be recorded in collections yet undocumented, sites still uninvestigated, and regions now but lightly examined. As these new data emerge, they warrant careful investigation and documentation, for they continue to provide important insights into the adaptive strategies of the first hunter-gatherers of Texas.

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REFERENCES CITED

Alexander, H. J.
1963 The Levi site: a paleo-indian campsite in central Texas. *American Antiquity* 28:510-528.

Amick, D. S.
1995 Patterns of technological variation among Folsom and Midland projectile points in the American southwest. *Plains Anthropologist* 40:23-38.

Arbingast, S. et al.
1976 *Atlas of Texas.* Bureau of Business Research, The University of Texas, Austin.

Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest.* Memoir No. 4. Oklahoma Anthropological Society, Oklahoma City.

Baumgardner, R.
1986 Terraces of the Upper Little Red River. In *Geomorphology and Quaternary Stratigraphy of the Rolling Plains, Texas Panhandle*, edited by T. Gustavson, pp. 20-28. Bureau of Economic Geology, The University of Texas at Austin.

Biesaart, L., W. Roberson, and L. Spotts
1985 *Prehistoric archaeological sites in Texas: a statistical overview.* Special Report 28. Office of the State Archeologist, The Texas Historical Commission.

Bleed, P.
1986 The optimal design of hunting weapons. *American Antiquity* 51:737-747.

Blum, M., J. T. Abbott, and S. Valastro
1992 Evolution of landscapes on the Double Mountain Fork of the Brazos River, West Texas: implications for preservation and visibility of the archaeological record. *Geoarchaeology* 7:339-370.

Blum, M., and S. Valastro
1992 Quaternary stratigraphy and geoarchaeology of the Colorado and Concho Rivers, West Texas. *Geoarchaeology* 7:419-448.

Bradley, B.
1993 Paleo-indian flaked stone technology in the North American High Plains. In *From Kostenski to Clovis: Upper Paleolithic-Paleo-indian adaptations*, edited by O. Soffer and N. Praslov, pp. 251-262. Plenum Press, New York.

Brown, T., K. Killen, H. Simons, and V. Wulfkuhle
1982 *Resource protection planning process for Texas.* Texas Historical Commission, Austin.

Brown, K. M.
1976 Fused volcanic glass from the Manning Formation. *Bulletin of the Texas Archeological Society* 47:189-207.

1994 Four Clovis points from San Augustine County, Texas. *La Tierra* 21:24-39.

Bryant, V. M. and R. G. Holloway
1985 A Late-Quaternay paleoenvironmental record of Texas: an overview of the pollen evidence. In *Pollen records of Late-Quaternary North American sediments*, edited by V. M. Bryant and R. G. Holloway, pp. 39-70. American Association of Stratigraphic Palynologists, Dallas.

Chandler, C. K.
1982 Paleo-indian projectile points from San Patricio County, Texas. *La Tierra* 9(3):26-28.
1983 Paleo-indian projectile points from Kendall County, Texas. *La Tierra* 10(4):36-37.

Chandler, C. K. and D. Rogers
1995 Clovis points from Montgomery and Brazoria counties in southeast Texas. *La Tierra*, In press.

Collins, M. B.
1976 Terminal Pleistocene cultural adaptations in southern Texas. In *Habitats humains anterieurs a l'Holocene en Amerique*, edited by J. B. Griffin, pp. 102-135. UISPP, Nice, France.
1990 Observations on Clovis lithic technology. *Current Research in the Pleistocene* 7:73-74.

Collins, M. B., G. E. Evans, T. N. Campbell, M. C. Winans, and C. E. Mear
1989 Clovis occupation at Kincaid Shelter, Texas. *Current Research in the Pleistocene* 6:3-4.

Collins, M. B., T. R. Hester, and P. Headrick
1992 Engraved cobbles from the Gault site, Central Texas. *Current Research in the Pleistocene* 9:3-4.

Collins, M. B., T. R. Hester, D. Olmstead, and P. Headrick
1991 Engraved cobbles from early archaeological contexts in central Texas. *Current Research in the Pleistocene* 8:13-15.

Collins, M. B., C. B. Bousman, P. Goldberg, P. Takac, J. Guy, J. L. Lanata, T. W. Stafford, and V. T. Holliday
1993 The Paleoindian sequence at the Wilson-Leonard site, Texas. *Current Research in the Pleistocene* 10:10-12.

Cooper, B.
1974 A fluted point from McMullen County, Texas. *La Tierra* 1(3):18.

Crook, W. W. and R. K. Harris
1955 Scottsbluff points in the Obshner site near Dallas, Texas. *Bulletin of the Texas Archeological Society* 26:75-100.
1957 Hearths and artifacts of early man near Lewisville, Texas and associated fauna. *Bulletin of the Texas Archeological Society* 28:7-97.
1958 A Pleistocene campsite near Lewisville, Texas. *American Antiquity* 23:233-246.

Deller, D. B. and C. J. Ellis
1992 *Thedford II: A Paleoindian site in the Ausable River watershed of southwestern Ontario.* Memoirs No. 24. University of Michigan, Museum of Anthropology, Ann Arbor.

Enlow, D. and T. N. Campbell
1955 Some Paleo-indian projectile points from the southeastern periphery of the Great Plains. *The Panhandle-Plains Historical Review* 28:29-38.

Espey, Huston & Associates, Inc.
1981 *A Cultural Resource Inventory and Assessment of the Proposed Stacy Reservoir, Concho, Coleman and Runnels Counties, Texas*. Espey, Huston & Associates, Inc., Austin.

Etchieson, G., R. Speer, and J. Hughes
1979 *Archaeological investigations in the Crowell Reservoir area, Cottle, Foard, King, and Knox counties, Texas*. Report submitted to the U.S. Army Corps of Engineers, by the Archaeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon, Texas.

Everitt, B. S.
1977 *The analysis of contingency tables*. Chapman and Hall, London.

Faught, M., D. G. Anderson, and A. Gisiger
1994 North American Paleoindian database: an update. *Current Research in the Pleistocene* 11:32-34.

Ferring, C. R.
1989 The Aubrey Clovis site: a Paleoindian locality in the Upper Trinity River basin, Texas. *Current Research in the Pleistocene* 6:9-11.
1990 The 1989 investigations at the Aubrey Clovis site, Texas. *Current Research in the Pleistocene* 10:10-12.
1995a Middle Holocene environments, geology, and archaeology in the Southern Plains. In *Archaeological Geology of the Archaic Period in North America*, edited by E.A. Bettis, pp. 21-35. Special Paper 297. Geological Society of America, Boulder.
1995b Subsistence and mobility patterns at the Aubrey Clovis site, Texas. Paper presented at the 60th Annual Meeting, Society for American Archaeology, Minneapolis.

Frederick, C. and C. Ringstaff
1994 Lithic resources at Fort Hood: further investigations. In *Archaeological investigations on 571 prehistoric sites at Fort Hood, Bell, and Coryell Counties, Texas*, edited by W. N. Trierweiler, pp. 125-181. Research Report No. 31, Archaeological Resourse Management Series. U.S. Army, Fort Hood.

Frison, G. C.

1991 The Clovis cultural complex: new data from caches of flaked stone and worked bone artifacts. In *Raw material economies among prehistoric hunter-gatherers*, edited by A. Montet-White and S. Holen, pp. 321-333. Publications in Anthropology, No. 19. University of Kansas, Lawrence.

Gramly, R. M.

1982 *The Vail site: a palaeo-indian encampment in Maine.* Bulletin of the Buffalo Society of Natural Sciences, Volume 30.

Greer, J. W.

1968 Some unusual artifacts from Val Verde county, Texas. *The Texas Journal of Science* 20:183-192.

Gustavson, T. C., R. J. Finley, and K. McGillis

1980 *Regional distribution of Permian salt in the Anadarko, Dalhart, and Palo Duro Basins of the Texas Panhandle.* Report of Investigations No. 106. Bureau of Economic Geology, The University of Texas at Austin.

Hartwell, W. T., E. Johnson, V. T. Holliday, R. Ralph, and S. Lupton

1989 A re-evaluation of Ryan's site: a disturbed Plainview cache on the Southern High Plains of Texas. *Current Research in the Pleistocene* 6:14-15.

Hays, T. R. (editor)

1982 *Archaeological investigations of the San Gabriel Resevoir Districts, Central Texas.* 4 Vols. Institute of Applied Sciences, North Texas State University, Denton.

Hayner, E.W.

1955 Research in east Texas projectile points. *Bulletin of the Texas Archeological Society* 26:235-243.

Haynes, C.V.

1982 Were Clovis progenitors in Beringia? In *Paleoecology of Beringia*, edited by D. M. Hopkins, J. Matthews, C. Schweger, and S. Young, pp. 383-398. Academic Press, New York.

1991 Geoarchaeological and palaeohydrological evidence for a Clovis-age drought in North America and its bearing on extinctions. *Quaternary Research* 35:438-450.

Hedrick, John A.

1989 A preliminary report on archaeological resources in southern Culberson County in the vicinity of Van Horn, Texas. *Bulletin of the Texas Archeological Society* 59:129-156.

Henderson, J. and G. Goode

1991 Pavo Real: an early Paleoindian site in south-central, Texas. *Current Research in the Pleistocene* 8:26-28.

Hester, T. R.

n.d. A distributional study of Paleo-indian projectile point types in Texas. Unpublished paper, on file with the author (prepared 1967).

1974 On fluted points and south Texas archaeology. *Texas Archeology* (The Newsletter of the Texas Archeological Society) 18(2):11-14.

1980 A survey of Paleo-indian archaeological remains along the Texas Coast. In *Papers on the Archaeology of the Texas Coast*, edited by L. Highley and T. R. Hester, pp. 1-12. Special Report No. 11. Center for Archaeological Research, The University of Texas at San Antonio.

1988 Paleoindian obsidian artifacts from Texas: a review. *Current Research in the Pleistocene* 5:27-29.

Hester, T. R., M. B. Collins, D. A. Story, E. S. Turner, P. Tanner, K. Brown, L. D. Banks, D. Stanford, and R. J. Long

1992 Paleoindian archaeology at McFaddin Beach, Texas. *Current Research in the Pleistocene* 9:20-22.

Hester, T., G. Evans, F. Asaro, F. Stross, T. Campbell, and H. Michel

1985 Trace element analysis of an obsidian Paleoindian projectile point from Kincaid Rockshelter, Texas. *Bulletin of the Texas Archeological Society* 56:143-153.

Hofman, J.

1992 Recognition and interpretation of Folsom technological variability on the Southern Plains. In *Ice-Age hunters of the Rockies*, edited by D. Stanford, and J. Day, pp. 193-224. New Series, No. 1. Denver Museum of Natural History and University Press of Colorado, Denver and Niwot.

1996 Sites, localities, and isolates: a regional perspective on southern Plains Folsom evidence. In *Folsom Archaeology*, edited by P. Jodry and D. Stanford. Smithsonian Institution Press, Washington, D.C. In press.

Hofman, J. L. and D. G. Wyckoff

1991 Clovis occupation in Oklahoma. *Current Research in the Pleistocene* 8:29-32.

Hofman, J. L., L. C. Todd, and M. B. Collins

1991 Identification of central Texas Edwards chert at the Folsom and Lindenmeier sites. *Plains Anthropologist* 36:297-308.

Holliday, V. T.

1989 Middle Holocene drought on the Southern High Plains. *Quaternary Research* 31:74-82

1995 *Stratigraphy and paleoenvironments of Late Quaternary valley fills on the Southern High Plains.* Memoir 186. Geological Society of America, Boulder, in press.

Holliday, V. T., C. V. Haynes, J. L. Hofman, and D. J. Meltzer
1994 Geoarchaeology and geochronology of the Miami (Clovis) site, southern High Plains of Texas. *Quaternary Research* 41:234-244.

House, K.
1974 A Paleo-Indian fluted point from Live Oak County, Texas. *Texas Archeology* (The Texas Archeological Society Newsletter) 18(1):17-19.

Humphrey, J. D. and C. R. Ferring
1994 Stable isotope evidence for latest Pleistocene and Holocene climatic change in north-central Texas. *Quaternary Research* 41:200-213.

Jensen, H.
1968 Report on excavations at the Field Ranch site (X41CO-10) Cooke County, Texas. *Bulletin of the Texas Archeological Society* 39:133-146.

Johnson, E.
1983 The Lubbock Lake Paleoindian record. In *Guidebook to the Central Llano Estacado*, edited by V. T. Holliday. Center for Arid Land Studies, Texas Tech University, Lubbock.

Johnson, E. and V. T. Holliday
1984 Comments on "Large springs and early American indians" by Joel L. Shiner. *Plains Anthropologist* 29:65-70.

Johnson, E., V. Holliday, F. Asaro, F. Stross, and H. Michel
1985 Trace element analysis of Paleoindian obsidian artifacts from the southern High Plains. *Current Research in the Pleistocene* 2:51-53.

Johnson, L.
1961 The Yarbrough and Miller sites of northeastern Texas, with a preliminary definition of the La Harpe Aspect. *Bulletin of the Texas Archeological Society* 32:141-284.

Judge, W. J.
1973 *Paleoindian occupation of the central Rio Grande Valley in New Mexico.* University of New Mexico Press, Albuquerque.

Keeley, L.
1982 Hafting and retooling: effects on the archaeological record. *American Antiquity* 47:798-809.

Kelly, T. C.
1983 The Brom Cooper Paleo-indian collection from McMullen County, Texas. *La Tierra* 10(3):17-40.

Kingston, M. (editor)
1993 *The Texas Almanac.* A. H. Belo Corporation, Dallas.

Largent, F. B.
1995 Some new additions to the Texas Folsom point database. *Plains Anthropologist* 40:69-71.

Largent, F. B., M. R. Waters, and D. L. Carlson
1991 The spatiotemporal distribution and characteristics of Folsom projectile points in Texas. *Plains Anthropologist* 36:323-341.

Long, R. J.
1977 *McFaddin Beach.* The Patillo Higgins Series of Natural History and Anthropology, Number 1. Spindletop Museum, Lamar University, Beaumont.

MacNeish, R. S. and A. Nelken-Turner
1983 The preceramic of Mesoamerica. *Journal of Field Archaeology* 10:71-84.

Mallouf, R. J.
1981 Observations concerning environmental and cultural interactions during the terminal Pleistocene and Early Holocene in the Big Bend of Texas and adjoining regions. *Bulletin of the Texas Archeological Society* 52:121-146.

1985 A synthesis of eastern Trans-Pecos prehistory. Unpublished Master's Thesis, Department of Anthropology, The University of Texas at Austin.

1988 The Yellow Hawk site: a Clovis quarry workshop in north-central Texas. *Current Research in the Pleistocene* 5:17-18.

1989 A Clovis quarry workshop in the Callahan Divide: the Yellow Hawk site, Taylor County, Texas. *Plains Anthropologist* 34:81-103.

Meier, C. J. and T. R. Hester
1972 Notes on the Meier site, Fayette County, Texas. *Bulletin of the Lower Plains Archeological Society* 3:69-72.

1976 Paleo-indian artifacts from the Meier site, southeast Texas. *La Tierra* 3(1):16-19.

Meltzer, D. J.
1986 A study of Texas Clovis points. *Current Research in the Pleistocene* 3:33-36.

1987 The Clovis Paleoindian occupation of Texas: results of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archeological Society* 57:27-68.

1989a An update on the Texas Clovis Fluted Point Survey. *Current Research in the Pleistocene* 6:31-33.

1989b Was stone exchanged among eastern North American Paleo-indians? In *Eastern Paleo-indian lithic resource use*, edited by C. Ellis and J. Lothrop, pp. 11-39. Westview Press, Boulder.

1993a Was there a Clovis adaptation? In *From Kostenski to Clovis: Upper Paleolithic-Paleo-indian adaptations*, edited by O. Soffer and N. Praslov, pp. 293-310. Plenum Press, New York.

Meltzer, D.J. *(Continued)*

1993b *Search for the first Americans.* Smithsonian Books, Washington, D.C..

1995 Clocking the first Americans. *Annual Review of Anthropology* 24:21-45.

Mitchell, J. B. and J. Winsch

1973 A Paleo-Indian point from south Texas. *Ohio Archeologist* 23(2):9.

Odell, G.

1994 Prehistoric hafting and mobility in the North American Midcontinent: examples from Illinois. *Journal of Anthropological Archeology* 13:51-73.

Orchard, C. and T. Campbell

1954 Evidences of early man from the vicinity of San Antonio, Texas. *The Texas Journal of Science* 4:454-465.

Parker, W.

1983 Preliminary notes on a Clovis point associated with mammoth tusk fragments in Hockley County, Texas. *La Tierra* 10(4):31-35.

Patterson, L. W.

1986 Site 41HR571, a long prehistoric sequence in Harris County, Texas. *Journal of the Houston Archeological Society* 88:15-18.

1993 The archaeology of inland southeast Texas: a quantitative study. *Bulletin of the Texas Archeological Society* 61:255-280.

Patterson, L. W., J. D. Lockwood, R. L. Gregg, and S. M. Kindall

1992a The Lockwood collection (41HR343), Harris County, Texas. *Journal of the Houston Archeological Society* 104:16-24.

1992b Prehistoric sites 41HR354, 730, 731, 732, Harris County, Texas. *Journal of the Houston Archeological Society* 104:25-30.

Perttula, T. K.

1989 The Paleoindian archaeological record in Northeast Texas: evidence from avocational collecting activities. *Current Research in the Pleistocene* 6:19-21.

Ray, C. N.

1930 Report on some recent archaeological researches in the Abilene section. *Bulletin of the Texas Archeological and Paleontological Society* 2:59-78.

Sabin, T. J. and V. T. Holliday

1995 Playas and lunettes on the Southern High Plains: morphometric and spatial relationships. *Annals of the Association of American Geographers* 85:286-305.

Saner, B.

1995 An in situ Clovis point find from Kerr County. *La Tierra*, in press.

Scurlock, J. and W. Davis

1962 *Appraisal of the archeological resources of Toledo Bend Reservoir, Panola, Newton, Sabine, and Shelby Counties, Texas; Sabine and De Soto Parishes, Louisiana.* Report submitted to the National Park Service by the Texas Archeological Salvage Project, The University of Texas at Austin.

Sellards, E. H.

1940 Pleistocene artifacts and associated fossils from Bee County, Texas. *Bulletin of the Geological Society of America* 51:1627- 1658.

1952 *Early man in America.* University of Texas Press, Austin.

Shiner, J. L.

1983 Large Springs and early American Indians. *Plains Anthropologist* 28:1-7.

Shott, M.

1986 Technological organization and settlement mobility: an ethnographic examination. *Journal of Anthropological Research* 42:15-51.

Skinner, S. A. and R. Rash

1969 A Clovis fluted point from Hood County, Texas. *Bulletin of the Texas Archeological Society* 40:1-2.

Sollberger, J. B.

1988 On replicating fluted projectile points. *Bulletin of the Texas Archeological Society* 59:1-17.

Stanford, D. and M. Jodry

1988 The Drake Clovis cache. *Current Research in the Pleistocene* 5:21-22.

Stanford, D., M. Jodry, and L. Banks

1995 Early Paleoindian diet breadth as seen from the Lewisville site: critter buffet as an alternative to mammoth barbecue. Paper presented at the 60th Annual Meeting, Society for American Archaeology, Minneapolis.

Story, D. A.

1981 An overview of the archaeology of east Texas. *Plains Anthropologist* 26:139-156.

1990 Culture history of the Native Americans. In *The archeology and bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Suhm, D. A. and E. B. Jelks
1962 *Handbook of Texas archeology: type descriptions.* Special Publication 1, Texas Archeological Society and Bulletin 4, Texas Memorial Museum, Austin.

Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An introductory handbook of Texas archaeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Takac, P.
1991 Underwater excavations at Spring Lake: a Paleoindian site in Hays County, Texas. *Current Research in the Pleistocene* 8:46-48.

Tankersley, K.B.
1994 The effects of stone and technology on fluted-point morphometry. *American Antiquity* 59:498-510.

Turner, E. S. and P. Tanner
1994 The McFaddin Beach site on the upper Texas coast. *Bulletin of the Texas Archeological Society* 65:319-336.

Walter, R. W.
1990 Similarities between two Texas Clovis fluted points found on the South Plains. *The South Plains Archeological Society Newsletter* 99.

Weir, F.
1956 Surface artifacts from La Perdida, Starr County, Texas. *Bulletin of the Texas Archeological Society* 27:59-78.

Wheat, J. B.
1953 *An archaeological survey of the Addicks Dam basin, southeast Texas.* River Basin Surveys Papers 4, Bulletin 154:143-252. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Willig, J. A.
1988 Paleo-Archaic adaptations and lakeside settlement patterns in the northern Alkali Basin. In *Early human occupation in far western North America: the Clovis-Archaic interface*, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 417-482. Anthropological Papers, Number 21. Nevada State Museum, Carson City.

Wilson, J.
1979 A preliminary report on the Little Pin Oak Creek site (41FY53): a campsite with Clovis, Plainview, and subsequent artifacts in Fayette County, Texas. *Bulletin of the Texas Archeological Society* 50:135-140.

APPENDIX A: TEXAS CLOVIS FLUTED POINT SURVEY FORM

Sequence ____________ County______________

Please attach a tracing of the outline (or a photocopy) of both faces of the fluted point. Be sure to show the outline of the flute(s), broken areas, and the extent of edge grinding. If possible, please take measurements in centimeters. Refer to Figure 1 as a guide for the measurements.

1. Maximum length		2. Maximum width	
3. Width of base		4. Distance from maximum width to base	
5. Maximum blade thickness		6. Distance from maximum thickness to base	
7. Maximum thickness		8. Basal concavity depth	
9. Obverse flute length		10. Obverse flute width	
11. Reverse flute length		12. Reverse flute width	
13. Number of flutes obverse		14. Number of flutes reverse	
15. Length of grinding left edge		16. Length of grinding right edge	
17. Basal grinding	Yes No	18. Measurements in	cm in

19. Location where point was discovered: ______________________________

____

____

____

(Please be as specific as possible: include County name)

20. Artifacts or features found with the point: ______________________________

____

____

____

21. Color and type of stone material: ______________________________

____

____

____

22. Please print name and address:

____

____

____

____

Please return the completed form to:

David J. Meltzer
Department of Anthropology
Southern Methodist University
Dallas, Texas 75275-0336

Distributions of Typed Projectile Points in Texas

Elton R. Prewitt

ABSTRACT

Distribution and density data for 151 projectile point types currently recognized in Texas are presented in a series of maps. Drawn from 736 sources, the data encompassing 60,519 projectile points show generalized distribution areas. Gaps are indicated in the 67 (of 254) counties which lack published data, and in the 110 counties represented by three or fewer reports. While extensive, the database is limited and does not include every published source that deals with Texas archeology.

INTRODUCTION

During the period 1980-82 I reviewed 428 journal articles and monographs to compile distribution data for projectile points at the county level for the state of Texas. Subsequently, numerous people have been subjected to my admonishments that unquantified perceptions of type distributions are not necessarily accurate. When I was approached to write an overview of a particular region of the state for this volume of the Bulletin, I returned a counter-proposal to update the point type data and present an article consisting of distribution and density maps with no accompanying interpretation. The proposal was accepted, and I reviewed another 308 articles and monographs for a total of 736 bibliographic entries. For the most part the sources are readily obtainable, but the list is by no means complete.

In general, reports published before 1947 are not included in the review. These early reports tend to be very difficult to work with because of incomplete descriptions and poor illustrations. This makes typological assignments difficult and uncertain. The cutoff date for recent reports is December 1994. A number of reports dated 1994 but which were not received before March 1995 are not included either. Other omissions include many theses and dissertations, and some local or regional journals. *The Record* published by the Dallas Archeological Society, for example, was not readily available and is not included. A glance at the database sources will quickly reveal the journals utilized. Reports published by private contracting firms are included where possible, but some firms provide minimal distribution of their reports. The final source not consulted is the compliance and review holdings of the Texas Historical Commission. The primary caveat is that this review of the literature is extensive, but it is certainly not comprehensive.

Readers will find that the distribution and density data presented in this article varies from their firsthand knowledge. Reactions will vary, but I expect most will be along the lines of "This map is wrong; it does not show type Zeta in Alpha County, and I have 49 Zeta points from there in my collection!" My advance reply to all such comments is simple: publish descriptions of your collections so the rest of us can use the information. It is just as important to remember that, while these maps may not show a particular type extending into a nearby county, it does not mean the type cannot occur there. The accuracy of the maps reflects the accuracy of published data, and as is demonstrated later in this article, there are large gaps in the existing database.

METHODS

Each report was examined critically in regard to typological assignments. Written descriptions and illustrations were compared to my own set of illustrations and descriptions as well as to standard references such as Suhm, Krieger, and Jelks (1954), Suhm and Jelks (1962), Bell (1958, 1960), Perino (1968, 1971), Chapman (1975, 1980), and Turner and Hester (1985, 1993). Detectable errors in typological assignment were corrected. A number of reports were disregarded as unusable because, although type names and quantities were given, there were inadequate descriptions and few or no illustrations.

Also not used are articles devoted exclusively to descriptions of single point types or to surveys of point types. It was extremely difficult to sort out specimens already reported in other sources from those previously unreported. Rather than bias the sample with an unknown quantity of duplicate entries, these two types of articles were disregarded. This created a different problem in a number of instances where quantities of reported specimens are low: some types are seriously under-represented in the database compared to the published distributions. Notable examples include Axtell (Prewitt and Chandler 1992), Caracara (Saunders and Hester 1993), Clovis (Meltzer 1987; see also Meltzer and Bever, this volume), Folsom (Largent, Waters, and Carlson 1991) and Jetta (Hester 1979). Several types, especially recently named groups such as Devils (Turpin and Bement 1992), do not appear at all in the database.

Adjustments have been made in the definition of a few point types. Neches River is used as originally defined by Kent (1961; see also Jelks 1965:Figure 72A-F). The Oletha variety of Neches River (Prewitt 1974:66-67) is treated as a separate type rather than as a variety, and the name is accordingly given as Oletha. Baird and Taylor are used as defined by Kelley (1947), while Tortugas is used for those specimens not clearly assignable to the earlier two types. One type only cursorily defined in print is used: the Zephyr (Prewitt 1976) category includes specimens formerly subsumed along with Hoxie under Darl, and the Mahomet designation (originally proposed as a variety) is dropped in favor of using Darl. Another type not yet defined in print is Merrell; closely resembling and usually misidentified as Frio, published examples of this type can be found in Campbell (1948:Plate 3A9), Suhm and Jelks (1962:Plate 98C, E) and Sorrow, Shafer and Ross (1967:Figure 15d).

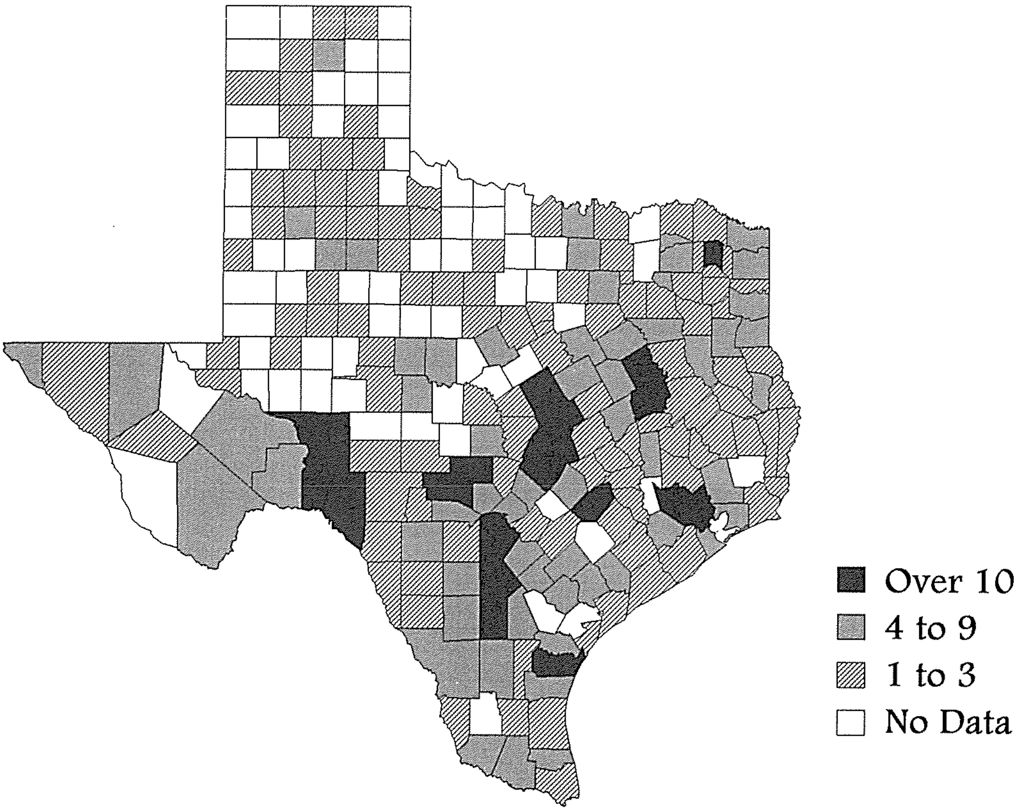
Data were compiled on worksheets that contained a reference number, county, site number, site name (or other identifier as appropriate), type code number, type name, quantity, and short bibliographic reference. Reference numbers were assigned in sequential order of review; these numbers are included in parentheses following the authors' names in the alphabetical listing of database sources. Type codes are taken from my as yet unpublished compilation of type names (with dates and references) that have been used in Texas or proposed for use in print. Type names are sometimes used with a following question (?) mark, or in other cases have "-like" appended. These reflect uncertainties by either the original analyst, myself, or both. I felt that these specimens should be included on a broad scale so that if they formed distinctive distribution patterns, then we should look toward defining new types or varieties. In most cases the questionable specimens did not alter distributions for the types as a whole, so they were included in the final density maps. However, in a very few cases questionable specimens occurred at considerable distances from the core distribution areas. These were reviewed once more, and in all but two instances the specimens were removed from the final density maps.

The data sheets for the first 428 reports were entered into the Excel spreadsheet application on a Macintosh IIsi. After initial proofing and manipulation, the data were shipped into the Quattro Pro spreadsheet application on a Dell 486DX, and the additional 308 reports were entered. The entire compilation was imported into the Paradox database application where final sorting and preparations were made. This database was then imported into the Mapviewer thematic mapping application where the individual distribution maps were created.

Preceding the projectile point maps are two key maps that aid in evaluating the distributions. Figure 1a illustrates the distribution and density of reports per county included in the database. Because some reports cover multiple counties they are tallied more than one time. Thus, 736 sources are counted as 822 in this figure. Sixty-seven counties (26 percent) lack reported data (keep in mind that the database is extensive, but it is not complete), while 110 counties (43 percent) are represented by one to three reports, 60 counties (24 percent) by four to nine reports, and 17 counties (7 percent) by ten or more reports (n=276, or 33.5 percent). The five counties with the greatest numbers of reports (15 percent) are Bexar (32), Val Verde (27), Travis (23), Harris (22), and Williamson (22).

Figure 1b illustrates the distribution and density of 60,519 projectile points by county. As noted above, 67 counties (26 percent) lack reported data while 103 counties (40.5 percent) are represented

DISTRIBUTION OF REFERENCES CONSULTED BY COUNTY (N=822)



DISTRIBUTION OF ALL PROJECTILE POINTS BY COUNTY (N=60,519)

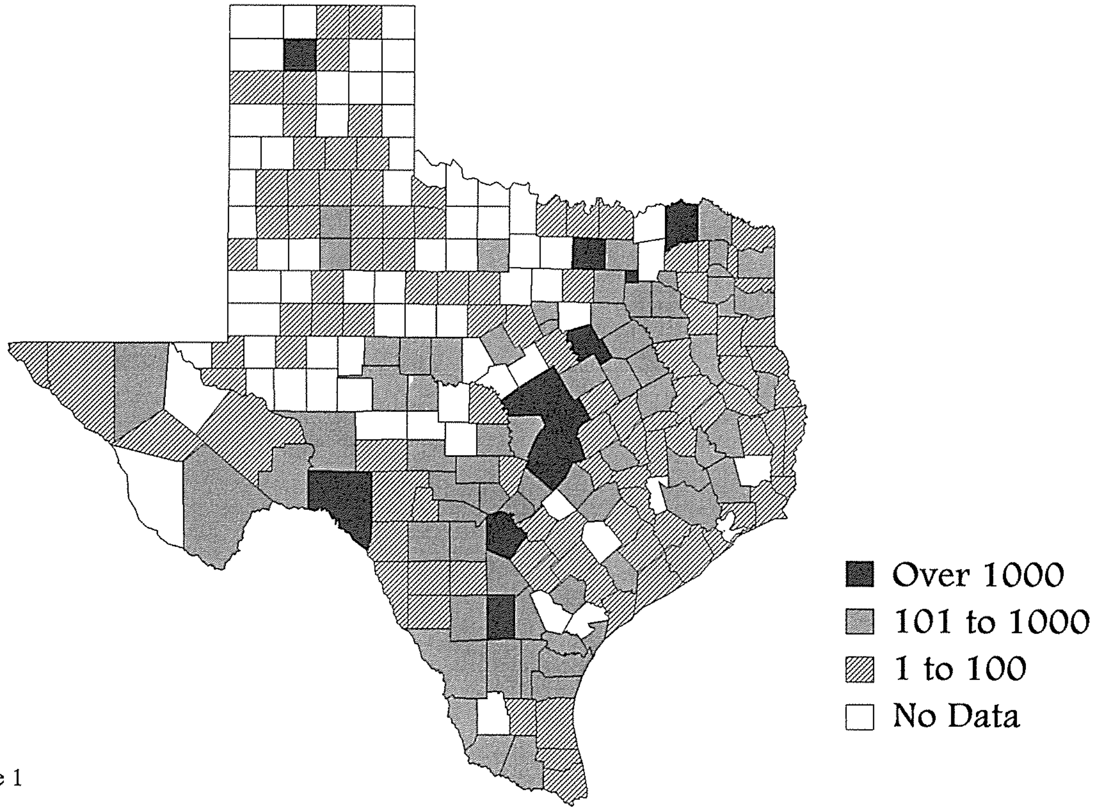


Figure 1

by 1 to 100 points, 70 counties (27.5 percent) by 101 to 1,000 points, and 14 counties (5.5 percent) by more than 1,000 points. The five counties with the greatest numbers of points are Williamson with 10,236 (16.7 percent), Val Verde with 4,642 (8 percent), Travis with 2,081 (3.5 percent), Rockwall with 1,732 (3 percent), and Hill with 1,660 (3 percent). These five counties (2 percent) contain 20,351 (33.6 percent) of the points in the database, while the 14 counties (5.5 percent) with more than 1,000 points contain 32,491 (53.7 percent) of the points.

The distribution and density maps are presented in alphabetical order beginning with Abasolo in Figure 2a. Each map is accompanied by an illustration of the type. Key references provided for each type are indicated by one or more numbers enclosed in parentheses following the type name. These numbers (from 1-36) refer to entries listed in the References Cited, not the Projectile Point Data Base Sources (no. 1-736). Additional interpretive information such as arrow point or dart point, age estimates, and period assignments are not included in order for the distributions to be presented as free of interpretation as possible. Distributions are presented in a shaded density format with darker shading indicating higher density. Values remain constant for all of the types.

The database is maintained on file at the offices of Prewitt and Associates, Inc., 7701 North Lamar Blvd., Suite 104, Austin, Texas 78752-1012. Should one desire to review the actual numbers or obtain a copy of the database, inquiries should be sent to the preceding address.

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REFERENCES CITED

Bell, R. E.

1958 *Guide to the Identification of Certain American Indian Projectile Points.* Special Bulletin 1. Oklahoma Anthropological Society, Oklahoma City. (1)

1960 *Guide to the Identification of Certain American Indian Projectile Points.* Special Bulletin 2. Oklahoma Anthropological Society, Oklahoma City. (2)

Bement, L. C.

1991 The Statistical Analysis of Langtry Variants from Arenosa Shelter, Val Verde County, Texas. In *Papers on Lower Pecos Prehistory*, edited by S. A. Turpin, pp. 51-64. Studies in Archeology No. 8. Texas Archeological Research Laboratory, The University of Texas at Austin. (3)

Campbell, T. N.

1948 The Merrell Site: Archaeological Remains Associated with Alluvial Terrace Deposits in Central Texas. *Bulletin of the Texas Archeological and Paleontological Society* 19:7-35. (4)

Chapman, C. H.

1975 *The Archaeology of Missouri, I.* University of Missouri Press, Columbia, Missouri. (5)

1980 *The Archaeology of Missouri, II.* University of Missouri Press, Columbia, Missouri. (6)

Flinn, R. and J. Flinn

1968 The High Bluff Site on the Clear Fork of the Brazos River. *Bulletin of the Texas Archeological Society* 38:93-125. (7)

Hester, T. R.

1979 Notes on Gower, Jetta and Other Projectile Points of the Pre-Archaic Period. *La Tierra* 6(3):5-8. (8)

Hughes, J. T. and P. S. Willey (editors)

1978 *Archeology at Mackenzie Reservoir.* Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin. (9)

Jelks, E. B.

1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas.* Archaeology Series No. 5. Department of Anthropology, The University of, Texas at Austin. (10)

1965 The Archeology of McGee Bend Reservoir, Texas. Unpublished Ph.D. Dissertation, Department of Anthropology, The University of Texas at Austin. (11)

Johnson, L., Jr.
1962 The Yarbrough and Miller Sites of Northeastern Texas, with a Preliminary Definition of the La Harpe Aspect. *Bulletin of the Texas Archeological Society* 32:141-284. (12)

Kelley, J. C.
1947 The Cultural Affiliations and Chronological Position of the Clear Fork Focus. *American Antiquity* 13(2):97-109. (13)

Kelly, T. C.
1983 The Brom Cooper Paleo-Indian Collection from McMullen County, Texas. *La Tierra* 10(3):17-40. (14)

Kent, D. T., Jr.
1961 Letter to Lathel F. Duffield containing MS descriptions of Neches River and Booker dart points. In McGee Bend Reservoir Files, Texas Archeological Research Laboratory, The University of Texas at Austin. (15)

Krone, M. F.
1976 The Ahumada Point: A Projectile Point from Northern Chihuahua, Mexico. *The Artifact* 14(2):41-43. (16)

Largent, F. B., Jr., M. R. Waters and D. L. Carlson
1991 The Spatiotemporal Distribution and Characteristics of Folsom Projectile Points in Texas. *Plains Anthropologist* 36(137):323-341. (17)

Leslie, R.
1978 Projectile Point Types and Sequence of the Eastern Jornada-Mogollon, Extreme Southeastern New Mexico. *Transactions of the 13th Regional Archeological Symposium for Southeastern New Mexico and Western Texas.* (18)

Meltzer, D. J.
1987 The Clovis Paleoindian Occupation of Texas: Results of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archeological Society* 57:27-68. (19)

Mitchell, J. L.
1976 A Tentative New Type of Late Paleo-Indian Point from South Texas. *La Tierra* 3(1):20-22. (20)

Nunley, J. P., L. F. Duffield, and E. B. Jelks
1965 *Excavations at Amistad Reservoir, 1962 Season.* Miscellaneous Papers No. 3. Texas Archeological Salvage Project, The University of Texas at Austin. (21)

Perino, G.
1968 *Guide to the Identification of Certain American Indian Projectile Points.* Special Bulletin 3. Oklahoma Anthropological Society, Oklahoma City. (22)

1971 *Guide to the Identification of Certain American Indian Projectile Points.* Special Bulletin 4. Oklahoma Anthropological Society, Oklahoma City. (23)

Prewitt, E. R.
1974 *Upper Navasota Reservoir: An Archeological Assessment.* Research Report 47. Texas Archeological Survey, The Univesity of Texas at Austin. (24)

1976 The Rogers Springs Site: 1974 Excavations. Research Report 54. Texas Archeological Survey, The University of Texas at Austin (unpublished manuscript on file, Texas Archeological Research Laboratory). (25)

Prewitt, E. R. and C. K. Chandler
1992 Axtell: A Middle Archaic Dart Point Type. *La Tierra* 19(1):15-20. (26)

Saunders, R. K. and T. R. Hester
1993 A Typological Study of Side-Notched Arrow Points from the Falcon Lake Region of Texas and Mexico. *La Tierra* 20(2):22-31. (27)

Smith, C. B.
1965 A New Method of Projectile Point Classification and Site Survey. *Transactions of the First Southeastern New Mexico and West Texas Symposium Papers*, pp. 15-17. (28)

Sorrow, W. M., H. J. Shafer and R. E. Ross
1967 *Excavations at Stillhouse Hollow Reservoir.* Papers 11. Texas Archeological Salvage Project, The University of Texas, Austin. (29)

Suhm, D. A. and E. B. Jelks
1962 *Handbook of Texas Archeology: Type Descriptions.* Joint Publication, Texas Archeological Society Special Publication No. 1 and Texas Memorial Museum Bulletin No. 4. Austin. (30)

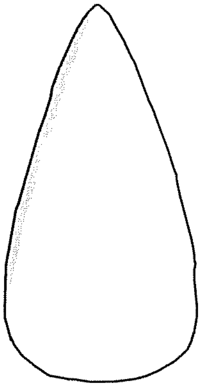
Suhm, D. Ann, A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume). (31)

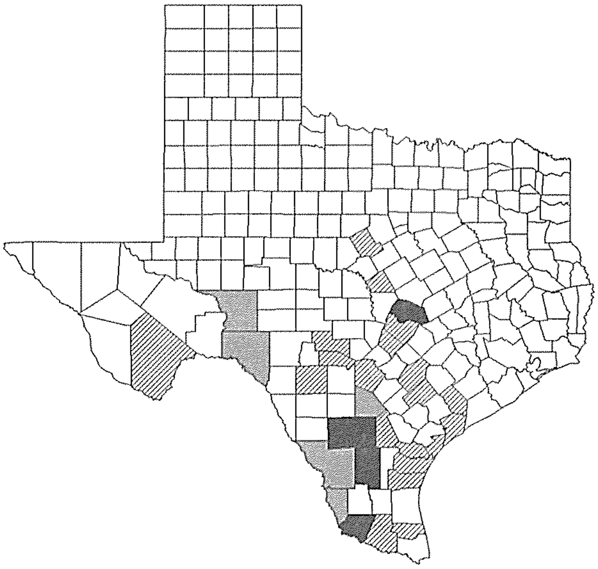
Taylor, W. W.
1966 Archaic Cultures Adjacent to the Northeastern Frontiers of Mesoamerica. In *Handbook of Middle American Indians, Archaeological Frontiers and External Connections,* Volume 4, edited by R. Wauchope, pp. 59-94. University of Texas Press, Austin. (32)

Turner, E. S. and T. R. Hester
1993 *A Field Guide to the Stone Artifacts of Texas Indians.* 2nd Edition. Gulf Publishing Company, Houston. (33)

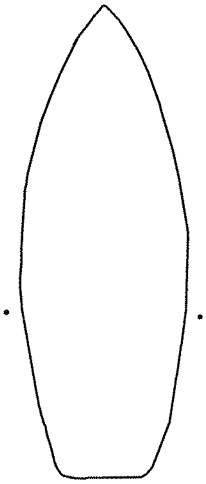
Turpin, S. A. and L. C. Bement
1992 Skyline Shelter and Devils Triangular Dart Points: Evidence for a New Component of the Lower Pecos Early Archaic Sequence, Southwest Texas. *Plains Anthropologist* 37(138):41-57. (34)

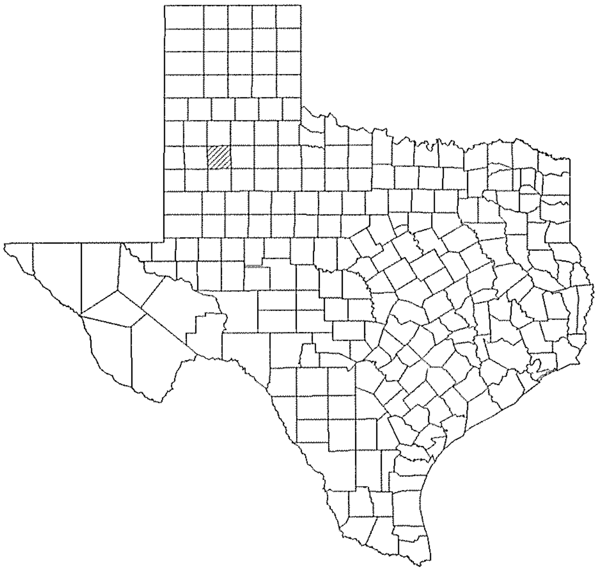
ABASOLO (1, 30, 33)





AGATE BASIN (5, 22)





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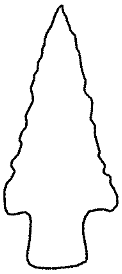

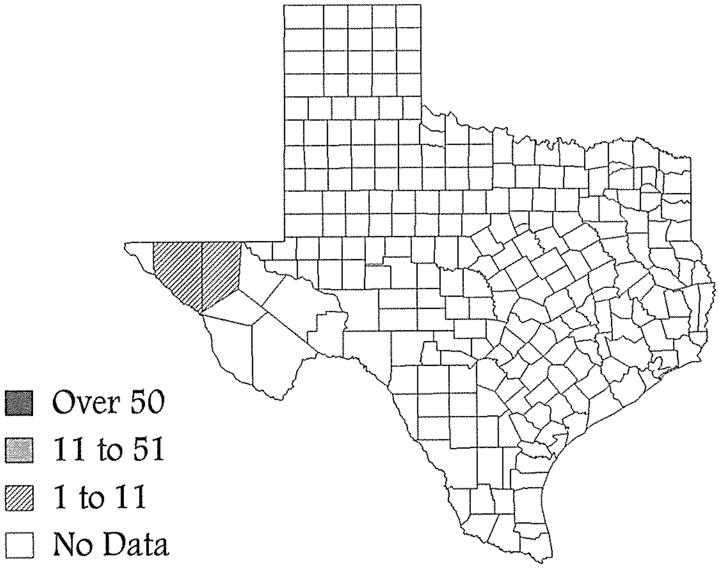

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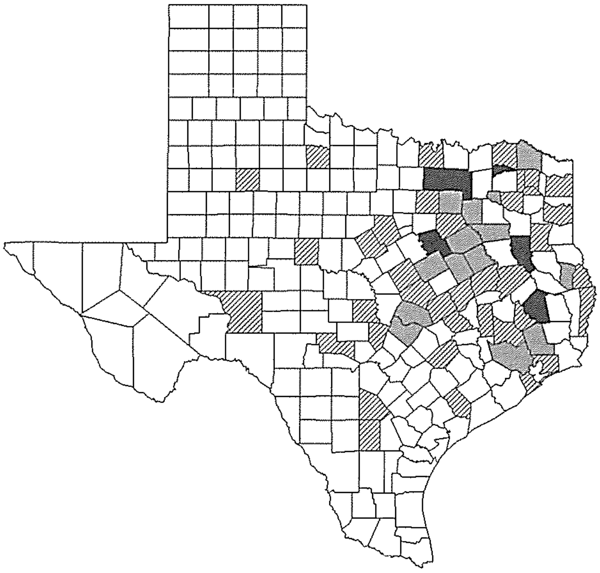

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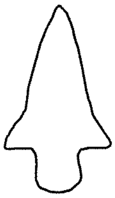

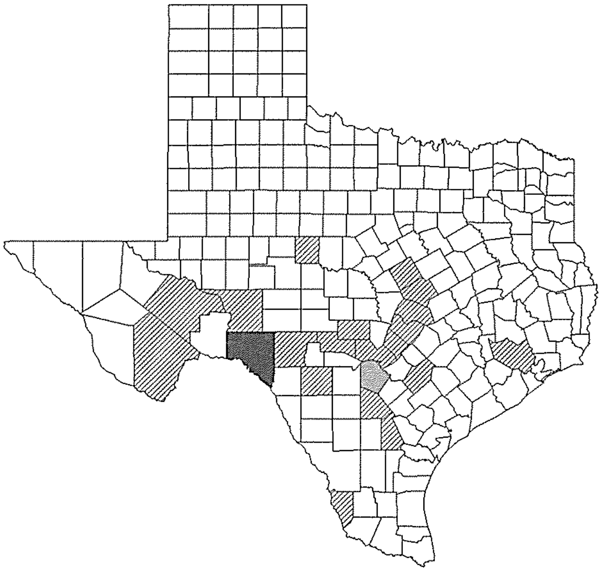

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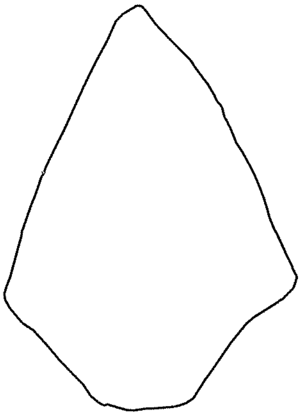

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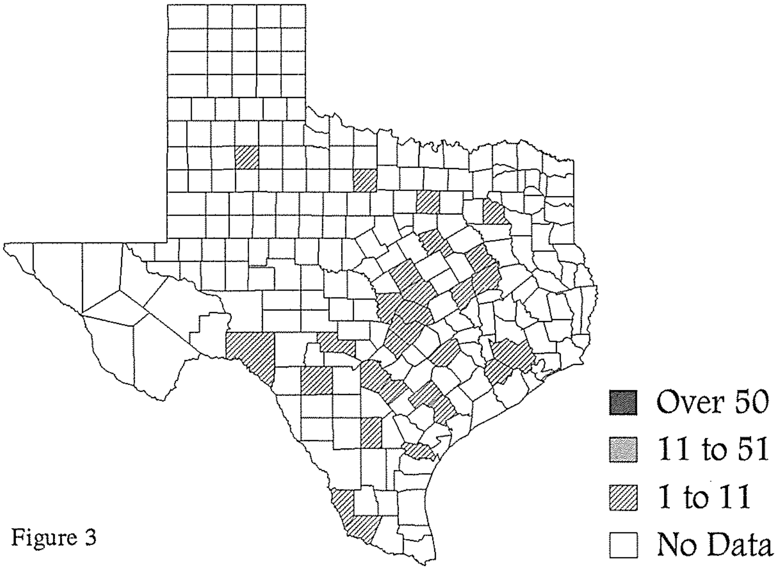

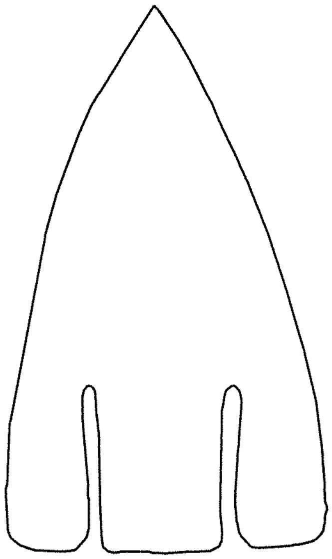

Figure 3

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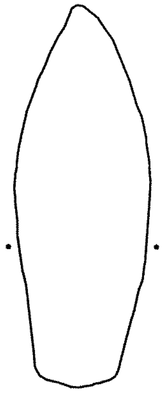

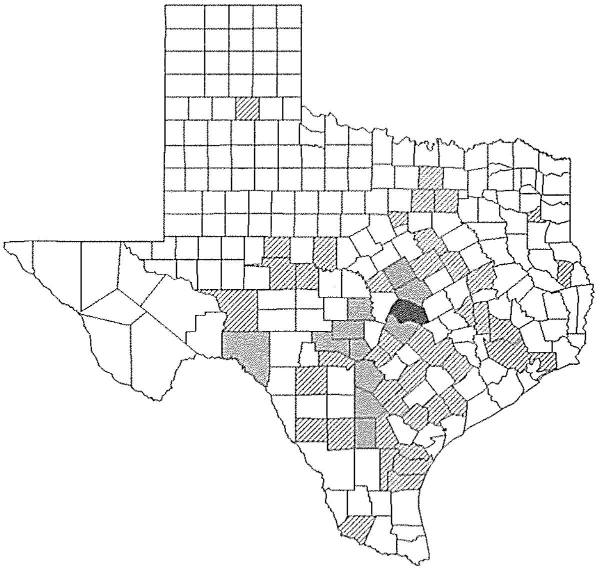

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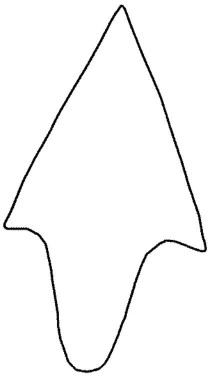

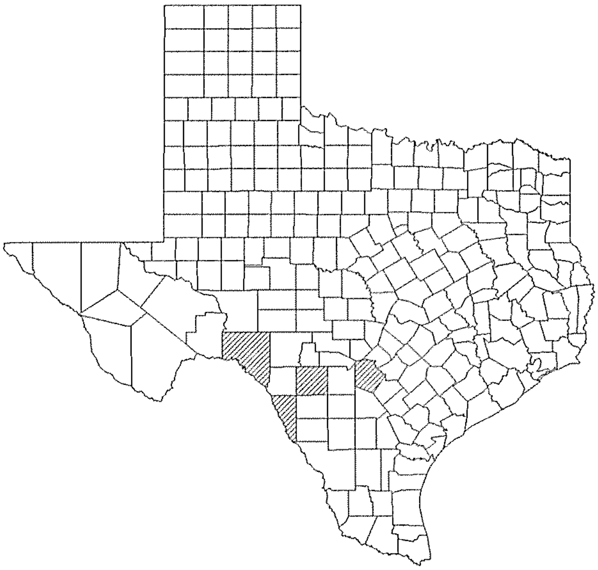

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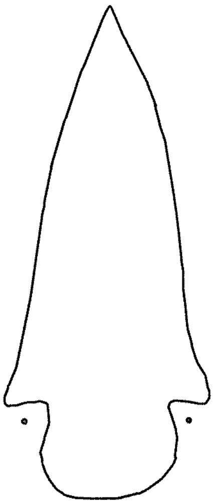
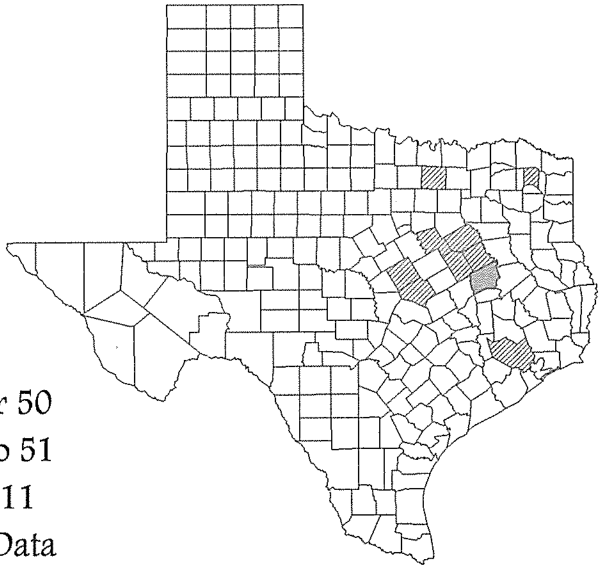
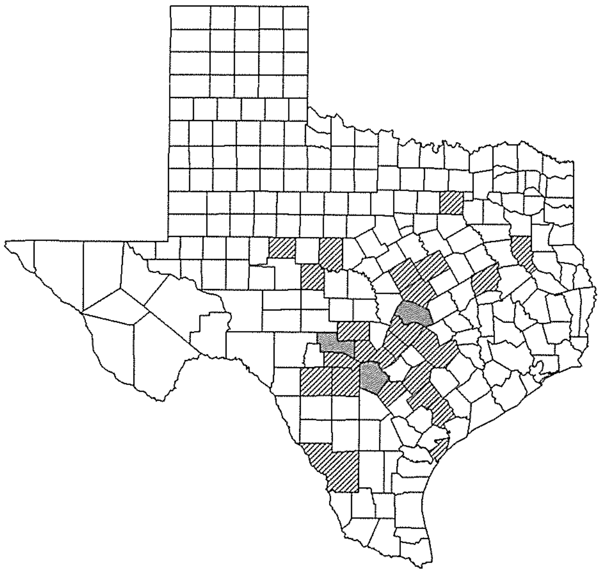




Over 50
11 to 51
1 to 11
No Data

Figure 4



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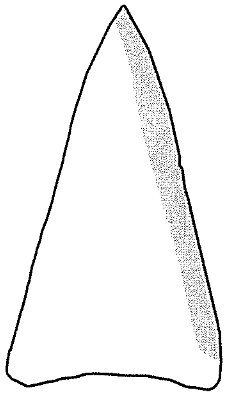

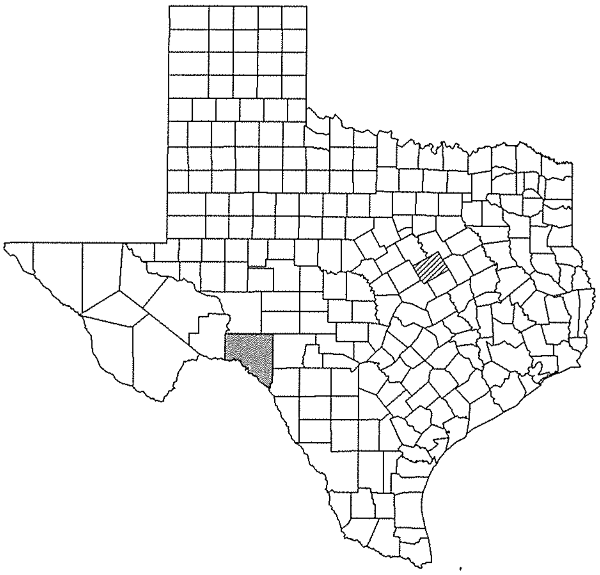

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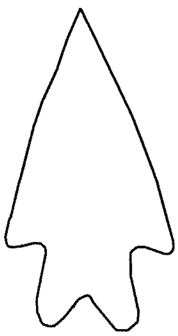

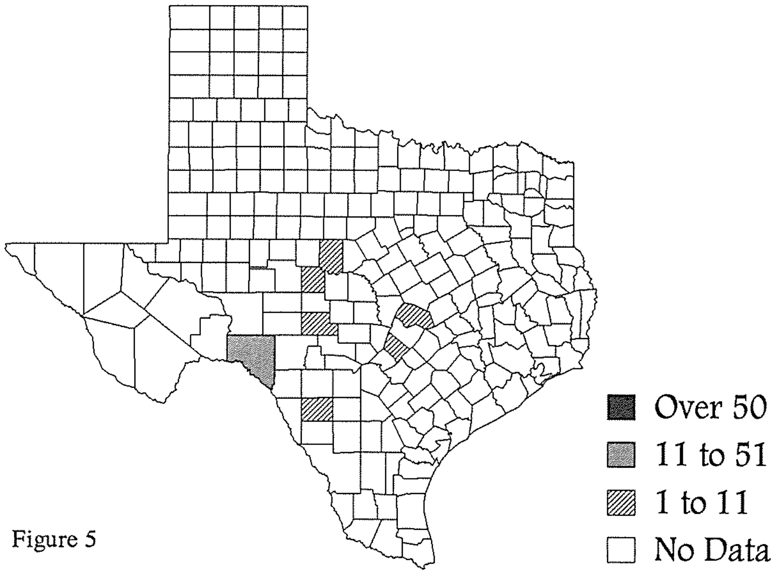

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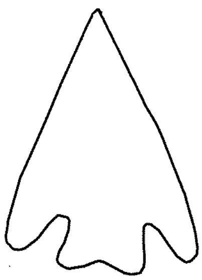

Figure 5

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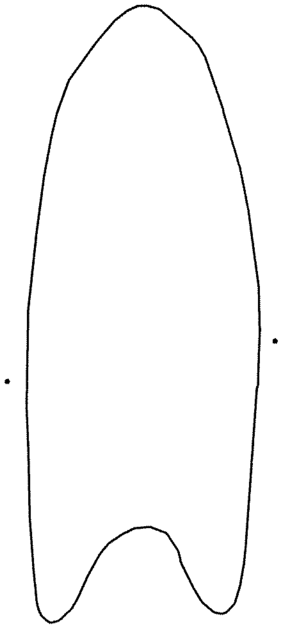
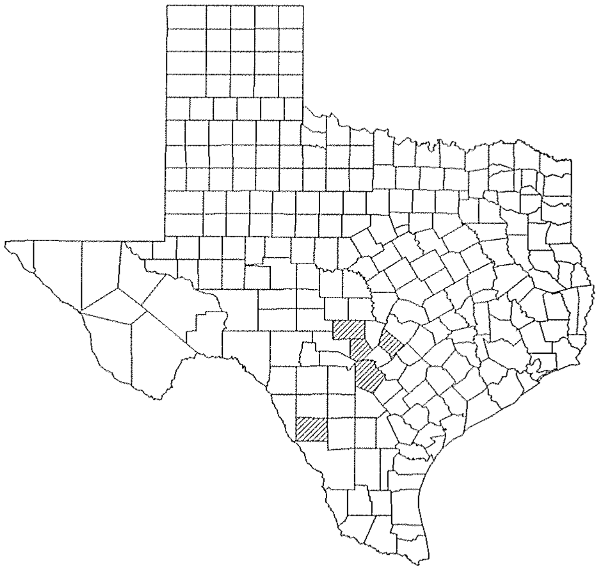
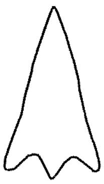
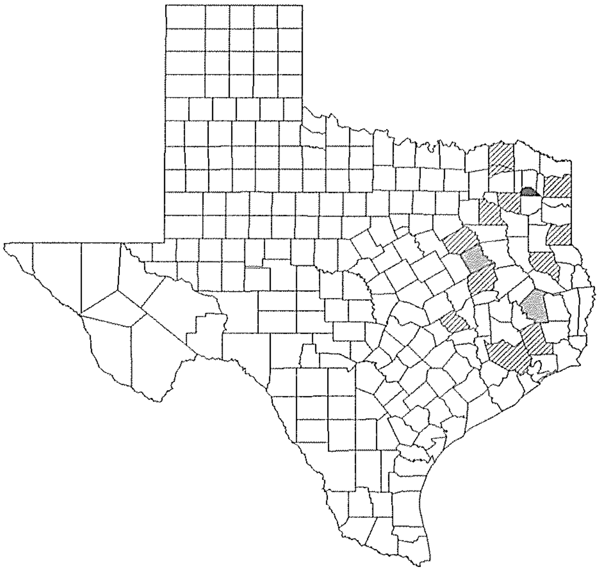




Bassett (1, 30, 33)





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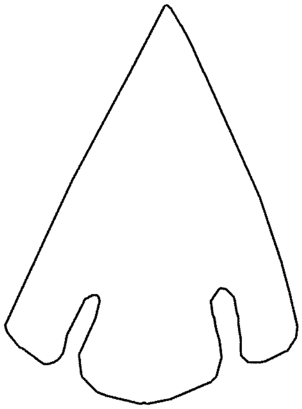
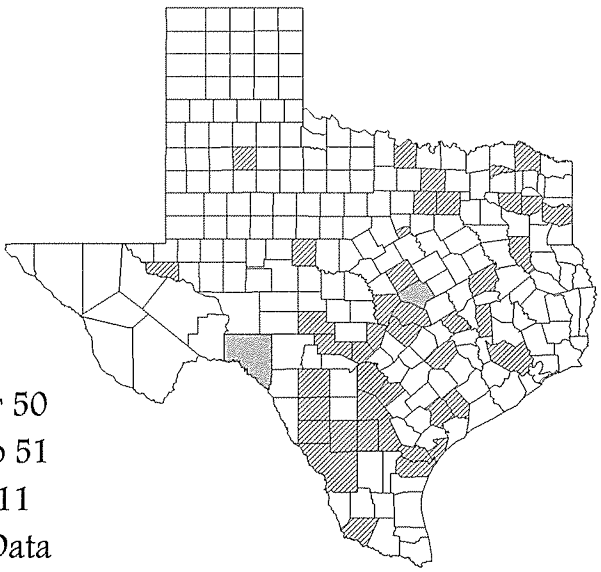
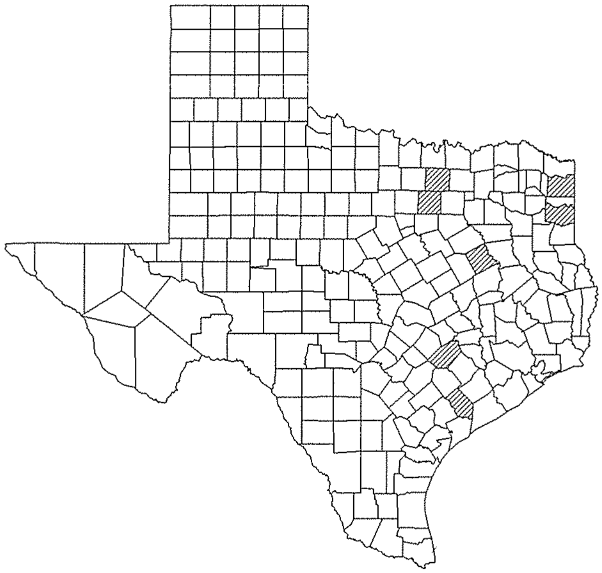


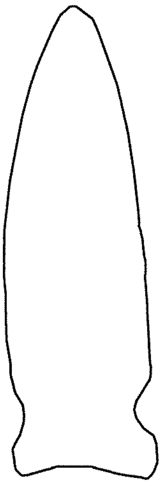


Over 50
11 to 51
1 to 11
No Data

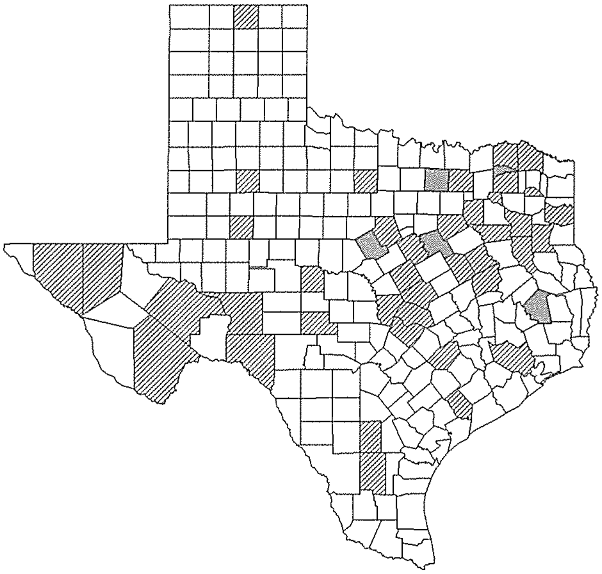
Figure 6

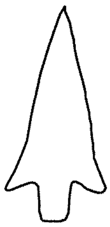
Big Sandy (2, 5)





Bonham (2, 30, 33)





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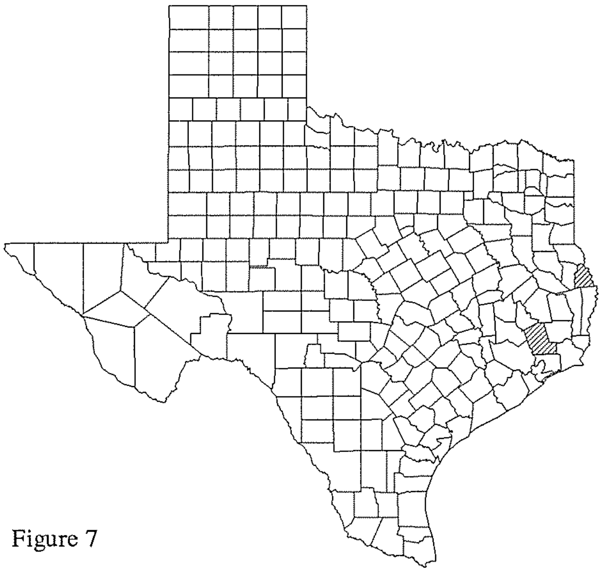
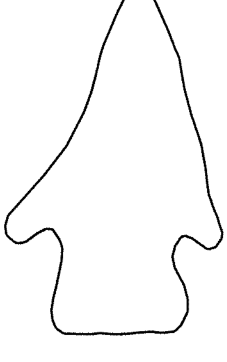




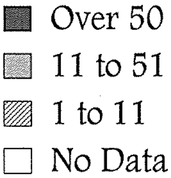
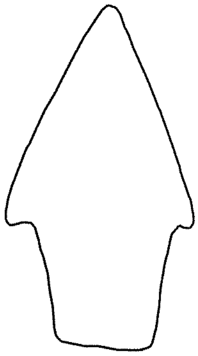
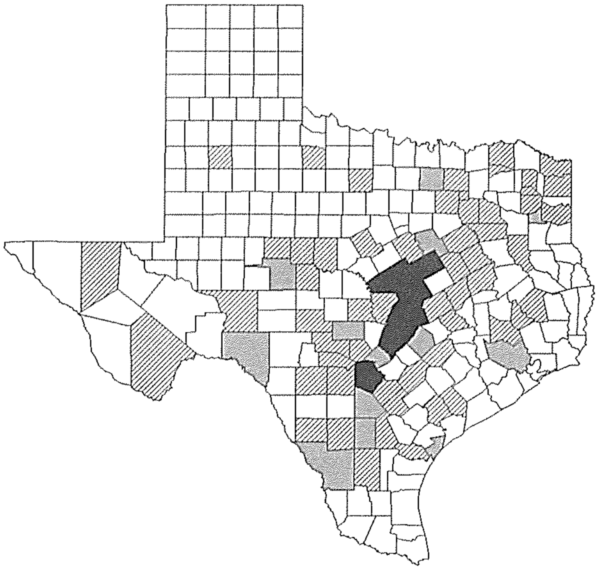


Figure 7

Bulverde (2, 30, 33)





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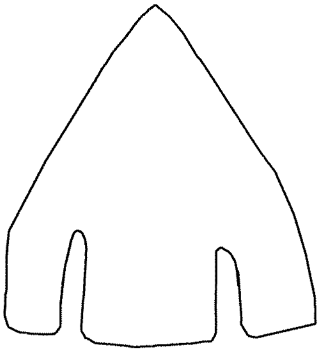
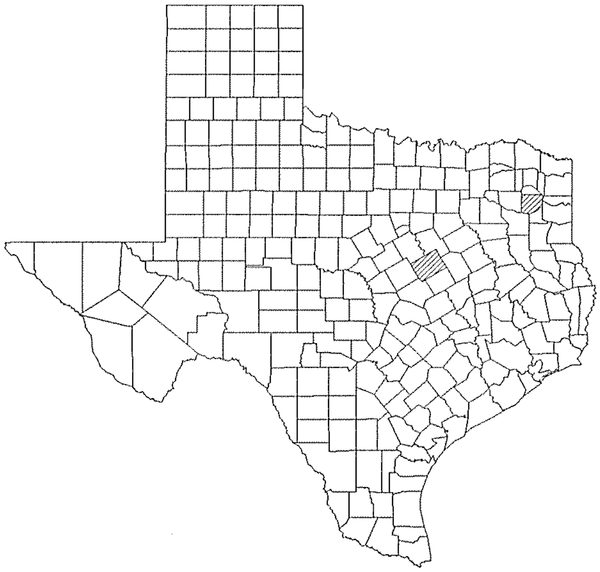
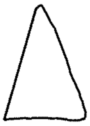
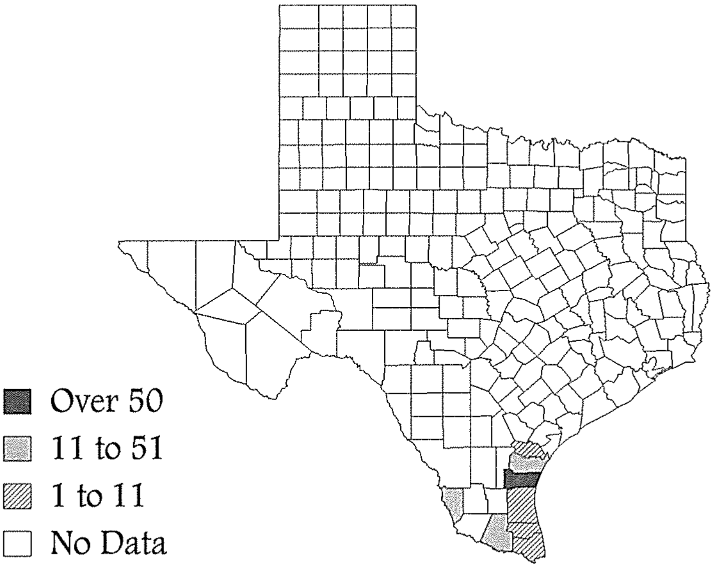




Cameron (30, 33)





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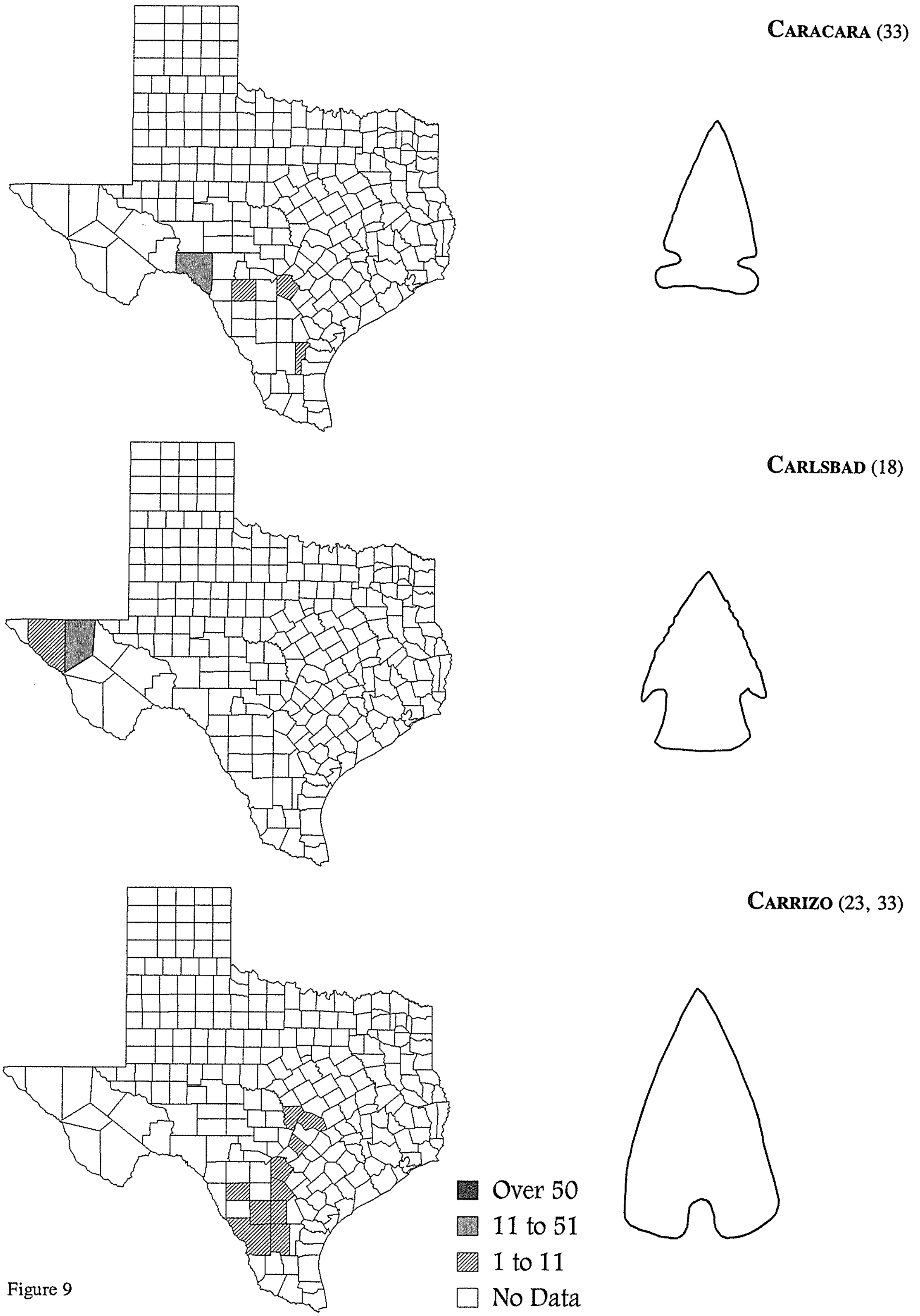
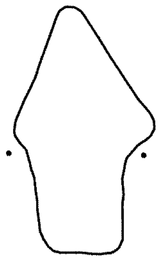
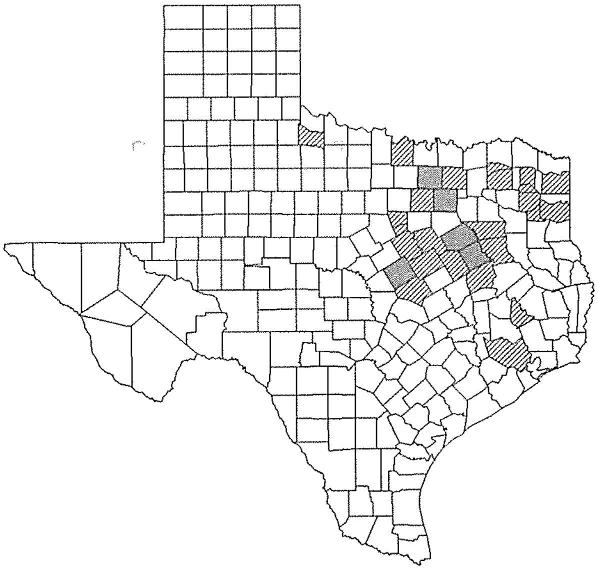

CARACARA (33)
CARLSBAD (18)
CARRIZO (23, 33)
Over 50
11 to 51
1 to 11
No Data

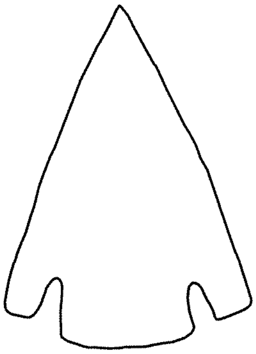
Figure 9

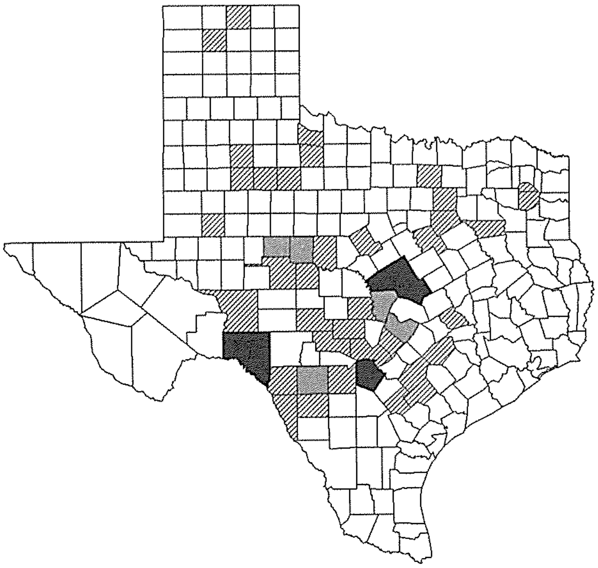
CARROLLTON (1, 30, 33)



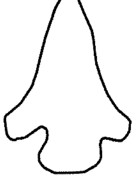


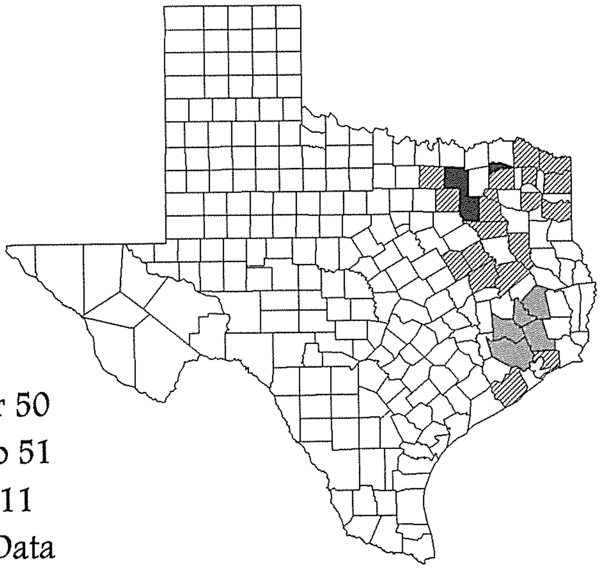
CASTROVILLE (2, 30, 33)





CATAHOULA (2, 33)

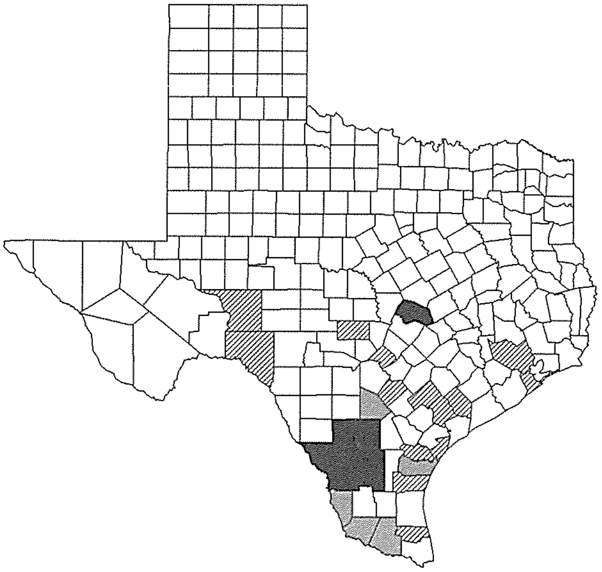


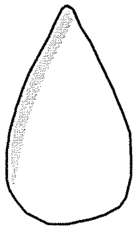


Over 50
11 to 51
1 to 11
No Data

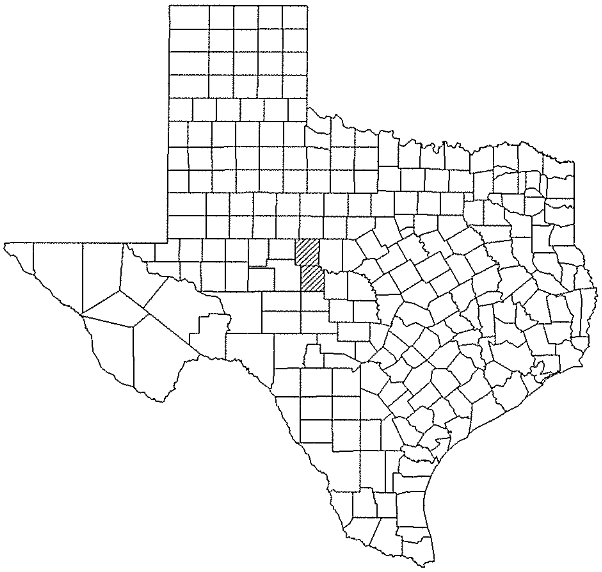
Figure 10

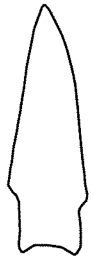
CATAN (1, 30, 33)





CHADBOURNE (33)





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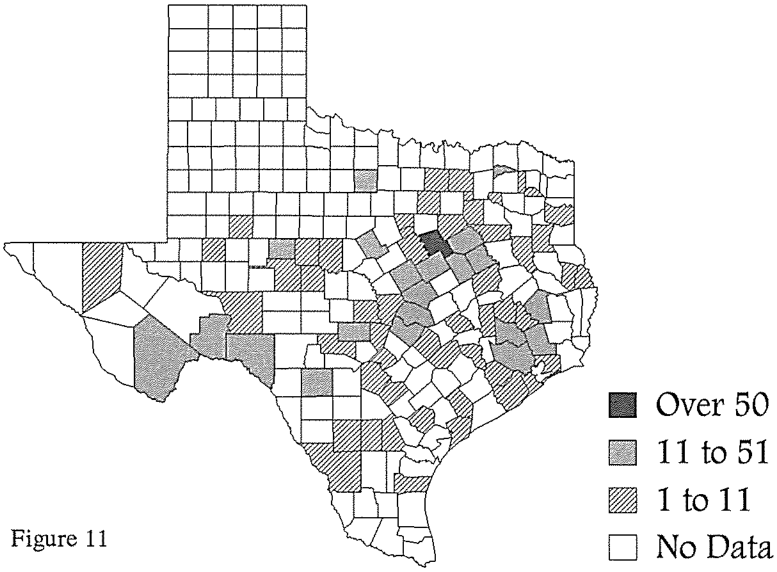


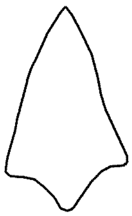
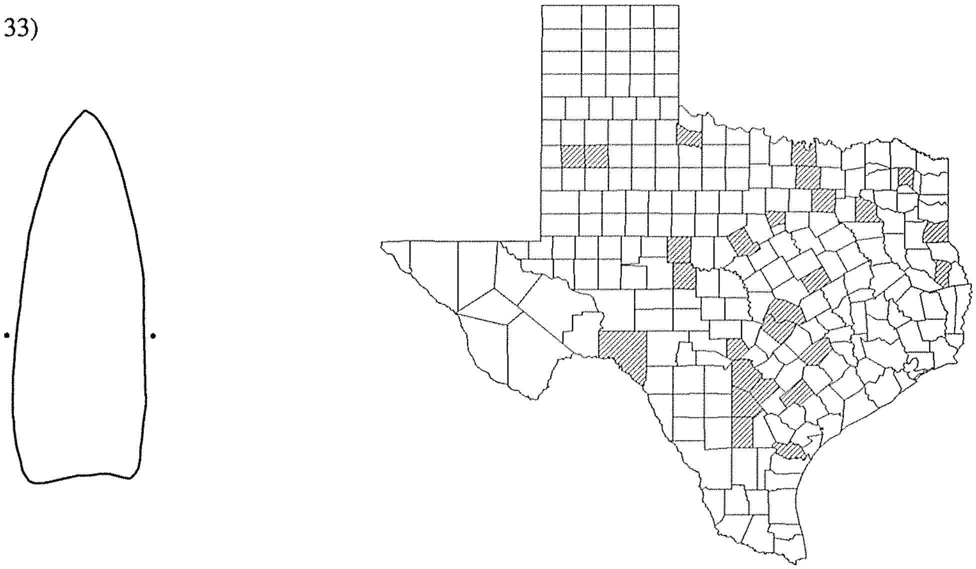


Figure 11

CLOVIS (1, 5, 30, 33)



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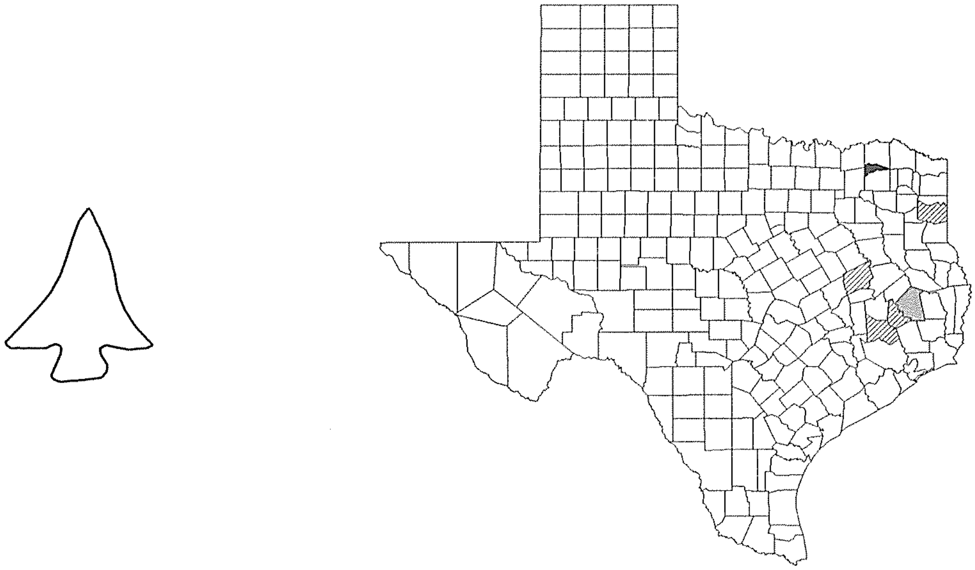

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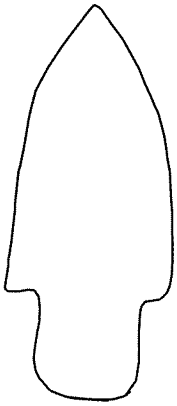
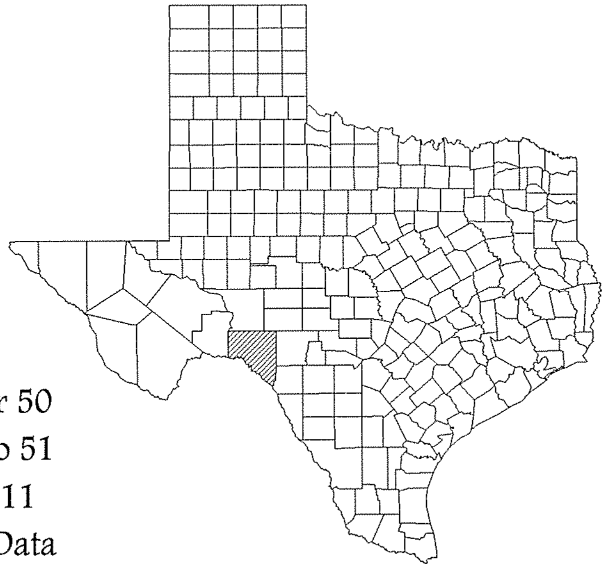
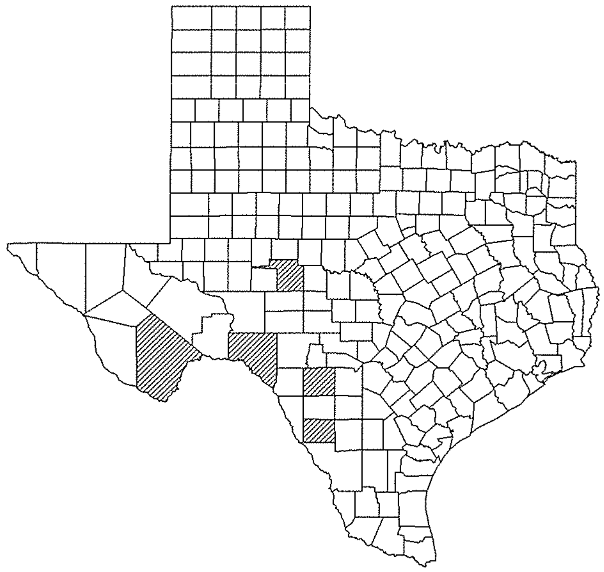


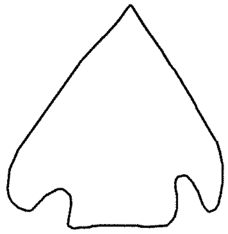


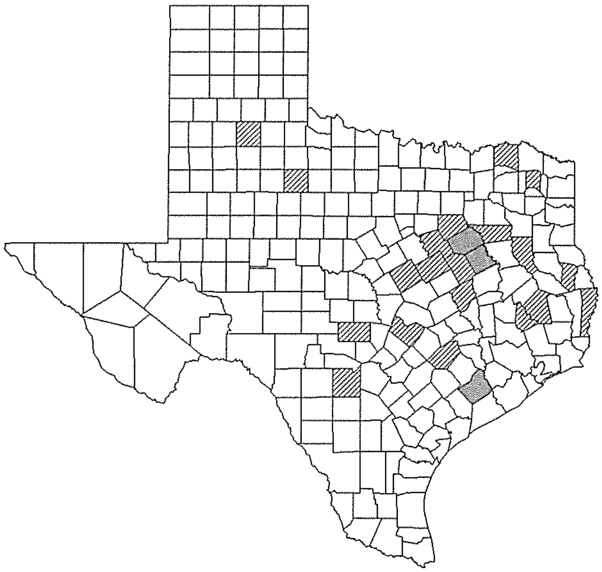
Over 50
11 to 51
1 to 11
No Data

Figure 12

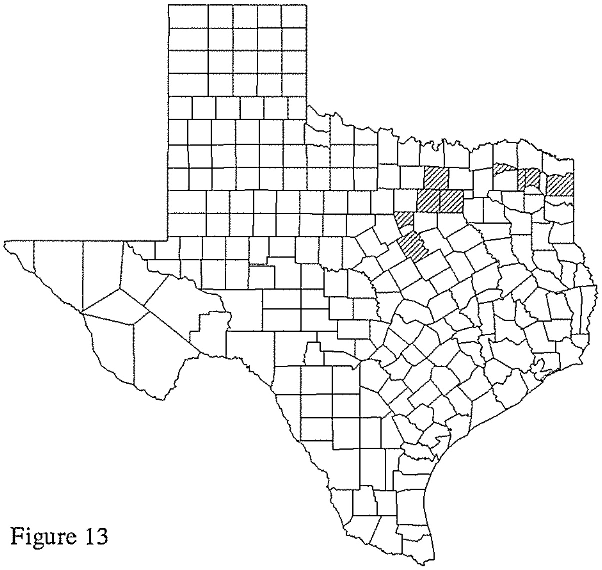


CONEJO (33)

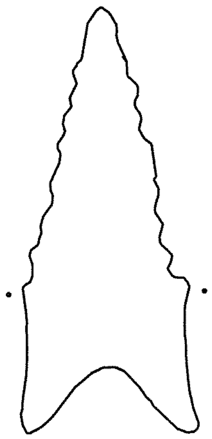




CUNEY (30, 33)



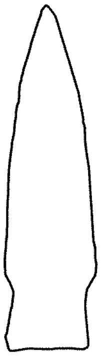
DALTON (1, 5, 33)

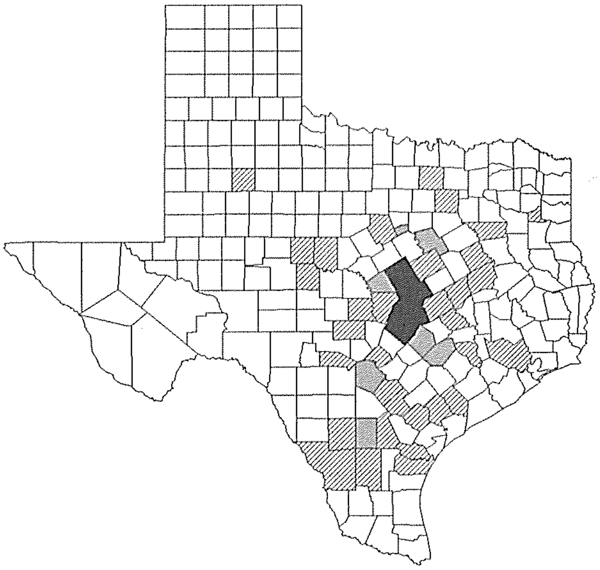


Over 50
11 to 51
1 to 11
No Data

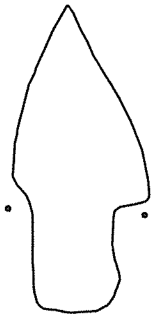
Figure 13

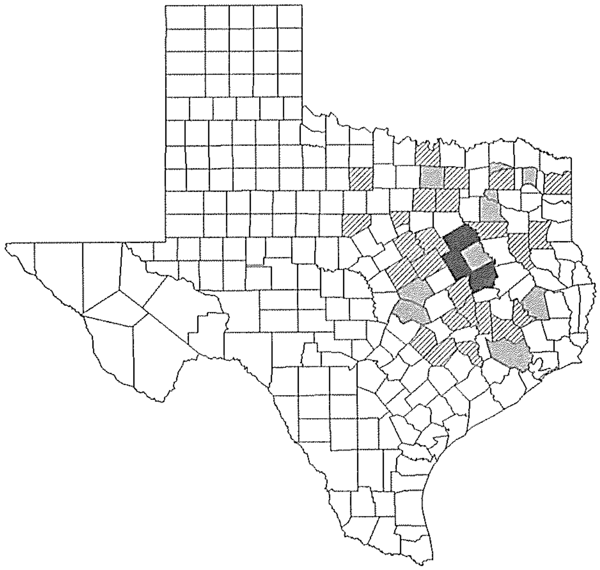
DARL (2, 30, 33)



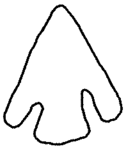


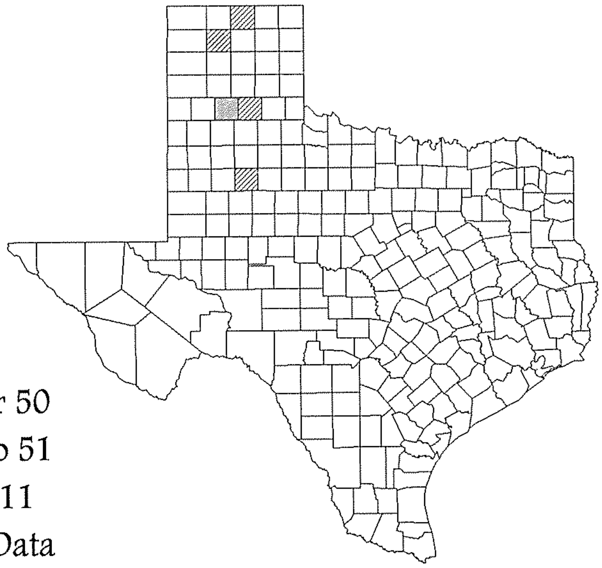
DAWSON (33)





DEADMANS (9)

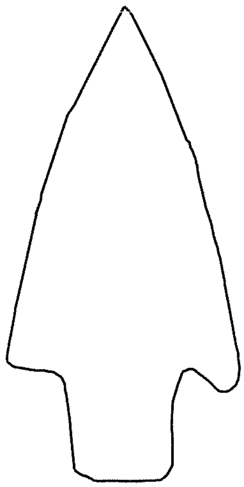


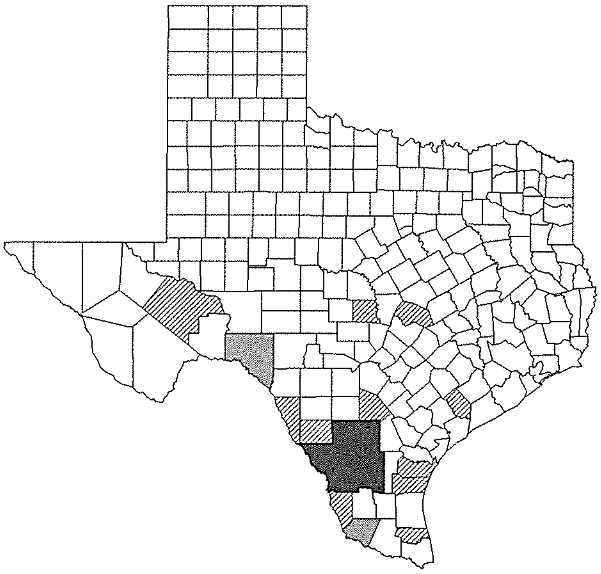


Over 50
11 to 51
1 to 11
No Data

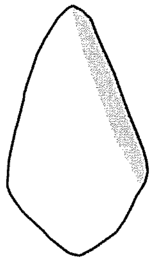
Figure 14

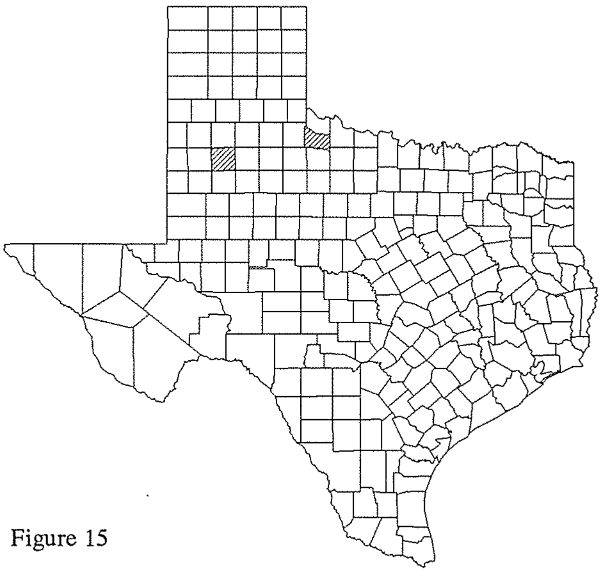
DELHI (22, 33)



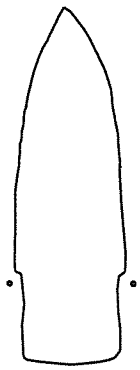


DESMUKE (2, 30, 33)





EDEN (22)



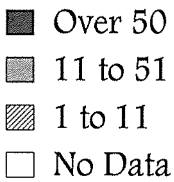
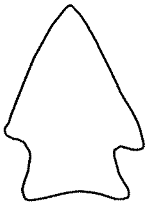
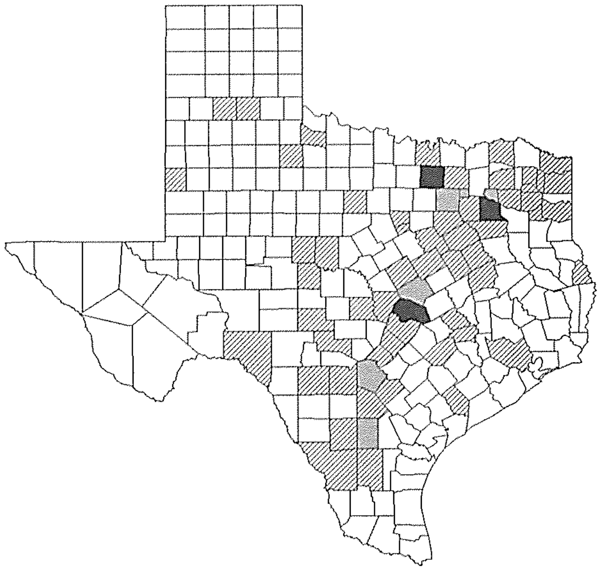


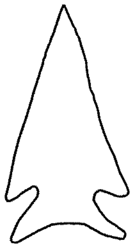
Figure 15

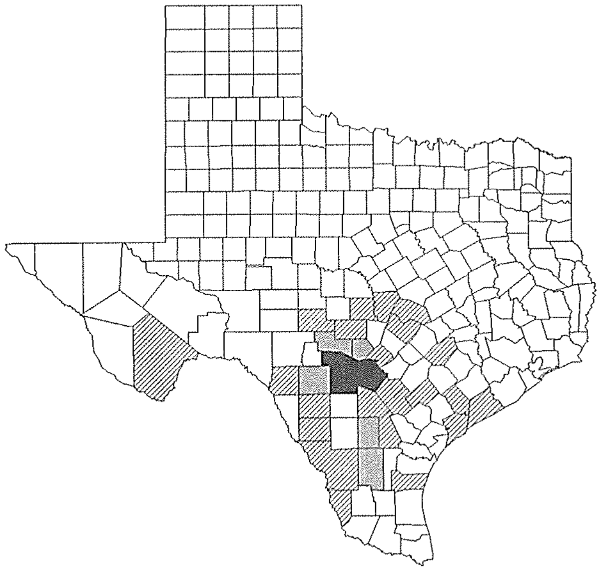
Edgewood (1, 30, 33)



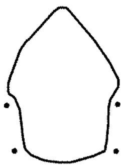


Edwards (23, 33)





Elam (30, 33)



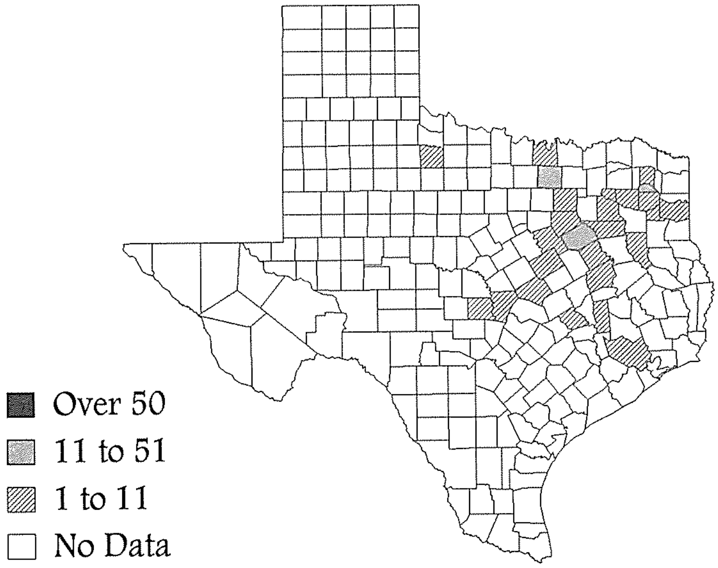
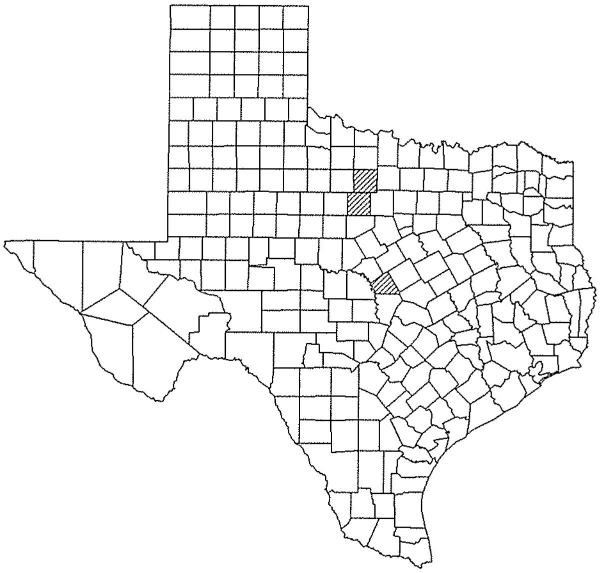
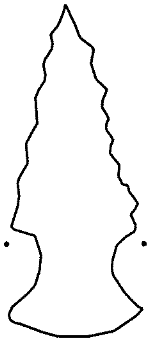
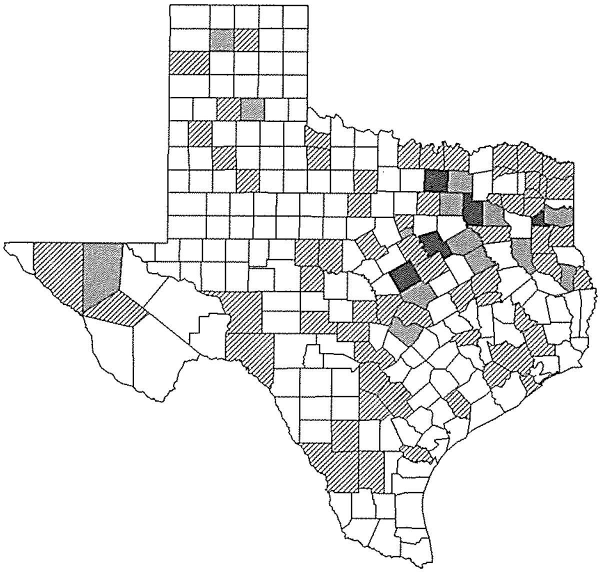


Figure 16

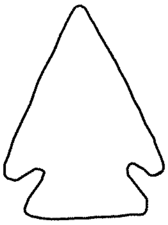


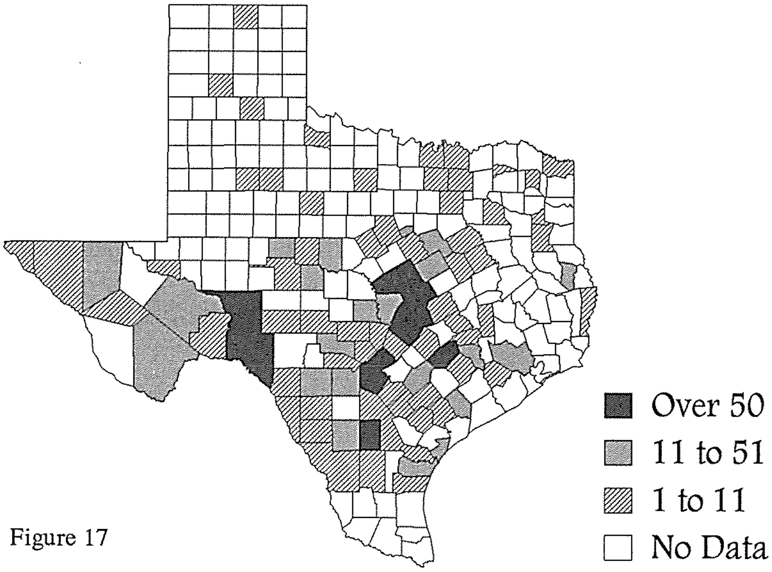
Eliasville (7)





Ellis (2, 30, 33)





Ensor (2, 30, 33)

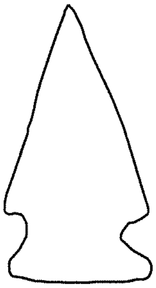
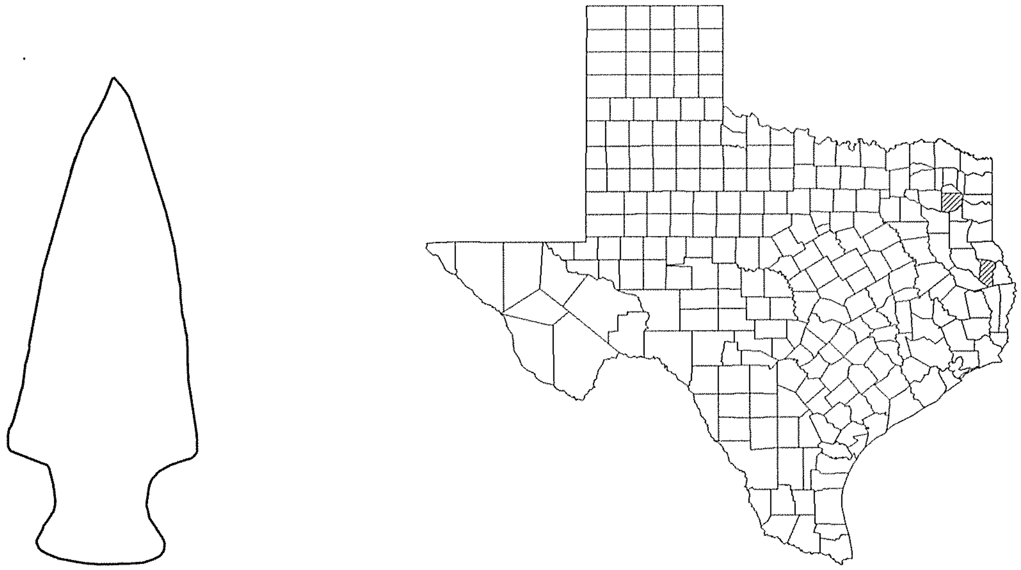
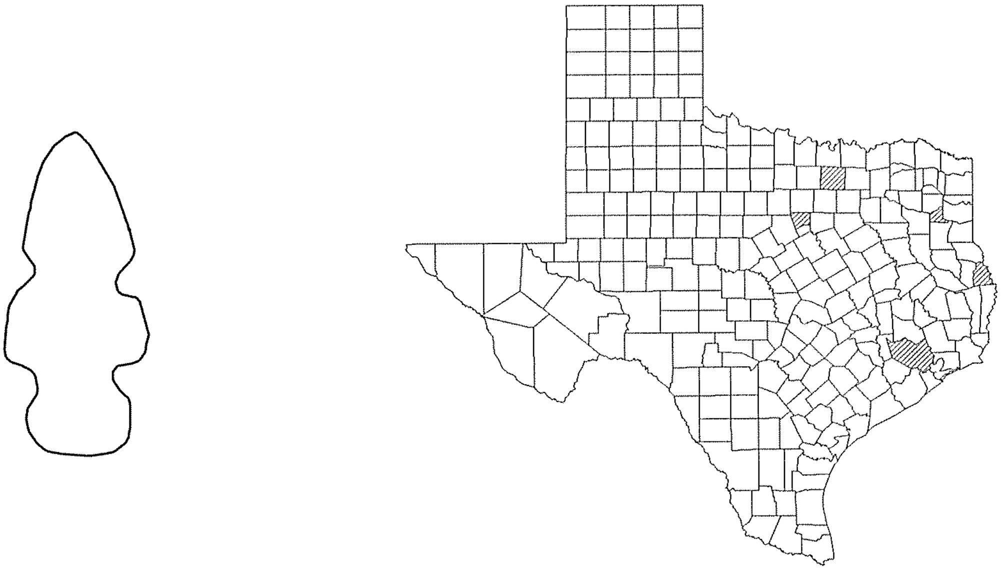


Figure 17

EPPS (22, 33)



EVANS (1, 33)



FAIRLAND (2, 30, 33)

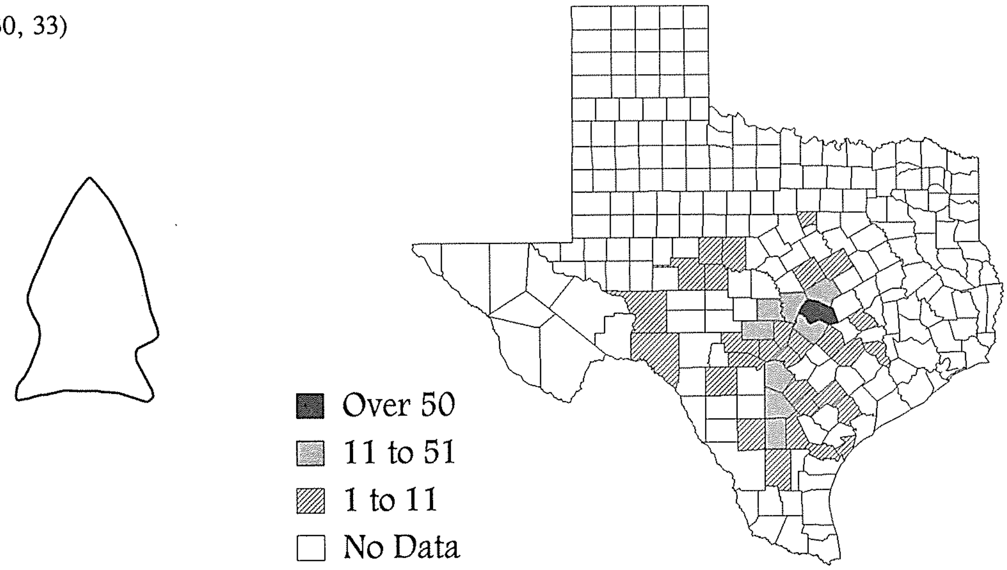
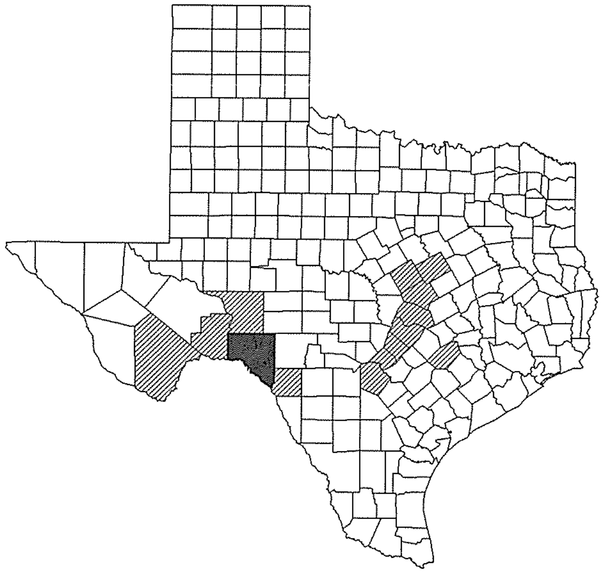
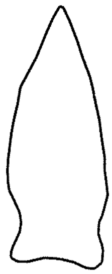
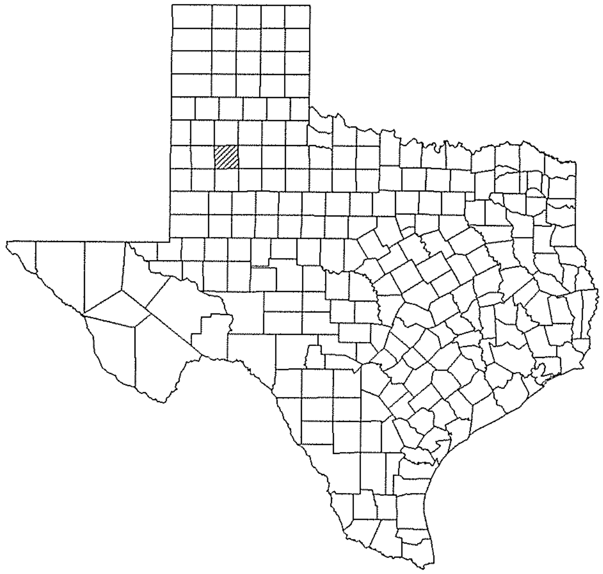


Figure 18

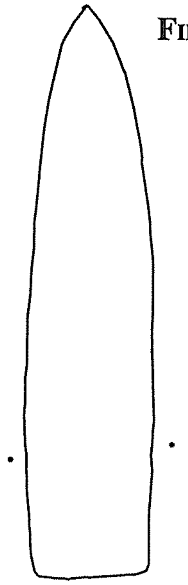


FIGUEROA (33)

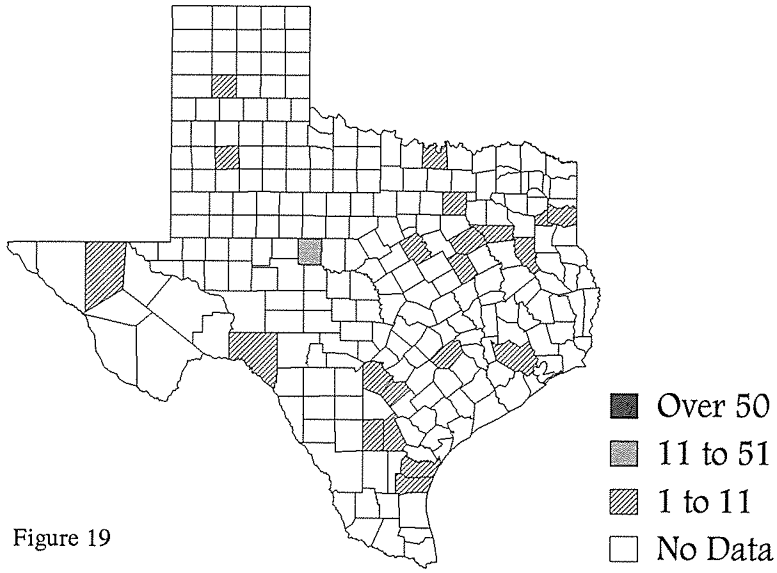




FIRSTVIEW (33)



FOLSOM (1, 5, 30, 33)



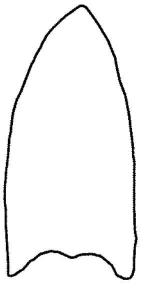
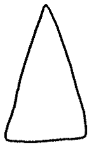
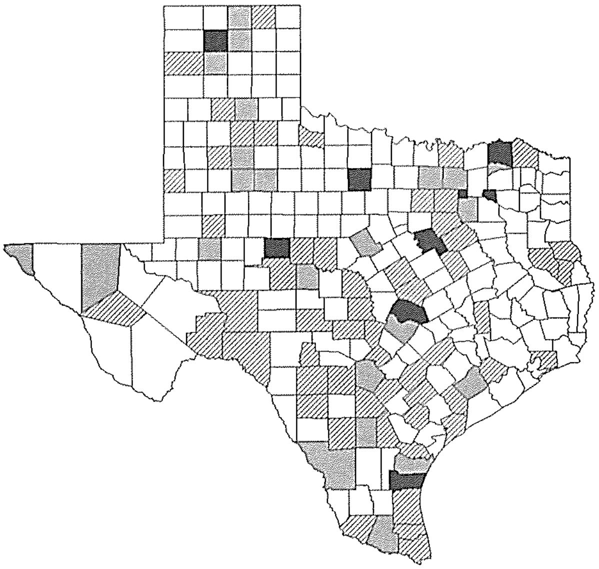


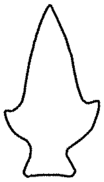
Figure 19

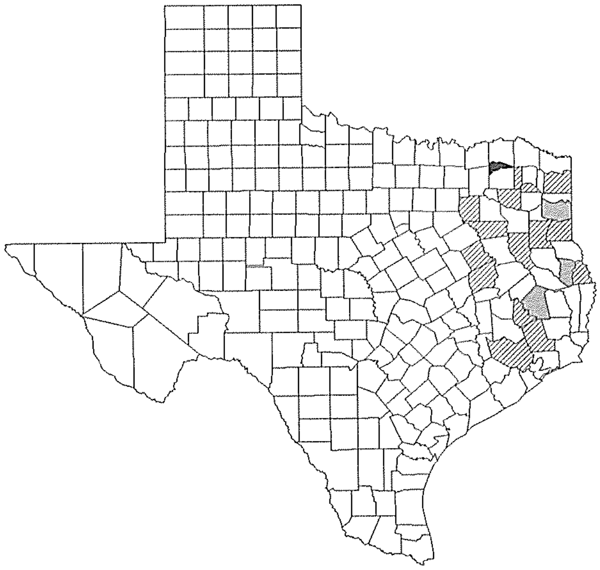
Fresno (30, 33)



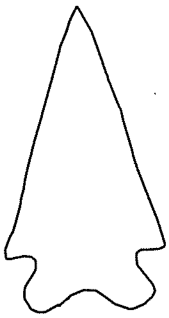


Friley (2, 33)





Frio (2, 30, 33)



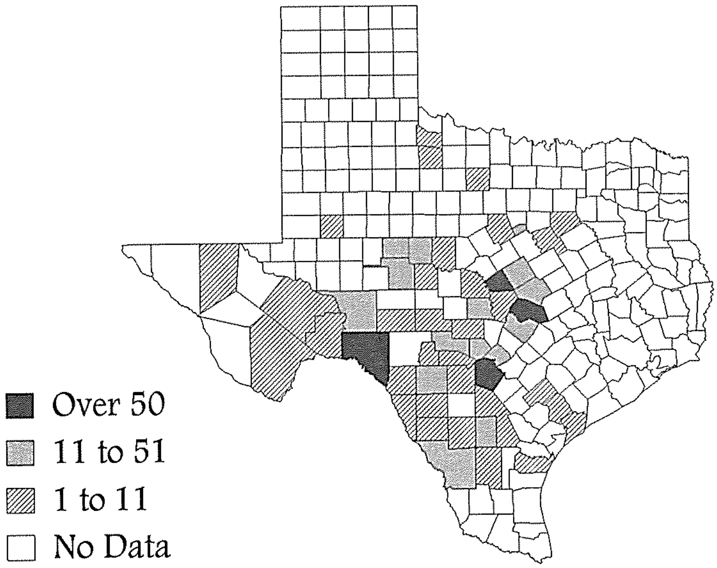
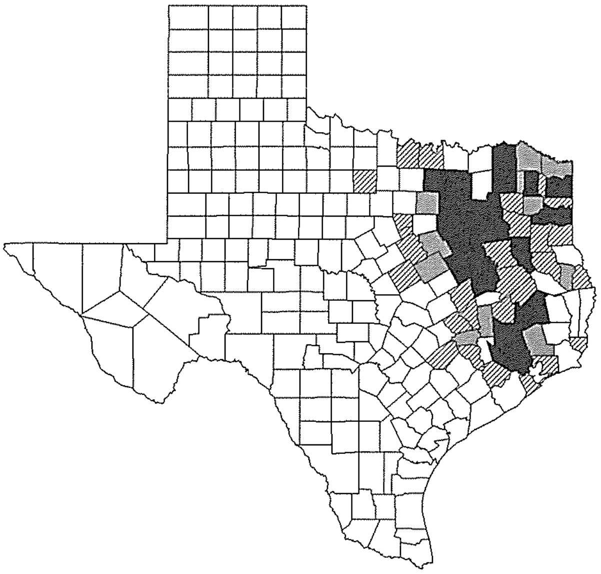
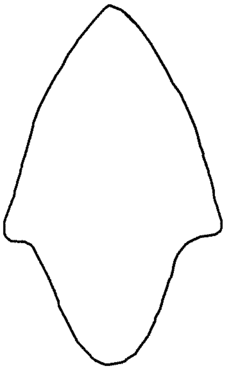


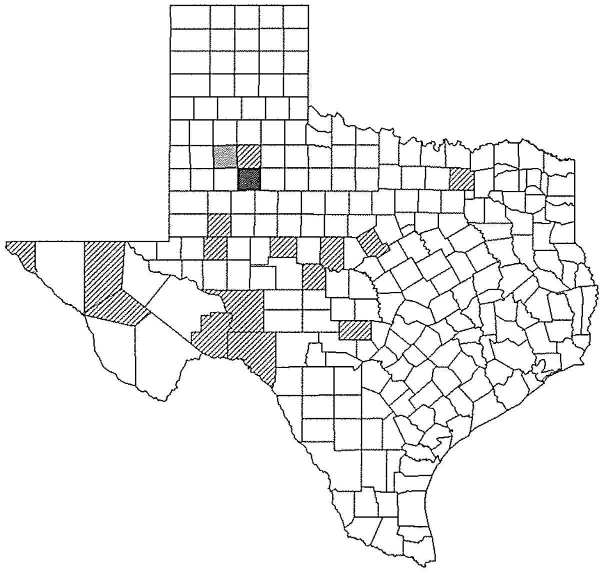
Figure 20

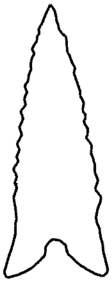
GARY (1, 6, 30, 33)



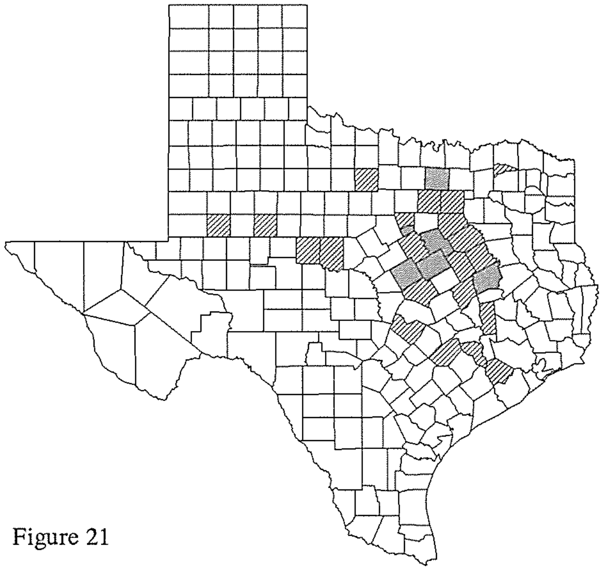


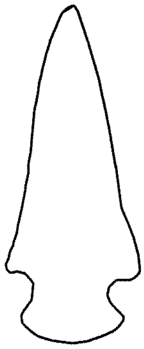
GARZA (23, 33)





GODLEY (23, 33)

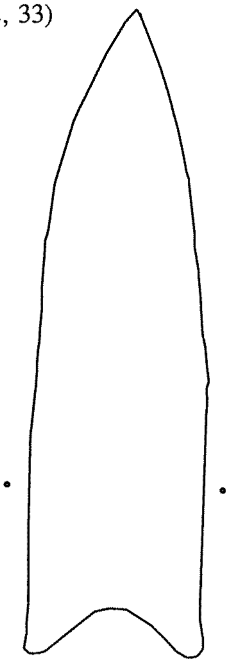


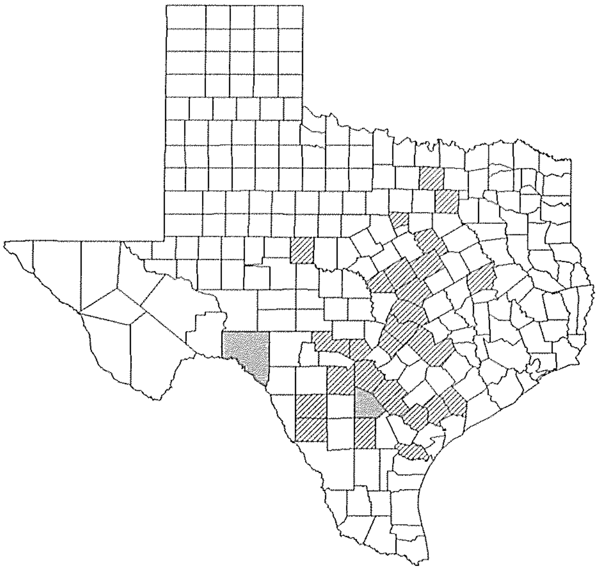


- Over 50
- 11 to 51
- 1 to 11
- No Data

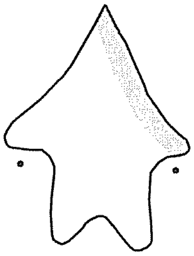
Figure 21

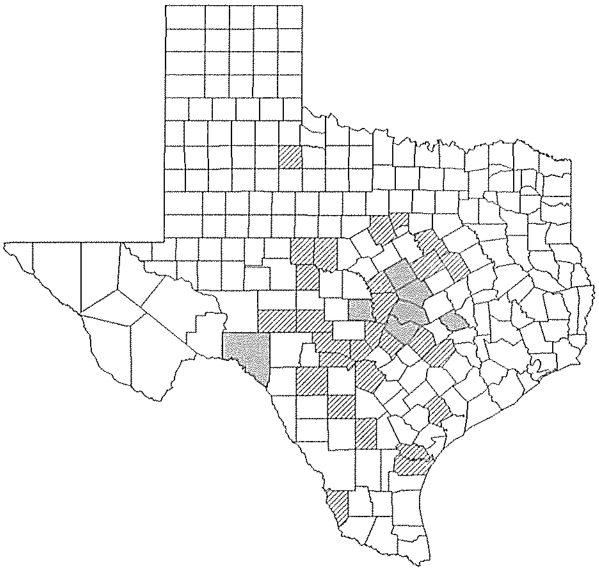
GOLONDRINA (22, 33)



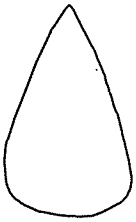


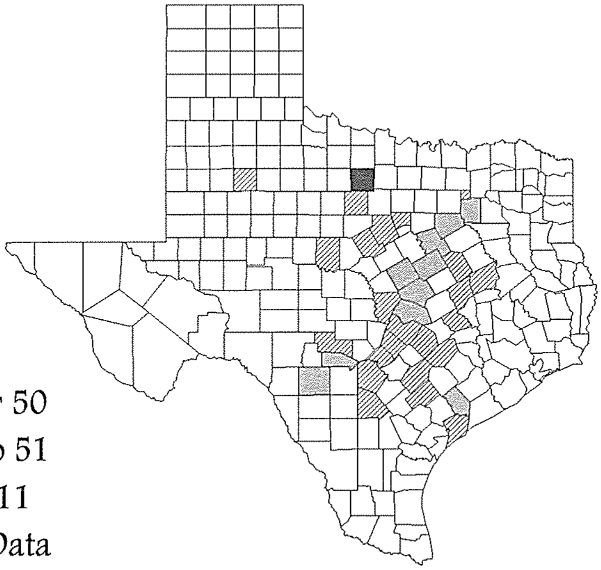
GOWER (33)





GRANBURY (10)

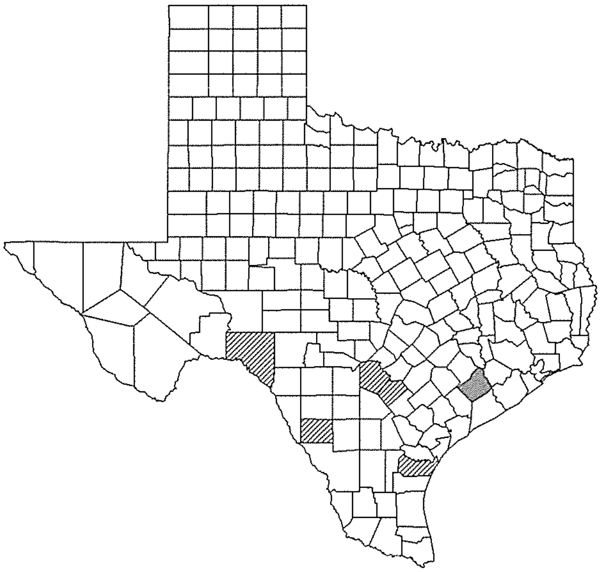


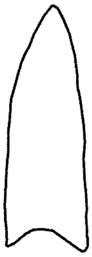


Over 50
11 to 51
1 to 11
No Data

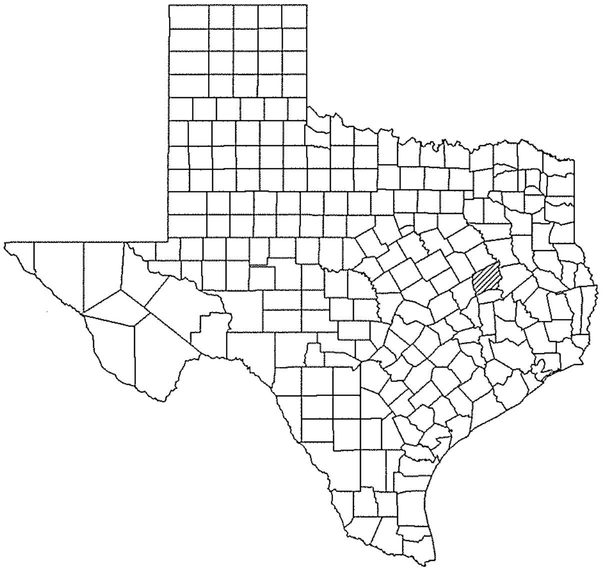
Figure 22

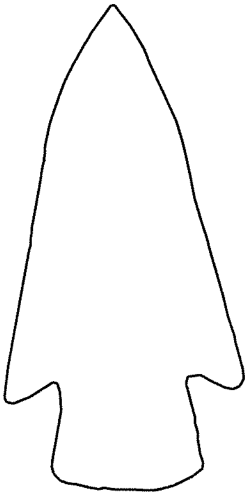
GUERRERO (33)



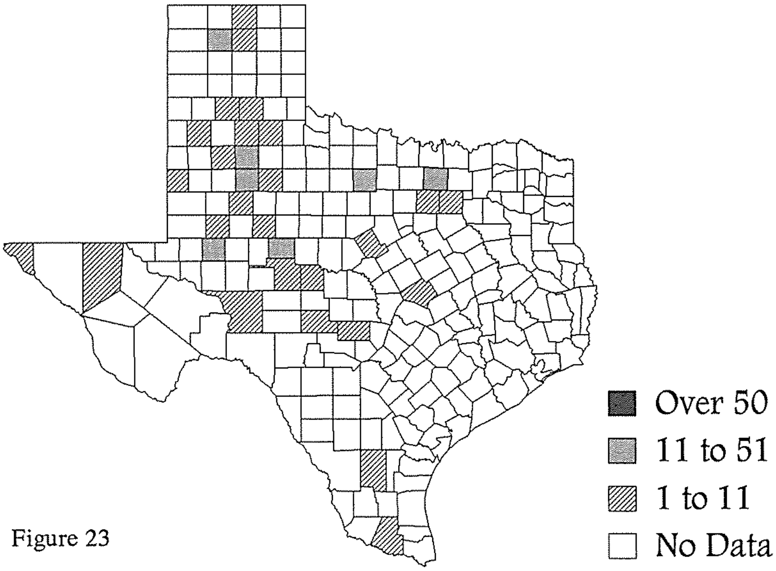


HARDIN (2, 5)





HARRELL (1, 30, 33)



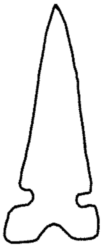
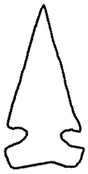
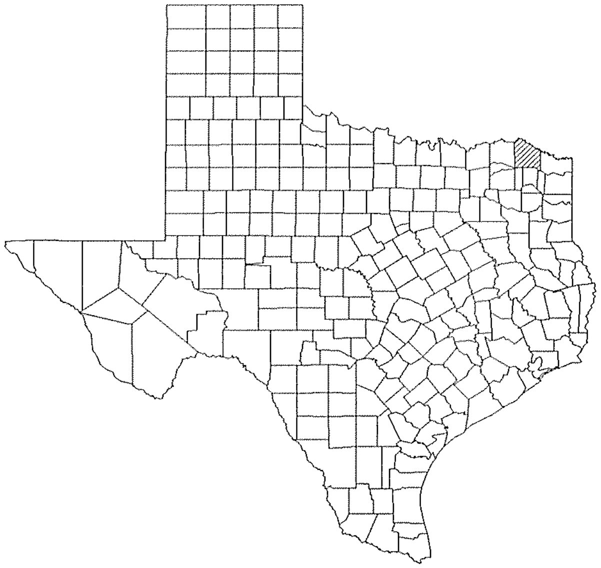


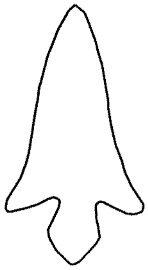
Figure 23

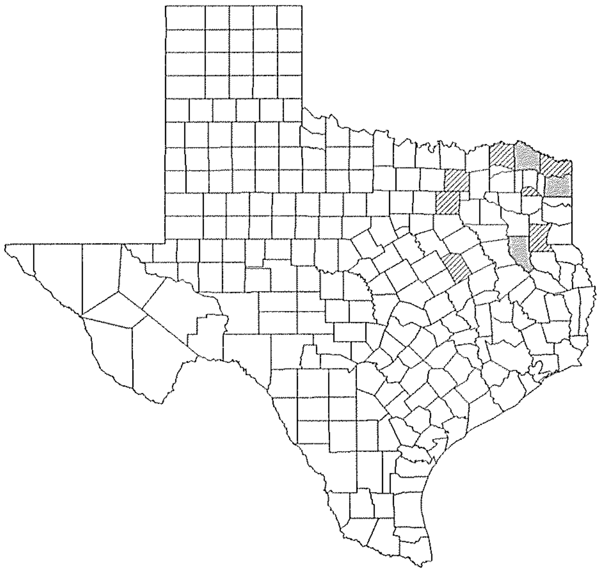
Haskell (23)



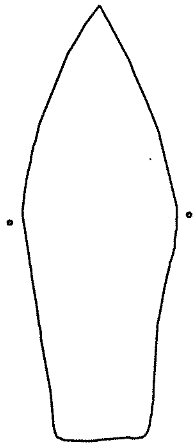


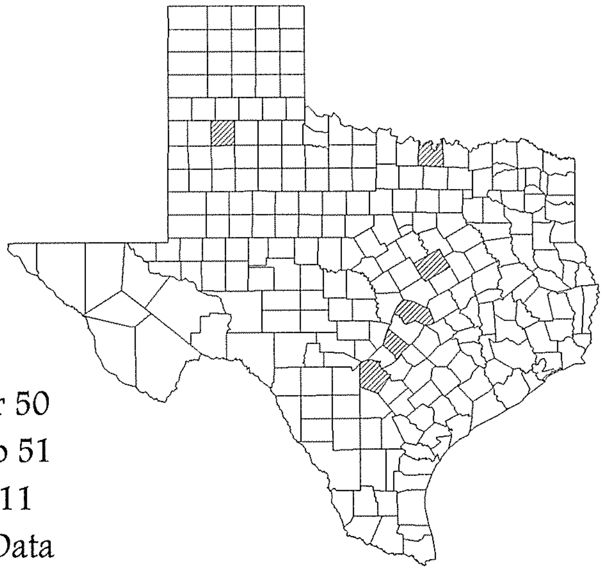
Hayes (1, 30, 33)





Hell Gap (22, 33)

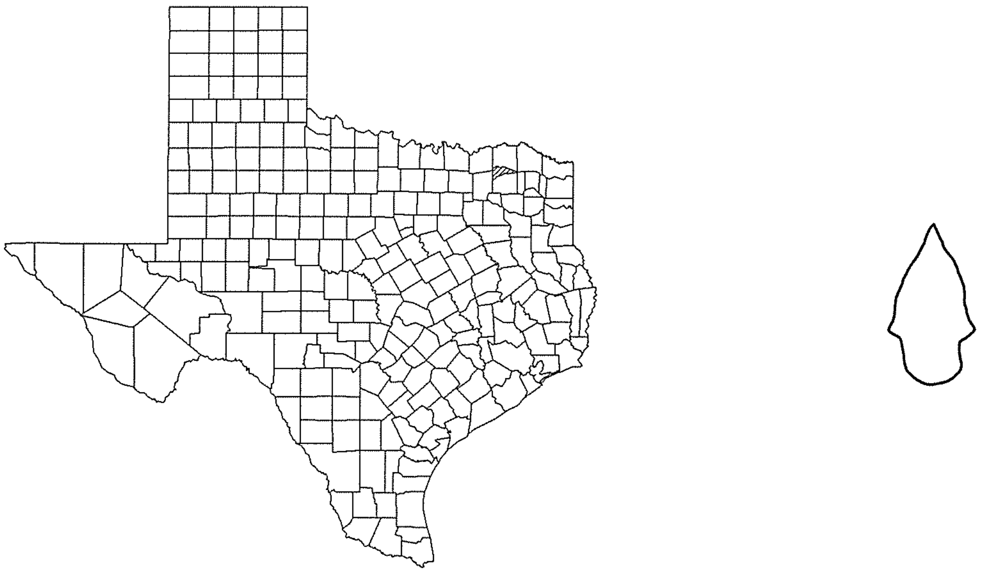




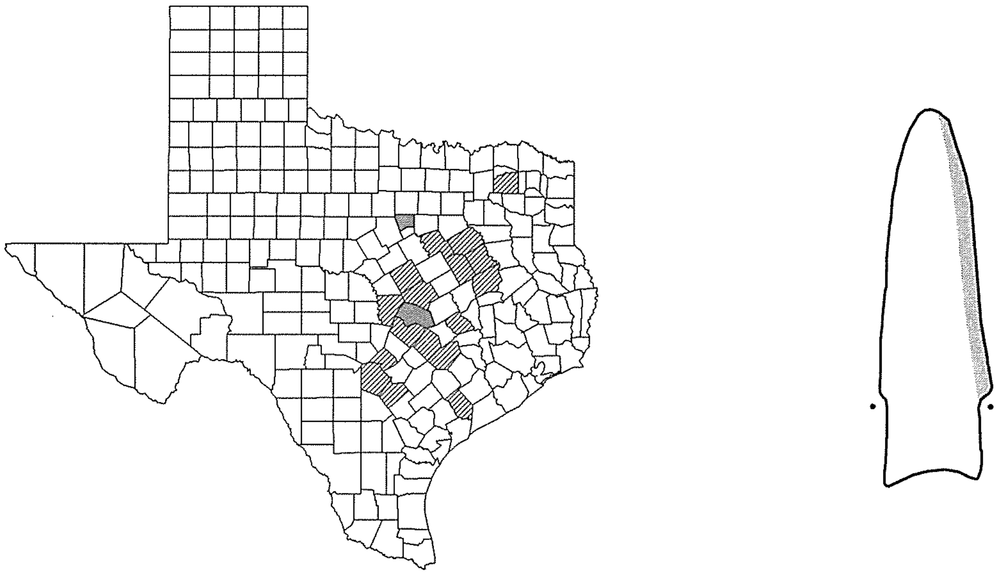
Over 50
11 to 51
1 to 11
No Data

Figure 24

HOMAN (23, 33)



HOXIE (33)



HUFFAKER (2, 6)

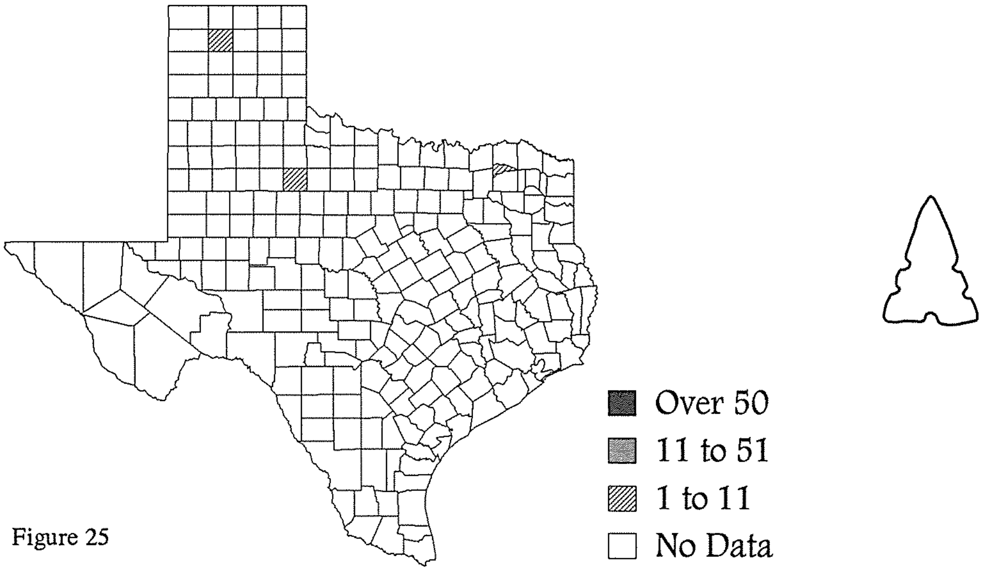
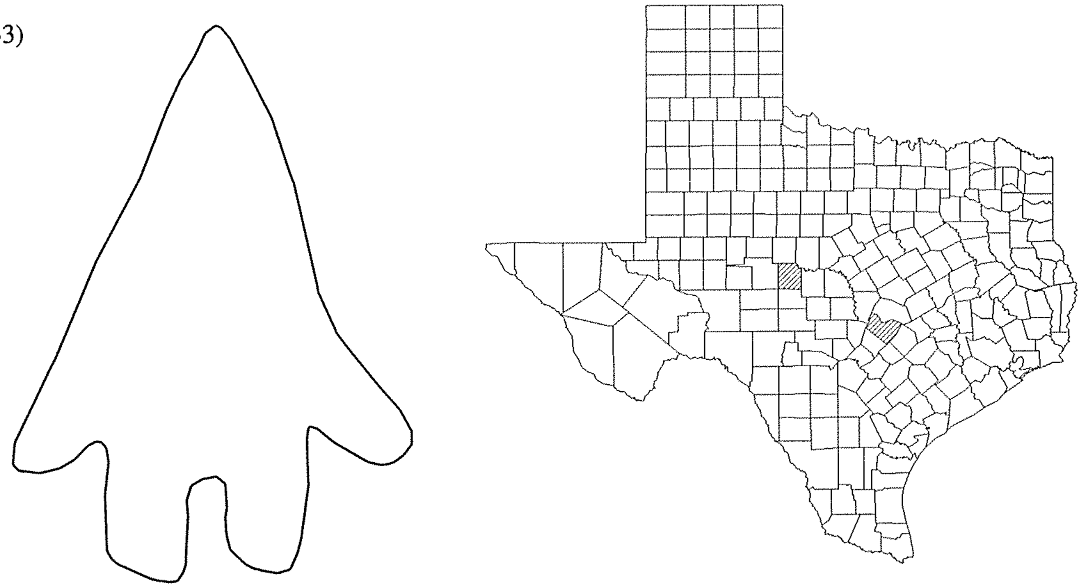
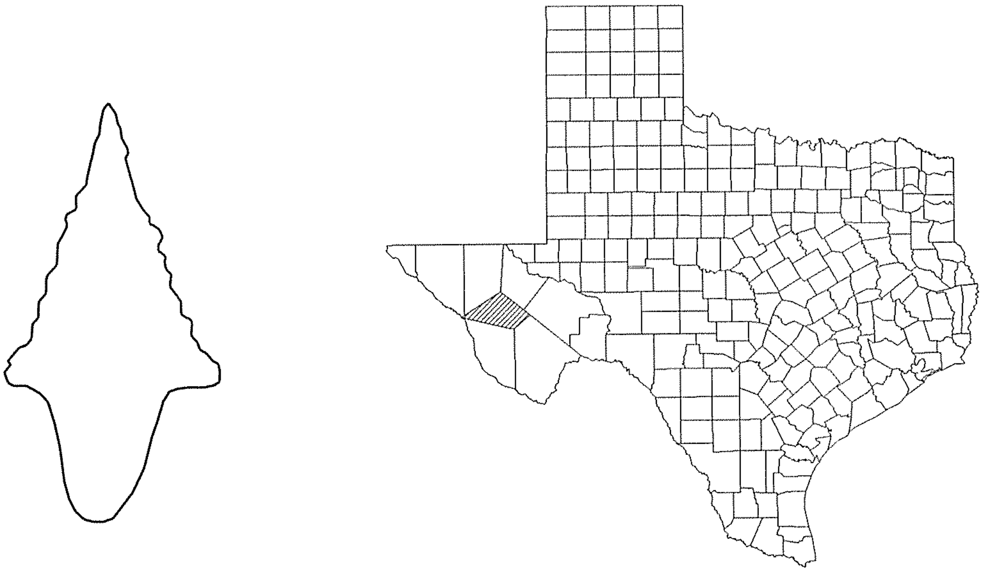


Figure 25

JETTA (33)



JORA (32)



KENT (2, 30, 33)

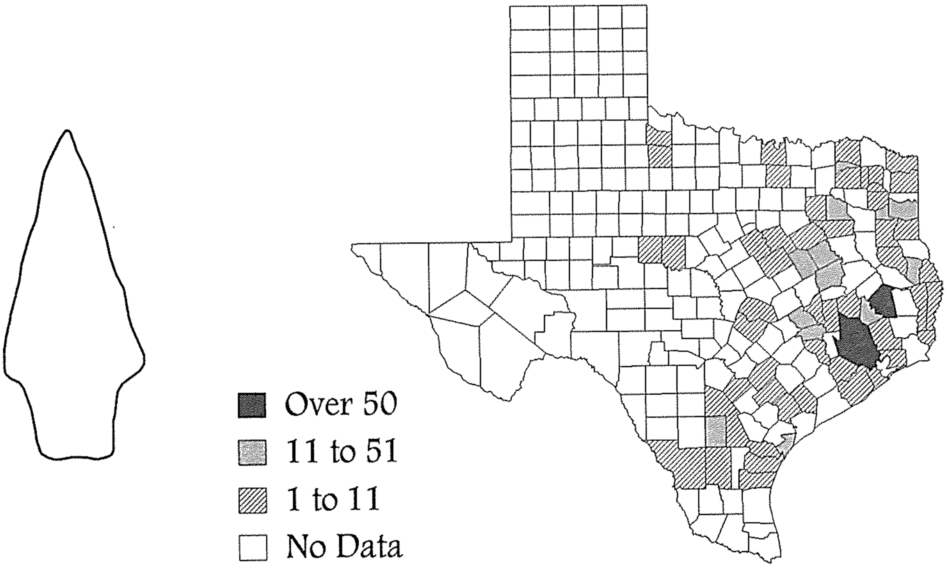
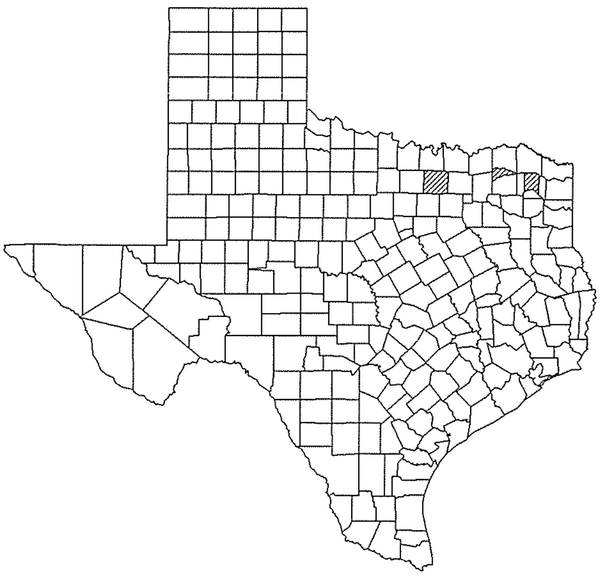
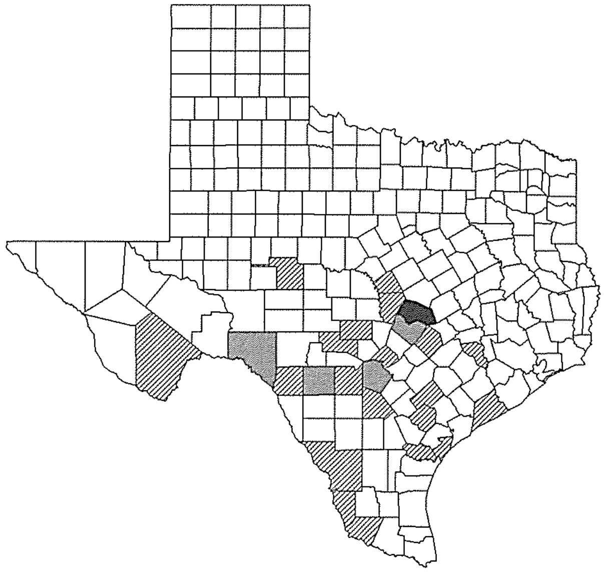


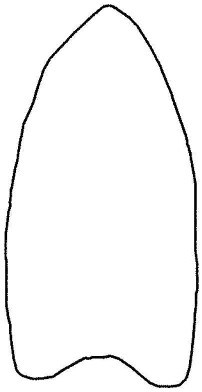
Figure 26

KEOTA (23)

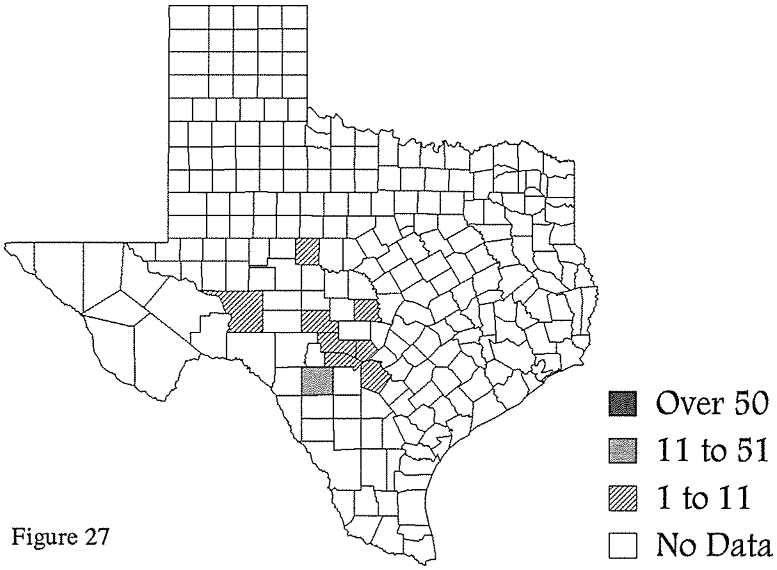


KINNEY (1, 30, 33)





LA JITA (33)



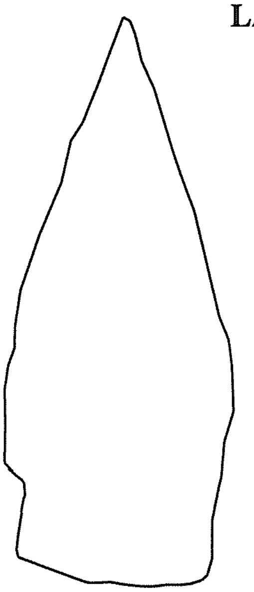
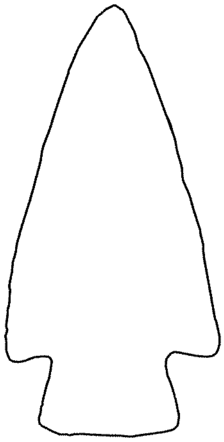
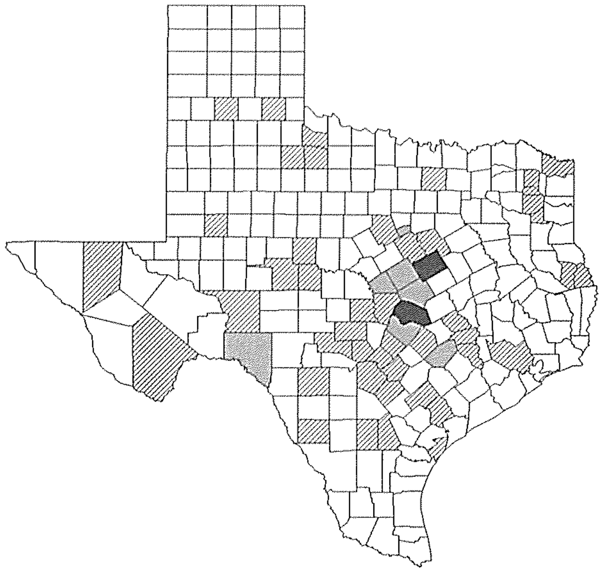


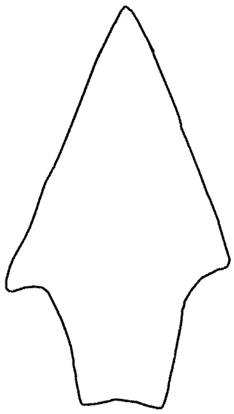
Figure 27

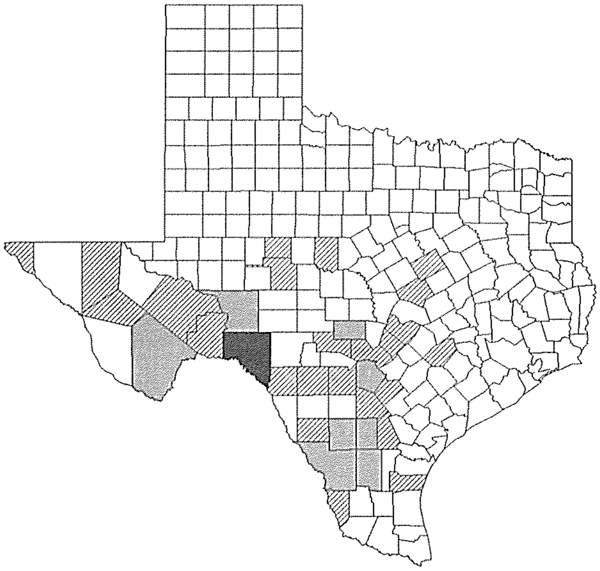
Lange (1, 30, 33)



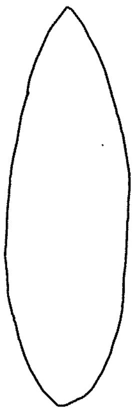


Langtry (19, 30, 33)





Lerma (1, 30, 33)



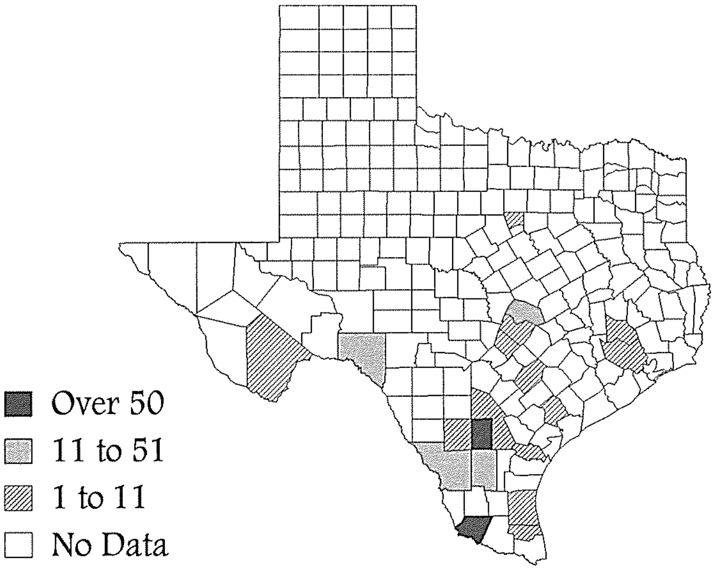
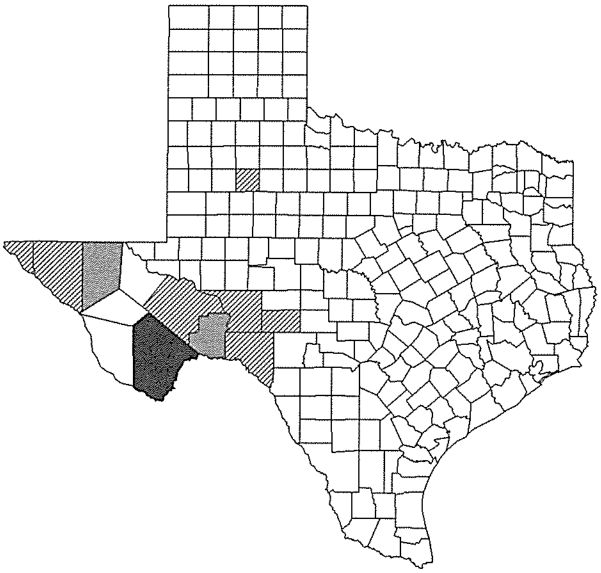
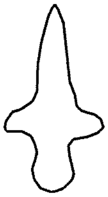


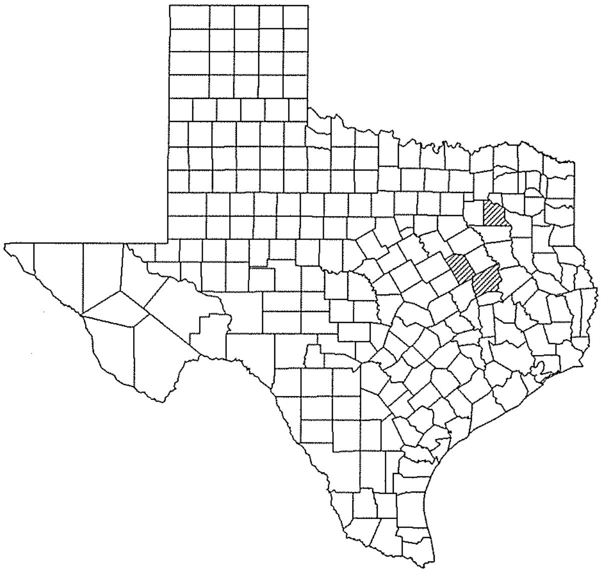
Figure 28

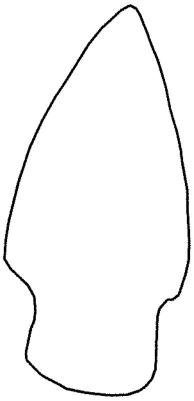
LIVERMORE (2, 30, 33)



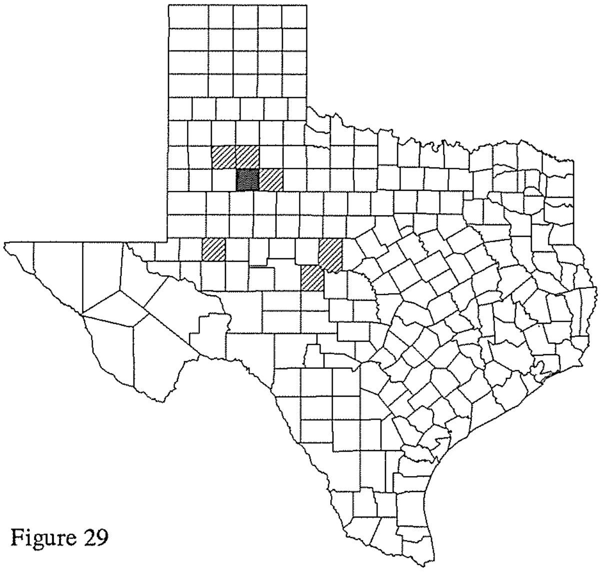


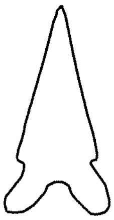
LONE OAK (33)





LOTT (33)

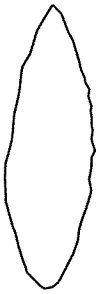




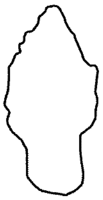
Over 50
11 to 51
1 to 11
No Data

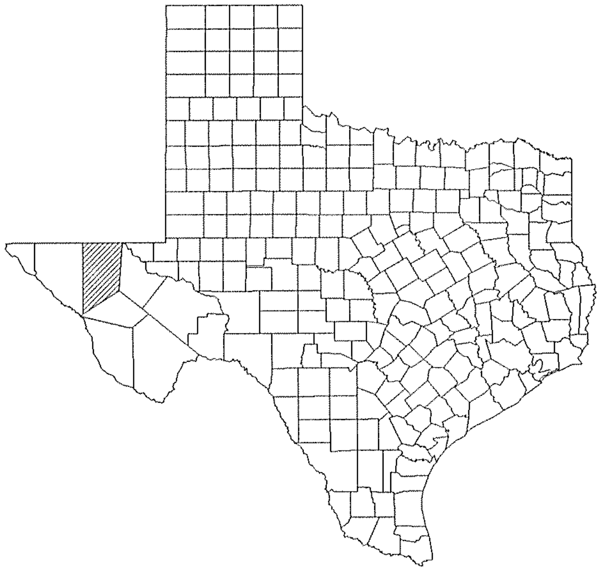
Figure 29

Maljamar 1 (28)

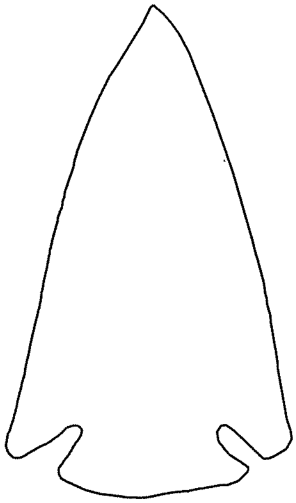


Maljamar 2 (28)





Marcos (1, 30, 33)



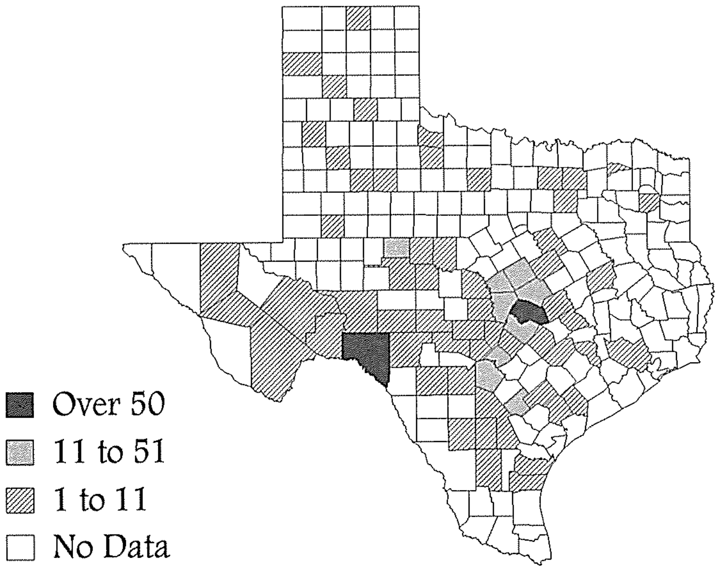


Figure 30

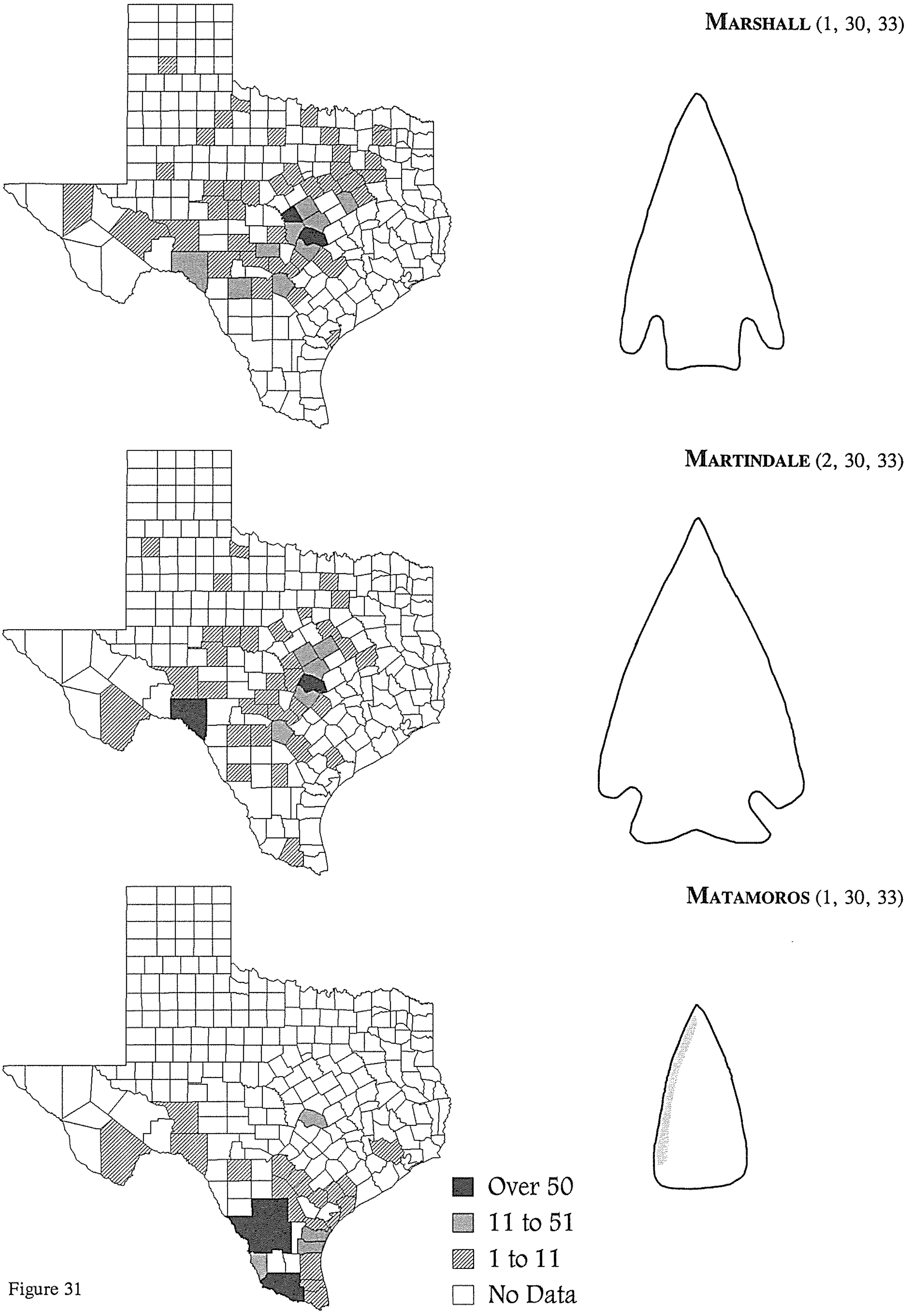
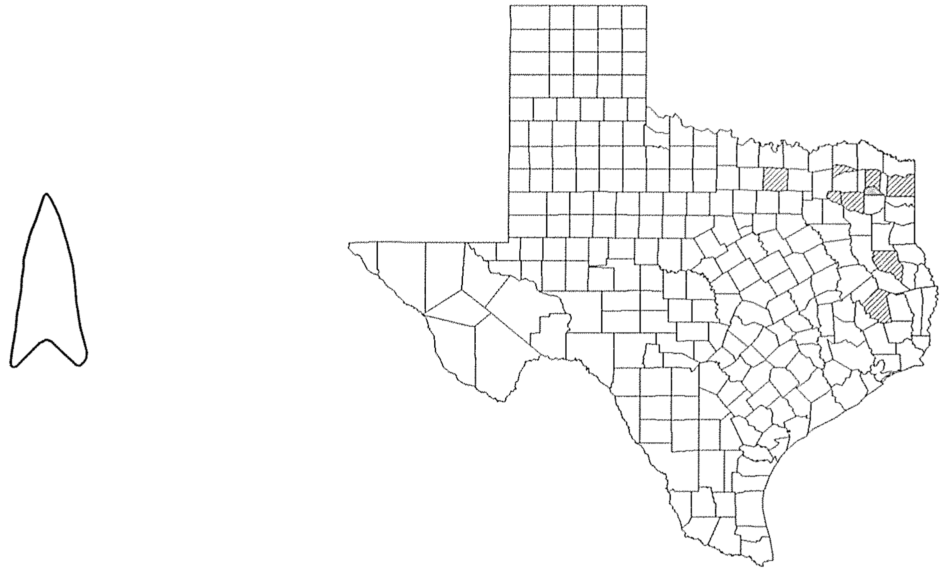
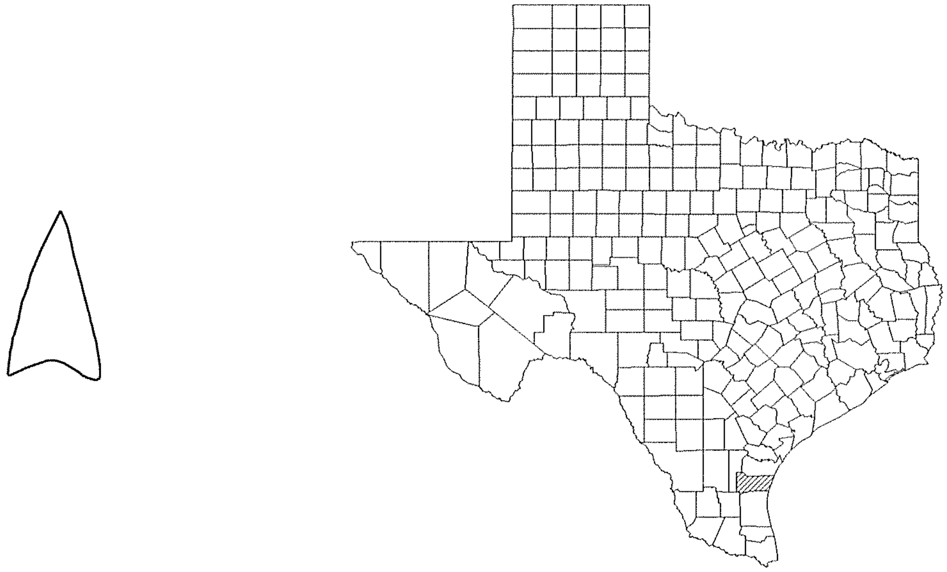

MARSHALL (1, 30, 33)
MARTINDALE (2, 30, 33)
MATAMOROS (1, 30, 33)
Over 50
11 to 51
1 to 11
No Data

Figure 31

Maud (1, 30, 33)



McGloin (33)



McKean (1)

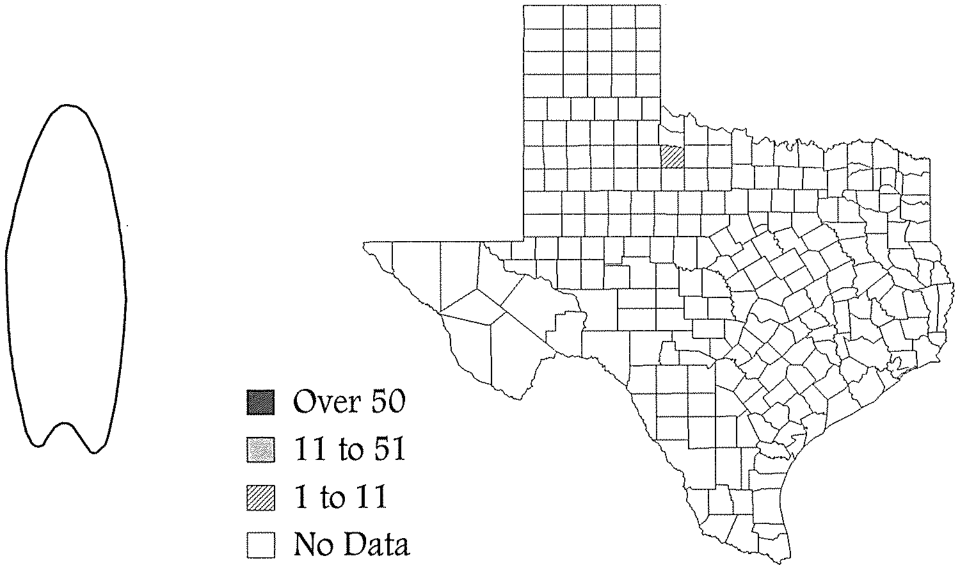
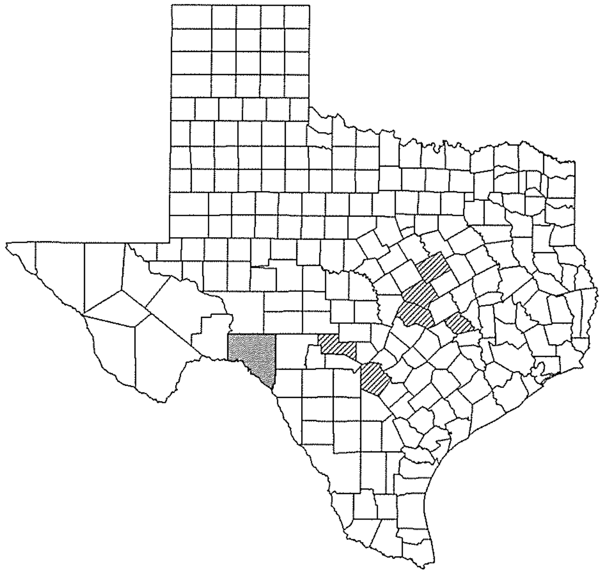
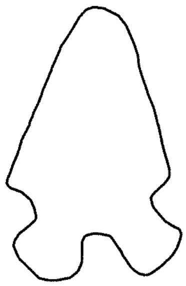


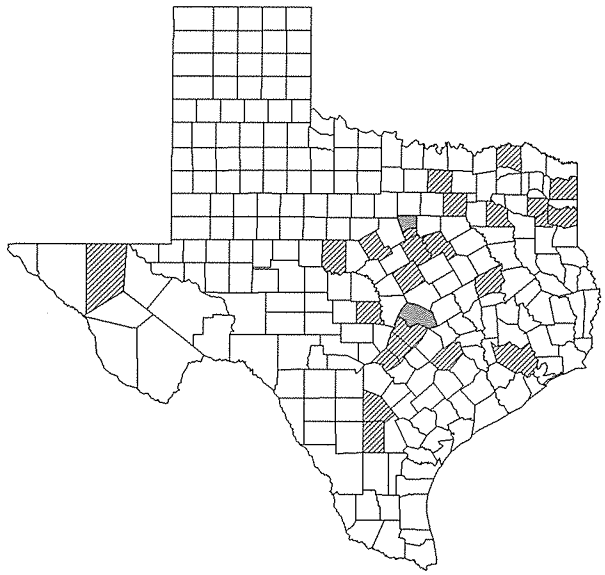
Figure 32

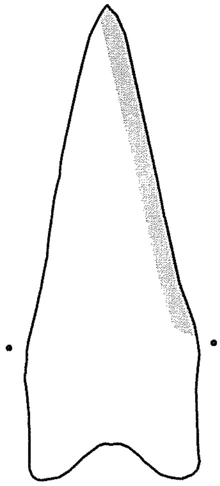
Merrell (4)



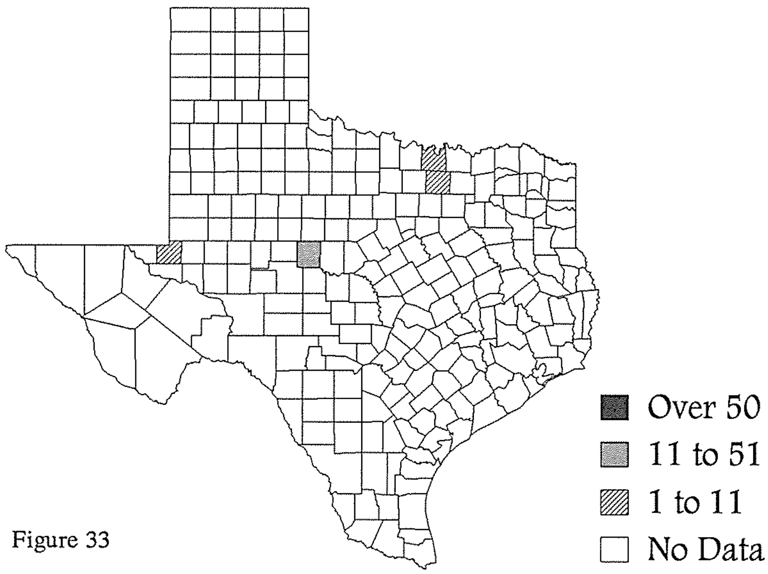


Meserve (1, 30, 33)





Midland (22, 33)



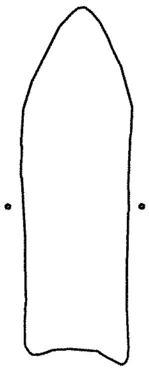
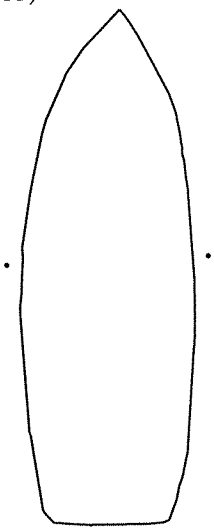
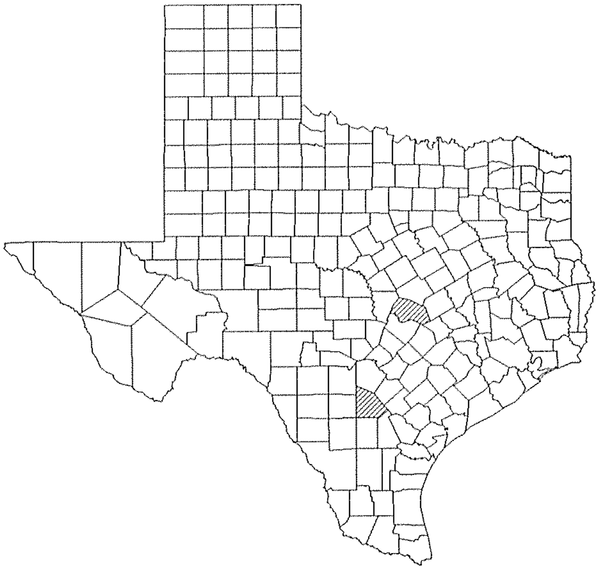


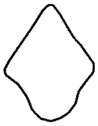
Figure 33

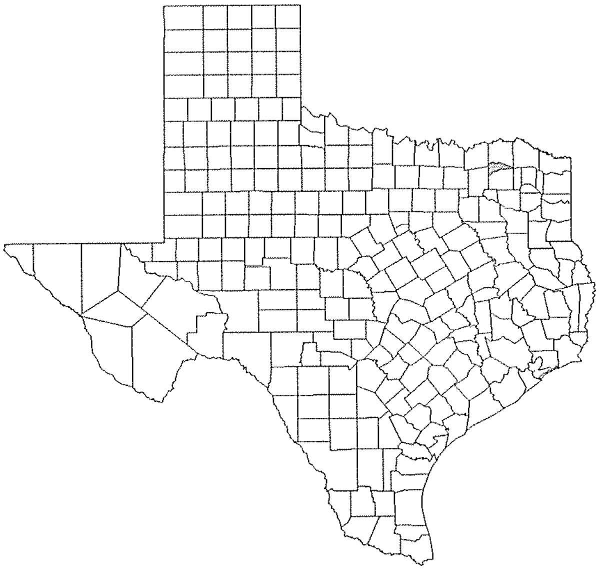
MILNESAND (1, 33)



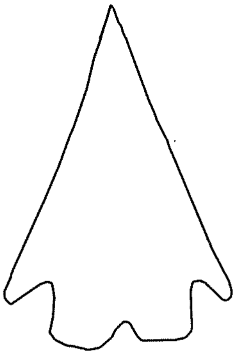


MINTER (12)





MONTELL (1, 30, 33)



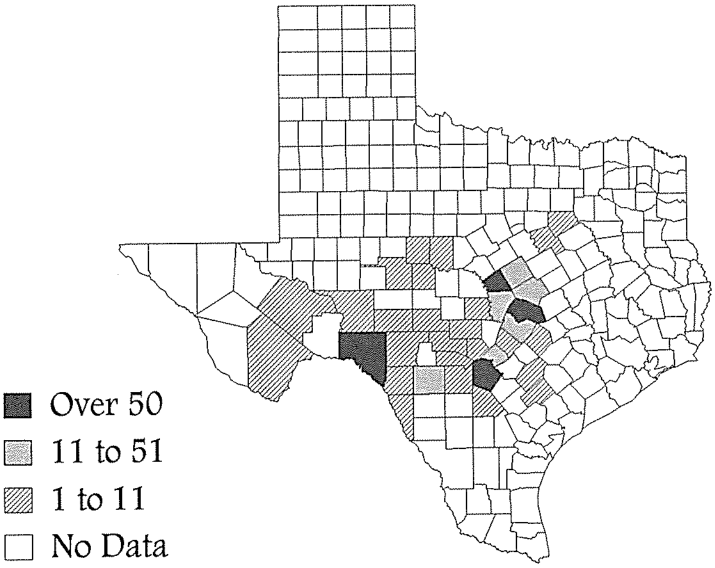
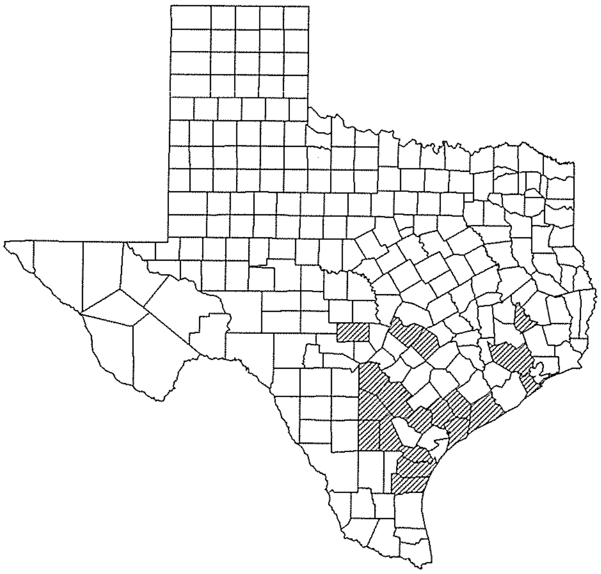
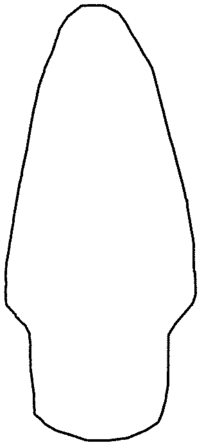
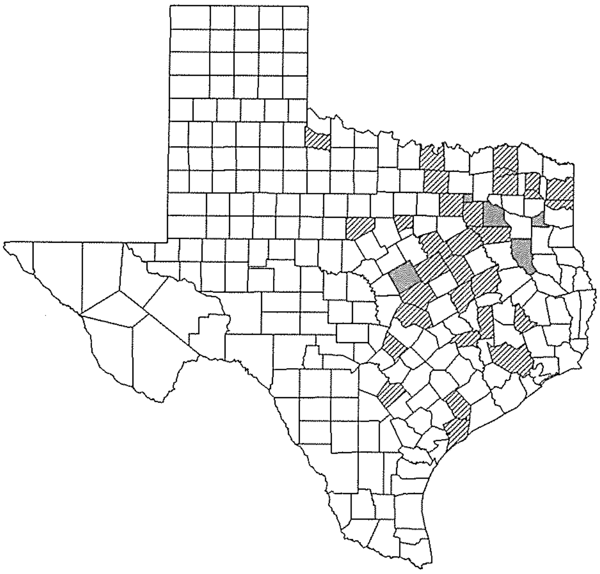


Figure 34



MORHISS (1, 30, 33)





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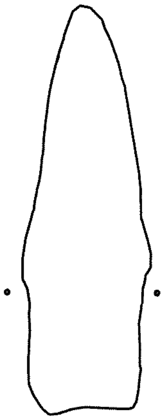

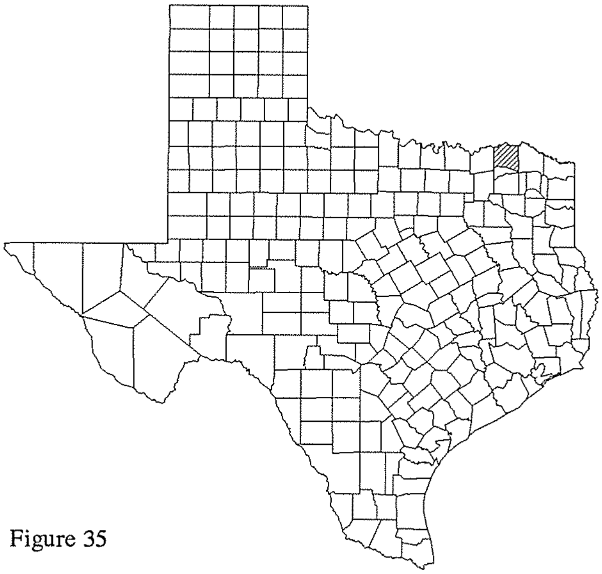

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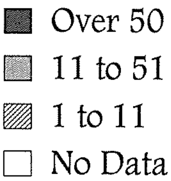
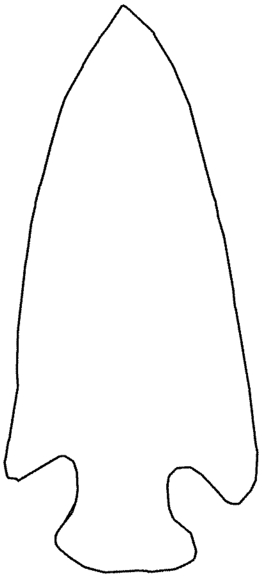
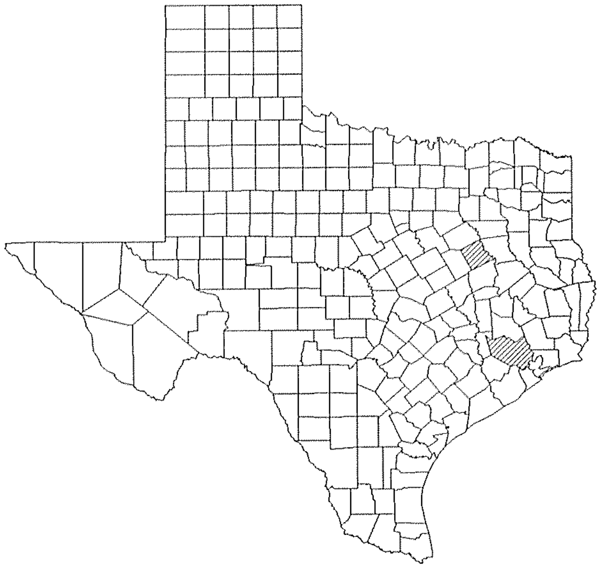


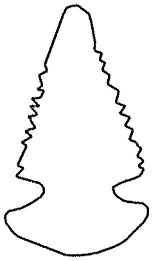
Figure 35

Motley (1, 33)





Neches River (15, 33)



Neff (36)

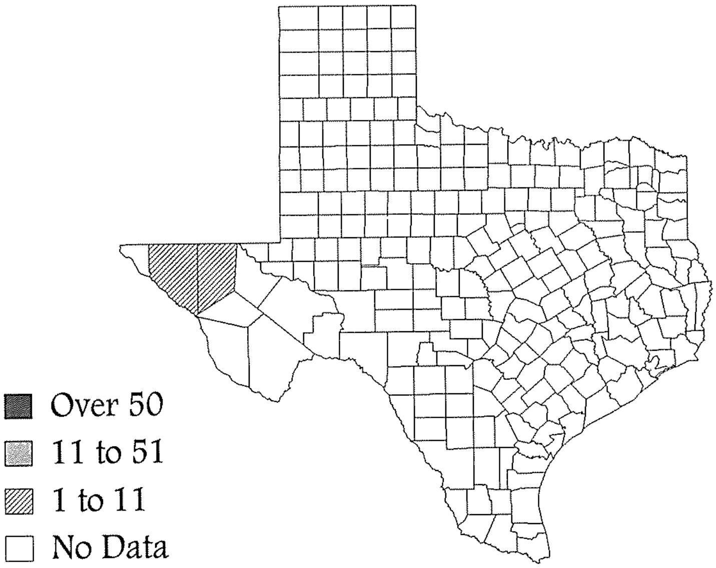
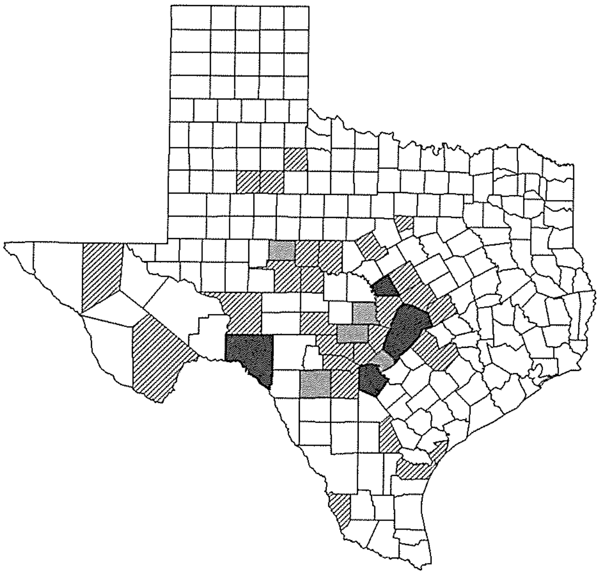
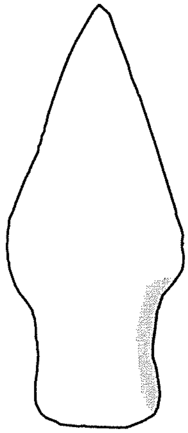
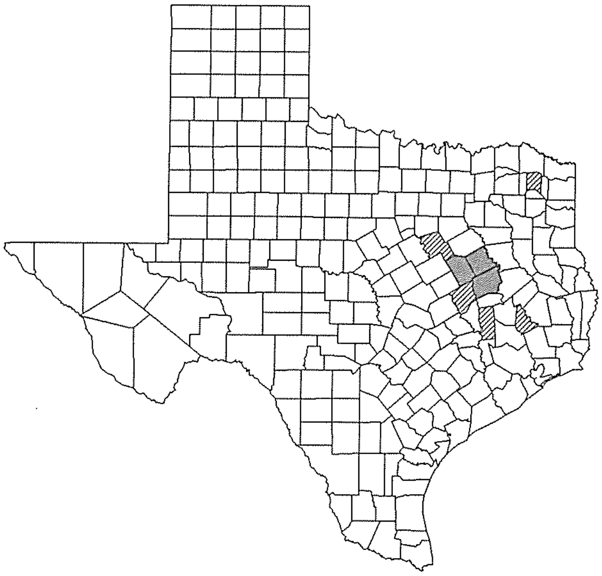


Figure 36

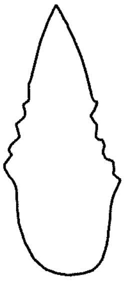


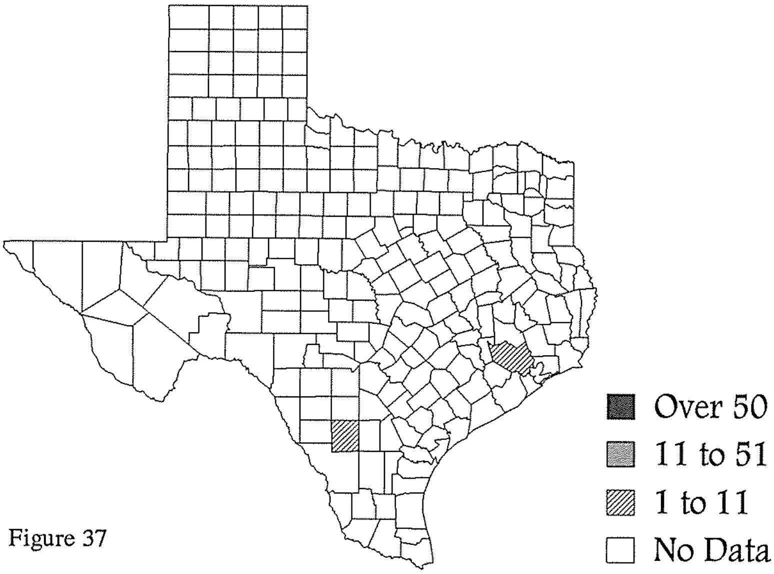
NOLAN (1, 30, 33)





OLETHA (24, 33)





ORCHARD (20)

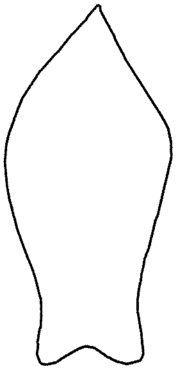
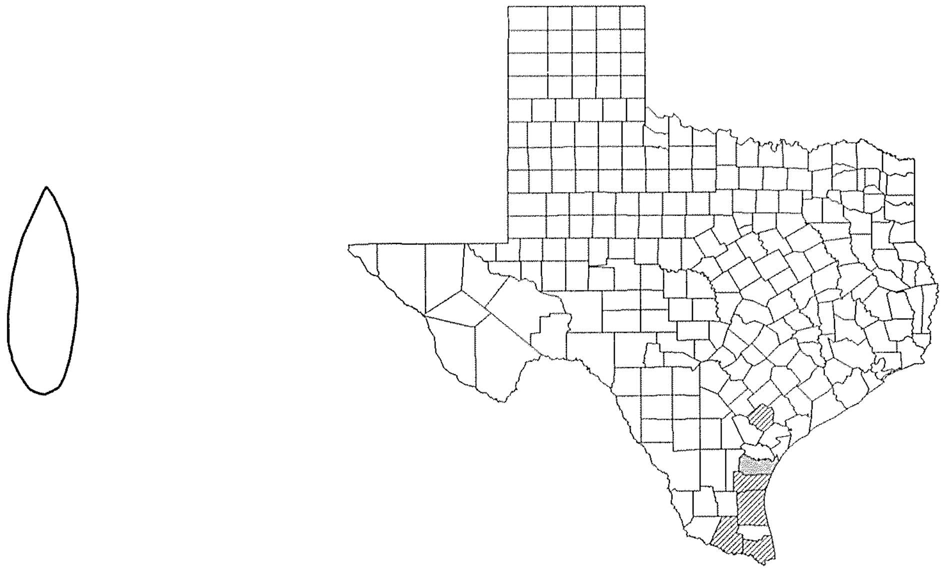
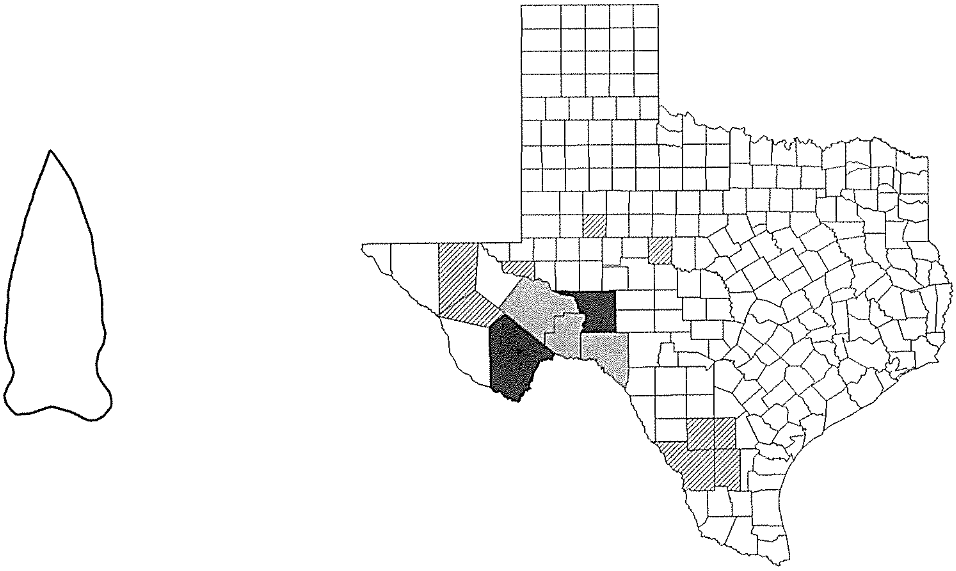


Figure 37

PADRE (33)



PAISANO (30, 33)



PALMILLAS (2, 30, 33)

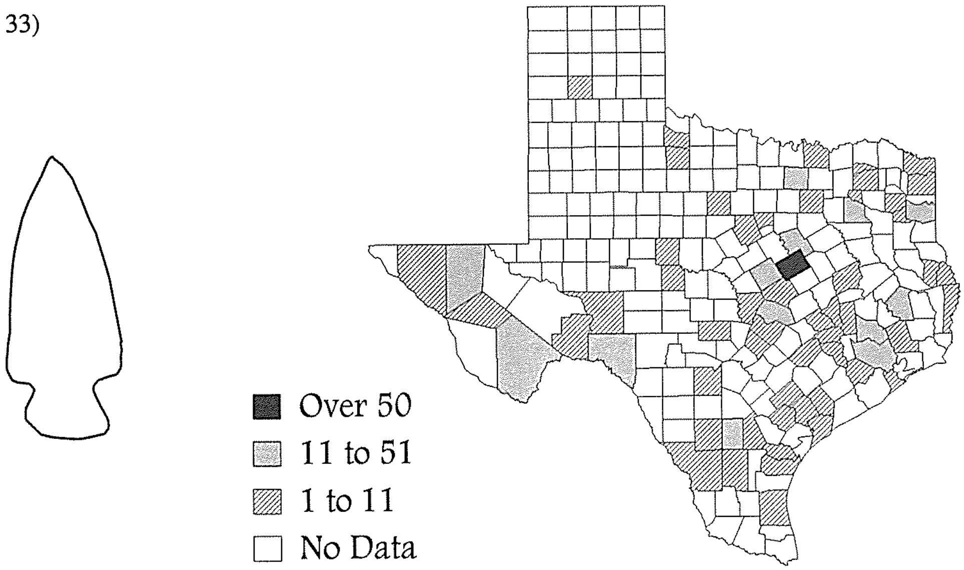
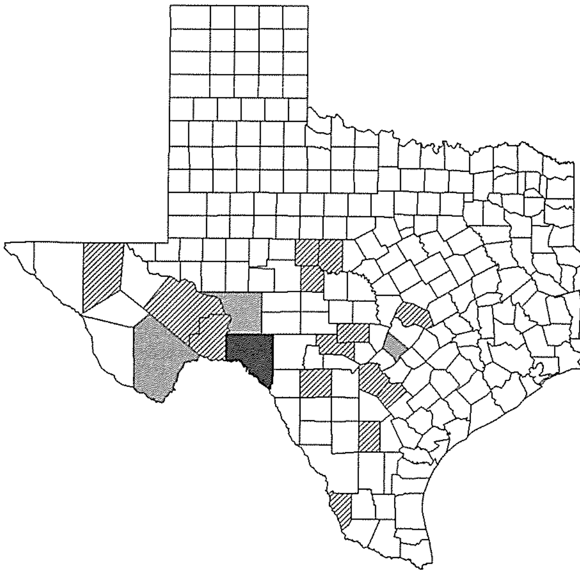
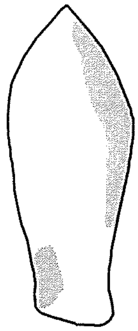
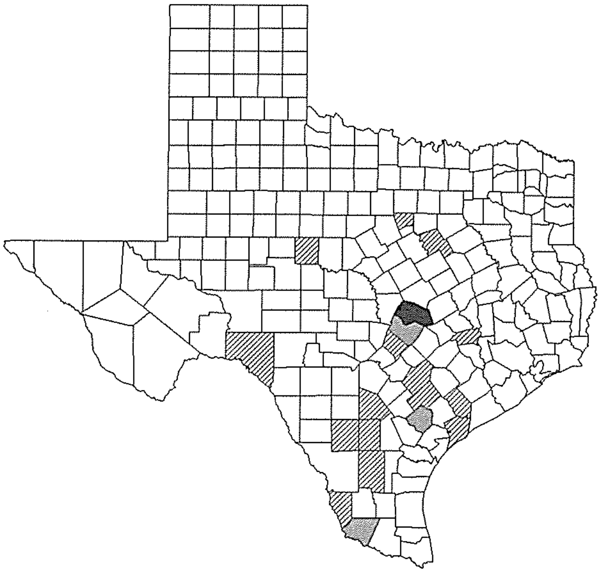


Figure 38



PANDALE (1, 30, 33)





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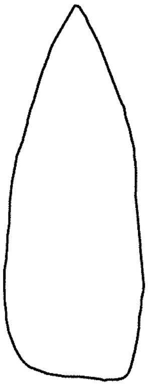
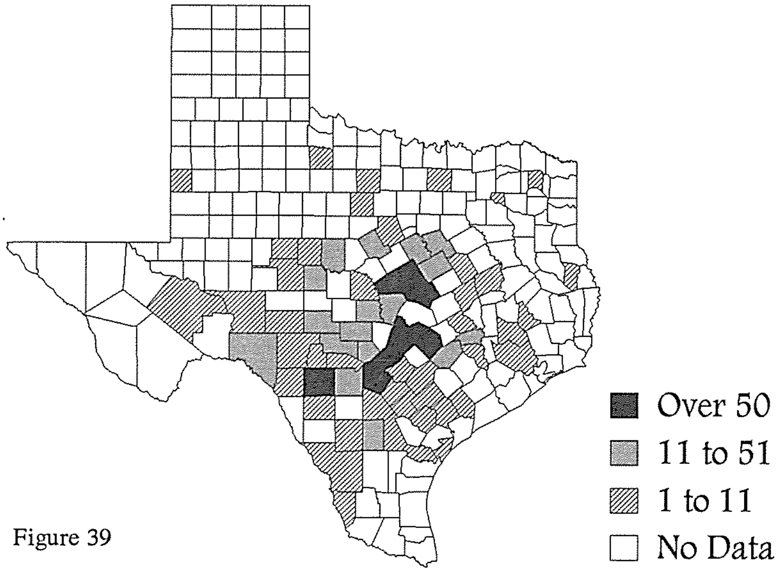




PEDERNALES (1, 30, 33)

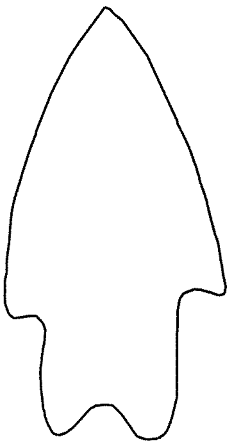
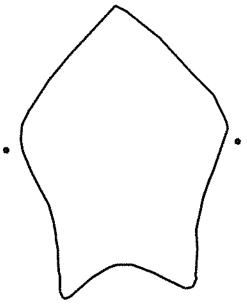
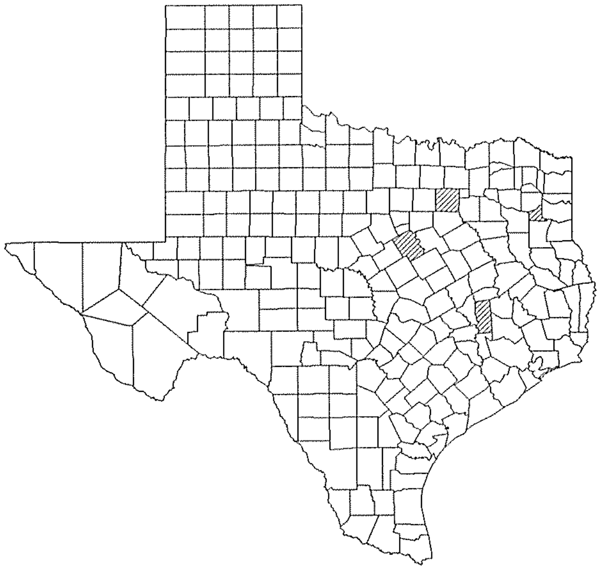


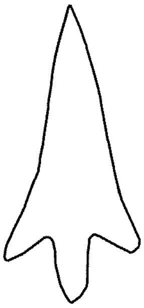
Figure 39

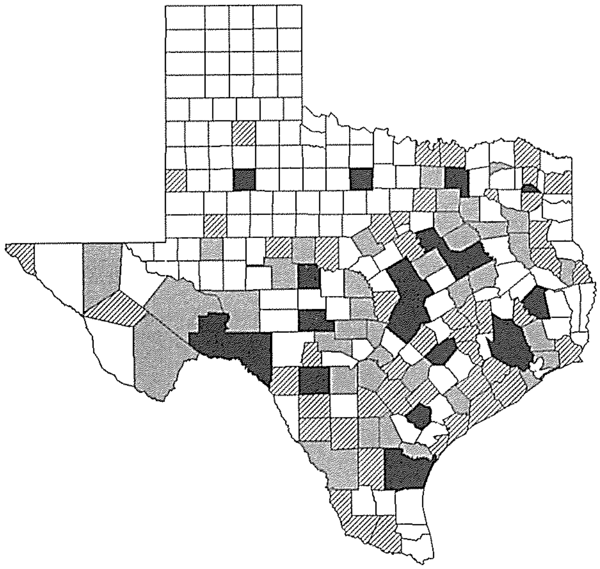
PELICAN (23, 33)



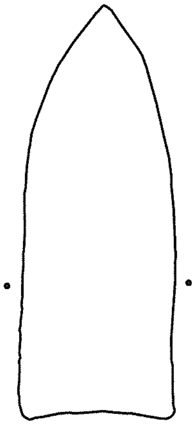


PERDIZ (2, 30, 33)





PLAINVIEW (1, 30, 33)



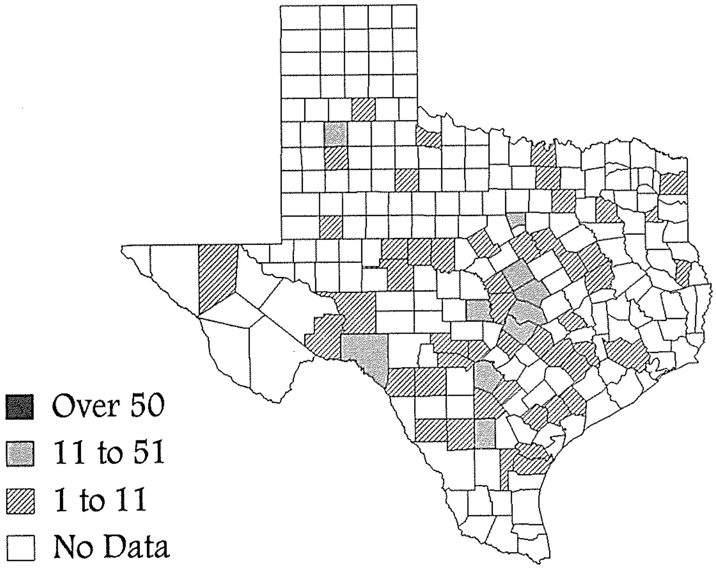
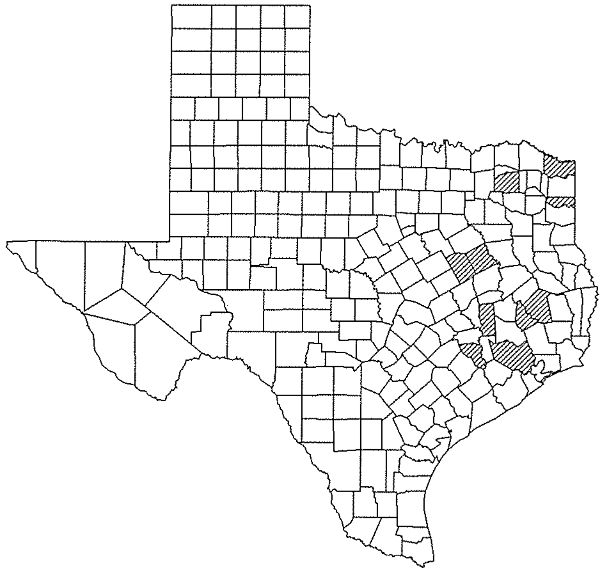
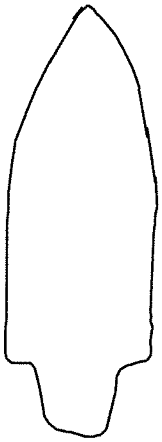
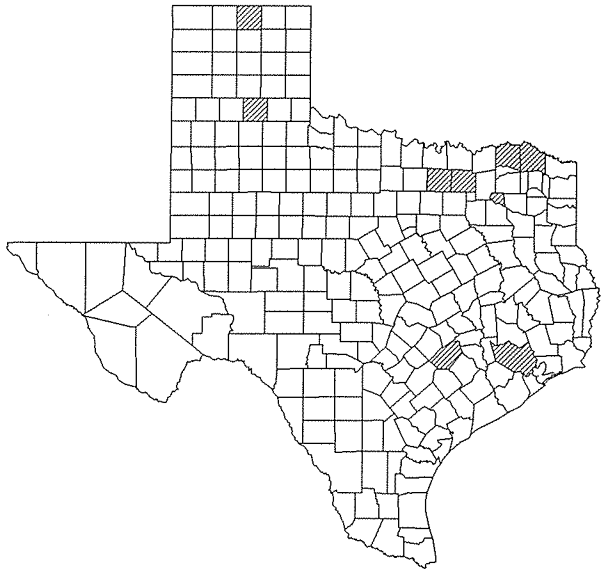


Figure 40



PONTCHARTRAIN (23, 33)





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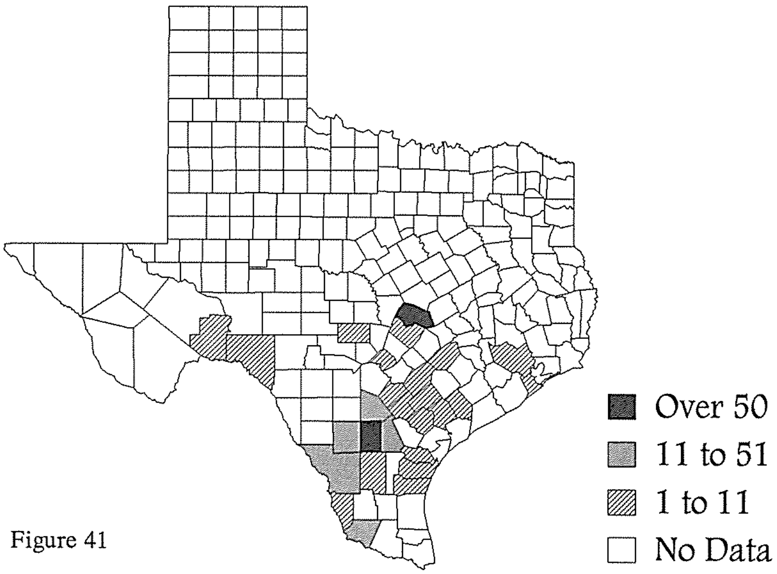


REFUGIO (1, 30, 33)

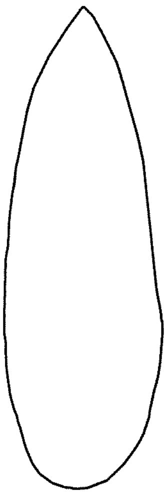
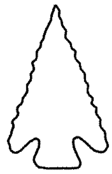
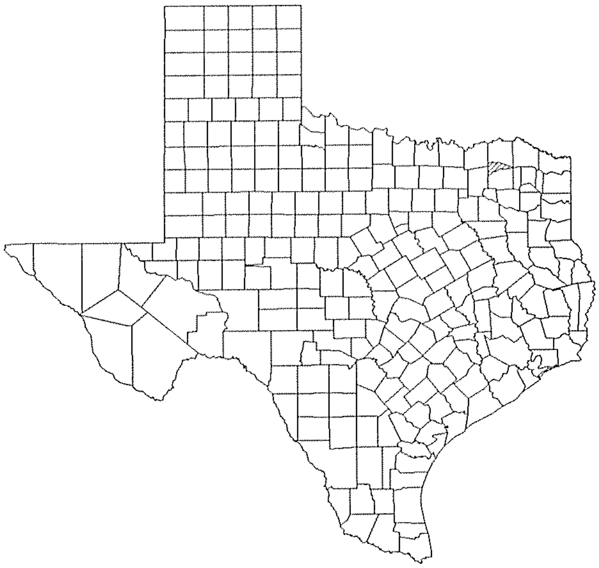


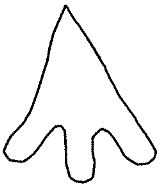
Figure 41

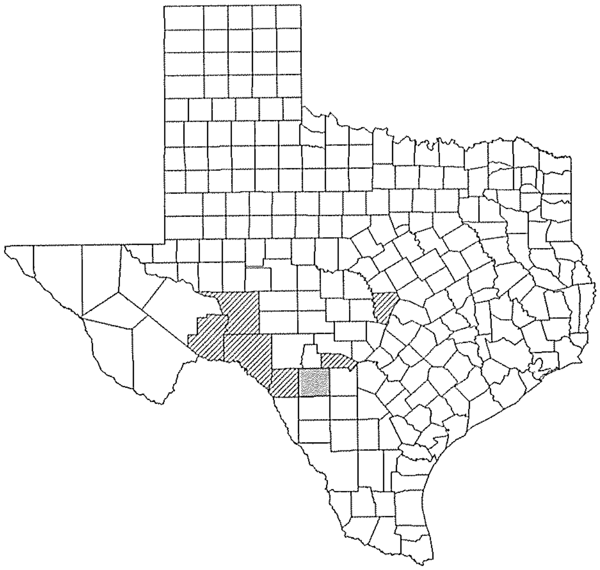
Rockwall (22)



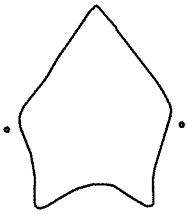


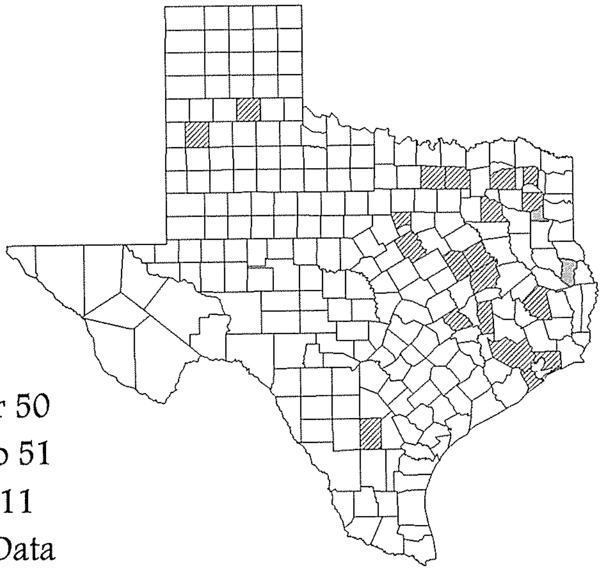
Sabinal (33)





San Patrice (1, 33)

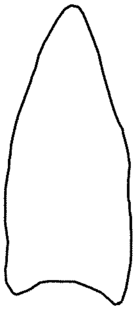


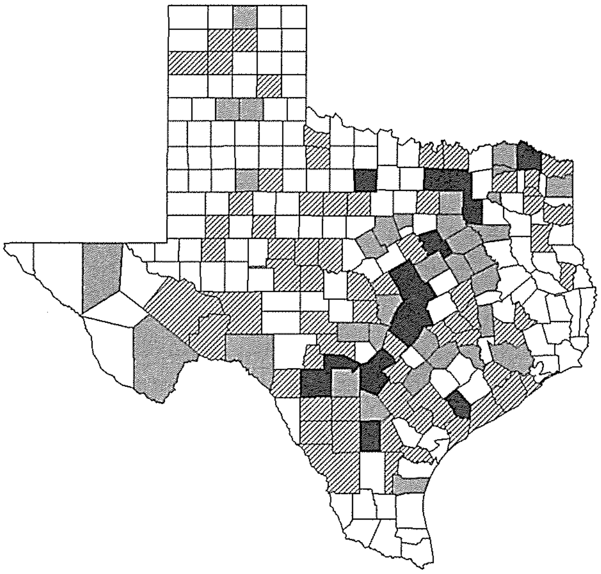


Over 50
11 to 51
1 to 11
No Data

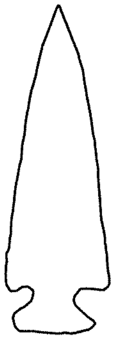
Figure 42

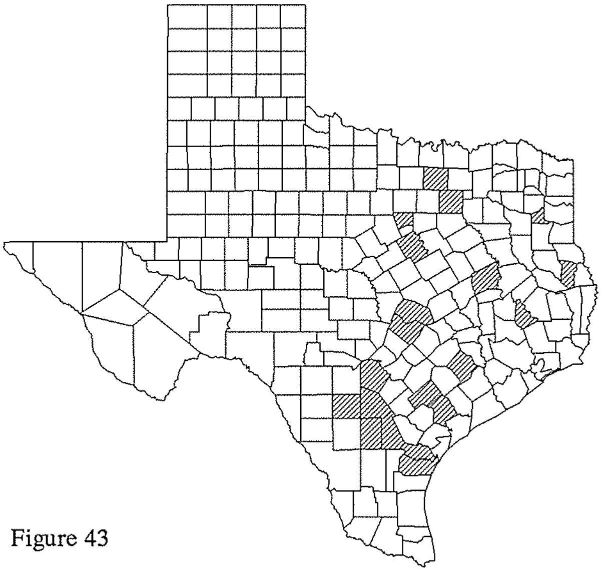
Sandy Creek (12)



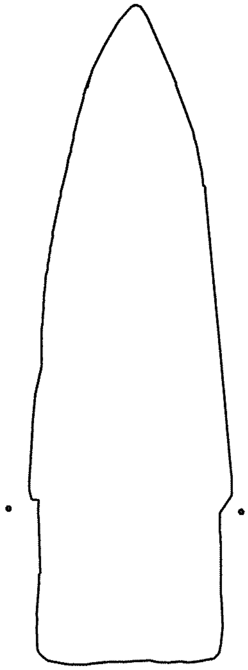


Scallorn (2, 6, 30, 33)





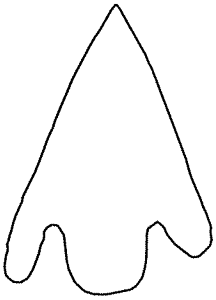
Scottsbluf (1, 30, 33)

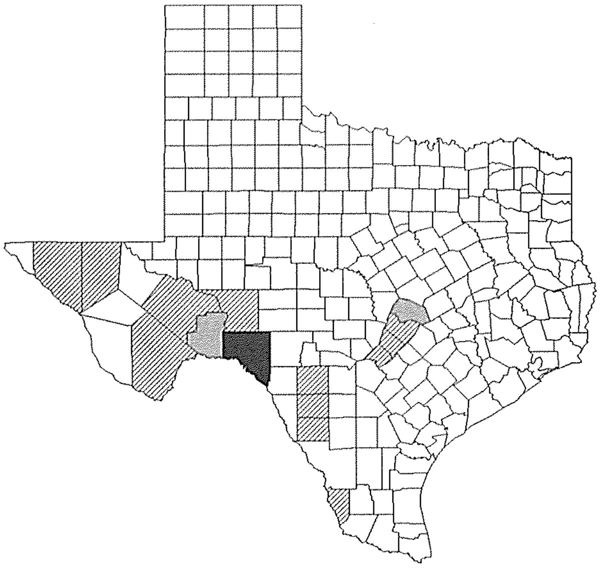


- Over 50
- 11 to 51
- 1 to 11
- No Data

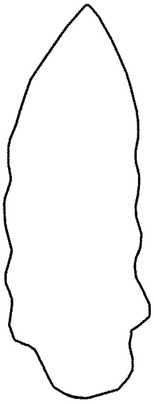
Figure 43

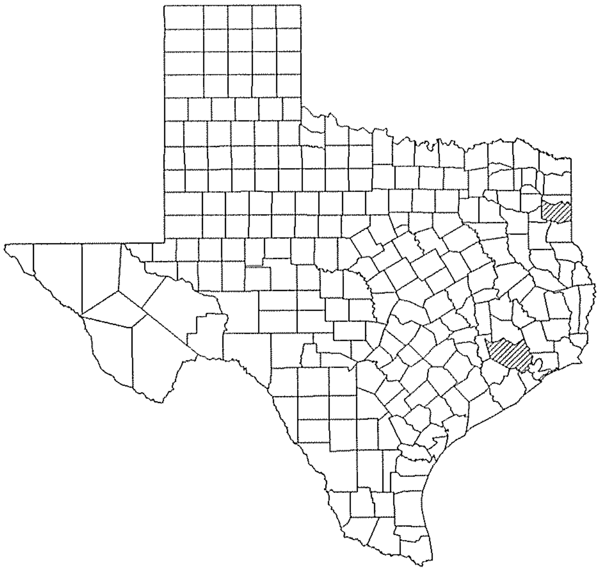
SHUMLA (2, 30, 33)



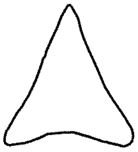


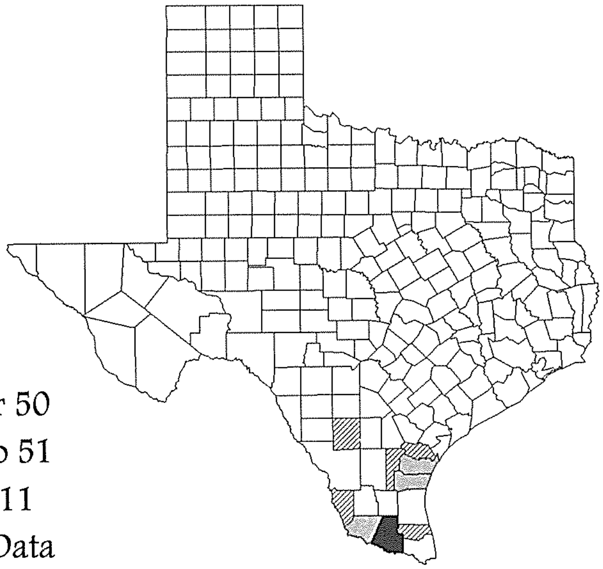
SINNER (33)





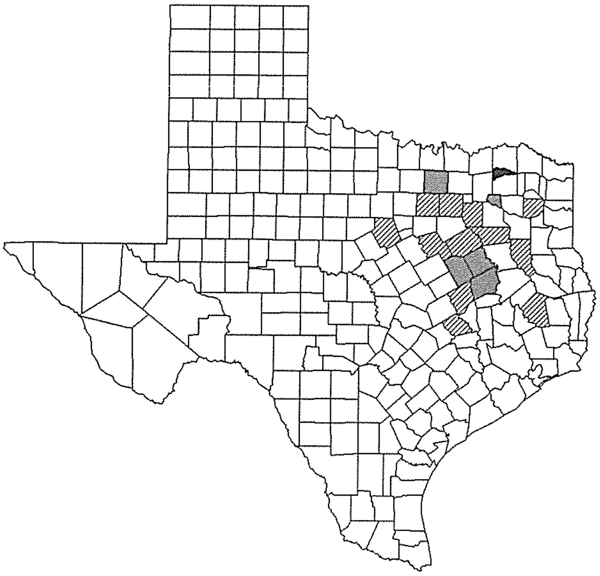
STARR (30, 33)



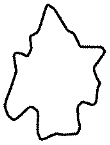


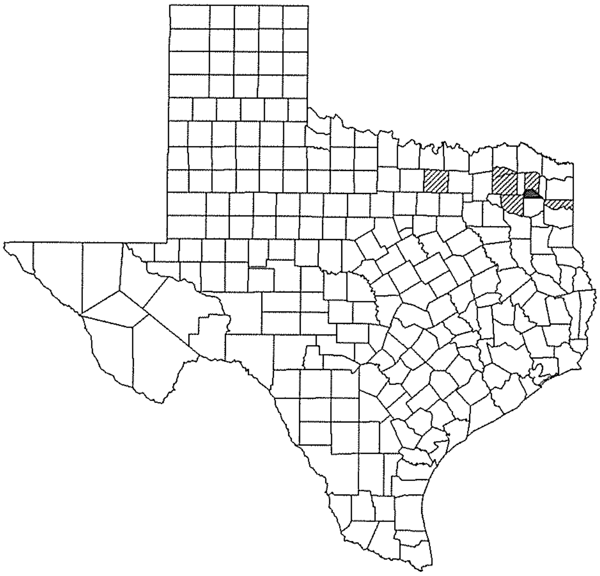
Over 50
11 to 51
1 to 11
No Data

Figure 44

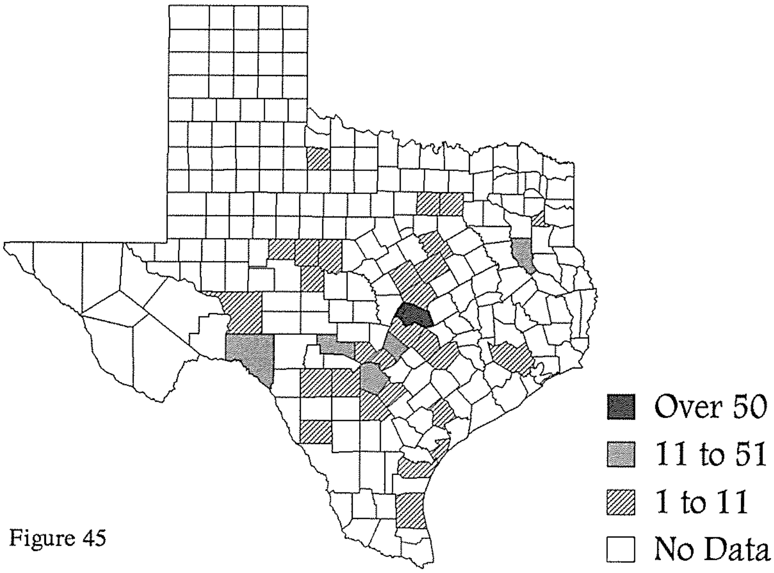


STEINER (33)





TALCO (1, 30, 33)



TAYLOR (13)

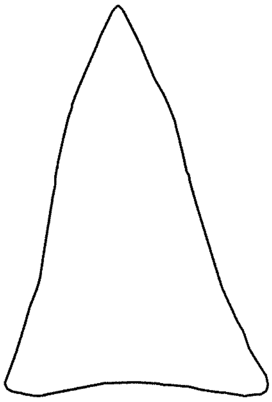
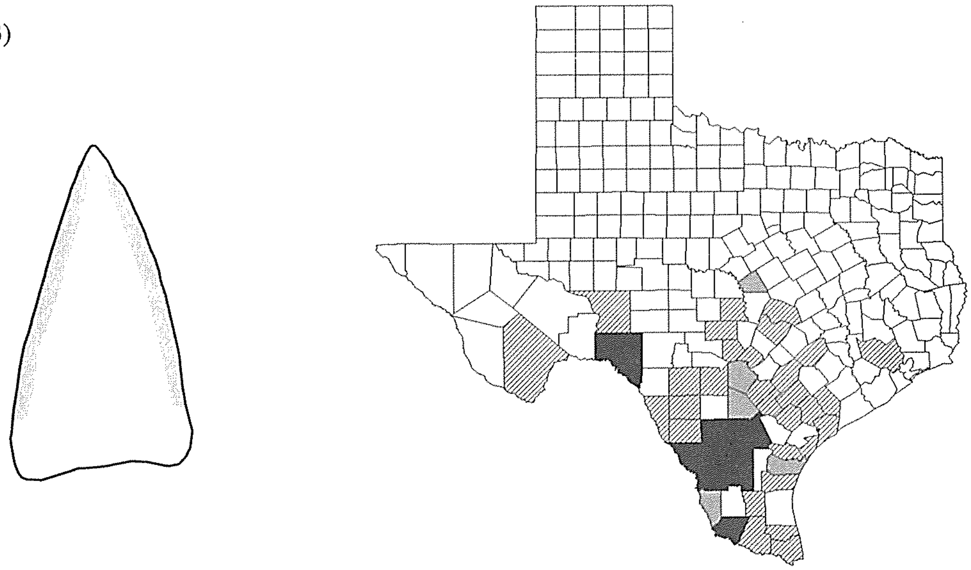
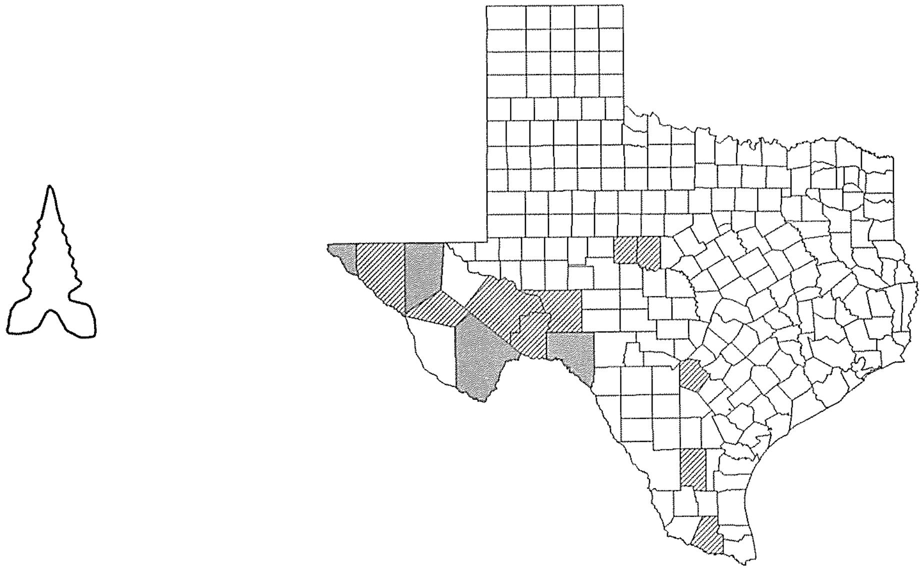


Figure 45

TORTUGAS (30, 33)



TOYAH (2, 30, 33)



TRAVIS (1, 30, 33)

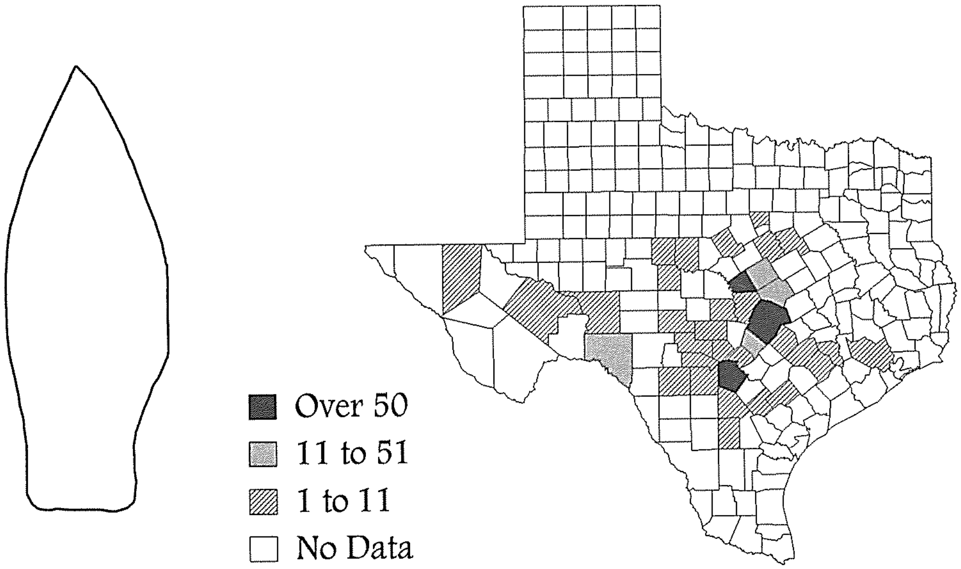
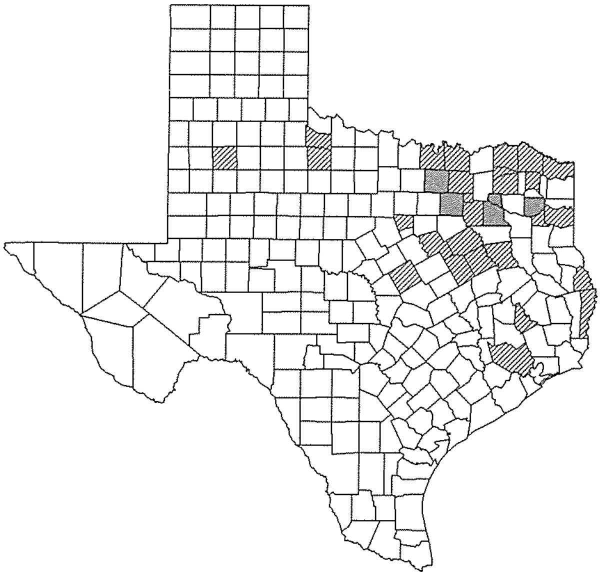
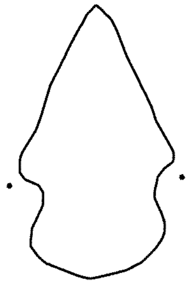


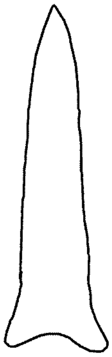
Figure 46

Trinity (1, 30, 33)

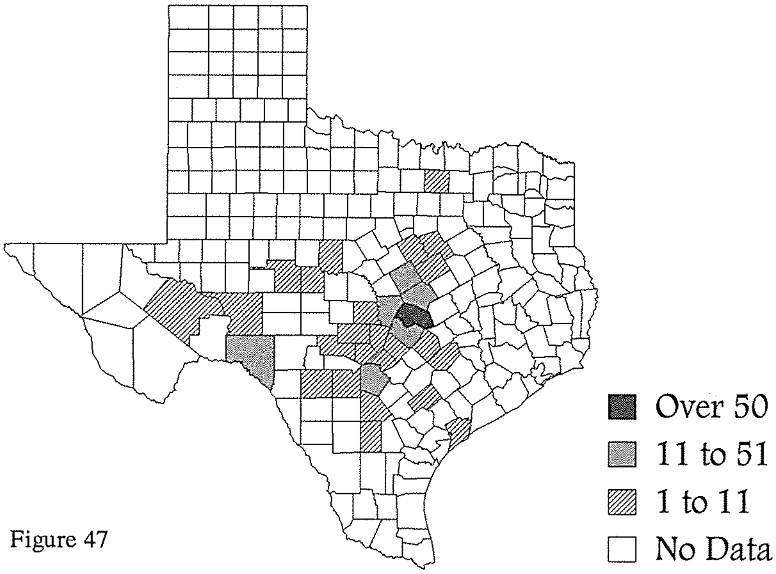




Turney (30, 33)



Uvalde (2, 30, 33)



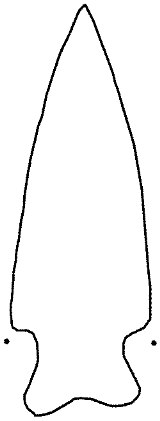
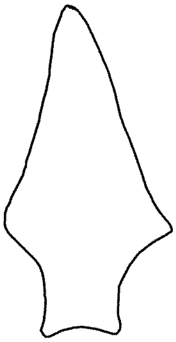
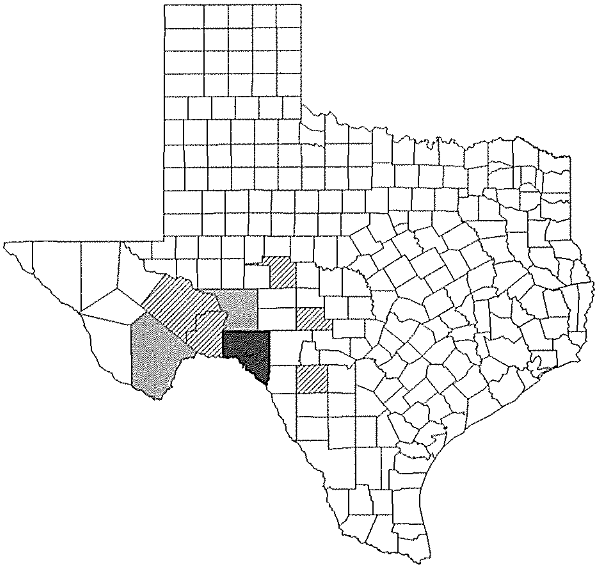


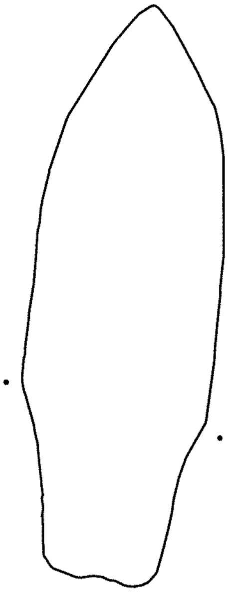
Figure 47

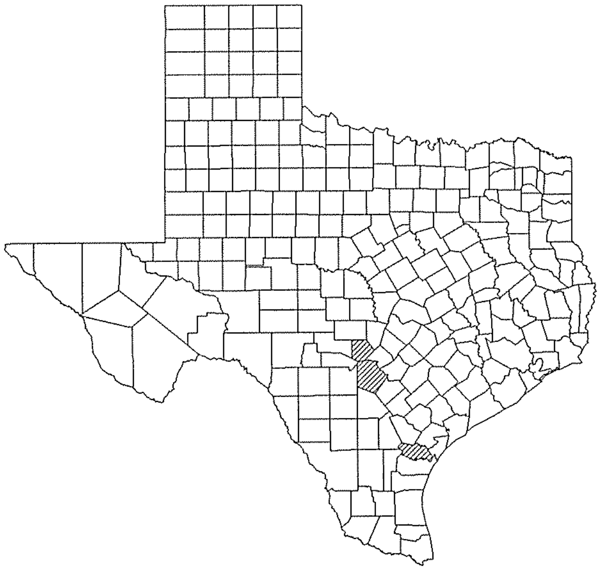
VAL VERDE (33)



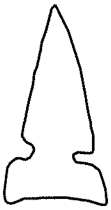


VICTORIA (14)





WASHITA (1, 33)



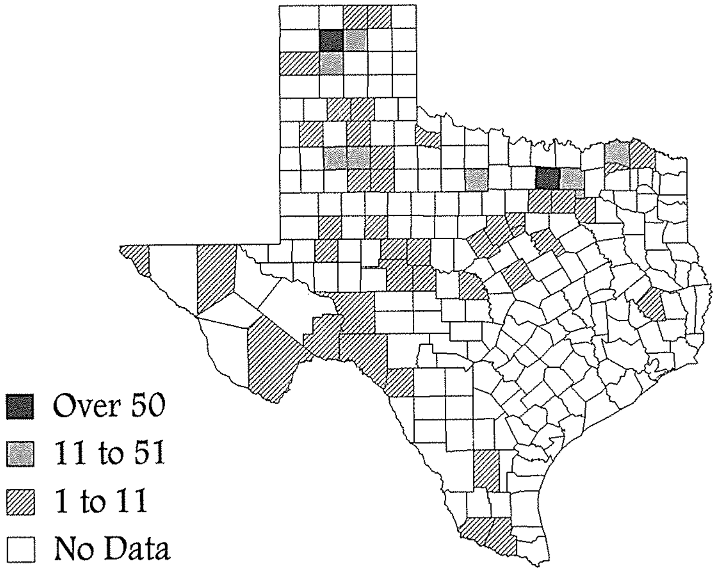
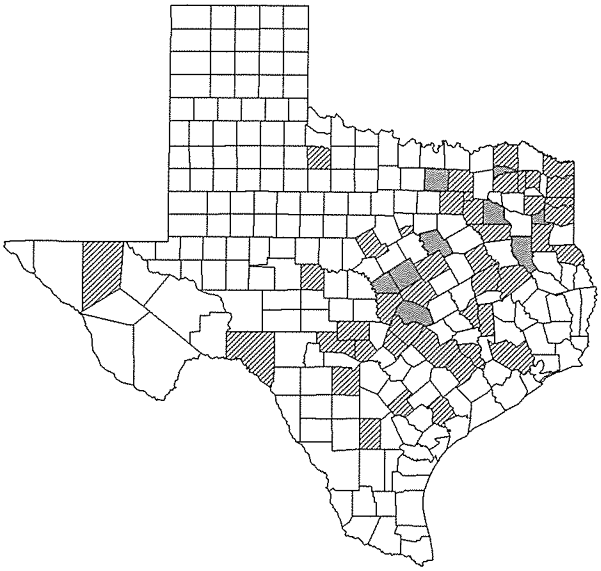
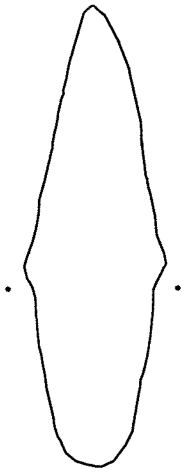


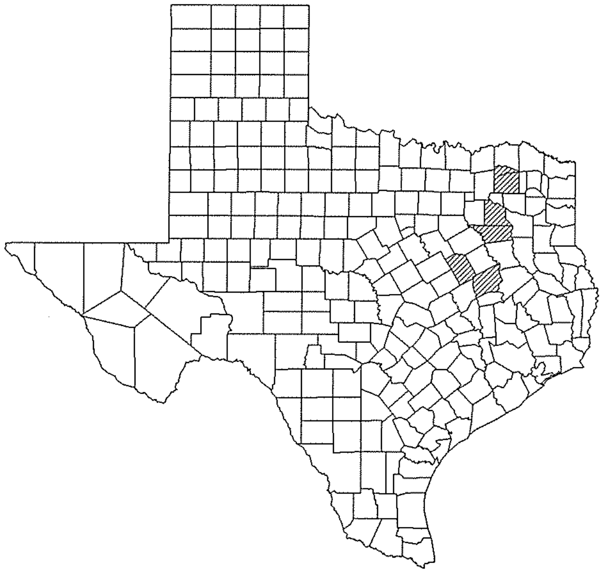
Figure 48

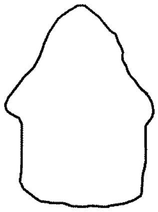
WELLS (1, 30, 33)



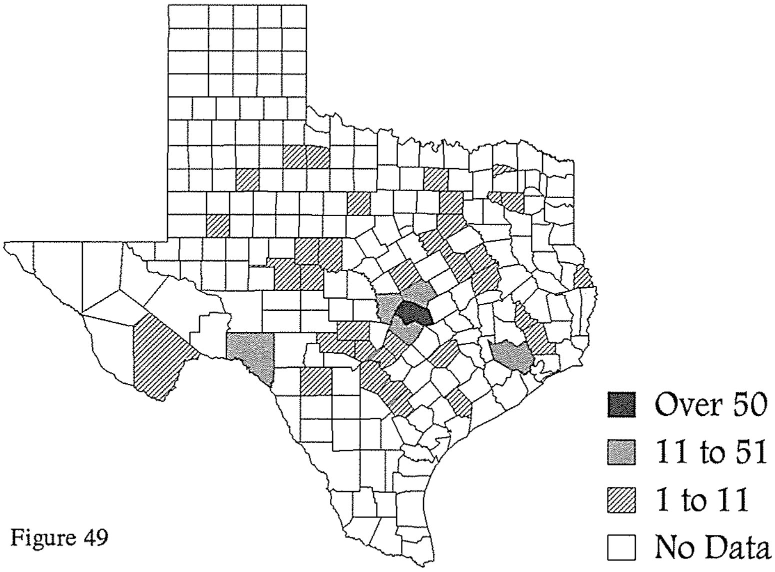


WESLEY (12)





WILLIAMS (2, 30, 33)



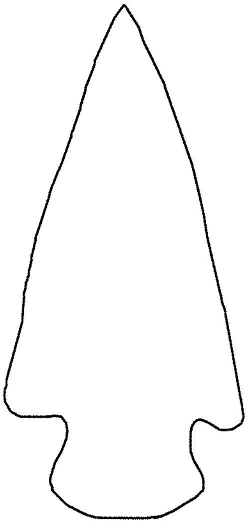
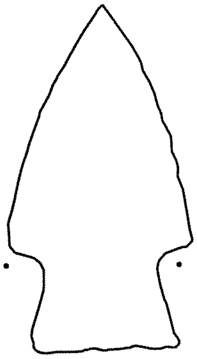
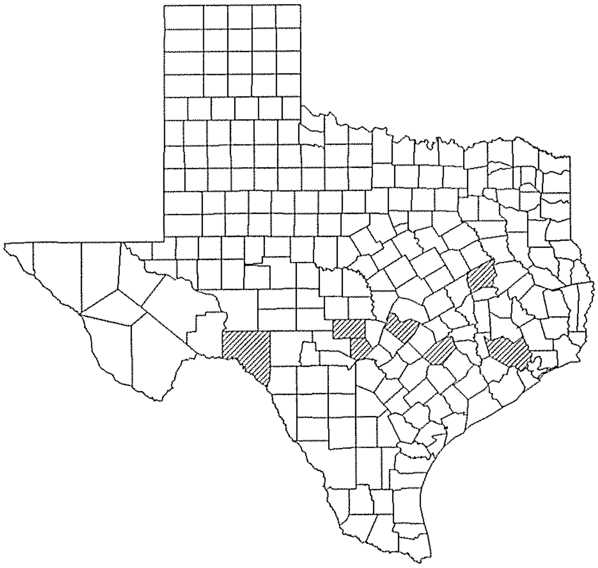


Figure 49

WILSON (35)





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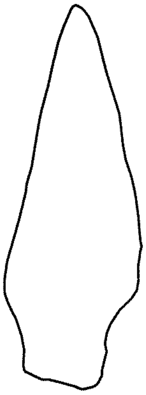
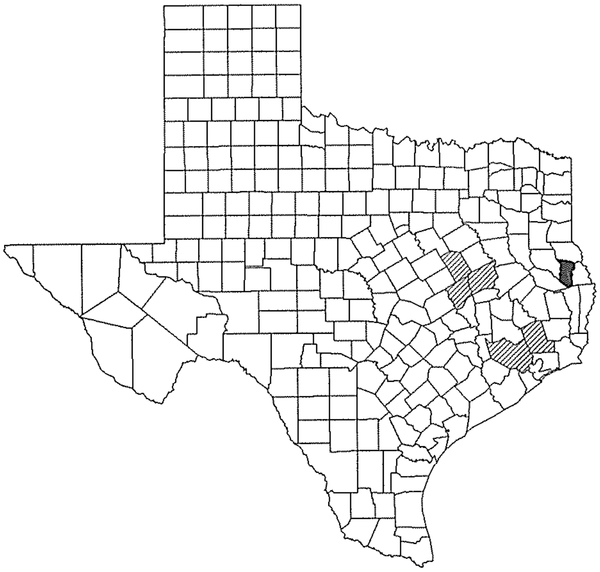
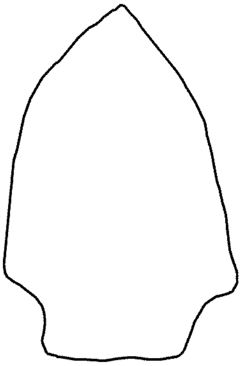
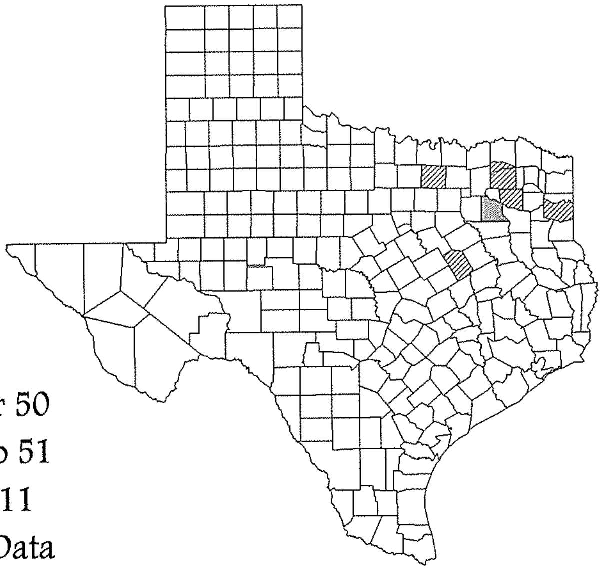




YANTIS (12)

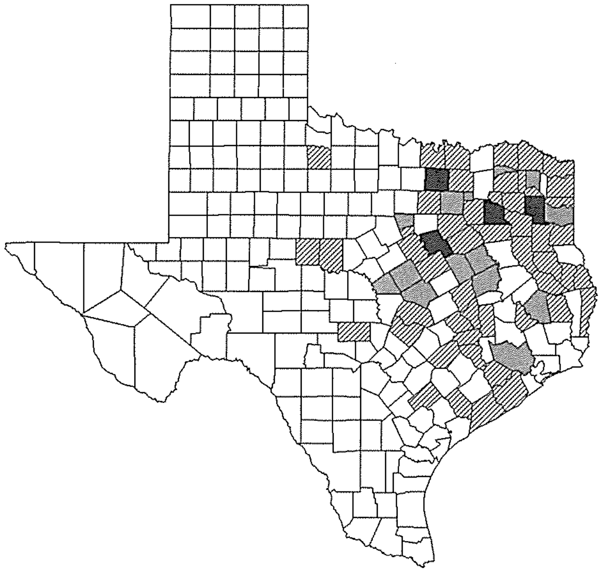


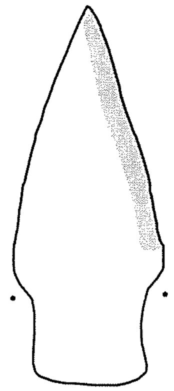


Over 50
11 to 51
1 to 11
No Data

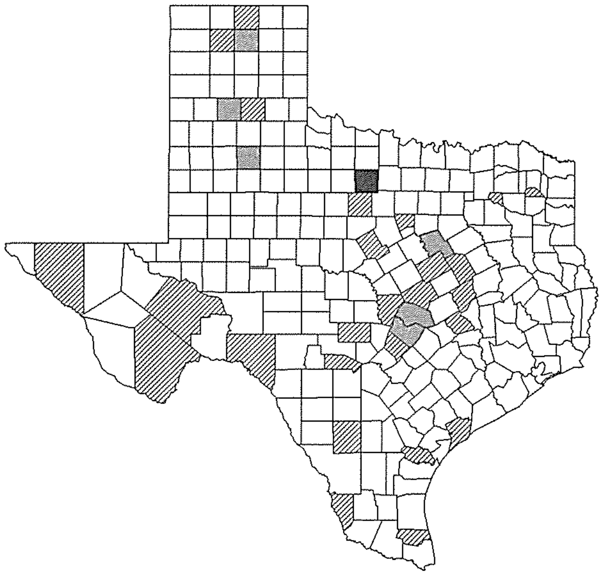
Figure 50

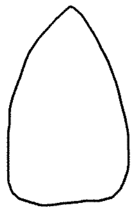
YARBROUGH (2, 30, 33)



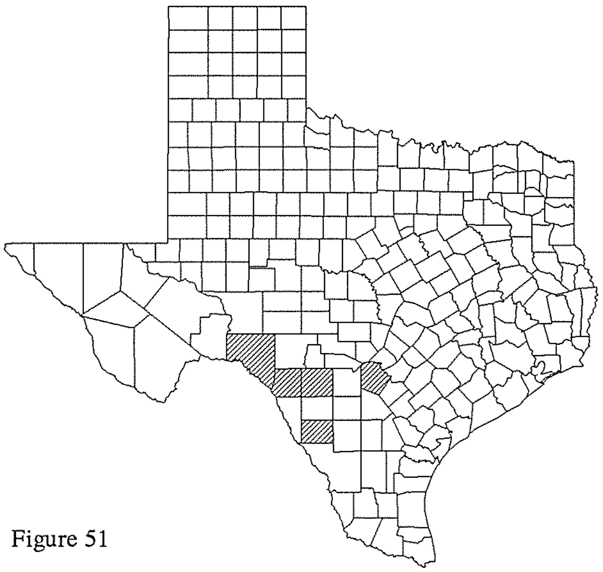


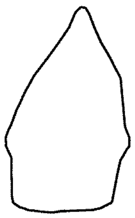
YOUNG (2, 30, 33)





ZAVALA (33)

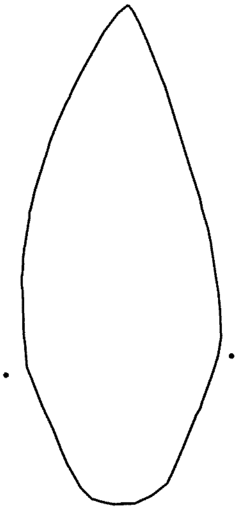


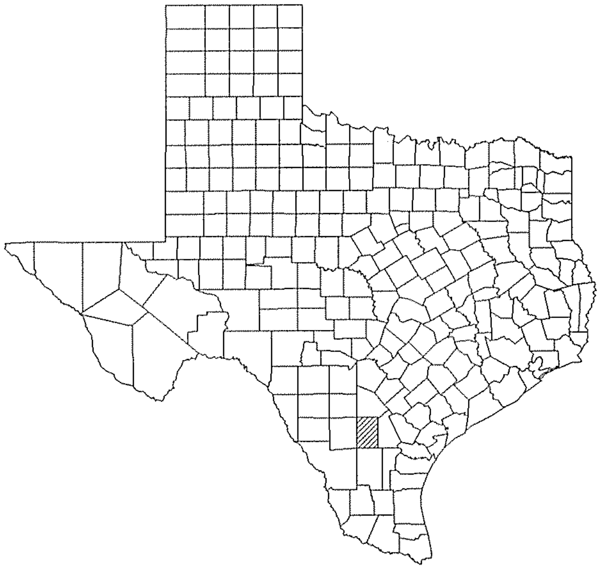


- Over 50
- 11 to 51
- 1 to 11
- No Data

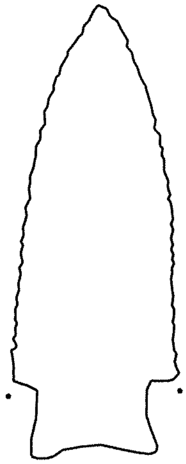
Figure 51

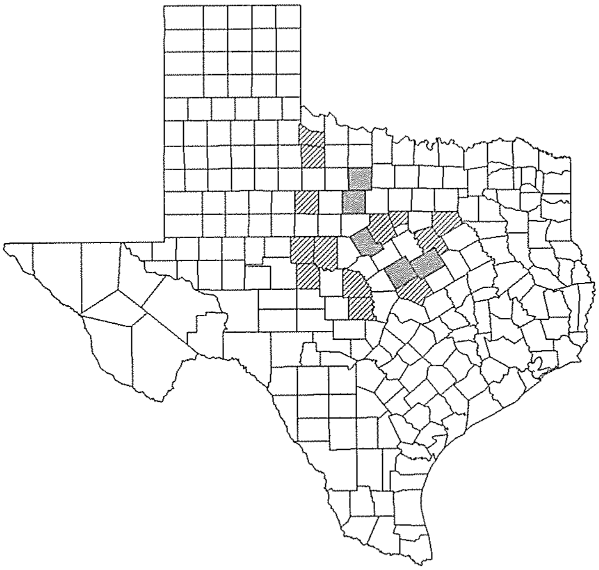
ZELLA (14)



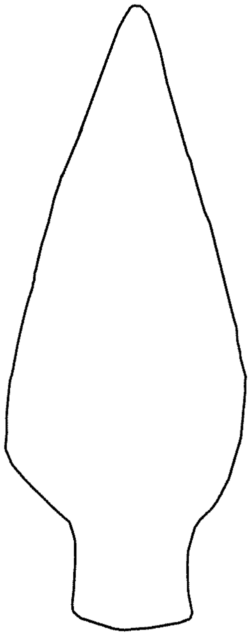


ZEPHYR (25)





ZORRA (33)



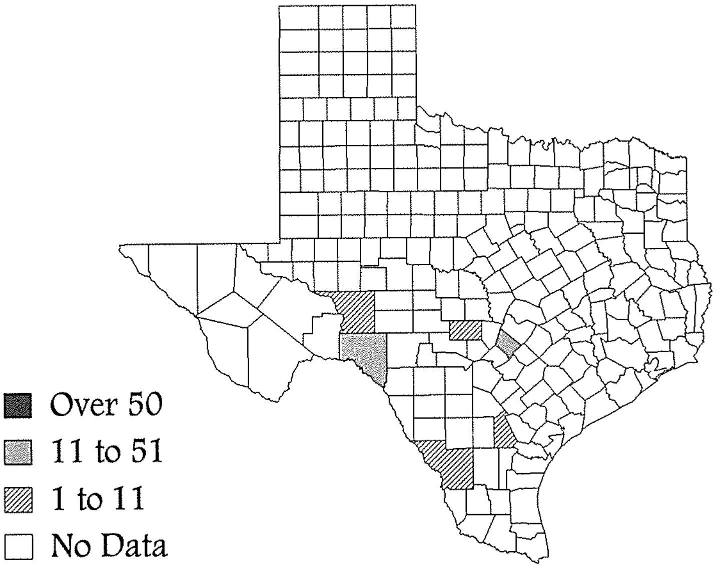


Figure 52

Weir, F. A.
1985 An Early Holocene Burial at the Wilson-Leonard Site in Central Texas. *The Mammoth Trumpet* 2(1):1, 3. (35)

Wiseman, R. N.
1971 The Neff Site, A Ceramic Period Lithic Manufacture Site on the Rio Felix, Southeastern New Mexico. *The Artifact* 9(1):1-30. (36)

PROJECTILE POINT DATA BASE SOURCES

Alexander, Herbert L., Jr. (415)
1963 The Levi Site: A Paleo-Indian Campsite in Central Texas. *American Antiquity* 28(4):510-528.

Alexander, Robert K. (192)
1970 *Archaeological Excavations at Parida Cave, Val Verde County, Texas.* Papers 19. Texas Archeological Salvage Project, The University of Texas at Austin.

Ambler, J. Richard (258)
1967 *Three Prehistoric Sites near Cedar Bayou, Galveston Bay Area.* Report 8. Archeological Program, State Building Commission, Austin.

Ambler, J. Richard (173)
1970 *Additional Archeological Survey of the Wallisville Reservoir Area, Southeast Texas.* Survey Reports 6. Texas Archeological Salvage Project Survey, The University of Texas at Austin.

Anderson, Keith M. (354)
1971 *Archeological Resources of Lake Palestine, Texas.* Department of Anthropology, Southern Methodist University, Dallas.

Assad, Cristi (311)
1978 *An Evaluation of Archaeological Sites in the Vicinity of Floodwater Retarding Structure 2, Dry Comal Creek, Comal County, Texas.* Archaeological Survey Report 50. Center for Archaeological Research, The University of Texas at San Antonio.

Assad, Cristi A. (312)
1979 *Archaeological Testing in the Devine Road Area North of Olmos Dam, San Antonio, Texas.* Archaeological Survey Report 53. Center for Archaeological Research, The University of Texas at San Antonio.

Assad, Cristi A. and Daniel R. Potter (319)
1979 *An Intensive Archaeological Survey of Enchanted Rock State Natural Area, Llano and Gillespie Counties, Texas.* Archaeological Survey Report 84. Center for Archaeological Research, The University of Texas at San Antonio.

Aten, Lawrence E. (86)
1967 *Excavations at the Jamison Site (41 LB 2), Liberty Co., Texas.* Report 1. Houston Archeological Society, Houston.

Aten, Lawrence E. (642)
1971 *Archaeological Excavations at the Dow-Cleaver Site, Brazoria County, Texas.* Technical Bulletin 1. Texas Archeological Salvage Project, The University of Texas at Austin.

Aten, Lawrence E. (653)
1983 *Analysis of Discrete Habitation Units in the Trinity River Delta, Upper Texas Coast.* Occasional Papers 2. Texas Archeological Research Laboratory, University of Texas at Austin.

Aten, Lawrence E., Charles K. Chandler, Al B. Wesolowsky, and Robert M. Malina (84)
1976 *Excavations at the Harris County Boys' School Cemetery: Analysis of Galveston Bay Area Mortuary Practices.* Special Publication No. 3. Texas Archeological Society, Dallas.

Bailey, Gail L., and Douglas K. Boyd (563)
1990 *Archeological Investigations at 41TL38, Tyler County, Texas.* Technical Reports 10. Prewitt and Associates, Inc., Austin.

Bailey, Gail L., Douglas K. Boyd, and C. Britt Bousman (564)
1991 *Archeological Survey of the City Lakes Area and Geomorphological and Magnetometer Surveys, Cooper Lake Project, Delta and Hopkins Counties, Texas.* Technical Reports 11. Prewitt and Associates, Inc., Austin.

Bailey, Gail L., Ross C. Fields, and Martha Doty Freeman (525)
1986 *Inventory and Assessment of Cultural Resources at the Buttercup Creek II Subdivision, Williamson County, Texas.* Reports of Investigations 50. Prewitt and Associates, Inc., Austin.

Ball, Henry F. (434)
1986 Rock Art at Monk's Cave (41RK84) Rusk County, Texas. *Bulletin of the Texas Archeological Society* 55:153-169 .

Bandy, Phillip A. (336)
1980 *Archaeological Investigations at Sanderson Canyon Watershed, Terrell, Pecos, and Brewster Counties, Texas.* Environment Consultants, Inc., Dallas, Texas.

Banks, Larry D., and Joe Winters (85)
1975 *The Bentsen-Clark Site, Red River County, Texas: A Preliminary Report.* Special Publication No. 2. Texas Archeological Society, San Antonio.

Baskin, Barbara J. (284)
1978 *Test Excavations at a Prehistoric, Stratified Campsite: Big Bend National Park, Brewster County, Texas*. Submitted to the National Park Service, Southwest Region Office, by Author. Privately printed, Austin.

Beadles, Murray L. (496)
1992 A Preliminary Report on the Dewees Site (41KR38), Kerr County, Texas. *La Tierra* 19(3):27-39.

Beasley, Tom S. (116)
1978a A Site with *Edwards* Arrow Point Type. *La Tierra* 5(4):23-31.

Beasley, Tom S. (117)
1978b A Late Prehistoric Site in Webb County, Texas. *La Tierra* 5(2):4-9.

Beasley, Tom S. (95)
1982 Paleo-Indian Artifacts from a Site in McMullen County. *La Tierra* 9(3):34-38.

Bell, Milton (243)
1981 *The Alex Justiss Site: A Caddoan Cemetery in Titus County, Texas*. Publications in Archaeology, Report 21. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Bement, Leland C. (635)
1984 *Intensive Investigations of 41BP191 and 41BP192, The Powell Bend Prospect, Bastrop County, Texas*. Research Report 87. Texas Archeological Survey, The University of Texas at Austin.

Bement, Leland C. (468)
1987 Ephemeral Site Morphology: Fuller Shelter (41 KY 27), Kinney County, Texas. *La Tierra* 14(3):5-23.

Bement, Leland C. (583)
1989 *Excavations at 41BP19, The Kennedy Bluffs Site, Bastrop County, Texas*. Contract Reports in Archaeology, Report 5. Texas State Department of Highways and Public Transportation, Austin.

Bement, Leland C. (488)
1990 Archeological Assessment of 41HY197: The Beecroft Site Complex, Hays County, Texas. *La Tierra* 17(4):10-30.

Bement, Leland C. (446)
1993 A Flexed Burial from Llano County, Texas. *Bulletin of the Texas Archeological Society* 61:281-287.

Bement, Leland C., Rolfe D. Mandel, Jesus F. de la Teja, Dan K. Utley, and Solveig A. Turpin (639)
1987 *Buried in the Bottoms: The Archeology of Lake Creek Reservoir, Montgomery County, Texas*. Research Report 97. Texas Archeological Survey, The University of Texas at Austin.

Bement, Leland C., and Solveig A. Turpin (469)
1988 A Folsom Point from Hinds Cave, 41 VV 456, Val Verde County, Texas. *La Tierra* 15(1):5-7.

Benfer, Alice and Robert Benfer (100)
1981 The Mason Ranch Burial Cave, Uvalde County, Texas. *La Tierra* 8(3):16-26.

Birmingham, W. W. (105)
1980 Scottsbluff Points from Victoria and De Witt Counties. *La Tierra* 7(4):27-29

Birmingham, W. W., E. H. Schmiedlin, and Thomas R. Hester (126)
1976 Archaeology at the Wells Site (41 JK 146), Jackson County, Texas. *La Tierra* 3(4):29-33.

Black, Stephen L. (314)
1978 *Archaeological Investigations at the Banquete Bend Site (41 NU 63) Nueces County, Texas*. Archaeological Survey Report 63. Center for Archaeological Research, The University of Texas at San Antonio.

Black, Stephen L. (629)
1986 *The Clemente and Herminia Hinojosa Site, 41 JW 8: A Toyah Horizon Campsite in Southern Texas*. Special Report 18. Center for Archaeological Research, The University of Texas at San Antonio.

Black, Stephen L., and A. Joachim McGraw (601)
1985 *The Panther Springs Creek Site: Cultural Change and Continuity within the Upper Salado Creek Watershed, South-Central Texas*. Archaeological Survey Report 100. Center for Archaeological Research, The University of Texas at San Antonio.

Blaine, Jay C. (406)
1968 A Preliminary Report of an Early Man Site in West Texas. *Transactions of the Third Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-11.

Blaine, Jay C., R. K. Harris, Wilson W. Crook, and Joel L. Shiner (140)
1968 The Acton Site: Hood County, Texas. *Bulletin of the Texas Archeological Society* 39:45-94.

Boisvert, Richard (430)
1985 A Technological Analysis of Lithic Assemblages from Guadalupe Mountains National Park, Texas. *Bulletin of the Texas Archeological Society* 54:1-103.

Bond, Clell L. (291)
1978 *Three Archeological Sites at Hoxie Bridge, Williamson County, Texas*. Report 43. Anthropology Laboratory, Texas A&M University, College Station.

Bond, Clell L. (287)
1981 *Testing of Three Archeological Sites: TMPA Gibbons Creek Project, Grimes County, Texas.* Report 15. Cultural Resources Laboratory, Texas A&M University, College Station.

Bond, Clell L. (670)
1982 *Archaeological Testing of Site 41TT309, Titus County, Texas.* Document 82404. Espey, Huston & Associates, Inc., Austin.

Bond, Clell L., and Stan Grysinski (585)
1980 *San Miguel-Marion Transmission Line: An Archeological Assessment.* Report 2. Cultural Resources Laboratory, Texas A&M University, College Station.

Bond, Clell L., and William E. Moore (584)
1980 *Archeological Investigations in the Davy Crockett National Forest.* Report 1. Cultural Resources Laboratory, Texas A&M University, College Station.

Bond, Clell L., Greg Sundborg, and Jeff Goodson (669)
1982 *Archeological Testing of Nine Sites, North Tract Big Brown, Freestone County, Texas.* Document 82301. Espey, Huston & Associates, Inc., Austin.

Bousman, C. Britt, Michael B. Collins, and Timothy K. Perttula (529)
1988 *Quaternary Geomorphology at Cooper Basin: A Framework for Archeological Inquiry, Delta and Hopkins Counties, Texas.* Reports of Investigations 55. Prewitt and Associates, Inc., Austin.

Bousman, C. Britt, Steve A. Tomka, and Gail L. Bailey (542)
1990 *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations.* Reports of Investigations 76. Prewitt and Associates, Inc., Austin.

Bousman, C. Britt, and Linda Verrett (355)
1973 *An Archaeological Reconnaissance of Aubrey Reservoir.* Archaeology Research Program, Southern Methodist University, Dallas.

Bowman, Bradley F. (436)
1985 Winnie's Mound (41BU17): A Study in the Prehistory of Burleson County, Texas. *Bulletin of the Texas Archeological Society* 56:39-74.

Boyd, Douglas K., James T. Abbott, William A. Bryan, Colin M. Garvey, Steve A. Tomka, and Ross C. Fields (538)
1990 *Phase II Investigations at Prehistoric and Rock Art Sites, Justiceburg Reservoir, Garza and Kent Counties, Texas.* Reports of Investigations 71. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., C. Britt Bousman, and Martha Doty Freeman (545)
1991 *Archeological Survey of Wildlife Mitigation Lands, Justiceburg Reservoir, Garza County, Texas.* Reports of Investigations 79. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., I. Wayne Cox, and Herbert G. Uecker (541)
1990 *Archeological and Historical Investigations at Camp Bullis, Bexar and Comal Counties, Texas: The 1989 Season.* Reports of Investigations 75. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., Martha Doty Freeman, Michael D. Blum, Elton R. Prewitt, and J. Michael Quigg (535)
1989 *Phase I Cultural Resources Investigations at Justiceburg Reservoir on the Double Mountain Fork of the Brazos River, Garza and Kent Counties, Texas.* Reports of Investigations 66. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., and Margaret A. Howard (560)
1988 *Archeological Testing at 41WA97, Sam Houston National Forest, Walker County, Texas.* Technical Reports 3. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., Jay Peck, Steve A. Tomka, and Karl W. Kibler (553)
1993 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2.* Reports of Investigations 88. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., Jay Peck, Steve A. Tomka, Karl W. Kibler, and Martha Doty Freeman (557)
1994 *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3.* Reports of Investigations 93. Prewitt and Associates, Inc., Austin.

Boyd, Douglas K., Steve A. Tomka, C. Britt Bousman, Karen M. Gardner, and Martha Doty Freeman (549)
1992 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1.* Reports of Investigations 84. Prewitt and Associates, Inc., Austin.

Breeding, A. W. (401)
1971 Gresham Lake Site: 41 Mt 3. *Transactions of the Sixth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-8.

Briggs, Alton K. (266)
1971 *An Archeological Survey of Ingram Reservoir.* Archeological Survey 9. Texas Historical Survey Committee and Texas Water Development Board, Austin, Texas.

Brook, Vernon Ralph (395)
1980 The Sabina Mountain Site. *Transactions of the 15th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 15-86.

Brown, Claude H. (407)
1968 A Multiple Fire Pit Excavation - 41 LU 5. *Transactions of the Third Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 33-40.

Brown, Claude H. (451)
1993 S.P.A.S. LU-22. *Transactions of the 29th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-8.

Brown, David O. (605)
1983 *The Berger Bluff Site (41 GD 30A): Excavations in the Upper Deposits, 1979*. Archaeological Survey Report 115. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, David O. (compiler) (630)
1987 *Archeology at Aquilla Lake, 1978-1982 Investigations, Volumes I/II/III*. Research Report 81. Texas Archeological Survey, The University of Texas at Austin.

Brown, David O., Wayne Glander, Ken White, Sally Victor, Clell Bond, Ed Baxter, Doug Allen, Juana L. C. Ibanez, and Cliff Ladd (682)
1987 *Archeological Investigations in the Texas Municipal Power Agency Gibbons Creek Mine Areas, Grimes County, Texas*. Document 861142. Espey, Huston & Associates, Inc., Austin.

Brown, David O., Laura Jones, Juana L. C. Ibanez, Clay Carruthers, and Joe Lara (686)
1986 *Cultural Resources Survey and Testing of the Monticello-Winfield Coal Surface Mine, Titus County, Texas*. Document 851200. Espey, Huston & Associates, Inc., Austin.

Brown, David O., Paul Lukowski, Thomas R. Hester, and Jack D. Eaton (302)
1977 *Archaeological Assessment of Two Sites in the Vicinity of Floodwater Retarding Structure No. 11, Salado Creek Watershed, Bexas County, Texas*. Archaeological Survey Report 35. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, David O., and Ray D. Kenmotsu (225)
1980 *Test Excavations in the Fayette to Lytton Springs Transmission Corridor, Bastrop and Fayette Counties, Texas*. Research Report 77. Texas Archeological Survey, The University of Texas at Austin.

Brown, Kenneth L., and Susan A. Lebo (699)
1991 *Archaeological Testing of the Lewisville Lake Shoreline, Denton County, Texas*. Institute of Applied Sciences, University of North Texas, Denton.

Brown, Kenneth M. (616)
1983 *Archaeological Studies at the CPS Butler Lignite Prospect, Bastrop and Lee Counties, Texas, 1983*. Archaeological Survey Report 140. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, Kenneth M. (609)
1986a *Archaeological Survey and Backhoe Testing for Flume No. 3 Right-of-Way at Coleto Creek Reservoir, Goliad County, Texas*. Archaeological Survey Report 128. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, Kenneth M. (613)
1986b *Archaeological Testing at Sunrise Canyon Subdivision (41BX441), Universal City, Texas*. Archaeological Survey Report 133. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, Kenneth M. (505)
1994 Four Clovis Points from San Augustine County, Texas. *La Tierra* 21(2):24-39.

Brown, Kenneth M., Daniel R. Potter, Grant D. Hall, and Stephen L. Black (329)
1982 *Excavations at 41 LK 67: A Prehistoric Site in the Choke Canyon Reservoir, South Texas*. Choke Canyon Series, Volume 7. Center for Archaeological Research, The University of Texas at San Antonio.

Bryant, William A., Jack M. Jackson, and Elton R. Prewitt (522)
1985 *Inventory and Assessment of Cultural Resources at the Village at Western Oaks Municipal Utility District, Travis County, Texas*. Reports of Investigations 44. Prewitt and Associates, Inc., Austin.

Bryant, William A., Jack M. Jackson, and Elton R. Prewitt (523)
1985 *Inventory and Assessment of Cultural Resources at the Southland Oaks Municipal Utility District, Travis County, Texas*. Reports of Investigations 45. Prewitt and Associates, Inc., Austin.

Campbell, T. N. (81)
1947 The Johnson Site: Type Site of the Aransas Focus of the Texas Coast. *Bulletin of the Texas Archeological and Paleontological Society* 18:40-75.

Campbell, T. N. (80)
1948 The Merrell Site: Archeological Remains Associated with Alluvial Terrace Deposits. *Bulletin of the Texas Archeological and Paleontological Society* 19:7-35.

Campbell, T. N. (75)
1952 The Kent-Crane Site: A Shell Midden on the Texas Coast. *Bulletin of the Texas Archeological Society* 23:39-77.

Carlson, David L. (editor) (731)
1992 *Archaeological Investigations in Spicewood Creek: Results of the 1991 Summer Archaeological Field School*. Research Report No. 22, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Carlson, David L. (editor) (728)
1993 *Archaeological Investigations in Bull Branch: Results of the 1990 Summer Archaeological Field School*. Research Report No. 19, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Carlson, David L. (editor) (734)
1994 *Archaeological Site Testing and Evaluation on the Henson Mountain Helicopter Range AWSS Project Area, Fort Hood, Texas*. Research Report No. 26, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Carlson, David L., Shawn Bonath Carlson, Frederick L. Briuer, Erwin Roemer, Jr., and William E. Moore (723)
1986 *Archeological Survey at Fort Hood, Texas, Fiscal Year 1983, The Eastern Training Area*. Research Report No. 11, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Carlson, David L., John E. Dockall, and Ben W. Olive (733)
1994 *Archaeological Survey at Fort Hood, Texas, Fiscal Year 1990, The Northeastern Perimeter Area*. Research Report No. 24, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Carlson, David L., D. Gentry Steele and Henry L. Bruno (296)
1982 *Archeological Investigations at the Allison Site (41NU185), Nueces County, Texas*. Reports of Investigations 1. Archeological Research Laboratory, Texas A&M University, College Station.

Carlson, Shawn B., Cristi Assad, Erwin Roemer, and David L. Carlson (595)
1983 *Archeological and Historical Investigations in Milam County*. Archeological Surveys 1. Archeological Research Laboratory, Texas A&M University, College Station.

Carlson, Shawn B., H. Blaine Ensor, David L. Carlson, Elizabeth A. Miller, and Diane E. Young (724)
1987 *Archeological Survey at Fort Hood, Texas, Fiscal Year 1984*. Research Report No. 14, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Chadderdon, Mary Frances (135)
1975 Notes on the Menger Collection, Site 41BX272, Bexar County, Texas. *La Tierra* 2(1):15-18.

Chadderdon, Mary Frances (628)
1983 *Baker Cave, Val Verde County, Texas: The 1976 Excavations*. Special Report 13. Center for Archaeological Research, The University of Texas at San Antonio.

Chandler, C. K. (94)
1982 Paleo-Indian Projectile Points from San Patricio County, Texas, Texas Coastal Bend. *La Tierra* 9(3):26-33.

Chandler, C. K. (453)
1983a Notes on Some Bell Points from San Patricio County, Texas. *La Tierra* 10(3):7-10.

Chandler, C. K. (458)
1983b Paleo-Indian Projectile Points from Kendall County, Texas. *La Tierra* 10(4):36-39.

Chandler, C. K. (477)
1989 Paleo-Indian Projectile Points from Kendall County, Texas: The George S. Meyer Collection. *La Tierra* 16(3):29-37.

Chandler, C. K. (482)
1990a Clovis Points from Comanche and Falls Counties, Texas. *La Tierra* 17(1):26-28.

Chandler, C. K. (483)
1990b A Folsom Point from Bexar County, Texas. *La Tierra* 17(2):12-13.

Chandler, C. K. (500)
1993 A Boatstone from Kerr County, Texas. *La Tierra* 20(3):19-21.

Chandler, C. K. (504)
1994 Paleo-Indian Projectile Points from the Olmos Basin in San Antonio, Texas. *La Tierra* 20(1):11-19.

Chandler, C. K., and Kay Hindes (498)
1993 Scottsbluff Points from Atascosa, Frio and McMullen Counties, South-Central Texas. *La Tierra* 20(1):31-36.

Chandler, C. K., Florence Knolle, and Mary Margaret Knolle (452)
1983 Paleo-Indian Projectile Points from Jim Wells and Nueces Counties, Texas. *La Tierra* 10(2):23-27.

Chandler, C. K., and Don Kumpe (501)
1993 Stemmed Points with Massive Barbs from the Lower Rio Grande Valley. *La Tierra* 20(3):26-28.

Clark, John W., Jr., and James E. Ivey (205)
1974 *Archeological and Historical Investigations at Martin Lake, Rusk and Panola counties, Texas.* Research Report 32. Texas Archeological Survey, The University of Texas at Austin.

Cliff, Maynard B. (editor) (716)
1994 *Cultural Resources Survey of a Portion of The White Oak Creek Mitigation Area (WOCMA), Bowie, Cass, and Morris Counties, Texas: 1990-1992.* White Oak Creek Mitigation Area Archeological Technical Series, Report of Investigations 2. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B., Marie Brown, Duane E. Peter, and Sharlene N. Allday (711)
1990 *Cultural Resources Survey Along Salado Creek, Bexar County, Texas.* Miscellaneous Report of Investigations 17. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B. and Duane E. Peter (358)
1975 *Prehistoric Archaeology within the Sabanna River Watershed.* Archaeology Research Program, Southern Methodist University, Dallas.

Cliff, Maynard B. and Duane E. Peter (editors) (709)
1990 *Intensive Archeological Survey and Archival Investigations at the Red River Army Depot and Lone Star Army Ammunition Plant, Bowie County, Texas.* RRAD/LSAAP Archeological Technical Series, Report of Investigations 2. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B. and Duane E. Peter (editors) (715)
1992 *Cultural Resources Survey of the Moist Soils Management Area, White Oak Creek Mitigation Area (WOCMA), Cass County, Texas.* White Oak Creek Mitigation Area Archeological Technical Series, Report of Investigations 1. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B. and Duane E. Peter (editors) (708)
1994 *Cultural Resources Survey of 2,226 Hectares within the Red River Army Depot and Lone Star Army Ammunition Plant, Bowie County, Texas.* RRAD/LSAAP Archeological Technical Series, Report of Investigations 4. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B. and Duane E. Peter (editors) (714)
1994 *Archeological Survey of Selected Portions of the Longhorn Army Ammunition Plant, Harrison County, Texas, 1989-1992.* Miscellaneous Report of Investigations 38. Geo-Marine, Inc., Plano, Texas.

Cliff, Maynard B., Carol Carter, and Linda Verrett (357)
1974 *Archaeological Survey of the Welsh Power Plant.* Archaeology Research Program, Southern Methodist University, Dallas.

Cloud, William A., and James E. Smith II (449)
1993 The Trinque Site (41ER27), Erath County, Texas. *Bulletin of the Texas Archeological Society* 64:269-327.

Coffman, Robert J., and Martha Doty Freeman (521)
1985 *Inventory and Assessment of Cultural Resources at the Meadows at Chandler Creek Municipal Utility District No. 1, Williamson County, Texas.* Reports of Investigations 41. Prewitt and Associates, Inc., Austin.

Coffman, Robert J., Martha Doty Freeman, and Ross C. Fields (518)
1985 *Inventory and Assessment of Cultural Resources at the Ideal Basic Tract, Williamson County, Texas.* Reports of Investigations 38. Prewitt and Associates, Inc., Austin.

Coffman, Robert J., and Elton R. Prewitt (517)
1985 *Phase 2 Cultural Resources Investigations in Portions of the Buttercup Creek Subdivision, Williamson County, Texas.* Reports of Investigations 36. Prewitt and Associates, Inc., Austin.

Coffman, Robert J., Margaret C. Trachte, and Michael B. Collins (528)
1986 *Cultural Ecology of the Kenyon Rockshelter and the Cunningham Site, Canyon Creek Development, Travis County, Texas.* Reports of Investigations 53. Prewitt and Associates, Inc., Austin.

Coleman, Roger E., Shawn B. Carlson, and David L. Carlson (597)
1984 *An Archeological Reconnaissance in Selected Areas of Western Shelby County, Texas.* Archeological Surveys 3. Archeological Research Laboratory, Texas A&M University, College Station.

Collins, Michael B. (189)
1969 *Test Excavations at Amistad International Reservoir, Fall, 1967.* Miscellaneous Papers 6. Texas Archeological Salvage Project, The University of Texas at Austin.

Collins, Michael B. (18)
1972 The Devil's Hollow Site, A Stratified Archaic Campsite in Central Texas. *Bulletin of the Texas Archeological Society* 43:77-100.

Collins, Michael B., Bruce Ellis, and Cathy Dodt-Ellis (657)
1990 *Excavations at the Camp Pearl Wheat Site (41KR243), An Early Archaic Campsite on Town Creek, Kerr County, Texas*. Studies in Archeology 6. Texas Archeological Research Laboratory, The University of Texas at Austin.

Collins, Michael B., Thomas Roy Hester, and Frank A. Weir (33)
1969 Part I: The Floyd Morris Site (41CF2): A Prehistoric Cemetery Site in Cameron County, Texas. *Bulletin of the Texas Archeological Society* 40:119-146.

Cooper, Brom (138)
1974 A Fluted Point from McMullen County, Texas. *La Tierra* 1(1):18.

Corbin, James E. (45)
1963 Archeological Materials From the Northern Shore of Corpus Christi Bay, Texas. *Bulletin of the Texas Archeological Society* 34:5-30.

Corbin, James E. (352)
1977 *Archeological Research at 41SA25, Mission Dolores de Los Ais*. Stephen F. Austin State University, Nacogdoches, Texas.

Corbin, James E., Joseph M. Studer, and Lee Nummi (353)
1977 *The Chayah Site*. Papers in Anthropology 1. Stephen F. Austin State University, Nacogdoches.

Couzzourt, Jim (393)
1982 Archeological Testing at Cal Farley's Boys Ranch, Oldham County, Texas. Part One: The Maintenance Barn Site (A1543). *Transactions of the 17th Regional Archeological Symposium for Southeastern New Mexico, and Western Texas*, pp. 57-134.

Cox, David (122)
1977 A Preliminary Report on "Early Man" Artifacts Found in Northeast Bexar County. *La Tierra* 4(3):7-9.

Crawford, Daymond D. (36)
1965 The Granite Beach Site, Llano County, Texas. *Bulletin of the Texas Archeological Society* 36:71-97.

Crawford, Daymond D. (641)
1971 *An Archaeological Reconnaissance of Ecleto Creek Watershed, South Central Texas*. Survey Reports 8. Texas Archeological Salvage Project, The University of Texas at Austin.

Crawford, Daymond D. (228)
1973 *An Archaeological Survey on Interstate Highway 10*. Publications in Archaeology Report 2. Highway Design Division, Texas Highway Department, Austin.

Creel, Darrell (8)
1978 An Archeological Survey in the South Concho River Area, West Central Texas. *Bulletin of the Texas Archeological Society* 49:241-307.

Creel, Darrell (294)
1979 *Archeological Investigations at the George C. Davis Site, Cherokee County, Texas, Summer 1978*. Texas Antiquities Permit Series, Report 1. Texas A&M University and Texas Antiquities Committee, College Station.

Creel, Darrell (575)
1990 *Excavations at 41TG91, Tom Green County, Texas*. Publications in Archaeology Report 38. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Crook, Wilson W., Jr., and R. K. Harris (73)
1955 Scottsbluff Points in the Obshner Site near Dallas, Texas. *Bulletin of the Texas Archeological Society* 75-100.

Crook, Wilson W., Jr., and R. K. Harris (64)
1957 Hearths, and Artifacts of Early Man Near Lewisville, Texas and Associated Faunal Material. *Bulletin of the Texas Archeological Society* 28:7-97.

Cruse, Brett (394)
1982 The Bobby Clay Site (A2070) in Motley County, Texas. *Transactions of the 17th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 135-146.

Daniels, Roger L. (125)
1976 Preliminary Excavations at the Randig Site, Williamson County, Texas. *La Tierra* 3(4):21-28.

Davis, E. Mott, and Bernard Golden (423)
1960 *The Ben McKinney Site: A Titus Focus Site in the Ferrell's Bridge Reservoir Area, Northeastern Texas*. Division of Research in Anthropology, The University of Texas at Austin.

Davis, Michael W. (650)
1985 *An Archeological Survey and Assessment at the San Marcos (Wood) Fish Hatchery, Hays County, Texas*. Technical Bulletin 79. Texas Archeological Survey, The University of Texas at Austin.

Davis, Michael W., Dan K. Utley, Steve A. Tomka, and Solveig A. Turpin (638)
1987 *Continuing Cultural Resource Investigations in the Calvert Prospect: The 1986 Season, Robertson County, Texas*. Research Report 95. Texas Archeological Survey, The University of Texas at Austin.

Davis, W. A. (153)
1962 *Appraisal of the Archeological Resources of Sanford Reservoir: Hutchinson, Moore and Potter Counties, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Davis, W. A., and Helen Ruth Horn (44)
1964 The Zavonian Springs Site: An Archaic—Neo-American Site in McGee Bend Reservoir, San Augustine County, Texas. *Bulletin of the Texas Archeological Society* 35:213-250.

Davis, William A., and E. Mott Davis (253)
1960 *The Jake Martin Site. An Archaic Site in the Ferrell's Bridge Reservoir Area, Northeastern Texas.* Archaeology Series, Report 3. Department of Anthropology, The University of Texas at Austin.

Day, D. William (676)
1984 *Archeological Mitigation at the Doyle Martin Site, 41LN178 and the P. I. Ridge Site, 41FT52, Leon, and Freestone Counties, Texas.* Document 82209. Espey, Huston & Associates, Inc., Austin.

Day, D. William, Jane Laurens-Day, and Elton R. Prewitt (382)
1981 *Cultural Resources Surveys, and Assessments in Portions of Hidalgo, and Willacy Counties, Texas.* Reports of Investigations 15. Prewitt, and Associates, Inc., Austin.

Denney, Pamela (668)
1981 *A Cultural Resource Survey, and Assessment of the Maverick County Coal Project.* Document 81252. Espey, Huston & Associates, Inc., Austin.

Denton, Joe T. (233)
1976 *No-Name Creek Site: A Terrace Site of the Middle, and Late Archaic Period in Gillespie County, Texas.* Publications in Archaeology, Report 7. Highway Design Division, Texas State Department of Highways, and Public Transportation, Austin.

Dibble, David S. (164)
1967 *Excavations at Arenosa Shelter, 1965-66.* Texas Archeological Salvage Project, The University of Texas at Austin.

Dibble, David S. (640)
1979 *Archaeological Reconnaissance in the Salado Creek Watershed, Bexar County, Texas.* Survey Report 9. Texas Archeological Survey, The University of Texas at Austin.

Dibble, David S., and Dessamae Lorrain (246)
1968 *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas.* Miscellaneous Papers 1. Texas Memorial Museum, University of Texas at Austin.

Dibble, David S., and Elton R. Prewitt (169)
1967 *Survey and Test Excavations at Amistad Reservoir, 1964-65.* Survey Report 3. Texas Archeological Salvage Project, The University of Texas at Austin.

Dillehay, Tom D. (215)
1975 *Prehistoric Subsistence Exploitation in the Lower Trinity River Delta, Texas.* Research Report 51. Texas Archeological Survey, The University of Texas at Austin.

Doehner, Karen, and Richard E. Larson (359)
1978 *Archaeological Research at the Proposed Cooper Lake, Northeast Texas 1974-1975.* Research Report 108. Archaeology Research Program, Southern Methodist University, Dallas.

Duffield, Lathel F. (151)
1960 *Survey and Appraisal of the Archeological Resources of Navarro Mills Reservoir, Navarro, and Hill Counties, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Duffield, Lathel F. (59)
1961 The Limerick Site at Iron Bridge Reservoir, Rains County, Texas. *Bulletin of the Texas Archeological Society* 30:51-116.

Duffield, Lathel F. (155)
1963a *The Strawn Creek Site: A Mixed Archaic and Neo-American Site at Navarro Mills Reservoir, Navarro County, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Duffield, Lathel F. (48)
1963b The Wolfshead Site: An Archaic—Neo-American Site in San Augustine County, Texas. *Bulletin of the Texas Archeological Society* 34:83-141.

Duffield, Lathel F. (41)
1964 Three Panhandle Aspect Sites at Sanford Reservoir, Hutchinson County, Texas. *Bulletin of the Texas Archeological Society* 35:19-81.

Duffield, Lathel F., and Edward B. Jelks (254)
1961 *The Pearson Site. A Historic Indian Site at Iron Bridge Reservoir, Rains County, Texas.* Archaeology Series 4. Department of Anthropology, The University of Texas at Austin.

Duke, Paul L. (123)
1977 Lake Thunderbird Site (41BP78), Bastrop, Texas. *La Tierra* 4(3):15-26.

Dusek, Curtis (107)
1980 Plainview Points from 41MC10, McMullen County, Texas. *La Tierra* 7(3)39-41.

Dusek, Curtis (96)
1982 A Pottery Vessel from 41MC320, The Nichols I Site, McMullen County, Texas. *La Tierra* 9(2):40-42.

Earls, Amy C., and Darryl C. Newton (717)
1988 *Class III Survey and Testing of Cultural Resources in Proposed Flood Control System Rights-of-Way, Southeastern El Paso, El Paso County, Texas.* Mariah Associates, Inc., Albuquerque, New Mexico.

Eddy, Frank W. (166/167/168)
1973 *Salvage Archeology in the Laneport Reservoir District: Central Texas.* Texas Archeological Survey, The University of Texas at Austin.

Ellzey, Tom S. (410)
1966 A Panhandle Aspect Site (Preliminary Report). *Transactions of the Second Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 59-65.

Ensor, H. Blaine (587)
1984 *Archeological Investigations at Sites 41FB70, 41FB71 and 41FB72 in Barker Reservoir, Fort Bend County, Texas.* Reports of Investigation No. 3. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine (588)
1987 *The Cinco Ranch Sites, Barker Reservoir, Fort Bend County, Texas.* Reports of Investigation No. 4. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine (599)
1991 *Archeological Survey of Cypress Creek from Spring Branch to Kuykendahl Road, Harris County, Texas.* Archeological Survey 8. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine (732)
1991 *Archaeological Survey at Fort Hood, Texas, Fiscal Year 1987, The MCA Range Construction, Pidcoke Land Exchange and Phantom Range Projects.* Research Report No. 23, Archeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Ensor, H. Blaine, Saul Aronow, Martha Doty Freeman, and Joseph M. Sanchez (598)
1990 *An Archeological Survey of the Proposed Greens Bayou Regional Stormwater Detention Facility, Greens Bayou, Harris County, Texas.* Archeological Survey 7. Archeological Research Laboratory. Texas A&M University, College Station.

Ensor, H. Blaine, and David L. Carlson (582)
1988 *The Crawford Site, 41PK69, Central Trinity River Uplands, Polk County, Texas.* Contract Reports in Archaeology, Report 4. Texas State Department of Highways and Public Transportation, Austin.

Ensor, H. Blaine, Shawn B. Carlson, and David L. Carlson (596)
1983 *Archeological and Historic Investigations of the Harris County Lease in Barker Reservoir, Harris County, Texas.* Archeological Surveys No. 2. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine, John E. Dockall, and Frank Winchell (592)
1991 *National Register Eligibility Testing and Assessment at the Al Soloman I, and Al Soloman II Sites, Cypress Creek, Harris County, Texas.* Reports of Investigations 12. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine, Randy Korgel, Saul Aronow, and C. S. Mueller-Wille (591)
1989 *Archeological and Geomorphological Investigations of 41GM23, Rocky Creek, Grimes County, Texas.* Reports of Investigations 7. Archeological Research Laboratory, Texas A&M University, College Station.

Ensor, H. Blaine, and Catherine S. Mueller-Wille (581)
1988 *Excavations at the Bull Pen Site 41BP280, Colorado River Drainage, Bastrop County, Texas.* Contract Reports in Archaeology, Report 3. Texas State Department of Highways and Public Transportation, Austin.

Epstein, Jeremiah F. (49)
1962 Centipede and Damp Caves: Excavations in Val Verde County, Texas, 1958. *Bulletin of the Texas Archeological Society* 33:1-129.

Espey, Huston & Associates, Inc. (331)
1980 *A Cultural Resource Inventory and Assessment of the Limestone Electric Generating Station, Limestone & Freestone Counties, Texas.* Document 8023. Espey, Huston & Associates, Inc., Austin, Texas.

Espey, Huston & Associates, Inc. (334)
1981 *Archaeological Investigations at the Limestone Electric Generating Station, Limestone & Freestone Counties, Texas.* Document 81438. Espey, Huston & Associates, Inc., Austin, Texas.

Etchieson, Gerald Meeks (695)
1981 *Archeological Survey at Lake Meredith Recreation Area, Moore, and Potter Counties, Texas.* U.S. Department of the Interior, Water and Power Resources Service, Southwest Region, Amarillo.

Etchieson, Gerald Meeks, and Douglas K. Boyd (698)
1982 *Cultural Resources Survey for Proposed Rehabilitation and a New Drain for Hidalgo County Irrigation District No. 16.* U.S. Department of Interior, Bureau of Reclamation, Southwest Region, Amarillo.

Etchieson, Gerald Meeks, and James E. Couzzourt (696)
1987 *Shoreline Survey at Lake Meredith Recreation Area in the Texas Panhandle.* U.S. Department of the Interior, Bureau of Reclamation, Southwest Region, Amarillo.

Etchieson, Gerald Meeks, Roberta D. Speer, and Jack T. Hughes (349)
1978 *Archeological Investigations in the Truscott Reservoir Area, King and Knox Counties, Texas.* Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon, Texas.

Etchieson, Gerald Meeks, Roberta D. Speer, and Jack T. Hughes (348)
1979 *Archeological Investigations in the Crowell Reservoir Area, Cottle, Foard, King, and Knox Counties, Texas.* Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon, Texas.

Fields, Ross C. (652)
1978 *Report on the 1977 Investigations at the George C. Davis Site, Caddoan Mounds State Historic Site, Cherokee County, Texas.* Texas Parks and Wildlife Department and the Texas Archeological Research Laboratory, University of Texas at Austin.

Fields, Ross C. (516)
1984 *Archeological Investigations at 41LN134 and 41LN144, Jewett Mine Project, Leon County, Texas.* Reports of Investigations 35. Prewitt and Associates, Inc., Austin.

Fields, Ross C. (editor) (532)
1987 *Excavations at the Alley Road Site (41LN149B) and the Harris Hole Site (41LN30), Jewett Mine Project, Leon County, Texas.* Reports of Investigations 61. Prewitt and Associates, Inc., Austin.

Fields, Ross C. (editor) (534)
1988a *Archeological Survey of the 1989-1993 Permit Area, Jewett Mine Project, Freestone and Leon Counties, Texas.* Reports of Investigations 63. Prewitt and Associates, Inc., Austin.

Fields, Ross C. (editor) (533)
1988b *Cultural Resources Investigations Along Whiteoak Bayou, Harris County, Texas.* Reports of Investigations 62. Prewitt and Associates, Inc., Austin.

Fields, Ross C. (editor) (537)
1990 *Excavations at the Charles Cox, Lambs Creek Knoll, and Buffalo Branch Sites, Jewett Mine Project, Leon and Freestone Counties, Texas.* Reports of Investigations 70. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Stephen P. Austin, Roger W. Johnson, Karl W. Kibler, and Jerrilyn B. McLerran (552)
1992 *National Register Assessments of Seven Prehistoric and Two Historic Sites at the Jewett Mine, Freestone and Leon Counties, Texas.* Reports of Investigations 87. Prewitt and Associates, Inc., Austin.

Fields, Ross C., C. Britt Bousman, and Sylvia J. Kooren (536)
1988 *National Register Assessments of Six Prehistoric Sites at the Jewett Mine, Leon County, Texas.* Reports of Investigations 67. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Martha Doty Freeman, and Steven M. Kotter (386)
1983 *Inventory and Assessment of Cultural Resources at Addicks Reservoir, Harris County, Texas.* Reports of Investigations 22. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Eloise F. Gadus, L. Wayne Klement, C. Britt Bousman, and Jerrilyn B. McLerran (556)
1993 *Excavations at the Tick, Spike, Johns Creek, and Peerless Bottoms Sites, Cooper Lake Project, Delta and Hopkins Counties, Texas.* Reports of Investigations 91. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Eloise F. Gadus, L. Wayne Klement, and Karen M. Gardner (556)
1994 *Excavations at the Spider Knoll Site, Cooper Lake Project, Delta County, Texas.* Reports of Investigations 96. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Molly Ficklen Godwin, Martha Doty Freeman, and Susan V. Lisk (520)
1986 *Inventory and Assessment of Cultural Resources at Barker Reservoir, Fort Bend and Harris Counties, Texas.* Reports of Investigations 40. Prewitt and Associates, Inc., Austin.

Fields, Ross C., L. Wayne Klement, C. Britt Bousman, David H. Jurney, and Melissa M. Green (539)
1990 *National Register Assessments of Eight Prehistoric and Four Historic Sites at the Jewett Mine, Freestone and Leon Counties, Texas.* Reports of Investigations 73. Prewitt and Associates, Inc., Austin.

Fields, Ross C., L. Wayne Klement, C. Britt Bousman, Steve A. Tomka, Eloise F. Gadus, and Margaret A. Howard (547)
1991 *Excavations at the Bottoms, Rena Branch, and Moccasin Springs Sites, Jewett Mine Project, Freestone and Leon Counties, Texas*. Reports of Investigations 82. Prewitt and Associates, Inc., Austin.

Fields, Ross C., Susan V. Lisk, Jack M. Jackson, Martha Doty Freeman, and Gail L. Bailey (524)
1986 *National Register Assessments of Archeological and Historical Resources at the Jewett Mine, Leon County, Texas*. Reports of Investigations 48. Prewitt and Associates, Inc., Austin.

Fields, Ross C., and Nancy Reese (512)
1984 *Archeological and Historical Investigations at the Lost Lake Disposal Area, Harris County, Texas*. Reports of Investigations 29. Prewitt and Associates, Inc., Austin.

Fields, Ross C., and J. Peter Thurmond (378)
1980 *The George C. Davis Site, Cherokee County, Texas: Spring 1980 Archeological Investigations*. Reports of Investigations 8. Prewitt and Associates, Inc., Austin.

Flaigg, Norman G. (503)
1993 A Report on Some Paleo-Indian and Early Archaic Artifacts from the Sinkhole Site (41WM754), Williamson County, Texas. *La Tierra* 20(4):8-28.

Flinn, Richard, and Judy Flinn (146)
1968 The High Bluff Site on the Clear Fork of the Brazos River. *Bulletin of the Texas Archeological Society* 38:93-125.

Forrester, Robert E., Jr. (77)
1951 A Series of Eighteen Indian Skeletons Excavated in Shackelford County, Texas. *Bulletin of the Texas Archeological Society* 22:132-143.

Foster, Michael S., and J. Charles Kelley (506)
1989 Archaeological Investigations in the Three-Mile and Sulphur Draw Watershed, Culberson County, Texas. *The Artifact* 27(3):1-89.

Fox, Anne A. (626)
1992 *Archaeological Investigations in Alamo Plaza, San Antonio, Bexar County, Texas, 1988 and 1989*. Archaeological Survey Report 205. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, Anne A. (627)
1993 *Archaeological Testing and Monitoring in Connection with a Drainage Project at Mission San Juan Capistrano, San Antonio, Bexar County, Texas*. Archaeological Survey Report 217. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, Anne A., D. William Day, and Lynn Highley (600)
1980 *Archaeological and Historical Investigations at Wallisville Lake, Chambers and Liberty Counties, Texas*. Archaeological Survey Report 90. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, Anne A. and Thomas R. Hester (299)
1976 *An Archaeological Survey of Coleto Creek, Victoria and Goliad Counties, Texas*. Archaeological Survey Report 18. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, Daniel E. (317)
1979 *An Intensive Survey of Sixteen Prehistoric Archaeological Sites in Starr County, Texas*. Archaeological Survey Report 72. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, Daniel E. (108)
1980 Text Excavations at the Classen Rockshelter, Northeastern Bexar County, Texas, 1967. *La Tierra* 7(1):16-23.

Fox, Daniel E., Robert J. Mallouf, Nancy O'Malley, and William M. Sorrow (268)
1974 *Archeological Resources of the Proposed Cuero I Reservoir, Dewitt and Gonzales Counties, Texas*. Archeological Survey 12. Texas Historical Commission and Texas Water Development Board, Austin.

Fox, Daniel E., and H. G. Uecker (309)
1977 *An Archaeological Study of the McPherson Road Extension Project, Laredo, Texas*. Archaeological Survey Report 45. Center for Archaeological Research, The University of Texas at San Antonio.

Freeman, Martha Doty, and Joe C. Freeman (332)
1981 *A Cultural Resource Inventory and Assessment of the Proposed Stacy Reservoir, Concho, Coleman, and Runnels Counties, Texas*. Volume II, Historic Cultural Resources. Document 81052. Espey, Huston & Associates, Inc., Austin.

Freeman, Martha Doty, and Leonard R. Voellinger (671)
1982 *A Cultural Resources Survey of the First Five-Year Permit Area, Jewett Mine Project*. Document 81233. Espey, Huston & Associates, Inc., Austin.

Fritz, Gayle (212)
1975 *Matagorda Bay Area, Texas: A Survey of the Archeological and Historical Resources.* Research Report 45. Texas General Land Office and Texas Archeological Survey, The University of Texas at Austin.

Frkuska, Augustine, Jr., and Elizabeth G. Frkuska (322)
1982 *A Cultural Resource Survey for Medina Electric Cooperative, Inc., in Uvalde, Medina, and Frio Counties, Texas.* Archaeological Survey Report 117. Center for Archaeological Research, The University of Texas at San Antonio.

Fullem, Bruce B. (234)
1977 *The Black Hopper Site.* Publications in Archaeology, Report 10. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Gadus, Eloise F., Ross C. Fields, C. Britt Bousman, Steve A. Tomka, and Margaret A. Howard (544)
1992 *Excavations at the Finley Fan Site (41HP159), Cooper Lake Project, Hopkins County, Texas.* Reports of Investigations 78. Prewitt and Associates, Inc., Austin.

Gadus, Eloise F., Ross C. Fields, and C. Britt Bousman (551)
1992 *Archeological Investigations at 41DT11, 41DT21, 41DT50, 41DT54, and 41DT63, and 41DT63 at Cooper Lake, Delta County, Texas.* Reports of Investigations 86. Prewitt and Associates, Inc., Austin.

Gadus, Eloise F., Ross C. Fields, L. Wayne Klement, C. Britt Bousman, Margaret Ann Howard, and Karen M. Gardner (546)
1991 *Testing, Revisitation, and Evaluation of Selected Sites at Cooper Lake, Delta and Hopkins Counties, Texas.* Reports of Investigations 81. Prewitt and Associates, Inc., Austin.

Gadus, Eloise F., and Margaret Ann Howard (540)
1990 *Hunter-Fisher-Gatherers on the Upper Texas Coast: Archeological Investigations at the Peggy Lake Disposal Area, Harris County, Texas.* Reports of Investigations 74. Prewitt and Associates, Inc., Austin.

Gallagher, Joseph G., and Susan E. Bearden (372)
1976 *The Hopewell School Site: A Late Archaic Campsite in the Central Brazos River Valley.* Contributions in Anthropology, No. 19. Department of Anthropology, Southern Methodist University, Dallas.

Garrett, Clay M., and Timothy D. Smith (489)
1990 Lithic Artifacts from a Late Paleo-Indian Site in Terrell County, Texas. *La Tierra* 17(4):35-39.

Gates, Ted, and Alyce Hart (396)
1977 The Garza Burial. *Transactions of the 12th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 145-154.

Gibson, Eric C. (321)
1981 *The Santonino Project: An Archaeological Reconnaissance for Urex, Inc., Southeastern Webb County, Texas.* Archaeological Survey Report 102. Center for Archaeological Research, The University of Texas at San Antonio.

Gilmore, Kathleen (211)
1974 *Cultural Variation on the Texas Coast: Analysis of an Aboriginal Shell Midden, Wallisville Reservoir, Texas.* Research Report 44. Texas Archeological Survey, The University of Texas at Austin.

Glander, Wayne P., and Cynthia Brandimarte (672)
1983 *Cultural Resources Survey of the Martin Lake Mine: Tracts A, B and C, Panola County, Texas.* Document 83121. Espey, Huston & Associates, Inc., Austin.

Glander, Wayne P., Greg Sundborg, David Moore, David Brown, Nancy Barker, David Jurney, Ken White, and Laura Jones (683)
1987 *Cultural Resources Survey of the Proposed Monticello-Leesburg Mine, Camp County, Texas.* Document 861094. Espey, Huston & Associates, Inc., Austin.

Glander, Wayne P., and Sally Victor (678)
1984 *Additional Cultural Resource Investigations: Martin Lake Mine, Tracts A, B, and C.* Document 83718. Espey, Huston & Associates, Inc., Austin.

Glander, Wayne P., Sally Victor, Tom Bearden, Mark Turnbough, Don Blanton, David Jurney, Ken White, and Steve Tomka (680)
1986 *A Report on Continued Cultural Resources Investigations of the Martin Lake Coal Surface Mine, Tracts A, B, & C, Panola County, Texas.* Document 851165. Espey, Huston & Associates, Inc., Austin.

Glander, Wayne P., Sally Victor, Mark Turnbough, Greg Sundborg, David Jurney, Ken White, and Steve Tomka (679)
1986 *Cultural Resources Survey of the Monticello-Winfield Coal Surface Mine, Titus County, Texas.* Document 85417. Espey, Huston & Associates, Inc., Austin.

Glasscock, Keith and Alma Glasscock (390)
1955 A Preliminary Report on CR-1, an Indian Campsite in Moore County, Texas. *Panhandle-Plains Historical Review* XXVIII:96-106.

Good, Carolyn E., Solveig A. Turpin, and Martha Doty Freeman (224)
1980 *A Cultural Resource Assessment of the Calvert and Cole Creek Lignite Prospects, Robertson County, Texas*. Research Report 75. Texas Archeological Survey, The University of Texas at Austin.

Graham, John Allen and William A. Davis (148)
1958 *Appraisal of the Archeological Resources of Diablo Reservoir, Val Verde County, Texas*. Texas Archeological Salvage Project, The University of Texas at Austin.

Green, F. E. (61)
1961 Archaeological Salvage in the Twin Buttes Reservoir Area, San Angeleo, Texas. *Bulletin of the Texas Archeological Society* 30:183-197.

Green, L. M. (22)
1971 Notes on the Archeology of the Happy Patch Site, San Saba County, Texas. *Bulletin of the Texas Archeological Society* 42:319-333.

Green, L. M., and Thomas Roy Hester (15)
1973 The Finis Frost Site: A Toyah Phase Occupation in San Saba County, Central Texas. *Bulletin of the Texas Archeological Society* 44:69-88.

Greer, John W. (141)
1968 Excavations at a Midden Circle Site in El Paso County, Texas. *Bulletin of the Texas Archeological Society* 39:111-131.

Greer, John W. (11)
1976 Neo-American Occupation at the Wheatley Site, Pedernales Falls State Park, Blanco County, Texas. *Bulletin of the Texas Archeological Society* 47:89-169.

Greer, John W., and Robert A. Benfer (12)
1975 Austin Phase Burials at the Pat Parker Site, Travis County, Texas. *Bulletin of the Texas Archeological Society* 46:189-216.

Griffin, F. Eugene (127)
1976 Summary of S.T.A.A. Bear Creek Reservation Site Survey. *La Tierra* 3(3):2-6.

Guderjan, Thomas H. (360)
1981 *Archaeological Investigations in the Forest Grove/Big Rock Areas North-Central Texas*. Archaeology Research Program, Southern Methodist University, Dallas.

Guderjan, Thomas H. (435)
1986 Big Rock: a Woodland and Caddoan Rock-Shelter in East Texas. *Bulletin of the Texas Archeological Society* 55:171-187.

Gunn, Joel and Royce Mahula (323)
1977 *Hop Hill: Culture and Climatic Change in Central Texas*. Special Report 5. Center for Archaeological Research, The University of Texas at San Antonio.

Gunter, Rita R. (461)
1985 The Ben Bickham Collection from North Padre Island, Texas. *La Tierra* 12(1):6-17.

Hall, Grant D. (207)
1974 *Leona River Watershed, Uvalde County, Texas: An Archeological and Historical Survey of Areas Proposed for Modification*. Research Report 37. Texas Archeological Survey, The University of Texas at Austin.

Hall, Grant D. (219)
1981 *Allens Creek: A Study in the Cultural Prehistory of the Lower Brazos River Valley, Texas*. Research Report 61. Texas Archeological Survey, The University of Texas at Austin.

Hall, Grant D., Stephen L. Black, and Carol Graves (328)
1982 *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*. Choke Canyon Series No. 5. Center for Archaeological Research, The University of Texas at San Antonio.

Hall, Grant D., Michael B. Collins, and Elton R. Prewitt (531)
1987 *Cultural Resources Investigations along Drainage Improvements, Hidalgo and Willacy Counties, Texas: 1986 Investigations*. Reports of Investigations 59. Prewitt and Associates, Inc., Austin.

Hamilton, D. L. (439)
1988 Archaeological Investigations at Shy Pond, Brazoria County, Texas. *Bulletin of the Texas Archeological Society* 58:77-145.

Harris, R. K., Inus Marie Harris, Jay C. Blaine, and Jerrylee Blaine (40)
1965 A Preliminary Archeological and Documentary Study of the Womack Site, Lamar County, Texas. *Bulletin of the Texas Archeological Society* 36:287-363.

Harris, R. K., and Dee Ann Suhm (editors) (156/157)
1963 *An Appraisal of the Archeological Resources of Forney Reservoir, Collin, Dallas, Kaufman, and Rockwall Counties, Texas*. Texas Archeological Salvage Project, University of Texas at Austin.

Harrison, Billy R., and Bob T. Griffin (14)
1973 An Infant Burial in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 44:61-68.

Hasskarl, Robert A., Jr. (63)
1961 The Boggy Creek Sites of Washington County, Texas. *Bulletin of the Texas Archeological Society* 30:287-300.

Hays, T. R. (compiler and editor) (339/340/341/342/343)
1982 *Archaeological Investigations at the San Gabriel Reservoir Districts, Central Texas.* Volumes I-III. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.

Headrick, Pamela (662)
1993 *The Archeology of 41NU11, The Kirchmeyer Site, Nueces County, Texas: Long-Term Utilization of A Coastal Clay Dune.* Studies in Archeology No. 15. Texas Archeological Research Laboratory, The University of Texas at Austin.

Hedrick, John A. (441)
1989 A Preliminary Report on Archeological Resources in Southern Culberson County in the Vicinity of Van Horn, Texas. *Bulletin of the Texas Archeological Society* 59:129-156.

Henderson, Jerry (236)
1979 *The Mothershed Spring Site.* Publications in Archaeology, Report No. 12. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Hester, Thomas Roy (143)
1968 Paleo-Indian Artifacts from Sites Along San Miguel Creek: Frio, Atascosa and McMullen Counties, Texas. *Bulletin of the Texas Archeological Society* 39:147-161.

Hester, Thomas Roy (261)
1969 *Archeological Investigations in Kleberg and Kenedy Counties, Texas in August, 1967.* Report 15. Archeological Program, State Building Commission, Austin.

Hester, Thomas Roy (19)
1971 Archeological Investigations at the La Jita Site, Uvalde County, Texas. *Bulletin of the Texas Archeological Society* 42:51-148.

Hester, Thomas Roy (307)
1977 *Archaeological Research at the Hinojosa Site (41 JW 8), Jim Wells County, Southern Texas.* Archaeological Survey Report No. 42. Center for Archaeological Research, The University of Texas at San Antonio,

Hester, Thomas Roy (478)
1989 Notes on South Texas Archaeology: 1989-4. A Cremation Burial from a Site in Dimmit County, Southern Texas. *La Tierra* 16(4):2-4.

Hester, Thomas Roy, Byron D. Barber, and Pamela Headrick (499)
1993 Notes on South Texas Archaeology: 1993-3. Insights into Clovis Technology: A Clovis Point from Atascosa County, Southern Texas. *La Tierra* 20(3):3-5.

Hester, Thomas Roy, and Michael B. Collins (416)
1969 Burials from the Frisch Auf! Site:41FY42. *The Texas Journal of Science* XXI(2):131-166.

Hester, Thomas Roy, Michael B. Collins, Frank A. Weir, and Frederick Ruecking, Jr. (33)
1969 Two Prehistoric Cemetery Sites in the Lower Rio Grande Valley of Texas. *Bulletin of the Texas Archeological Society* 40:119-166.

Hester, Thomas Roy, and T. C. Hill, Jr. (16/17)
1972 Prehistoric Occupation at the Holdsworth and Stewart Sites on the Rio Grande Plain of Texas. *Bulletin of the Texas Archeological Society* 43:33-76.

Hester, Thomas Roy, Thomas C. Kelly, and Feris A. Bass, Jr (327)
1975 *An Initial Archaeological and Historical Assessment of Three Proposed Dam Sites in Gonzales and Kendall Counties, Texas.* Regional Studies 2. Center for Archaeological Research, The University of Texas at San Antonio.

Hester, Thomas Roy, and Robert C. Parker (24)
1970 The Berclair Site: A Late Prehistoric Component in Goliad County, Southern Texas. *Bulletin of the Texas Archeological Society* 41:1-23.

Hester, Thomas Roy, and Charles M. Whatley (492)
1992a Notes on South Texas Archaeology: 1992-1. Archaeological Materials from Site 41UV20: Uvalde County, South-Central Texas. *La Tierra* 19(1):3-8.

Hester, Thomas Roy, and Charles M. Whatley (495)
1992b Notes on South Texas Archaeology: 1992-3. Chipped Stone Artifacts from Site 41DM59: Dimmit County, Southern Texas. *La Tierra* 19(3):1-7.

Hester, Thomas Roy, L. D. White, and Joy White (424)
1969 Archeological Materials from the Oulline Site (41 LS 3) and Other Sites in La Salle County, Southwest Texas. *The Texas Journal of Science* XXI(2):131-166.

Hester, Thomas Roy, Diane Wilson, and Pamela Headrick (497)
1993 Notes on South Texas Archaeology: 1993-1. An Austin Phase Burial from Frio County, South Texas: Archaeology and Physical Anthropology. *La Tierra* 20(1):5-8.

Highley, Lynn (110)
1979 A Note on Arrowpoints Collected in Webb and Duval Counties. *La Tierra* 6(4):36-39.

Highley, Lynn, Jeffery A. Huebner, Joseph H. Labadie, Rochelle J. Leneave, and Robert R. Harrison. (473)
1988 Salvage Archaeology at the Brandes Site (41 AU 55), Austin County, Texas. *La Tierra* 15(3):6-19.

Highley, Lynn, Carol Graves, Carol Land, and George Judson (7)
1978 Archeological Investigations at Scorpion Cave (41 ME 7) Medina County, Texas. *Bulletin of the Texas Archeological Society* 49:139-194.

Highley, Lynn (325)
1980 Archaeological Materials from the Alazan Bay Area, Kleberg County, Texas. In *Papers on the Archaeology of the Texas Coast*, edited by Lynn Highley and Thomas R. Hester, pp. 61-78. Special Report 11. Center for Archaeological Research, The University of Texas at San Antonio.

Highley, Lynn, and Dan Lengefeld (121)
1977 Preliminary Investigations at the Wolf Site, Blanco County, Texas. *La Tierra* 4(4):16-19.

Hillier, Laura E. (290)
1977 *An Archeological Survey of the Industrial Generating Company Lignite Mining Area, Milam County, Texas.* Report 35. Anthropology Laboratory, Texas A&M University, College Station.

Hines, Margaret Howard (554)
1992 *Exploratory Investigations at 41GV53 on Clear Creek, Galveston County, Texas.* Reports of Investigations 89. Prewitt and Associates, Inc., Austin.

Hines, Margaret Howard, Steve A. Tomka, and Karl W. Kibler (559)
1994 *Data Recovery Excavations at the Wind Canyon Site, 41HZ119, Hudspeth County, Texas.* Reports of Investigations 99. Prewitt and Associates, Inc., Austin.

Holliday, Vance T. (411)
1977 *Cultural Chronology of the Lubbock Lake Site.* Master's thesis, Museum Science Department, Texas Tech University, Lubbock.

Holliday, Vance T., and Kerry A. Grombacher (204)
1974 *An Assessment of the Archeological and Historical Resources to be Affected by the Proposed Chiltipin Creek Flood Control Project San Patricio County, Texas.* Research Report No. 29. Texas Archeological Survey, The University of Texas at Austin.

Honea, Kenneth (2)
1980 Marks Beach, Stratified Paleoindian Site, Lamb County, Texas: Preliminary Report. *Bulletin of the Texas Archeological Society* 51:243-269.

Houk, Brett A., and Jon C. Lohse (445)
1993 Archeological Investigations at the Mingo Site, Bandera County, Texas. *Bulletin of the Texas Archeological Society* 61:193-247.

Howard, Calvin D. (137)
1974 Paleo-Indian Surface Finds in Bexar County. *La Tierra* 1(3):14-18.

Howard, Margaret Ann (412)
1983 *A Quantitative Study of the Booker Site and Other Burned Rock Midden Sites of the Lake Travis Basin, Central Texas.* Master's thesis, Department of Anthropology, The University of Texas at Austin.

Howard, Margaret Ann, and Martha Doty Freeman (515)
1984 *Settlement in the Upper Bull Creek Basin: An Inventory and Assessment of Cultural Resources at the Canyon Creek Development, Travis County, Texas.* Reports of Investigations 32. Prewitt and Associates, Inc., Austin.

Howard, Margaret Ann (561)
1988 *An Archeological Survey of the Proposed City of Robinson Water Plant, McLennan County, Texas.* Technical Reports 4. Prewitt and Associates, Inc., Austin.

Howard, Margaret Ann (543)
1991 *National Register Testing at the Spanish Moss Site (41GV10) and 41GV53, Galveston County, Texas.* Reports of Investigations 77. Prewitt and Associates, Inc., Austin.

Howard, Margaret Ann, and Martha Doty Freeman (562)
1990 *Archeological Reconnaissance in the Second Reach of the Clear Creek Flood Control Project, Galveston and Harris Counties, Texas.* Technical Reports 8. Prewitt and Associates, Inc., Austin.

Howard, Margaret Ann, Martha Doty Freeman, and C. Britt Bousman (548)
1991 *Archeological Reconnaissance on Upper Greens Bayou, Harris County, Texas.* Reports of Investigations 83. Prewitt and Associates, Inc., Austin.

Howard, Margaret Ann, Martha Doty Freeman, and C. Britt Bousman (550)
1992 *Archeological Reconnaissance in the Third Reach of the Clear Creek Flood Control Project, Galveston and Harris Counties, Texas.* Reports of Investigations 85. Prewitt and Associates, Inc., Austin.

Hsu, Dick Ping, and Ronald W. Ralph (263)
1968 *An Appraisal of the Archeological Resources of Cibolo Reservoir, Wilson County, Texas.* Archeological Survey 1. Texas State Building Commission and Texas State Water Development Board, Austin.

Hudgeons, Mark D. (112)
1979 A Clovis Point Fragment from DeWitt County. *La Tierra* 6(1):24.

Hudgins, Joe D. (432)
1986 A Historic Indian Site in Wharton County, Texas. *Bulletin of the Texas Archeological Society* 55:29-51.

Hudgins, Joe D., and L. W. Patterson (485)
1990 Two Aboriginal Sites in Jeff Davis County, Texas. *La Tierra* 17(2):25-30.

Hudson, William R., Jr., Warren M. Lynn, and Dan Scurlock (282)
1974 *Walker Ranch: An Archeological Reconnaissance and Excavations in Northern Bexar County, Texas.* Report 26. Office of the State Archeologist, Texas Historical Commission, Austin.

Huebner, Jeffrey A., and Anthony G. Comuzzie (659)
1992 *The Archeology and Bioarcheology of Blue Bayou: A Late Archaic and Late Prehistoric Mortuary Locality in Victoria County, Texas.* Studies in Archeology 9. Texas Archeological Research Laboratory, The University of Texas at Austin.

Hughes, Jack Thomas (413)
1942 *An Archaeological Report on the Harrell Site of North-Central Texas.* Master's thesis, Department of Anthropology, The University of Texas at Austin.

Hughes, Jack T. (72)
1955 Little Sunday: An Archaic Site in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 26:55-74

Hughes, Jack T. (51)
1961 Lake Creek: A Woodland Site in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 32:65-84.

Hughes, Jack T. (347)
1972 *Archeological Reconnaissance in the Wichita River Drainage of North-Central Texas.* Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon, Texas.

Hughes, Jack T. and Patrick S. Willey (editors) (274)
1978 *Archeology at MacKenzie Reservoir.* Archeological Survey No. 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Hyatt, Robert D., and Karen Doehner (370)
1975 *Archaeological Research at Cooper Lake, Northeast Texas, 1973.* Contributions in Anthropology, No. 15. Department of Anthropology, Southern Methodist University, Dallas.

Ivey, James E. (607)
1983 *Archaeological Testing at Rancho de las Cabras, 41 WN 30, Wilson County, Texas, Second Season.* Archaeological Survey Report 121. Center for Archaeological Research, The University of Texas at San Antonio.

Ivey, James E., and Anne A. Fox (602)
1981 *Archaeological Survey and Testing at Rancho de las Cabras, Wilson County, Texas.* Archaeological Survey Report 104. Center for Archaeological Research, The University of Texas at San Antonio.

Jackson, Jack M. (633)
1982 *A Cultural Resource Survey in Martin Lake Area D: Intensive Survey I, Rusk County, Texas.* Research Report 85. Texas Archeological Survey, The University of Texas at Austin.

Jackson, Jack M., and Ross C. Fields (526)
1986 *Archeological Investigations at 41LN208, A Workers Housing Area for an Early Twentieth-Century Lignite Mine, Jewett Mine Project, Leon County, Texas.* Reports of Investigations 51. Prewitt and Associates, Inc., Austin.

Jackson, Marsha F. (425)
1974 *Archeological Resources of the North Fork Reservoir Area: Results of Survey and Testing—1970 Season.* Texas Archeological Survey, The University of Texas at Austin.

Jarvis, R. Whitby and Daymond D. Crawford (229)
1974 *Archaeological Excavations on Interstate Highway 10, Sutton County, Texas.* Publications in Archaeology, Report 4. Highway Design Division, Texas State Highway Department, Austin.

Jelks, Edward B. (255)
1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas.* Archaeology Series 5. Department of Anthropology, The University of Texas at Austin.

Jelks, Edward B. (editor) (35)
1967 The Gilbert Site: A Norteño Focus Site in Northeastern Texas. *Bulletin of the Texas Archeological Society* 37 (whole volume).

Jelks, Edward B. and Curtis D. Tunnell (252)
1959 *The Harroun Site. A Fulton Aspect Component of the Caddoan Area, Upshur County, Texas.* Archaeology Series 2. Department of Anthropology, The University of Texas at Austin.

Jelks, Edward B. and Curtis D. Tunnell (150)
1960 *Appraisal of the Archeological Resources of Proctor Reservoir, Comanche County, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Jensen, Harald P., Jr. (142)
1968 Report on Excavations at the Field Ranch Site (X41CO-10). *Bulletin of the Texas Archeological Society* 39:133-146.

Jodry, Pegi, and Dan Prikryl (666)
1981 *Appendix C: Survey and Assessment of the Cultural Resources within Proposed Site Locations for a Steam Electric Plant, Ward County, Texas.* Document 81106. Espey, Huston & Associates, Inc., Austin.

Johnson, Eileen, Vance T. Holliday, Michael J. Kaczor, and Robert Stuckenrath (9)
1977 The Garza Occupation at the Lubbock Lake Site. *Bulletin of the Texas Archeological Society* 48:83-109.

Johnson, LeRoy, Jr. (57)
1961a An Archeological Survey of Blackburn Crossing Reservoir on the Upper Neches River. *Bulletin of the Texas Archeological Society* 31:213-238.

Johnson, LeRoy, Jr. (53/54)
1961b The Yarbrough and Miller Sites of Northeastern Texas, with a Preliminary Definition of the La Harpe Aspect. *Bulletin of the Texas Archeological Society* 32:141-284.

Johnson, LeRoy, Jr. (373)
1964 *The Devil's Mouth Site: A Stratified Campsite at Amistad Reservoir, Val Verde County, Texas.* Archaeology Series 6. Department of Anthropology, The University of Texas at Austin.

Johnson, LeRoy, Jr. (576)
1991 *Early Archaic Life at the Sleeper Archaeological Site 41BC65 of the Texas Hill Country, Blanco County, Texas.* Publications in Archaeology, Report 39. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Johnson, LeRoy (568)
1994 *The Life and Times of Toyah-Culture Folk: The Buckhollow Encampment Site, 41KM16, Kimble County, Texas.* Office of the State Archeologist, Report 38. Texas Historical Commission, Austin.

Johnson, LeRoy, Jr., Dee Ann Suhm, and Curtis D. Tunnell (247)
1962 *Salvage Archeology of Canyon Reservoir: The Wunderlich, Footbridge, and Oblate Sites.* Bulletin 5. Texas Memorial Museum, The University of Texas at Austin.

Johnson, Malcom L. (98)
1981 Notes on Two Sites Along Oso Creek, Nueces County, Southern Texas. *La Tierra* 8(4):12-28.

Johnson, Malcom L. (466)
1986 Site 41 NU 190: Indications of Ceremonial Activity on the Texas Coast. *La Tierra* 13(4):23-39.

Jones, Buddy C. (70)
1957 The Grace Creek Sites, Gregg County, Texas. *Bulletin of the Texas Archeological Society* 28:198-231.

Jones, Laura K., Gregory Sundborg, and Laurel A. Smyth (685)
1988 *A Cultural Resources Survey of the Lampasas to Goldthwaite Transmission Line, Lampasas, Mills, and San Saba Counties, Texas.* Document 880627. Espey, Huston & Associates, Inc., Austin.

Katz, Paul R. (303)
1978 *An Inventory and Assessment of Archaeological Sites in the High Country of Guadalupe Mountains National Park, Texas.* Archaeological Survey Report 36. Center for Archaeological Research, The University of Texas at San Antonio.

Katz, Paul R. (611)
1987 *Archaeological Mitigation at 41 BX 300, Salado Creek Watershed, South-Central Texas.* Archaeological Survey Report 130. Center for Archaeological Research, The University of Texas at San Antonio.

Katz, Susanna R. (304)
1977 *An Archaeological Test Excavation at John James Park, City of San Antonio, Texas.* Archaeological Survey Report 38. Center for Archaeological Research, The University of Texas at San Antonio.

Katz, Susanna R. and Paul R. Katz (270)
1976 *Archeological Investigations in Lower Tule Canyon, Briscoe County, Texas.* Archeological Survey Report 16. Office of the State Archeologist, Texas Historical Commission, Austin.

Keller, John Esten (230)
1975 *The Black Dog Village Site: A Panhandle Aspect Manifestation in Hutchinson County, Texas.* Publications in Archaeology, Report 5. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Keller, John Esten (232)
1976a *The Crystal Rivers Site.* Publications in Archaeology, Report 6. Texas State Department of Highways and Public Transportation, Austin.

Keller, John Esten (231)
1976b *The Stickleaf Site.* Publications in Archaeology, Report 8. Texas State Department of Highways and Public Transportation, Austin.

Keller, John Esten and Frank A. Weir (237)
1979 *The Strawberry Hill Site.* Publications in Archaeology, Report 13. Texas State Department of Highways and Public Transportation, Austin.

Kelley, David B., George J. Castille, Charles E. Pearson, Richard A. Weinstein, and Douglas D. Bryant (702)
1994 *Archaeological Testing and Evaluation of the Flat Bank Creek Site (41 FB 99), Fort Bend County, Texas.* Coastal Environments, Inc., Baton Rouge.

Kelley, J. Charles (83)
1947 The Lehmann Rock Shelter: A Stratified Site of the Toyah, Uvalde, and Round Rock Foci. *Bulletin of the Texas Archeological and Paleontological Society* 18:115-128.

Kelley, J. Charles (78)
1949 Archaeological Notes on Two Excavated House Structures in Western Texas. *Bulletin of the Texas Archeological and Paleontological Society* 20:89-114.

Kelly, Thomas C. (58)
1961 The Crumley Site: A Stratified Burnt Rock Midden, Travis County, Texas. *Bulletin of the Texas Archeological Society* 31:239-272.

Kelly, Thomas C. (50)
1962 Archeological Investigations at Roark Cave, Brewster County, Texas. *Bulletin of the Texas Archeological Society* 33:191-227.

Kelly, Thomas C. (455)
1983 The Brom Cooper Paleo-Indian Collection from McMullen County, Texas. *La Tierra* 10(3):17-40.

Kelly, Thomas C. (467)
1987 Archeology of the Gamenthaler Valley, Gillespie County, Central Texas: A Preliminary Report. *La Tierra* 14(1):5-27.

Kelly, Thomas C. (474)
1988 The Nockenut Clovis Point. *La Tierra* 15(4):7-18.

Kelly, Thomas C. (484)
1990 The La Vernia Folsom Point, Wilson County, Texas. *La Tierra* 17(2):14-24.

Kelly, Thomas C. and Carol Graves (320)
1980 *The El Sauz Project: Archaeological Testing of Selected Sites in the Arroyo Los Olmos Watershed, Starr County, Texas.* Archaeological Survey Report 88. Center for Archaeological Research, The University of Texas at San Antonio.

Kelly, Thomas C. and Thomas R. Hester (298)
1976a *Archaeological Investigations at Sites in the Upper Cibolo Creek Watershed, Central Texas.* Archaeological Survey Report 17. Center for Archaeological Research, The University of Texas at San Antonio.

Kelly, Thomas C. and Thomas R. Hester (300)
1976b *The McQueeney Municipal Utility District Project: An Archaeological Reconnaissance.* Archaeological Survey Report 19. Center for Archaeological Research, The University of Texas at San Antonio.

Kelly, Thomas C. and Lynn Highley (316)
1979 *The Jackpump Project: An Archaeological Survey of Portions of Karnes and Gonzales Counties, Texas.* Archaeological Survey Report 65. Center for Archaeological Research, The University of Texas at San Antonio.

Kelly, Thomas C. and Harvey P. Smith, Jr. (50)
1962 An Investigation of Archeological Sites in Reagan Canyon, Brewster County, Texas. *Bulletin of the Texas Archeological Society* 33:167-190.

Kenmotsu, Nancy Adele (447)
1992 The Mayhew Site: A Possible Hasinai Farmstead, Nacogdoches County, Texas. *Bulletin of the Texas Archeological Society* 63:135-173.

Kenmotsu, Nancy Adele (569)
1993 *Survey in the McKittrick Canyon Watershed, Guadalupe Mountains National Park, Culberson County, Texas.* Department of Antiquities Protection, Texas Historical Commission, Austin.

Kibler, Karl W., and Martha Doty Freeman (555)
1993 *Preliminary Cultural Resources Investigations for the Pharr-Reynosa International Bridge, Hidalgo County, Texas.* Reports of Investigations 90. Prewitt and Associates, Inc., Austin.

Kibler, Karl W., Margaret Howard Hines, and Ross C. Fields (565)
1992 *National Register Testing of 41GV91, Galveston County, Texas.* Technical Reports No. 17. Prewitt and Associates, Inc., Austin.

Koch, Joan K., and C. S. Mueller-Wille (726)
1989a *Archeological Survey at Fort Hood, Texas, Fiscal Year 1985, The Southwestern Training Area.* Research Report No. 17, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Koch, Joan K., and C. S. Mueller-Wille (727)
1989b *Archeological Survey at Fort Hood, Texas, Fiscal Year 1985, The Northern Training Area.* Research Report No. 18, Archaeological Resource Management Series, United States Army Fort Hood, Fort Hood, Texas.

Kotter, Steven M. (379)
1980 *Archeological Assessments at Site 41ZP73, Falcon State Recreation Area, Zapata County, Texas.* Reports of Investigations 9. Prewitt and Associates, Inc., Austin.

Kotter, Steven M. (384)
1982 *A Preliminary Assessment of the Cultural Resources within the Millican Project, Navasota River Basin, Brazos, Grimes, Leon, Madison and Robertson Counties, Texas.* Reports of Investigations 19. Prewitt and Associates, Inc., Austin.

Kotter, Steven M. (637)
1985 *Cherry Tree Shelter: Excavation of a Stratified Late Archaic and Neoarchaic Rockshelter, Travis County, Texas.* Research Report 92. Texas Archeological Survey, The University of Texas at Austin.

Kotter, Steven M., and Ross C. Fields (507)
1983 *National Register Testing of Site 41HR436, Addicks Reservoir, Harris County, Texas.* Reports of Investigations 23. Prewitt and Associates, Inc., Austin.

Kotter, Steven M., and Jan A. Guy (376)
1980 *Archeological Survey and Assessment of Two Areas to be Affected by Proposed Critical Area Treatment Measures within the Ecleto Creek Watershed, Karnes County, Texas.* Reports of Investigations 5. Prewitt and Associates, Inc., Austin.

Kotter, Steven M., and Henry B. Moncure (651)
1985 *Cultural Resource Survey at the Proposed City of Austin Water Treatment Plant Number Four, Travis County, Texas.* Technical Bulletin 80. Texas Archeological Survey, The University of Texas at Austin.

Kotter, Steven M., and Linda A. Nance (380)
1980 *Archeological Assessments at 41GL57 and 41GL91, Enchanted Rock State Natural Area, Gillespie County, Texas.* Reports of Investigations 10. Prewitt and Associates, Inc., Austin.

Kotter, Steven M., Patience E. Patterson, Dan K. Utley, and Henry B. Moncure (660)
1991 *Final Report on Cultural Resource Investigations at the Cummins Creek Mine, Fayette County, Texas.* Studies in Archeology 11. Texas Archeological Research Laboratory, The University of Texas at Austin.

Kotter, Steven M., Robert Rogers, Richard Taylor, Kathryn Reese-Taylor, and Wayne P. Glander (692)
1993 *Archaeological Investigation within the Monticello B-2 First Five-Year Disturbance Area, Titus County, Texas.* Document 920013. Espey, Huston & Associates, Inc., Austin.

Kuykendall, Mark C. (494)
1992 Archaeological Survey of the Lower San Geronimo Creek Watershed, South-Central Texas. *La Tierra* 19(1):21-38.

Labadie, Joseph H. (620)
1987 *A Reconnaissance of Electrical Transmission Line Rights-of-Way in Bandera and Kerr Counties, Texas.* Archaeological Survey Report 164. Center for Archaeological Research, The University of Texas at San Antonio.

Labadie, Joseph H. (580)
1988 *Archaeological Excavations at the Shrew Site 41WN73, Wilson County, Southern Texas.* Contract Reports in Archaeology, Report 2. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Land, Howard D. (433)
1986 The Gregg Ranch Site (41HY131), Hays County, Texas. *Bulletin of the Texas Archeological Society* 55:73-113.

Largent, Floyd B., Jr., and Elinore Stewart (475)
1989 A Folsom Point from Live Oak County, Texas. *La Tierra* 16(1):36-39.

Lebo, Susan A., and Kenneth Lynn Brown (700)
1990 *Archaeological Survey of the Lewisville Lake Shoreline, Denton County, Texas.* Institute of Applied Sciences, University of North Texas, Denton.

Lintz, Christopher, Abby C. Treece, Fred M. Oglesby, Karl Kibler, Patrick O'Neill, W. Nicholas Trierweiler, Charles Frederick, J. Michael Quigg, and A. J. Taylor (719)
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume II: Test Excavations at Prehistoric Sites and Assessment of Rock Cairn Features.* Technical Report 346-II. Mariah Associates, Inc., Austin.

Long, Joseph K., II (62)
1961 Three Central Texas Aspect Sites in Hill County, Texas. *Bulletin of the Texas Archeological Society* 30:223-252.

Lorrain, Dessamae (260)
1968 *Archeological Excavations in Northwestern Crockett County, Texas, 1966-1967.* Report 12. Archeological Program, State Building Commission, Austin.

Luke, Clive J. (235)
1978 *The Marshall Powder Mill Site: The 1973-74 Excavation.* Publications in Archaeology, Report 11. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Luke, Clive J. (239)
1979 *The Cook's Slough Site (41 UV 68).* Publications in Archaeology, Report 15. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Luke, Clive J. (240)
1980a *Continuing Archaeology on State Highway 16 in Kerr County, Texas: The Excavations of The Shep Site (41 KR 109) and The Wounded Eye Site (41 KR 107).* Publications in Archaeology, Report 16. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.

Luke, Clive J. (241)
1980b *Test Excavations at the Famous Amos Site, Crockett County, Texas.* Publications in Archaeology, Report 17. Highway Design Division, Texas State Department of Highways and Public Transportation.

Luke, Clive J. (570)
1983 *Continuing Archaeology on Interstate 10: The Musk Hog Canyon Project, Crockett County, Texas.* Publications in Archaeology, Report 24. Highway Design Division, Texas State Department of Highways and Public Transportation.

Lukowski, Paul D. (612)
1987 *Archaeological Investigations Along the Leona River Watershed, Uvalde County, Texas.* Archaeological Survey Report 132. Center for Archaeological Research, The University of Texas at San Antonio.

Lukowski, Paul D. (614)
1988 *Archaeological Investigations at 41 BX 1, Bexar County, Texas.* Archaeological Survey Report 135. Center for Archaeological Research, The University of Texas at San Antonio.

Lynn, Warren M., Barbara J. Baskin, and William R. Hudson, Jr. (269)
1975 *A Preliminary Archeological Reconnaissance of Selected Public Free School Lands in El Paso County, Texas.* Archeological Survey Report 13. General Land Office and Texas Historical Commission, Austin.

Lynn, Warren M., and John R. Fuszek (335)
1981 *Walnut Creek District Park Archeological Testing at the Wells Site 41TV368, City of Austin, Travis County, Texas.* Parks and Recreation Planning Associates, Inc., Austin.

Lynott, Mark J. (371)
1975 *Archaeological Excavations at Lake Lavon 1974.* Contributions in Anthropology, No. 16. Department of Anthropology, Southern Methodist University, Dallas.

Lynott, Mark J. (364)
1978 *An Archaeological Assessment of the Bear Creek Shelter, Lake Whitney, Texas.* Research Report 115. Archaeology Research Program, Southern Methodist University, Dallas.

Lynott, Mark J., and Duane E. Peter (362)
1977 *1975 Archaeological Investigations at Aquilla Lake, Texas.* Archaeology Research Program, Southern Methodist University, Dallas.

Mallouf, Michael G. (221)
1977 *Archeological Investigations at Lake Limestone.* Research Report 71. Texas Archeological Survey, The University of Texas at Austin.

Mallouf, Robert J. (271)
1976 *Archeological Investigations at Proposed Big Pine Lake, 1974-1975, Lamar and Red River Counties, Texas.* Archeological Survey Report 18. Office of the State Archeologist, Texas Historical Commission, Austin.

Mallouf, Robert J. and Barbara J. Baskin (272)
1976 *Archeological Surveys in the Tehuacana Creek Watershed Hill and McLennan Counties, Texas.* Archeological Survey Report 19. Office of the State Archeologist, Texas Historical Commission, Austin.

Mallouf, Robert J., Barbara J. Baskin, and Kay L. Killen (273)
1977 *A Predictive Assessment of Cultural Resources in Hidalgo and Willacy Counties, Texas.* Archeological Survey Report 23. Office of the State Archeologist, Texas Historical Commission, Austin.

Mallouf, Robert J. and Anthony N. Zavaleta (283)
1979 *The Unland Site: A Prehistoric Group Burial from Laguna Atascosa National Wildlife Refuge, Cameron County, Texas.* Special Report 25. Office of the State Archeologist, Texas Historical Commission, Austin.

Malone, James M. (265)
1970 *Archeological Reconnaissance in the MacKenzie Reservoir Area of Tule Canyon.* Archeological Survey No. 8. Texas Historical Survey Committee and Texas Water Development Board, Austin.

Malone, James M. (267)
1972 *Archeological Reconnaissance at Proposed Mineola Reservoir.* Archeological Survey 10. Texas Historical Survey Committee and Texas Water Development Board, Austin.

Malone, James M. and Alton K. Briggs (264)
1970 *An Archeological Survey of the Texarkana Reservoir Enlargement Area:Report on the First Season.* Archeological Survey 7. Texas Historical Survey Committee and Texas Water Development Board, Austin.

Marmaduke, William S. (272)
1978 *Prehistory at Bear Creek, Brewster County, Texas.* Archeological Survey Report No. 25. Office of the State Archeologist, Texas Historical Commission, Austin.

McClurkan, Burney B. (195)
1968 *Livingston Reservoir, 1965-66: Late Archaic and Neo-American Occupations*. Papers of the Texas Archeological Salvage Project, No. 12. Texas Archeological Salvage Project, The University of Texas at Austin.

McCormick, Olin F., III (367)
1973 *Archaeological Resources in the Lake Monticello Area of Titus County, Texas*. Contributions in Anthropology, No. 8. Department of Anthropology, Southern Methodist University, Dallas.

McCormick, Olin F. and C. Reid Ferring (350)
1980 *Cultural Resource Evaluation of the Proposed Lake Amon G. Carter Enlargement, Montague County, Texas*. Privately printed.

McCormick, Olin F. and Roger E. Filson (351)
1975 *Archaeological Survey of Portions of Hamilton Creek Watershed, Burnet County, Central Texas*. Institute for Environmental Studies, North Texas State University, Denton.

McDonald, Andrew J. (197)
1972 *An Archeological Survey of the Martin Lake Area, Rusk and Panola Counties, Texas*. Research Report 14. Texas Archeological Salvage Project, The University of Texas at Austin.

McGraw, A. Joachim (318)
1979 *A Preliminary Archaeological Survey for the Conquista Project in Gonzales, Atascosa, and Live Oak Counties, Texas*. Archaeological Survey Report 76. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim (603)
1983 *Arroyo de los Muertos and Other Prehistoric Terrace Sites along the Rio Grande, Laredo, Texas*. Archaeological Survey Report 106. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim (610)
1984 *Archaeology in the South Texas Sand Sheet: A Study of Chevron Properties in Brooks County*. Archaeological Survey Report 129. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim (621)
1987 *An Archaeological Survey of Proposed Seismic and Pipeline Routes at the Chaparral Wildlife Management Area, Dimmit and La Salle Counties, Southern Texas*. Archaeological Survey Report 165. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim, and Kay Hindes (619)
1987 *Chipped Stone and Adobe: A Cultural Resources Assessment of the Proposed Applewhite Reservoir, Bexar County, Texas*. Archaeological Survey Report 163. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim, and Dennis A. Knepper (608)
n.d. *The East Chacon Project: 11,000 Years of Prehistory Along the Upper Nueces River, Southern Texas*. Archaeological Survey Report 125. Center for Archeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim and Fred Valdez, Jr. (313)
1978 *Investigation of Prehistoric Rockshelter and Terrace Sites Along Portions of the Salado Creek Drainage, Northern Bexar County, Texas*. Archaeological Survey Report 55. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim, Fred Valdez, Jr. and Waynne Cox (305)
1977 *An Archaeological Survey of Areas Proposed for Modification in the Encino Park Development, Northern Bexar County, Texas*. Archaeological Survey Report 39. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. Joachim, Beverly J. Van Note, and Courtenay J. Jones (604)
1987 *Archaeology of the Brasada: A Cultural Resources Assessment of the Chevron Resources Company Properties in Northeastern Duval County, Texas*. Archaeological Survey Report 113. Center for Archaeological Research, The University of Texas at San Antonio.

McGuff, Paul R. (217)
1978 *Prehistoric Archeological Investigations at Palmetto Bend Reservoir: Phase 1, Jackson County, Texas*. Palmetto Bend Reservoir Series, Volume 3, Research Report 58. Texas Archeological Survey, The University of Texas at Austin.

McNatt, Logan D. (292)
1978 *Archeological Investigations at the Kaygal Recreation Area Site (41WA82) Walker County, Texas*. Report No. 44. Anthropology Laboratory, Texas A&M University, College Station.

McReynolds, Mary Jane, H. Blaine Ensor, and David L. Carlson (589)
1988 *Archeological Investigations at 41HR530 and 41HR608, Langham Creek, Addicks Reservoir, Harris County, Texas*. Reports of Investigations 6. Archeological Research Laboratory, Texas A&M University, College Station.

McReynolds, Mary Jane, Randy Korgel, and H. Blaine Ensor (590)
1988 *Archeological Investigations at a Late Ceramic Period Bison Kill Site, (41HR541), Whiteoak Bayou, Harris County, Texas.* Reports of Investigations 7. Archeological Research Laboratory, Texas A&M University, College Station.

McReynolds, Richard L. (101)
1981 Additional Paleo-Indian Artifacts from the Coleto Creek Project Area of Southern Texas. *La Tierra* 8(3):28-31.

McReynolds, Richard L. (91)
1982 Marine Shell Artifacts from Southwest Bexar County. *La Tierra* 9(4):13-16.

McReynolds, Richard L. (456)
1983 Two Late Paleolithic Tools from Coleto Creek, Victoria County, Southern Texas. *La Tierra* 10(4):26-30.

McReynolds, Richard, and Keith Grunewald (104)
1981 An Archaeological Sample from an Undocumented Edwards Site in Northern Bexar County, Southern Texas. *La Tierra* 8(1):15-22.

McReynolds, Richard, Ben McReynolds, and Mike McReynolds (106)
1980 Additional Late Paleo-Indian Artifacts from Southwestern Atascosa County, Texas. *La Tierra* 7(3):34-38.

Meier, Carl J., Jr., and Thomas R. Hester (130)
1976 Paleo-Indian Artifacts from the Meier Site, Southeast Texas. *La Tierra* 3(1):16-19.

Mercado-Allinger, Patricia A. (385)
1983 *Survey, Testing and Assessment of Cultural Resources in Portions of Willacy County Drainage District No. 1, Willacy County, Texas.* Reports of Investigations 20. Prewitt and Associates, Inc., Austin.

Mercado-Allinger, Patricia A., Ross C. Fields, Kathleen Gilmore, and Nancy Reese (509)
1984 *Inventory and Assessment of Cultural Resources, Clear Lake Channel Improvement Project, Galveston and Harris Counties, Texas.* Reports of Investigations 26. Prewitt and Associates, Inc., Austin.

Mercado-Allinger, Patricia A., Elton R. Prewitt, and Crystal Sasse Ragsdale (513)
1984 *Inventory and Assessment of Cultural Resources in Portions of the Buttercup Creek Subdivision, Williamson County, Texas.* Reports of Investigations 30. Prewitt and Associates, Inc., Austin.

Mercado-Allinger, Patricia A., and Crystal Sasse Ragsdale (512)
1984 *Inventory and Assessment of Cultural Resources, Jamail Property Development, Williamson County, Texas.* Reports of Investigations 28. Prewitt and Associates, Inc., Austin.

Miller, E. O. and Edward B. Jelks (76)
1952 Archeological Excavations at the Belton Reservoir, Coryell County, Texas. *Bulletin of the Texas Archeological Society* 23:168-217.

Mitchell, Jimmy L. (139)
1974 41AT18: An Archaeological Site in Atascosa County, Texas. *La Tierra* 1(1):32-36.

Mitchell, Jimmy L. (13)
1975 Notes on Some Archeological Materials from the Palo Duro Creek Area of Hansford County, Texas. *Bulletin of the Texas Archeological Society* 46:217-230.

Mitchell, Jimmy L. (128)
1976a Artifacts from the Johney Creek Area of LaSalle County, Southern Texas. *La Tierra* 3(3):7-10.

Mitchell, Jimmy L. (131)
1976b A Tentative New Type of Late Paleo-Indian Point from South Texas. *La Tierra* 3(1):20-22.

Mitchell, Jimmy L. (120)
1977 41CM52 - A Salvage Site in Comal County, Texas. *La Tierra* 4(4):2-9.

Mitchell, Jimmy L., C. K. Chandler, and T. C. Kelly (459)
1984 The Rudy Haiduk Site (41KA23): A Late Archaic Burial in Karnes County, Texas. *La Tierra* 11(2):12-39.

Mitchell, Jimmy L., and Shirley Van der Veer (454)
1983 Late Prehistoric Projectile Points from the Vicinity of the Dan Baker Site, 41 CM 104, Comal County, Texas. *La Tierra* 10(3):11-16.

Mokry, E. R., Jr. (132)
1976 Notes on Paleo-Indian Projectile Points from McMullen County. *La Tierra* 3(1):26-27.

Mokry, Edward R., Jr. (109)
1979 Survey of Archaeological Sites in Starr County, Texas. *La Tierra* 6(4):16-25.

Moncure, Hank (645)
1980 *Cultural Resource Survey of the Diamond I Lignite Prospect, Robertson County, Texas.* Technical Bulletin 42. Texas Archeological Survey, The University of Texas at Austin.

Moncure, Henry B. (648)
1981 *An Archeological Survey of the Verde Creek Transmission Line, Kerr County, Texas*. Technical Bulletin 54. Texas Archeological Survey, The University of Texas at Austin.

Moncure, Henry B. (649)
1983 *A Cultural Resource Survey and Assessment in the North Central Austin Growth Corridor, Travis County, Texas*. Technical Bulletin 63. Texas Archeological Survey, The University of Texas at Austin.

Moore, Bill (93)
1982 Report on Testing at the Wells Rockshelter (41 RE 53): A Middle Archaic Site in Real County, Texas. *La Tierra* 9(4):26-31.

Moore, Gary (289)
1976 *An Archeological Assessment of Sites 41WM21, 41WM124, & 41WM133 in Granger Reservoir, Williamson County, Texas*. Report 32. Anthropology Laboratory, Texas A&M University, College Station.

Moore, William E. (429)
1983 Archeological Investigations at Musk Hog Canyon, Crockett County, Texas: A Report of the 1976 Texas Archeological Society Field School. *Bulletin of the Texas Archeological Society* 53:13-81.

Moore, William E. (471)
1988 Analysis of Surface-Collected Materials from Site 41 GL 19, A Late Prehistoric Site in Gillespie County, Texas. *La Tierra* 15(2):21-26.

Moore, William E. (479)
1989 An Andice Point from the Fietsam Site (41 FY 52), Fayette County, Texas. *La Tierra* 16(4):8-9.

Moore, William E. (577)
1992 *Archaeological Investigations at the Connor Creek Site (41NY9), Young County, Texas*. Publications in Archaeology, Report 40. Texas State Department of Highways and Public Transportation, Austin.

Mueller-Wille, C. S., and David L. Carlson (729)
1990 *Archeological Survey at Fort Hood, Texas, Fiscal Year 1986*. Research Report No. 21, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Nash, Michael A. and Erwin Roemer, Jr. (693)
1994 *Cultural Resource Investigations at the Kingsland Archaeological Site (41BT215), Burnet County, Texas*. (Draft) Document 940243. Espey, Huston & Associates, Inc., Austin.

Nash, Michael A., and Robert M. Rogers (689)
1992 *Data Recovery on Four Archaeological Sites for the Channel to Liberty Project, Chambers and Liberty Counties, Texas*. Document 900737. Espey, Huston & Associates, Inc., Austin.

Neureuther, Rita (462)
1985 Archaeology of the Allen Haag Ranch: A Survey of Goss Creek, Kendall County, Texas. *La Tierra* 12(4):25-39.

Neureuther, Rita (464)
1986 Cecil's Rockshelter: The Goss Creek Shelter 2 (41 KE 110), Kendall County, Texas. *La Tierra* 13(2):12-31.

Newell, H. Perry and Alex D. Krieger (88)
1949 *The George C. Davis Site - Cherokee County, Texas*. Memoirs No. 5. Society for American Archaeology, Menasha, Wisconsin.

Newton, Milton B., Jr. (144)
1968 The Distribution and Character of Sites, Arroyo Los Olmos, Starr County, Texas. *Bulletin of the Texas Archeological Society* 38:18-24.

Nightengale, Bruce A., and Leland C. Bement (647)
1982 *A Cultural Resource Survey and Assessment of the Texaco-Sunedco Hobson Uranium Prospect, Karnes County, Texas*. Technical Bulletin 51. Texas Archeological Survey, The University of Texas at Austin.

Nightengale, Bruce A., William A. Cloud, Henry B. Moncure, David G. Robinson, and Solveig A. Turpin (655)
1988 *Intensive Survey of Cultural Resources in the Extended San Miguel Prospect, Atascosa and McMullen Counties, Texas*. Studies in Archeology 2. Texas Archeological Research Laboratory, The University of Texas at Austin.

Nightengale, Bruce A., Cheryl Lynn Highley, and S. Christopher Caran (656)
1989 *Continuing Cultural Resource Assessments in the San Miguel Prospect 1988 Season, Atascosa and McMullen Counties, Texas*. Studies in Archeology 3. Texas Archeological Research Laboratory, The University of Texas at Austin.

Nightengale, Bruce A., and Jack M. Jackson (634)
1983 *Intensive Survey of Cultural Resources in the Cummins Creek Prospect, Fayette County, Texas*. Research Report 86. Texas Archeological Survey, The University of Texas at Austin.

Nightengale, Bruce A., Jack M. Jackson, and Henry B. Moncure (636)
1985 *Additional Intensive Survey of Cultural Resources in the Cummins Creek Prospect, Fayette County, Texas.* Research Report 89. Texas Archeological Survey, The University of Texas at Austin.

Nunley, John P. (194)
1963a *Appraisal of the Archeological Resources of Livingston Reservoir Polk, San Jacinto, Trinity, and Walker Counties, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Nunley, John P. (417)
1963b *Appraisal of the Archeological Resources of Columbus Bend Reservoir, Colorado and Fayette Counties, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Nunley, John P., Lathel F. Duffield, and Edward B. Jelks (176)
1965 *Excavations at Amistad Reservoir, 1962 Season.* Miscellaneous Papers No. 3. Texas Archeological Salvage Project, The University of Texas at Austin.

O'Brien, Michael (23)
1971 The Fullen Site, 41HR82. *Bulletin of the Texas Archeological Society* 42:335-365.

Olds, Dorris L. (38)
1965 Report on Materials from Brawley's Cave, Bosque County, Texas. *Bulletin of the Texas Archeological Society* 36:111-152.

Parker, Wayne (92)
1982 The Wooden Bow Burial Site, Floyd County, Texas. *La Tierra* 9(4):17-25.

Parker, Wayne (457)
1984 Preliminary Notes on a Clovis Point Associated with Mammoth Tusk Fragments in Hockley County, Texas. *La Tierra* 10(4):31-35.

Parker, Wayne and Jim Mitchell (111)
1979 Notes on Some Bell Points from A Site in Crosby County, Texas. *La Tierra* 6(2):26-27.

Parsons, Mark L. (177)
1965 *1963 Test Excavations at Fate Bell Shelter, Amistad Reservoir, Val Verde County, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Parsons, Mark L. (257)
1967 *Archeological Investigations in Crosby and Dickens Counties, Texas During the Winter, 1966-1967.* Report 7. State Building Commission Archeological Program, Austin.

Parsons, Mark L., Ronnie Hill, and Wayne Parker (4)
1979 The Old Tom Burial, Dickens County, Texas. *Bulletin of the Texas Archeological Society* 50:69-87.

Patterson, L. W. (136)
1974 A Multiple Rock Midden Site. *La Tierra* 1(3):10-13.

Patterson, L. W. (134)
1975 41HR210, A Multicomponent Site in Harris County, Texas. *La Tierra* 2(4):17-22.

Patterson, L. W. (129)
1976 The Hillboldt Site, Austin County, Texas. *La Tierra* 3(3):23-28.

Patterson, L. W. (124)
1977 An Archeological Complex in Kendall County, Texas. *La Tierra* 4(2):6-16.

Patterson, L. W. (119)
1978 An Archaic Rock Midden Site (41 BN 11), Bandera County, Texas. *La Tierra* 5(1):21-26.

Patterson, L. W. (87)
1980a *The Owen Site, 41HR315: A Long Occupation Sequence in Harris County, Texas.* Report 3. Houston Archeological Society, Houston.

Patterson, L. W. (324)
1980b 41HR206, A Major Site in Harris County, Texas. In *Papers on the Archaeology of the Texas Coast*, edited by Lynn Highley and Thomas R. Hester, pp. 13-27. Special Report No. 11. Center for Archaeological Research, The University of Texas at San Antonio.

Patterson, L. W. (103)
1981 A Late Paleoindian and Archaic Rockshelter, Pecos County, Texas. *La Tierra* 8(2):21-24.

Patterson, L. W. (97)
1982 Some Prehistoric Sites on the Uvalde-Zavala County Line, Texas. *La Tierra* 9(1):11-14.

Patterson, L. W. (90)
1983 An Archaeological Survey in Northwest Val Verde County, Texas. *La Tierra* 10(1):32-38.

Patterson, L. W., R. W. McCausland, and J. D. Hudgins (480)
1989 Site 41 CD 122, A Long Occupation in Colorado County, Texas. *La Tierra* 16(4):33-38.

Patterson, L. W., and W. Robert Wehner (133)
1975 The Las Moras Site in Kinney County, Texas. *La Tierra* 2(4):11-15.

Patterson, Patience Elizabeth (209)
1974 *Upper San Marcos River Watershed, Hays County, Texas: An Archeological Survey of Areas Proposed for Modification*. Research Report 42. Texas Archeological Survey, The University of Texas at Austin.

Patterson, Patience Elizabeth (573)
1987 *Archaeological Excavations at 41LL78, The Slab Site, Llano County, Texas*. Publications in Archaeology, Report No. 34. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Patterson, Patience Elizabeth, and Mary Margaret Ford (206)
1974 *Oso Creek Flood Control Project Area, Nueces County, Texas: A Report on the Archeological and Historical Resources*. Research Report 35. Texas Archeological Survey, The University of Texas at Austin.

Peck, Jay (658)
1991 An Analysis of the Projectile Points from the 1932 Excavation of Fate Bell Rockshelter. In *Papers on Lower Pecos Prehistory*, edited by Solveig A. Turpin, pp. 65-85. Studies in Archeology 8. Texas Archeological Research Laboratory, The University of Texas at Austin.

Perkins, John L. (418)
1956 Tonk Creek Shelter. *Central Texas Archeologist* 7:40-47.

Perttula, Timothy K., Bob D. Skiles, Michael B. Collins, Margaret C. Trachte, and Fred Valdez, Jr. (527)
1986 *"This Everlasting Sand Bed": Cultural Resources Investigations at the Texas Big Sandy Project, Wood and Upshur Counties, Texas*. Reports of Investigations 52. Prewitt and Associates, Inc., Austin.

Perttula, Timothy K., Bob D. Skiles, and Bonnie C. Yates (444)
1993 The Goldsmith Site (41WD208): Investigations of the Titus Phase in the Upper Sabine River Basin, Wood County, Texas. *Bulletin of the Texas Archeological Society* 61:139-191.

Peter, Duane E., William A. Cloud, Cynthia Stiles-Hansen, and Maynard B. Cliff (710)
1990 *Intensive Survey Investigations of the Dughest Project, Val Verde County, Texas*. Miscellaneous Reports of Investigations 6. Geo-Marine, Inc., Plano, Texas.

Peter, Duane E., and Steven M. Hunt (712)
1992 *A Sample Survey of the San Antonio Ranch Property, Bexar County, Texas*. Miscellaneous Report of Investigations 31. Geo-Marine, Inc., Plano.

Peterson, Fredrick (149)
1965 *The Erwin's Bridge Site at Somerville Reservoir, Burleson County, Texas*. Texas Archeological Salvage Project, The University of Texas, Austin.

Pevey, Jody C., and Judy Van Cleve (381)
1981 *An Archeological Survey and Assessment of Overhead Power Distribution Lines, Fayette, Lavaca and Austin Counties, Texas*. Reports of Investigations 13. Prewitt and Associates, Inc., Austin.

Pliska, James R. (644)
1980 *Archeological Investigations at the Three Rivers Flood Control Project: A Final Report*. Technical Bulletin 30. Texas Archeological Survey, The University of Texas at Austin.

Pliska, James R., Bruce A. Nightengale, and Jack M. Jackson (226)
1980 *A Cultural Resource Inventory and Assessment of the North Tract, Big Brown Lignite Project, Freestone County, Texas*. Research Report 78. Texas Archeological Survey, The University of Texas at Austin.

Pollard, J.C., John W. Greer, and H. F. Sturgis (46)
1963 Archeological Excavations at the Boy Scout Rockshelter (41TV69), Travis County, Texas. *Bulletin of the Texas Archeological Society* 34:31-56.

Preston, Nolan E. (34)
1969 The McCann Site. *Bulletin of the Texas Archeological Society* 40:167-192.

Prewitt, Elton R. (43)
1964 Excavations at the Terri and Lightfoot Sites, Proctor Reservoir, Comanche County, Texas. *Bulletin of the Texas Archeological Society* 35:143-187.

Prewitt, Elton R. (419)
1966 A Preliminary Report on the Devils Rockshelter Site, Val Verde County, Texas. *The Texas Journal of Science* XVIII(2):206-224.

Prewitt, Elton R. (276/277/278/279/280)
1970 *The Piedra Del Diablo Site, Val Verde County, Texas and Notes on Some Trans-Pecos, Texas Archeological Material in the Smithsonian Institution, Washington, D.C.* Archeological Report 18. Texas Historical Survey Committee, Austin.

Prewitt, Elton R. (202)
1973 *An Archeological Reconnaissance of the Areas to be Affected by the Proposed Louisiana Loop Pipeline, Cameron Parish, Louisiana, Jefferson and Liberty Counties, Texas*. Research Report 25. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R. (213)
1974a *Upper Navasota Reservoir: An Archeological Assessment.* Research Report 47. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R. (214)
1974b *Archeological Investigations at the Loeve-Fox Site, Williamson County, Texas.* Research Report 49. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R. (216)
1975 *Upper Navasota Reservoir: Archeological Test Excavations at the Barkley and Louie Sadler Sites.* Research Report 53. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R. (344/345/346)
1982 *Archeological Investigations at the Loeve-Fox, Loeve and Tombstone Bluff Sites in the Granger Lake District of Central Texas.* Archeological Investigations at the San Gabriel Reservoir Districts, Central Texas, Volume IV. Archeology Program, Institute of Applied Sciences, North Texas State University, Denton.

Prewitt, Elton R. (editor) (508)
1984 *Archeological and Historical Investigations in the Proposed Baker's Port Project and Vicinity, Southern Live Oak Peninsula, San Patricio County, Texas.* Reports of Investigations 25. Prewitt and Associates, Inc., Austin.

Prewitt, Elton R. (editor) (566)
1991 *Camp Texlake: A Cultural Resources Survey and Assessment, Travis County, Texas.* Special Report 1. Travis County Archeological Society, Austin.

Prewitt, Elton R. (428)
n.d. *The Rogers Springs Site, 41TV39: 1974 Investigations.* Research Report 54. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R., and David S. Dibble (208)
1974 *The San Felipe Creek Watershed Project, Val Verde County, Texas: An Archeological Survey.* Research Report 40. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R., and Kerry A. Grombacher (210)
1974 *An Archeological and Historical Assessment of the Areas to be Affected by the Proposed Twin Oak and Oak Knoll Projects, East-Central Texas.* Research Report 43. Texas Archeological Survey, The University of Texas at Austin.

Prewitt, Elton R., and Douglas A. Lawson (163)
1972 *An Assessment of the Archeological and Paleontological Resources of Lake Texoma, Texas - Oklahoma.* Research Report 10. Texas Archeological Salvage Project, The University of Texas at Austin.

Prewitt, Elton R., Susan V. Lisk, and Margaret Ann Howard (530)
1987 *National Register Assessments of the Swan Lake Site, 41AS16, on Copano Bay, Aransas County, Texas.* Reports of Investigations 56. Prewitt and Associates, Inc., Austin.

Prewitt, Elton R., and Michael G. Mallouf (220)
1977 *Upper Navasota Reservoir: Test Excavations at Lake Limestone, Spring 1976.* Research Report 66. Texas Archeological Salvage Project, The University of Texas at Austin.

Prewitt, Elton R., and Linda A. Nance (377)
1980 *Archeological Survey and Assessments on the McBryde Lease, Duval County, Texas.* Reports of Investigations 7. Prewitt and Associates, Inc., Austin.

Prikryl, Daniel J. (567)
1990 *Lower Elm Fork Prehistory: A Redefinition of Cultural Concepts and Chronologies along the Trinity River, North-Central Texas.* Report 37. Office of the State Archeologist, Texas Historical Commission, Austin.

Prikryl, Daniel J., Kathleen Gilmore, Ross C. Fields, and Nancy Reese (510)
1984 *Archeological and Historical Investigations at 41TT310, Lake Bob Sandlin State Park, Titus County, Texas.* Reports of Investigations 27. Prewitt and Associates, Inc., Austin.

Prikryl, Daniel J., and Jack M. Jackson (519)
1985 *Waco Lake, McLennan County, Texas: An Inventory and Assessment of Cultural Resources.* Reports of Investigations 39. Prewitt and Associates, Inc., Austin.

Prikryl, Daniel J., and Crystal Sasse Ragsdale (514)
1984 *Inventory and Assessment of Cultural Resources, Scofield Farms Development, Travis County, Texas.* Reports of Investigations 31. Prewitt and Associates, Inc., Austin.

Prikryl, Daniel J., and Bonnie C. Yates (editors) (701)
1987 *Test Excavations at 41CO141, Ray Roberts Reservoir, Cooke County, Texas.* Contributions in Archeology, No. 4. Institute of Applied Sciences, North Texas State University, Denton.

Quigg, J. Michael, Christoper Lintz, Fred M. Oglesby, Amy C. Earls, Charles D. Frederick, W. Nicholas Trierweiler, Douglas Owsley, and Karl W. Kibler (721)
1993 *Historic and Prehistoric Data Recovery at Palo Duro Reservoir, Hansford County, Texas.* Technical Report No. 485. Mariah Associates, Inc., Austin.

Quinn, Jean, and Jane Holden (79)
1949 Caves and Shelters in Dawson and Bordon Counties. *Bulletin of the Texas Archeological Society* 20:115-131.

Raab, L. Mark, Allan J. McIntyre, James E. Bruseth, and Daniel E. McGregor (Part I), and C. Reid Ferring, and Nancy G. Reese (Part II) (414)
1982 *Archaeological Investigations at Lakeview Lake: 1979 and 1980, Part I and Part II.* Archaeological Monographs, Research Report No. 2. Archaeology Research Program, Southern Methodist University, Dallas.

Redder, Albert (391)
1967 Possum Branch, A Forest-Buried Type Midden. *Central Texas Archeologist* 8:21-26.

Redder, Albert (450)
1985 Horn Shelter Number 2: The South End, A Preliminary Report. *Central Texas Archeologist* 10:37-65.

Richner, Jeffrey J., and Reed Lee (363)
1977 *Archaeological and Ethnohistorical Survey at Tennessee Colony Lake, Texas, 1975.* Research Report No. 104. Archaeology Research Program, Southern Methodist University, Dallas.

Ricklis, Robert A. (438)
1988 Archeological Investigations at the McKenzie Site (41NU221), Nueces County, Texas: Description and Contextual Interpretations. *Bulletin of the Texas Archeological Society* 58:1-76.

Ricklis, Robert A., Michael D. Blum, and Michael B. Collins (661)
1991 *Archeological Testing at the Vera Daniel Site (41TV1364) Zilker Park, Austin, Texas.* Studies in Archeology, No. 12. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, Robert A., and Rita R. Gunter (463)
1986 Archeological Investigations at the Means Site (41 NU 184), Nueces County, Texas. *La Tierra* 13(1):15-32.

Riggs, Aaron D., Jr. (409)
1968a The Reed Shelter: A Petroglyph Site in Garza County, Texas. *Transactions of the Second Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 44-58.

Riggs, Aaron D., Jr. (404)
1968b A Preliminary Report on a Crockett County, Texas Shelter 41CX12. *Transactions of the 4th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 2-8.

Riggs, Aaron D., Jr. (408)
1968c A Crockett County Shelter (41 CX 10). *Transactions of the Ninth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 41-50.

Riggs, Aaron D., Jr. (145)
1968d Excavation of a Buried Midden, Site 41CX11 in Crockett County, Texas. *Bulletin of the Texas Archeological Society* 38:76-82.

Riggs, Aaron D., Jr. (399)
1972 The Petree Site: SPAS-MT-30. *Transactions of the Seventh Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-20.

Riggs, Aaron D., Jr. (398)
1974 Nan's Shelter: 41CX109. *Transactions of the Ninth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 25-38.

Robinson, David G. (227)
1980 *A Cultural Resource Survey of Rhode Ranch, McMullen County, Texas.* Research Report 79. Texas Archeological Survey, The University of Texas at Austin.

Roemer, Erwin, Jr., and Stephen L. Black (310)
1977 *Archaeological Survey and Testing at The City of Live Oak Park, Bexar County, Texas.* Archaeological Survey Report 47. Center for Archaeological Research, The University of Texas at San Antonio.

Roemer, Erwin, Jr., and Shawn Bonath Carlson (579)
1987 *Excavations at 41BU16: State Highway 21 at the Brazos River, Burleson County, Texas.* Contract Reports in Archaeology, Report 1. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Roemer, Erwin, Jr., Shawn Bonath Carlson, and David L. Carlson (722)
1985 *Archaeological Surveys at Fort Hood, Texas, The FY '82 Range Construction Projects, Final Report Vol. I and II.* Research Report No. 10 (Draft), Archeological Resource Management Series. U. S. Army Fort Hood, Fort Hood, Texas.

Rogers, Robert (687)
1990 *A Cultural Resources Survey of The Proposed Winchester-Salem 138kV Transmission Line, Fayette and Washington Counties, Texas.* Document 890550. Espey, Huston & Associates, Inc., Austin.

Rogers, Robert (688)
1991 *National Register Testing of Nine Prehistoric Sites at the Gibbons Creek Third Five-Year Mine Area, Grimes County, Texas.* Document 900500. Espey, Huston & Associates, Inc., Austin.

Rogers, Robert, and Eugene Foster (694)
1994 *National Register Assessment of Three Archaeological Sites at the Gibbons Creek Lignite Mine, Grimes County, Texas.* Document 940325. Espey, Huston & Associates, Inc., Austin.

Rogers, Robert, Eugene Foster, Mary McReady, Steve Kotter, and J. Phil Dering (691)
1993 *A Cultural Resources Survey of the Gibbons Creek Lignite Mine East Area (GCLM V), Grimes County, Texas.* Document 920305. Espey, Huston & Associates, Inc., Austin.

Rogers, Robert, Karen Yancy, Mary Parker, and Wayne Glander (690)
1992 *Cultural Resources Investigations of the Oak Hill 2280 Acre Study Area, Rusk County, Texas.* Document 900083R. Espey, Huston & Associates, Inc., Austin.

Ross, Richard E. (180)
1965 *The Archeology of Eagle Cage.* Papers 7. Texas Archeological Salvage Project, The University of Texas at Austin.

Ross, Richard E. (182)
1966 *The Upper Rockwall and Glen Hill Sites, Forney Reservoir, Texas.* Papers 9. Texas Archeological Salvage Project, The University of Texas at Austin.

Runkles, Frank A. (42)
1964 The Garza Site: A Neo-American Campsite Near Post, Texas. *Bulletin of the Texas Archeological Society* 35:101-125.

Runkles, Frank A., and E. D. Dorchester (437)
1987 The Lott Site (41GR56): A Late Prehistoric Site in Garza County, Texas. *Bulletin of the Texas Archeological Society* 57:83-115.

Sanders, John T. and Elaine L. Sanders (118)
1978 A Ranch Survey in the Upper Santa Isabella Watershed, Webb County, Texas. *La Tierra* 5(2):2-18.

Saunders, R. K. (465)
1986 Preliminary Report on the Fox Draw Site (41 GL 175): An Archaic Midden Site in Gillespie County, Texas. *La Tierra* 13(3):6-27.

Saunders, R. K. (470)
1988a Interim Report on the Fox Draw Site (41 GL 175): An Archaic Midden Site in Gillespie County, Texas. *La Tierra* 15(1):8-25.

Saunders, R. K. (472)
1988b A Possible Late Paleo-Indian Site on Chiltipin Creek, San Patricio County, Texas. *La Tierra* 15(2):27-35.

Saunders, R. K. (481)
1990 Second Interim Report on the Fox Draw Site (41GL175): An Archaic Midden Site in Gillespie County, Texas. *La Tierra* 17(1):13-25.

Saunders, R. K. (502)
1993 Third Interim Report on the Fox Draw Site (41GL175): A Paleo-Archaic Midden Site in Gillespie County, Texas. *La Tierra* 20(3):29-47.

Schmidt-Couzzourt, Beverly (697)
1983 *The Chicken Creek Site, Archeological Testing in the Lake Meredith Recreation Area, Potter County, Texas.* U.S. Department of the Interior, Bureau of Reclamation, Southwest Region, Amarillo.

Schmiedlin, E. H. (113)
1979 A Preliminary Report on the Burris Site (41 VT 66), Victoria County, Texas. *La Tierra* 6(1):25-27.

Schmiedlin, E. H. "Smitty" (102)
1981 Preliminary Investigation of the Kerlick Sites, DeWitt County, Texas. *La Tierra* 8(2):16-20.

Schuetz, Mardith K. (65/66/67/68/69)
1957 A Report on Williamson County Mound Material. *Bulletin of the Texas Archeological Society* 28:135-168.

Schuetz, Mardith K. (259)
1969 *The History and Archeology of Mission San Juan Capistrano, San Antonio, Texas.* Report 11. Archeological Program, State Building Commission, Austin.

Scott, Robert F., IV, and Daniel E. Fox (330)
1982 *Excavations at Sites 41 LK 31/32 and 41 LK 202 in the Choke Canyon Reservoir, South Texas.* Choke Canyon Series, Volume 8. Center for Archaeological Research, The University of Texas at San Antonio.

Scurlock, J. Dan (55)
1961 The Culpepper Site, A Late Fulton Aspect Site in Northeastern Texas. *Bulletin of the Texas Archeological Society* 32:285-320.

Scurlock, J. Dan, and W. A. Davis (152)
1962 *Appraisal of the Archeological Resources of Toledo Bend Reservoir, Panola, Newton, Sabine and Shelby Counties, Texas; Sabine and De Soto Parishes, Louisiana.* Texas Archeological Salvage Project, The University of Texas at Austin.

Scurlock, J. Dan, Warren M. Lynn, and R. Thomas Ray (281)
1974 *An Assessment of the Archeological Resources of Padre Island National Seashore, Texas.* Special Reports, No. 11. Office of the State Archeologist, Texas Historical Commission, Austin.

Sellards, E. H., Glen L. Evans, and Grayson E. Meade (426)
1947 Fossil Bison and Associated Artifacts from Plainview, Texas. *Bulletin of the Geological Society of America* 58:927-954.

Shafer, Harry J. (47)
1963 Test Excavations at the Youngsport Site: A Stratified Terrace Site in Bell County, Texas. *Bulletin of the Texas Archeological Society* 34:57-81.

Shafer, Harry J. (158)
1964 *An Appraisal of the Archeological Resources of Bardwell Reservoir, Ellis County, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (170)
1967 *An Archeological Survey of Robert Lee Reservoir, Coke County, Texas.* Survey Reports No. 4. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (186)
1968 *Archeological Investigations in the San Jacinto River Basin, Montgomery County, Texas.* Papers No. 13. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (190)
1969 *Archeological Investigations in Robert Lee Reservoir Basin, West Central Texas.* Papers No. 17. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (174)
1971a *An Archeological Reconnaissance of the Sanderson Canyon Watershed, Texas.* Papers No. 7. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (193)
1971b *Investigations into South Plains Prehistory, West Central Texas.* Papers No. 20. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. (1)
1981 Archeological Investigations at the Attaway Site, Henderson County, Texas. *Bulletin of the Texas Archeological Society* 52:147-178.

Shafer, Harry J., and Edward P. Baxter (288)
1976 *Archeological Investigations at 41CN13 and 41CN14, Northwest Laterals Watershed, Coleman County, Texas.* Report No. 30. Anthropology Laboratory, Texas A&M University, College Station.

Shafer, Harry J., Edward P. Baxter, Thomas B. Stearns, and James Phil Dering (338)
1975 *An Archeological Assessment of the Big Thicket National Preserve.* Report No. 19. Anthropology Laboratory, Texas A&M University, College Station.

Shafer, Harry J., and James E. Corbin (159/160/161/162)
1965 *An Appraisal of the Archeological Resources of North Fork, South Fork and Laneport Reservoirs, Williamson County, Texas.* Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J., Dee Ann Suhm, and J. Dan Scurlock (175)
1964 *An Investigation and Appraisal of the Archeological Resources of Belton Reservoir, Bell and Coryell Counties, Texas: 1962.* Miscellaneous Papers 1. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, Harry J. and Hayden Whitsett (286)
1975 *Pecan Creek Watershed, Hamilton County, Texas. Archeological Surveys of Structures No. 1, 2, 4.* Report 9. Anthropology Laboratory, Texas A&M University, College Station.

Shawn, Ronnie A. (402)
1971 Morgan Creek Mortar Camp. *Transactions of the Sixth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 49-62.

Shawn, Ronnie A. (397)
1975 The Bull Hill Site Excavation. *Transactions of the Tenth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-47.

Skelton, Duford W. (218)
1977 *Archeological Investigations at the Fayette Power Project, Fayette County, Texas.* Research Report 60. Texas Archeological Survey, The University of Texas at Austin.

Skelton, Duford W. and Martha Doty Freeman (222)
1979 *A Cultural Resource Inventory and Assessment at Camp Swift, Texas.* Research Report 72. Texas Archeological Survey, The University of Texas at Austin.

Skinner, S. Alan (20)
1971 Prehistoric Settlement of the De Cordova Bend Reservoir, Central Texas. *Bulletin of the Texas Archeological Society* 42:149-269.

Skinner, S. Alan (337)
1982 *The Archaeology and History of Lake Ray Roberts, Cultural Resources Survey*. Volume 1. Cultural Resources Report 82-6. Environment Consultants, Inc., Dallas, Texas.

Skinner, S. Alan and Maynard B. Cliff (356)
1973 *Archaeological Survey of the Blue Hills Station, Newton County, Texas*. Archaeology Research Program, Southern Methodist University, Dallas.

Skinner, S. Alan, and Deborah T. Connors (365)
1979 *Archeological Investigations at Lakeview Lake*. Research Report No. 118. Archaeology Research Program, Southern Methodist University, Dallas.

Skinner, S. Alan, and Joseph Gallagher (369)
1974 *An Evaluation of the Archaeological Resources at Lake Whitney, Texas*. Contributions in Anthropology, No. 14. Department of Anthropology, Southern Methodist University, Dallas.

Skinner, S. Alan, R. King Harris, and Keith M. Anderson (editors) (366)
1969 *Archeological Investigations at The Sam Kaufman Site, Red River County, Texas*. Contributions in Anthropology, No. 5. Department of Anthropology, Southern Methodist University, Dallas.

Skinner, S. Alan, and Gerald K. Humphreys (368)
1973 *The Historic and Prehistoric Archaeological Resources of the Squaw Creek Reservoir*. Contributions in Anthropology, No. 10. Department of Anthropology, Southern Methodist University, Dallas.

Skinner, S. Alan and Randle Rash (31)
1969 A Clovis Fluted Point From Hood County, Texas. *Bulletin of the Texas Archeological Society* 40:1-2.

Smith, Harvey P. (315)
1978 *Archaeological Survey and Assessment of Properties for the Conquista Project in Live Oak and Karnes Counties, Texas*. Archaeological Survey Report 64. Center for Archaeological Research, The University of Texas at San Antonio.

Smith, Harvey P. and Kenyon McDonald (297)
1975 *An Archaeological Survey of Friedrich Park, Bexar County, Texas*. Archaeological Survey Report 12. Center for Archaeological Research, The University of Texas at San Antonio,

Smith, James E., II. Contributions by Jay C. Blaine, Kathleen Gilmore, R. King Harris, and Inus M. Harris (448)
1993 The Vinson Site (41LT1): A Norteño Focus Indian Village in Limestone County, Texas. *Bulletin of the Texas Archeological Society* 64:65-162.

Smith, Timothy D., and Clay M. Garrett (490)
1991 Clovis Points from Southeast Dallas County, Texas. *La Tierra* 18(1):35-38.

Smith, Timothy D., and Clay M. Garrett (493)
1992 A Folsom Point from Southeast Dallas County, Texas. *La Tierra* 19(1):13-14.

Snavely, Ralph (615)
1984 *An Archaeological Survey of the Probst and McGriff Leases in Live Oak County, Texas*. Archaeological Survey Report 139. Center for Archaeological Research, The University of Texas at San Antonio.

Sollberger, J. B. (114)
1978a A Prehistoric Rockshelter in Kerr County, Texas. *La Tierra* 5(4):2-6

Sollberger, J. B. (115)
1978b Three Sites in Atascosa County, Texas. *La Tierra* 5(4):7-12.

Sollberger, J. B., and Thomas Roy Hester (420)
1972 The Strohacker Site: A Review of Pre-Archaic Manifestions in Texas. *Plains Anthropologist* 17(58):326-344.

Sommer, Arnold E. (405)
1968 Parker Ranch Ring Midden 1: 41CX30. *Transactions of the Fourth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 9-17.

Sommer, Arnold E. (403)
1971 Big Spring Site. *Transactions of the Sixth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 111-122.

Sommer, Arnold E. (400)
1972 The Windmill Site: 41CX57. *Transactions of the Seventh Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 115-121.

Sorrow, William M. (183)
1966 *The Pecan Springs Site, Bardwell Reservoir, Texas*. Papers No. 10. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, William M. (187/188)
1968 *The Devil's Mouth Site: The Third Season - 1967*. Papers No. 14. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, William M. (191)
1969 *Archeological Investigations at the John Ischy Site: A Burnt Rock Midden in Williamson County, Texas*. Papers No. 18. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, William M. (196)
1970 *Archeological Investigations at the Barker Site*. Research Report 1. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, William M. (165)
1973a *Test Excavations in the North Fork Reservoir Area*. Texas Archeological Survey, The University of Texas at Austin.

Sorrow, William M. (198/199/200/201/202)
1973b *Preliminary Archeological Reconnaissance of Selected Areas to be Affected by the Trinity River Multiple-Purpose Project*. Research Report 17. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, William M., and Wayne N. Cox (203)
1973 *A Reconnaissance of the Archeological and Historical Resources of the Navasota River Basin, Texas*. Research Report 26. Texas Archeological Survey, The University of Texas at Austin.

Sorrow, William M., Harry J. Shafer, and Richard E. Ross (184/185)
1967 *Excavations at Stillhouse Hollow Reservoir*. Miscellaneous Papers No. 11. Texas Archeological Salvage Project, University of Texas at Austin.

Steele, D. Gentry, and E. R. Mokry, Jr. (431)
1985 Archeological Investigations of Seven Prehistoric Sites along Oso Creek, Nueces County, Texas. *Bulletin of the Texas Archeological Society* 54:287-308.

Steele, Janet Fitzsimmons (476)
1989 Archaeology at Bear Creek Scout Reservation. *La Tierra* 16(2):10-37.

Stephenson, Robert L. (147)
1950 *Archeological Survey of McGee Bend Reservoir, Jasper, Sabine, San Augustine, Angelina and Nacogdoches Counties, Texas: A Preliminary Report*. River Basin Surveys, Smithsonian Institution, Washington, D.C.

Stephenson, Robert L. (25/26/27/28/29/30)
1970 Archeological Investigations in the Whitney Reservoir Area, Central Texas. *Bulletin of the Texas Archeological Society* 41:37-286.

Story, Dee Ann (39)
1965 The Archeology of Cedar Creek Reservoir, Henderson and Kaufman Counties, Texas. *Bulletin of the Texas Archeological Society* 36:163-257.

Story, Dee Ann (374/375)
1968 *Archeological Investigations at Two Central Texas Gulf Coast Sites*. Report 13. Archeological Program, State Building Commission, Austin.

Story, Dee Ann (editor) (251)
1981 *Archeological Investigations at the George C. Davis Site, Cherokee County, Texas: Summers of 1979 and 1980*. Occasional Papers No. 1. Texas Archeological Research Laboratory, The University of Texas at Austin.

Story, Dee Ann and Harry J. Shafer (178)
1965 *1964 Excavations at Waco Reservoir, McLennan County, Texas: The Baylor and Britton Sites*. Miscellaneous Papers No. 6. Texas Archeological Salvage Project, The University of Texas at Austin.

Suhm, Dee Ann (71)
1955 Excavations at the Collins Site, Travis County. *Bulletin of the Texas Archeological Society* 26:7-54.

Suhm, Dee Ann (421)
1957 Excavations at the Smith Rockshelter, Travis County. *The Texas Journal of Science* IX(1):26-58.

Suhm, Dee Ann (422)
1959 The Williams Site and Central Texas Archeology. *The Texas Journal of Science* XI(2):218-250.

Suhm, Dee Ann (56)
1961a The Beidleman Ranch Site: An Early Man Kill Site in Stonewall County, Texas. *Bulletin of the Texas Archeological Society* 31:207-212.

Suhm, Dee Ann (52)
1961b The White Site: An Historical Burial in Yoakum County, Texas. *Bulletin of the Texas Archeological Society* 32:85-119.

Suhm, Raymond W. and Thomas R. Hester
1980 The La Paloma Mammoth Site, Kenedy County, Texas, with notes on the archaeology. In *Papers on the Archaeology of the Texas Coast*, edited by Lynn Highley and Thomas R. Hester, pp. 79-103. Special Report No. 11. Center for Archaeological Research, The University of Texas at Austin.

Sullivan, Timothy L. (361)
1977 *Archaeological Investigations at Lake Bob Sandlin, Texas*. Research Report 99. Archaeology Research Program, Southern Methodist University, Dallas.

Sundborg, Greg, Jane Rathbun, Clell Bond, Jeff Goodson, and Wayne Glander (674)
1984 *Archaeological Site Evaluations, Monticello-Winfield Mine, Titus and Franklin Counties, Texas*. Document 82532. Espey, Huston & Associates, Inc., Austin.

Taylor, Anna J. (618)
1985 *Archaeological Investigations of a Shell Midden (41 HR 39) at de Zavala Point, Harris County, Texas.* Archaeological Survey Report 150. Center for Archaeological Research, The University of Texas at San Antonio.

Taylor, Anna J., and Anne A. Fox (617)
1985 *Archaeological Survey and Testing at Rancho de las Cabras, 41 WN 30, Wilson County, Texas, Fifth Season.* Archaeological Survey Report 144. Center for Archaeological Research, The University of Texas at San Antonio.

Texas Archeological Survey Research Staff (631)
1981 *Phase III: Prehistoric Archeological Research within Palmetto Bend Reservoir, Jackson County, Texas.* Palmetto Bend Reservoir Series/Volume 6, Research Report 82. Texas Archeological Survey, The University of Texas at Austin.

Thoms, Alston V. (editor) (593)
1993a *The Brazos Valley Slopes Archaeological Project: Cultural Resources Assessments for the Texas A&M University Animal Science Teaching and Research Complex, Brazos County, Texas.* Reports of Investigations 14. Archeological Research Laboratory, Texas A&M University, College Station.

Thoms, Alston V. (editor) (735)
1993b *Archaeological Survey at Fort Hood, Texas, Fiscal Years 1991 and 1992: Cantonment and Belton Lake Periphery Areas.* Research Report No. 27, Archaeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Thoms, Alston V. (editor) (594)
1994 *The Valley Branch Archaeological Project: Excavations at an Archaic Site (41MU55) in the Cross Timbers Uplands, North-Central Texas.* Reports of Investigations 15. Archeological Research Laboratory, Texas A&M University, College Station.

Thuesen, Kevin (491)
1991 Results of Preliminary Excavations in Sorcerer's Cave, Terrell County, Texas. *La Tierra* 18(3):30-38.

Thurmond, J. Peter (646)
1982 *Archeological Testing and Assessment of 41TV461 and the Onion Creek Wastewater Treatment Plant Site, Travis County, Texas.* Technical Bulletin 49. Texas Archeological Survey, The University of Texas at Austin.

Thurmond, J. Peter, and Ulrich Kleinschmidt (250)
1979 *Report on the Fall 1978 Investigations at the George C. Davis Site, Caddoan Mounds State Historic Site, Cherokee County, Texas.* Texas Archeological Research Laboratory, University of Texas at Austin, and Texas Antiquities Committee, Texas Antiquities Permit Series.

Thurmond, J. Peter, Martha Doty Freeman, and Susan L. Andrews (383)
1981 *A Preliminary Assessment of the Cultural Resources in the Brazos Natural Salt Pollution Control Project, Kent, King and Stonewall Counties, Texas.* Reports of Investigations 18. Prewitt and Associates, Inc., Austin.

Townsend, Richard E., Jr. (487)
1990 Possible Almagre Points from the Panther Springs Creek Sites, Bexar County, Texas. *La Tierra* 17(3):32-37.

Treece, Abby C., Christopher Lintz, W. Nicholas Trierweiler, J. Michael Quigg, and Kevin A. Miller (719)
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume III: Data Recovery Results from Non-Ceramic Sites.* Technical Report 346-III. Mariah Associates, Inc., Austin.

Treece, Abby C., Christopher Lintz, W. Nicholas Trierweiler, J. Michael Quigg, and Kevin A. Miller (720)
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume IV: Data Recovery Results from Ceramic Sites.* Technical Report 346-IV. Mariah Associates, Inc., Austin.

Trierweiler, W. Nicholas (editor) (736)
1994 *Archeological Investigations on 571 Prehistoric Sites at Fort Hood, Bell and Coryell Counties, Texas.* Research Report No. 31, Archeological Resource Management Series. United States Army Fort Hood, Fort Hood, Texas.

Turner, Robert L., Jr. (6)
1978 The Tuck Carpenter Site and Its Relation to Other Sites within the Titus Focus. *Bulletin of the Texas Archeological Society* 49:1-110.

Tunnell, Curtis D. (60)
1961 Evidence of a Late Archaic Horizon at Three Sites in the McGee Bend Reservoir, San Augustine County, Texas. *Bulletin of the Texas Archeological Society* 30:123-158.

Tunnell, Curtis D., and J. Richard Ambler (256)
1967 *Archeological Excavations at Presidio San Agustín de Ahumada.* Report 6. Archeological Program, State Building Commission, Austin.

Tunnell, Curtis D., and Jack T. Hughes (388)
1955 An Archaic Bison Kill in the Texas Panhandle. *Panhandle-Plains Historical Review* XXVIII:63-70.

Tunnell, Curtis D., and Harald P. Jensen, Jr. (262)
1969 *Archeological Excavations in Lyndon B. Johnson State Park, Summer, 1968*. Report 17. Archeological Program, State Building Commission, Austin.

Tunnell, Curtis D., and W. W. Newcomb, Jr. (249)
1969 *A Lipan Apache Mission: San Lorenzo de la Santa Cruz - 1762-1771*. Report 14. Texas Memorial Museum, The University of Texas at Austin.

Turpin, Solveig A. (632)
1982 *Seminole Canyon: The Art and the Archeology, Val Verde County, Texas*. Research Report 83. Texas Archeological Survey, The University of Texas at Austin.

Turpin, Solveig A., and Leland C. Bement (440)
1989 The Live Oak Hole Complex: Plains Indian Art and Occupation in the Lower Pecos River Region. *Bulletin of the Texas Archeological Society* 59:65-82.

Turpin, Solveig A., and Michael W. Davis (443)
1993 The 1989 TAS Field School: Devils River State Natural Area. *Bulletin of the Texas Archeological Society* 61:1-58.

Turpin, Solveig A., and Margaret J. Kluge (223)
1980 *Cultural Resource Sampling, Survey and Assessment in Areas to be Affected by the Twin Oak Steam Electric Station, Robertson County, Texas*. Research Report 74. Texas Archeological Survey, The University of Texas at Austin.

Usrey, Steve, Stan Grysinski, and Clell L. Bond (295)
1978 *Archeological Sites 41AT22 and 41AT24, South Central Texas*. Report No. 46. Anthropology Research Laboratory, Texas A&M University, College Station.

Valdez, Fred, Jr., and A. Joachim McGraw (308)
1977 *An Archaeological Evaluation of Three Prehistoric Sites, Upper Cibolo Creek Watershed, Kendall County, South Central Texas*. Archaeological Survey Report 44. Center for Archaeological Research, The University of Texas at San Antonio.

Valdez, Fred, Jr., Joy White, and L. D. White (99)
1981 Three Point Fragments of the Late Paleo-Indian Period from La Salle County, Southern Texas. *La Tierra* 8(4):35-38.

Vernon, Carol R. (654)
1989 *The Prehistoric Skeletal Remains from the Crestmont Site, Wharton County, Texas*. Studies in Archeology 1. Texas Archeological Research Laboratory, The University of Texas at Austin.

Voellinger, Leonard R. (684)
1987 *The National Register Testing of 41GV22, Galveston County, Texas*. Document 870648. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., Cynthia Brandimarte, and Melissa W. Voellinger (673)
1983 *Phase I Archaeological Testing in the Jewett Mine Project Area, Leon, Limestone, and Freestone Counties, Texas*. Document 83038. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., and Martha Doty Freeman (664)
1980 *A Cultural Resource Inventory and Assessment of the Limestone Electric Generating Station, Limestone & Freestone Counties, Texas*. Document 8023. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., and Martha Doty Freeman (665)
1980 *A Cultural Resources Survey of the First Impact Areas of the Jewett Mine Project Area, Appendix C to an Assessment of the Cultural Resources of the Jewett Mine Project Area*. Document 80353. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., Martha Doty Freeman, and Melissa Voellinger (663)
1980 *An Assessment of the Cultural Resources of the Jewett Mine Project Area*. Document 8011. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., Robert L. Gearhart, Charles Frederick, and David W. Moore, Jr. (681)
1987 *Archaeological and Historical Investigations at Cinco Ranch, Fort Bend and Harris Counties, Texas*. Document 870219. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., Thomas D. Hayes, and Melissa W. Voellinger (675)
1984 *The Cultural Resources Investigations of the Henry W. Pirkey Power Plant and South Hallsville Lignite Mine Transportive Systems Reroute, Harrison County, Texas*. Document 83434. Espey, Huston & Associates, Inc., Austin.

Voellinger, Leonard R., and Christian Nightengale (677)
1985 *A Cultural Resources Survey of the Block House Creek Development, Williamson County, Texas*. Document 84930. Espey, Huston & Associates, Inc., Austin.

Wakefield, Walter H. (171/172)
1968 *Archeological Surveys of Palmetto Bend and Choke Canyon Reservoirs, Texas*. Survey Report 5. Texas Archeological Salvage Project, The University of Texas at Austin.

Walley, Raymond (74)
1955 A Preliminary Report on the Albert George Site in Fort Bend County. *Bulletin of the Texas Archeological Society* 26:218-234.

Ward, Paul M. (460)
1984 A Statistical Analysis of Archaic Projectile Points from the Nueces River Area of Central South Texas: The Brom Cooper Collection. *La Tierra* 10(4):14-34.

Watt, Frank H. (37)
1965 Notes on the Clark Site, McLennan County, Texas. *Bulletin of the Texas Archeological Society* 36:99-110.

Watt, Frank H. (392)
1967 Lookout Point, Lake Waco. *Central Texas Archeologist* 8:27-39.

Webb, Clarence H., Forrest E. Murphey, Wesley G. Ellis, and H. Roland Green. (32)
1969 The Resch Site 41HS16, Harrison County, Texas. *Bulletin of the Texas Archeological Society* 40:3-106.

Weinstein, Richard A. (705)
1991 *Lido Harbor (41GV82): A Late Prehistoric Campsite and Extraction Locale, Galveston County, Texas.* Coastal Environments, Inc., Baton Rouge.

Weinstein, Richard A. (707)
1992 *Cultural Resources Investigations Along the Channel to Victoria, Calhoun and Victoria Counties, Texas.* Coastal Environments, Inc., Baton Rouge.

Weinstein, Richard A. (706)
1994 *Archaeological Investigations Along the Lower Lavaca River, Jackson County, Texas: The Channel to Red Bluff Project.* Coastal Environments, Inc., Baton Rouge.

Weinstein, Richard A., Thurston H. Hahn III, Margaret Swett Henson, David B. Kelley, and James P. Whelan, Jr. (703)
1989 *Archaeological Testing and Mitigation at Cedar Hill Park, Wallisville Lake Project, Chambers County, Texas.* Coastal Environments, Inc., Baton Rouge.

Weinstein, Richard A., Charles E. Pearson, James P. Whelan, Jr., and David B. Kelley (704)
1988 *Archeological Investigations Along the Lower Trinity River, Chambers and Liberty Counties, Texas.* Coastal Environments, Inc., Baton Rouge.

Weir, Frank A. (3)
1979 Greenhaw: An Archaic Site in Central Texas. *Bulletin of the Texas Archeological Society* 50:5-67.

Wesolowsky, Al B., Thomas R. Hester and Douglas R. Brown (10)
1976 Archeological Investigations at the Jetta Court Site (41TV151), Travis County, Texas. *Bulletin of the Texas Archeological Society* 47:25-87.

Wheat, Joe Ben (82)
1947 Notes on the W. A. Myatt Site. *Bulletin of the Texas Archeological Society* 18:87-93.

Whitsett, Hayden and Harry J. Shafer (285)
1975 *Rush Creek Watershed, Comanche County, Texas. An Archeological Survey of Floodwater Retarding Structures Nos. 1, 2 and 3.* Report 10. Anthropology Laboratory, Texas A&M University, College Station.

Wilson, Joseph B. (5)
1979 A Preliminary Report on the Little Pin Oak Creek Site (41FY53): A Campsite with Clovis, Plainview, and Subsequent Artifacts, in Fayette County, Texas. *Bulletin of the Texas Archeological Society* 50:135-140.

Winchell, Frank, George Brown, Maynard B. Cliff, and Sherrian K. Edwards (713)
1992 *Cultural Resources Monitoring/Survey of a JTF-6 Action, Van Horn, Texas Sector.* Miscellaneous Report of Investigations 33. Geo-Marine, Inc., Plano.

Witte, Adolph Henry (389)
1955 A Double Indian Burial From Donley County Texas. *Panhandle-Plains Historical Review* XXVIII:82-86.

Woerner, Michael C. and Lynn Highley (89)
1983 The Bromley F. Cooper Collection of Pre-Archaic and Archaic Dart Points from McMullen County. *La Tierra* 10(1)3-28.

Woolridge, H. G. (643)
1979 *A Cultural Resource Survey and Assessment of the Big Brown Lignite Project.* Technical Bulletin 29. Texas Archeological Survey, The University of Texas at Austin.

Woolridge, H. G., Michael Davis, Pamela Denney, Joe Freeman, Martha Doty Freeman, and Jeff Goodson (667)
1981 *Archaeological Investigations at the Limestone Electric Generating Station, Limestone, Freestone, Leon, and Robertson Counties, Texas.* Document 81438. Espey, Huston & Associates, Inc., Austin.

Word, James H. (21)
1971 The Dunlap Complex in Western Central Crockett County, Texas. *Bulletin of the Texas Archeological Society* 42:271-318.

Word, James H. (442)
1991 The 1975 Field School for the Texas Archeological Society. *Bulletin of the Texas Archeological Society* 60:57-106.

Word, James H. and Charles L. Douglas (248)
1970 *Excavations at Baker Cave, Val Verde County, Texas.* Bulletin No. 16. Texas Memorial Museum, The University of Texas at Austin.

Young, Wayne C. (238)
1979 *The Elm Creek Site (41UV67).* Publications in Archaeology, Report 14. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (242)
1981a *Investigations at the Squawteat Peak Site: Pecos County, Texas.* Publications in Archaeology, Report 20. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (244)
1981b *Test Excavations at the Tankersley Creek Site, A Multicomponent Campsite in Titus County, Texas.* Publications in Archaeology, Report 22. Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (245)
1982 *Excavations at the Ram's Head Site, 41PC35, Pecos County, Texas.* Publications in Archaeology, Report 23. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (571)
1985 *Archaeological Excavations at Site 41BT6, Burnet County, Texas.* Publications in Archaeology, Report 28. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (572)
1986 *Archaeological Investigations in Eastern Kimble County, Texas.* Publications in Archaeology, Report 30. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (574)
1987 *Archaeological Investigations at the Ammans Crossing Site, 41KE93, Kendall County, Texas.* Publications in Archaeology, Report 36. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Young, Wayne C. (578)
1990 *Archaeological Investigations at the Sandbur Site, 41FY135, Fayette County, Texas.* Publications in Archaeology, Review Draft. Highway Design Division, Texas State Department of Highways and Public Transportation, Austin.

Prehistoric and Historic Aboriginal Ceramics in Texas

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ABSTRACT

The use of ceramics by prehistoric Native Americans was widespread in Texas, being adopted by groups in East Texas as early as ca. 500 B.C. and then continued to be used as late as the nineteenth century among a number of different Native American groups across the state. The variety of ceramic forms, decorations, manufacturing technologies, and functions is impressive, ranging from: coastal Goose Creek and Rockport pottery; the Toyah and Henrietta ceramics of the buffalo hunters of the prairie-plains; the Puebloan and Antelope Creek ceramics of the Panhandle farmers and buffalo hunters; the impressive Jornada Mogollon ceramics of the El Paso area Puebloan groups; and the well-made and finely decorated ceramics of the Caddoan groups of Eastern Texas. This paper provides broad overviews of the different currently recognized prehistoric and historic regional ceramic assemblages in Texas, focusing on their technological and functional character, and changes over time in ceramic styles, types, and vessel forms.

INTRODUCTION

Much attention has been paid by Texas archeologists over the years to the stone projectile points, tools, and lithic debris made and discarded by the prehistoric Native Americans who lived in the state of Texas (e.g., Turner and Hester 1993; Davis 1991; Suhm and Jelks 1962). While not without problems of analytical scope and clarity (*sensu* Johnson 1989), the archeological focus on stone artifacts has produced a wealth of information on the manufacture and use of stone tools, as well as a better understanding of the cultural context and chronology of these tools—most notably the temporal sequences of the dart and arrow projectile points in the different regions of Texas (Turner and Hester 1993:11-63; see also Prewitt, this volume).

Unfortunately, the same cannot be said about the prehistoric and historic aboriginal ceramics in Texas. Certainly, valuable information has been gained since the 1940s and 1950s on the styles and types of ceramics made in Texas by Native Americans (Krieger 1946; Suhm et al. 1954; Suhm and Jelks 1962). This is especially true of the well-made and abundant ceramic vessels recovered in quantities from prehistoric Caddoan sites in Northeast Texas, and much of importance has been learned of late from analyses of Coastal (Aten 1983; Ellis 1992; Ricklis 1990), Canyonlands (Boyd et al. 1993), and Toyah phase ceramics (Johnson 1994; Quigg and Peck 1995; Treece et al. 1993). Nevertheless, overall it is fair to say that our general level of understanding concerning prehistoric ceramics, and the appreciation of the kinds of useful information their study can provide about cultural affiliations, well-defined temporal frameworks, site function, food processing and storage, and trade and exchange between groups, is not well developed in Texas archeology today.

This paper begins to redress this relative lack of attention given prehistoric and historic aboriginal ceramics by Texas archeologists. We consider regional ceramic assemblages in Texas (i.e., Northeast Texas [Caddoan], North Central [Plains Village], East Central, Southeast Texas, Central and South Texas [Toyah and Rockport], Rolling Plains and Panhandle [Antelope Creek] and Caprock Canyonlands, and West Texas Mountains and Basins [Jornada Mogollon]), and focus on two main goals: (a) to discuss the technology and functional character of these regional ceramic assemblages (Figure 1); and (b) to summarize the context and temporal framework of the assemblages, with particular attention to changes over time and space in the ceramic styles, design elements, types, and vessel forms for each Texas region.

Caddoan Ceramics from Northeast Texas

The distinctive styles and forms of ceramics found on sites in Northeast Texas hint at the variety, temporal span, and geographic extent of a number of prehistoric Caddoan groups in this region (cf. Thurmond 1985, 1990). The diversity in decoration and shape in Caddoan ceramics is substantial, both in the utility ware jars and bowls, as well as in the fine ware bottles, carinated bowls, and compound vessels. However, prehistoric ceramics had been manufactured in Northeast Texas for about 1000 years before the development of the Late Prehistoric (after ca. A.D. 800/900) Caddoan ceramic tradition.

Story (1990:246-247, 277-319), in an excellent discussion of the cultural context and archeological character of these early ceramic-making groups, indicates that the earliest ceramics in the

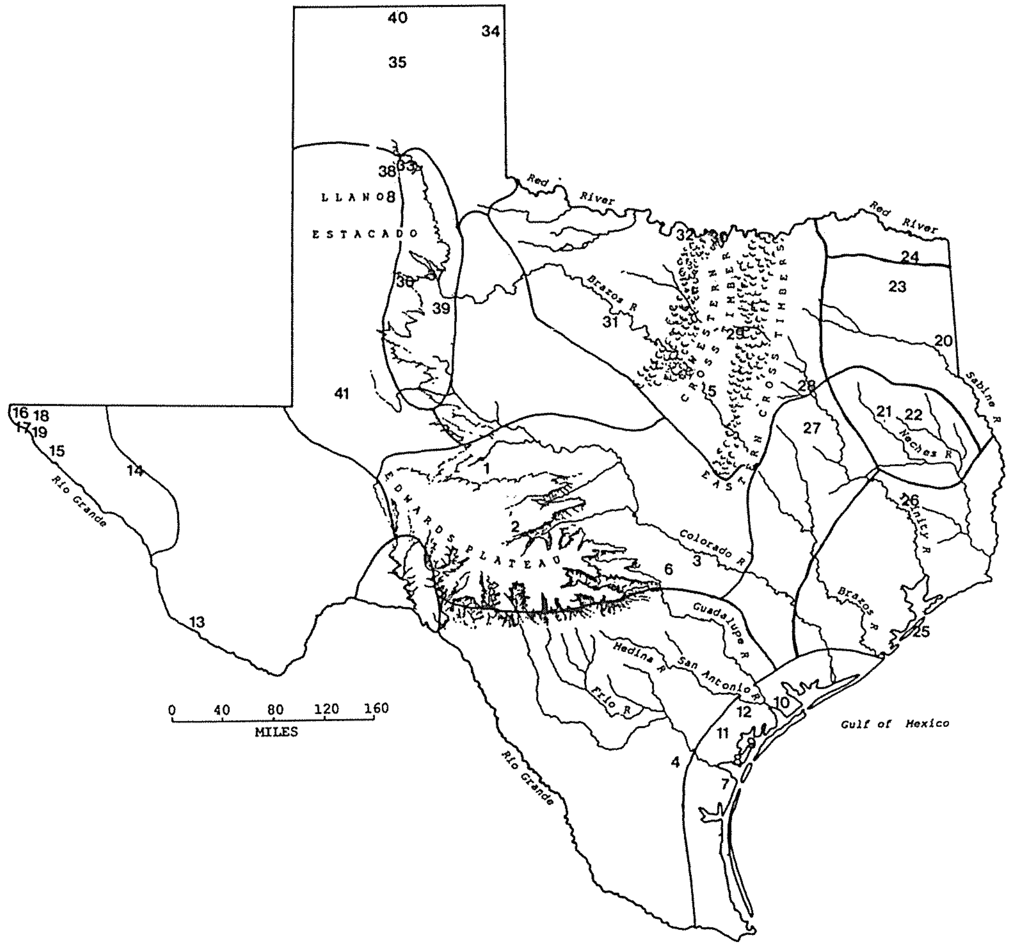


Figure 1. The Distribution of Regional Ceramic Assemblages in Texas and selected archeological sites mentioned in the text. Toyah phase sites: 1, East Levee; 2, Buckhollow; 3, Smith; 4, Hinojosa; 5, Kyle; 6, Mustang Branch. Rockport phase sites: 7, Kirchmeyer; 8, McGloin Bluff & 41SP120; 9, Live Oak Point; 10, Mustang Lake; 11, Aransas River sites; 12, Mellon. West Texas sites: 13, Polvo; 14, Granado Cave; 15, 41HZ493; 16, North Hills; 17, Firecracker Pueblo; 18, Hot Wells; 19, Ysleta WIC. Northeast Texas sites: 20, Resch; 21, George C. Davis; 22, Deshazo; 23, Benson's Crossing; 24, 41MX5. Southeast Texas sites: 25, Mitchell Ridge; 26, Carl Matthews. East Central Texas sites: 27, Jewett Mine sites; 28, Bird Point Island. North Central Texas sites: 29, Cobb-Pool; 30, Chicken House & Dillard; 31, Harrell; 32, Spanish Fort sites. Lower Plains, Caprock Canyonlands, and Texas Panhandle sites: 33, Deadman's Shelter; 34, Buried City Complex; 35, Antelope phase sites, Canadian River; 36, Lubbock Lake; 37, Bridwell; 38, Tierra Blanca; 39, Headstream & Longhorn; 40, Palo Duro Reservoir; and 41, Andrews Lake.

region date between ca. 500-100 B.C. and are closely related to the kinds of ceramics being produced in the Lower Mississippi Valley (LMV). Groups manufacturing these early ceramics were relatively sedentary hunter-gatherers. South of the Sabine River, the earliest locally produced ceramics are plain wares with sandy pastes (sharing similarities with the coastal and inland Southeast Texas ceramic Goose Creek Plain), while north of the Sabine River to the Red River, the early ceramics are principally from thick, plain grog- (Williams Plain) and bone-tempered (Cooper Boneware) vessels, although sandy paste wares are also present in low numbers (Story 1990:246).

Between the introduction of ceramics in the region, and the emergence of distinctive Caddoan vessel forms and decorative motifs around A.D. 800, the local plain ware traditions seem to have continued relatively unchanged. LMV-related ceramics are present as well, although not in great numbers, including distinctive Marksville, Troyville, and Coles Creek incised and stamped vessels (see Phillips 1970) from sites such as Resch, Coral Snake, Tankersley Creek, and James Pace in the Sabine River and Cypress Creek basins.

As Story (1990:247) notes:

> Sometime probably between A.D. 700 and A.D. 900 (there is a lot of room for arguing the age), Caddoan ceramics came to dominate the northeastern part of [Texas]. These ceramics are distinguished by certain vessel forms (especially a long-necked bottle with a globular body and a carinated bowl), engraved decorations, and other attributes. Although the bottle form and engraving may have an exotic origin, most of the Caddoan ceramics can be recognized as local developments with strong influences from the LMV.

A diverse and distinctive ceramic assemblage characterizes the Caddoan tradition in Northeast Texas. Ceramics are quite common in domestic contexts on habitation sites across the region (i.e., it is not unusual to recover more than 10,000 sherds from hundreds of vessels on Caddo settlements on excavation projects, and assemblages with upwards of 100,000 sherds are not uncommon at the larger sites), and also occur as grave goods in mortuary contexts (see for example the large well-analyzed sherd assemblages from George C. Davis [Newell and Krieger 1949; Stokes and Woodring 1981], Deshazo [Fields 1981], Benson's Crossing [Driggers 1985], and 41MX5 [Brewington et al. 1995]). Much attention has been paid by Caddoan archeologists over the years to the well-made ceramics manufactured by the Caddo peoples, and it is accurate, we think, to state that the study of Caddo ceramics is integral to the study of any Caddo site in the four-state Caddoan archeological area.

The Caddo made ceramics in a wide variety of vessel shapes (cf. Reynolds 1992), and with an abundance of well-crafted and executed (Johnson 1992) body and rim designs and surface treatments (Table 1). From the archeological contexts in which Caddo ceramics have been found, as well as inferences about their manufacture and use, it is evident that ceramics were important to the prehistoric Caddo in: the cooking and serving of foods and beverages, in the storage of foodstuffs, as personal possessions, as beautiful works of art and craftsmanship (i.e., some vessels were clearly made to never be used in domestic contexts), and as social identifiers (that is, certain shared and distinctive stylistic motifs and decorative patterns marked closely related communities and constituent groups [David et al. 1988; Thurmond 1985]).

The Caddo made both fine wares (with very finely crushed temper [Schambach and Miller 1984:109]), bottles and many bowls, and utility wares (some of the simple bowls, as well as the jars that were made in a variety of sizes). Almost without exception, Caddoan ceramics were tempered with grog (crushed sherds) or bone, although burned and crushed shells were used as temper after ca. A.D. 1300 among most of the Red River Caddo groups (see Bruseth 1995; Schambach and Miller 1984) and on later Caddoan sites in the upper Sulphur River basin (see Fields et al. 1994; Cliff and Perttula 1995). After adding the temper to the clay, the kneaded clay was formed into clay coils that were added to flat disk bases to form the vessel, and the coils were apparently smoothed with a round river pebble to create the finished vessel form. Decorations and slips were added before, as well as after, baking in an open fire, and commonly the vessels were then burnished and polished; red ochre and white kaolinite clay pigments were often added to or painted on to the decorations on bottles and carinated bowls.

These kinds of ceramics were designed to serve different purposes within Caddoan communities and family groups—from that of a cooking

Table 1. Caddoan Vessel Forms*

Decoration	ca. A.D. 900-1400	ca. A.D. 1400-1700
Engraved	bowls: carinated, boat-shaped, cylindrical, compound, hemispherical, simple, deep, flat, globular; bottles, effigy bottle, gourd-shaped bottle; compound bottle, goblet, spitoon-shaped, small jar, and cylindrical jar	bowls: compound, deep, simple, carinated, conical and globular, compound globular, vase-like, squat square box, hemispherical; hubcap; platter, ladle-like, barrel-shaped, short globular and tripod bottles, ollas, effigy bottles, bottles with legs, and small jars
Incised	cylindrical jar, small jar, oval effigy, barrel-shaped, bottle, bowls:simple with rim peaks, carinated, small hemispherical, compound and deep, globular, and square bowl	jars
Trailed-Incised	-	jars
Pinched	small jars (some with pedestal base), simple bowls, bottle	-
Fingernail-Impressed	small jars, carinated bowls, compound bowl, compound vessels	-
Punctated	small jars	jars
Punctated-Incised	carinated bowls, cylindrical vessels, shallow bowls	jars
Ridged	-	jars
Neck-banded	jars	jars
Appliqued	-	jars
Brushed	-	jars, ollas, barrel-shaped, carinated bowls
Stamped	-	globular jars, triple vessels (joined globular bowls)
Noded	bottles (includes tripod bottles)	bowls and bottles
Rattles & Effigies	-	bowls and bottles
Plain	bowls: simple, carinated, deep, hemispherical; jars, plates or platters, barrel-shaped vessels, and bottles	jars

* After Suhm and Jelks (1962)

pot to the mortuary function of a ceremonial beaker—and this is reflected in differences in paste, surface treatment, firing methods, decoration, and vessel form between the two wares. Both the early and later Caddoan fine wares were usually well-polished, and decorated with fine-line incised and engraved designs (Figure 2a-n, Figure 3a-p, and Figure 4a-e, h). The earlier Caddoan fine ware designs are curvilinear, rectilinear, and horizontal, and frequently cover the entire vessel surface; other fine ware designs simply are placed on the rim (see Figure 3c, f-k, m-n), or sometimes on the interior rim surface. In general, the earlier Caddoan fine wares across Northeast Texas (and indeed extend-

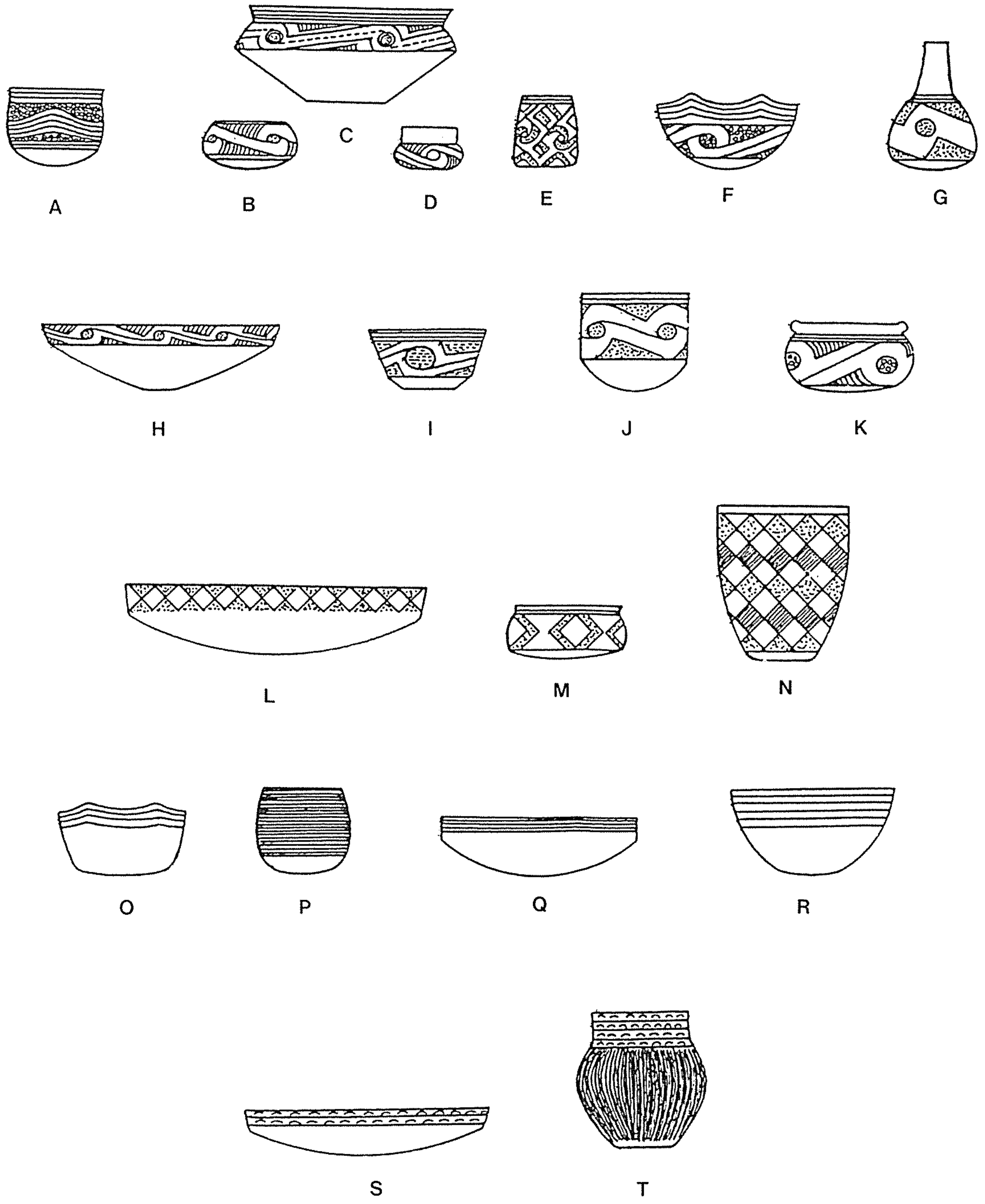


Figure 2. Early Caddoan Ceramic Forms and Decorations (after Krieger 1946): a-k, curvilinear incised and punctated; l-n, punctated-incised; o-r, horizontal incised; s, fingernail impressed; t, fingernail impressed-brushed.

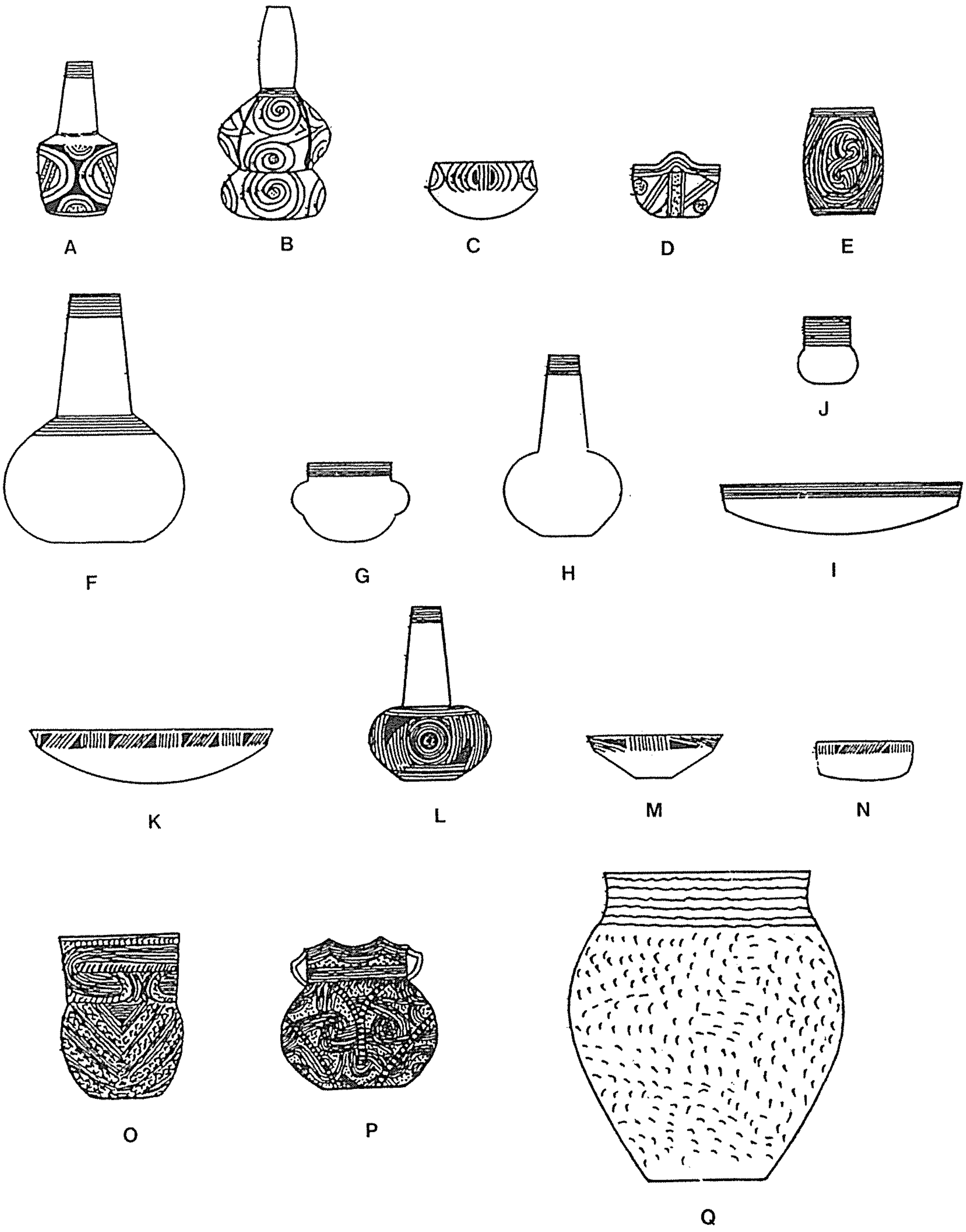


Figure 3. Early Caddoan Bottles, Bowls, and Jars (after Krieger 1946): a-e, l, curvilinear and scroll engraved; f-j, horizontal engraved; k, m-n, vertical and diagonal engraved; o-p, complicated incised; q, neck-banded-punctated.

ing across much of the Caddoan area itself) are quite uniform in style and form, suggesting broad and extensive social interaction between Caddoan groups across the region.

The later Caddoan fine ware designs in Northeast Texas include scrolls, scrolls with ticked lines, scrolls and circles, negative ovals and circles, pendant triangles, diagonal lines and ladders, and S-shaped motifs (see Figure 4a-e, h; also Suhm and Jelks 1962; Shafer 1981; Middlebrook 1994; Fields et al. 1994:Figure 13; Perino 1994:Figures 9-14). These kinds of decorative elements continued in

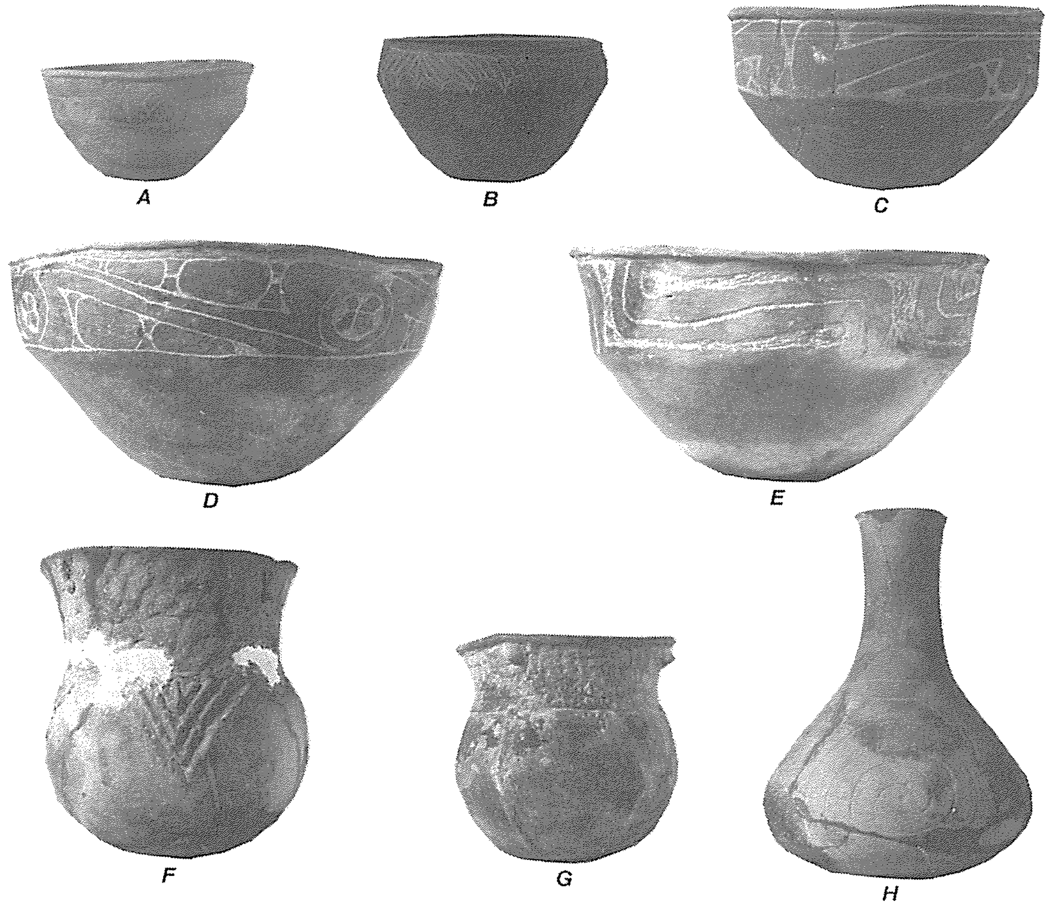


Figure 4. Late Caddoan bowls, jars, and bottle: a-e, engraved curvilinear and scrolls; f-g, neck-banded and applique; h, engraved scrolls. Photographs courtesy of the Texas Archeological Research Laboratory.

use in historic Caddoan ceramics (that is, until about A.D. 1800 [Gregory 1973]). They are best exemplified by the intricate scrolls, ovals, and circles on Hudson Engraved and Keno Trailed bottles and Natchitoches Engraved bowls among Red River Caddoan groups, the scrolls and ticks of Patton Engraved among Hasinai Caddo groups south of the Sabine River (Fields 1981), and the pendant triangles and engraved scolls on Womack Engraved bowls on the upper Sabine (Duffield and Jelks 1961; Jelks 1967) and the middle Red River (Harris et al. 1965).

The later Caddoan fine wares (that is, dating after ca. A.D. 1300/1400) are more stylistically diverse across Northeast Texas, and there are very specific differences in vessel shapes, designs, and decorative attributes between Caddoan ceramics in individual drainages, or even within specific smaller segments of river and creek basins (e.g., Thurmond 1985; Perttula et al. 1993). This diversity can be reasonably interpreted to be representative of specific Caddoan social groups. In historic Caddoan times, ceramic vessel forms and decorations are considerably more homogeneous across much of the Caddoan area, suggesting extensive intra-regional contact between contemporaneous Caddoan groups (Perttula 1992:154 and Table 14).

Table 1 indicates the impressive diversity of vessel forms among the Caddoan fine wares. This includes carinated bowls, deep compound bowls, double and triple vessels (joined bowls and bottles [Suhm and Jelks 1962:Plates 38k, 51e, 59d]), bottles, ollas, zoomorphic and anthropomorphic effigy bowls and bottles, ladles, platters, peaked jars, gourd and box-shaped bowls, and chalices.

The Caddoan utility vessels usually have a coarser paste, a rougher surface treatment, and thicker body walls than the fine wares, which was probably related to the performance needs of the cooking pot to withstand thermal shock and cracking during use (see the experimental studies by Schiffer et al. 1994 on the thermal response of cooking pots). Typical utility vessel shapes included small to large jars (see Figure 2t, Figure 3q, and Figure 4f-g), as well as a variety of conical and simple bowl and bottle forms, most of the latter in the earlier Caddoan ceramics (and the historic Caddoan ceramics) being plain and unpolished. The utility vessels have carbon encrustations, food residues, and soot stains, suggesting they were employed by the Caddo as cooking pots. Some of these kinds of vessels were used primarily for storage (those with large orifice diameters and vessel volumes) of foodstuffs and liquids.

While plain utility vessels were commonly used by Caddoan groups in Northeast Texas, particularly before ca. A.D. 1300-1400 (see Table 1), they were also decorated in a variety of ways. The earlier Caddoan utility wares had horizontal (see Figure 2o-r) and cross-hatched incised lines, fingernail impressions (see Figure 2s-t), pinching, fingernail and tool punctates on the rim and bodies, as well as neck-banding, at least south of the Sabine River [see Newell and Krieger 1949] (see Figure 3q). The types of decorations and/or surface treatments on later Caddoan utility vessels included neck-banding or corrugation (see Figure 4f-g), brushing, ridging, applique (Perino 1994:Figure 7e-f, h), and combinations of zoned and diagonal incised and punctated designs on the rim and body of jars. In historic Caddoan times, rows of fingernail punctations on the rim of everted-rim Emory Punctated-Incised jars are a common decorative treatment. Handles and lugs were present on some of the utility vessels.

Caddoan ceramics were apparently widely traded in Texas, as they have been found in significant quantities on North Central, East Central, Central, and inland Southeast Texas archeological sites (Story 1990:247). The earlier Caddoan ceramics (dating before ca. A.D. 1300) were most widely distributed in the upper Trinity and Brazos River basins of North Central Texas (see Prikryl and Perttula, below), and in inland Southeast Texas, while the Late Caddoan ceramic wares appear to have been most commonly exchanged with East Central and Central Texas groups after A.D. 1300, as well as with prehistoric peoples living along the Trinity River in inland Southeast Texas (McClurkan 1968). Caddoan ceramic finewares were also traded extensively in parts of the Midwest and Southeastern U.S., most notably after ca. A.D. 1300-1400 with Native American groups living in the Lower Mississippi Valley of Arkansas and Louisiana (Early 1993:232-233).

Other types of ceramic artifacts manufactured by prehistoric Caddoan groups include ceramic earspools and disks, figurines, and a variety of pipe forms (Jackson 1933:71). The earliest types of Caddoan clay pipes were plain, tubular and cigar-shaped forms, followed by the long-stem "Red River" pipes (Hoffman 1967) with burnished and polished stems and bowls; rectangular platform pipes and some elbow pipe forms (Bruseth and Perttula 1981:Figure 5-11a-b) have also been recovered in Caddoan sites dating before A.D. 1200. The later Caddoan pipe forms in Northeast Texas are biconical and elbow pipe forms with small bowls (< 25 mm) and small stem diameters (< 25 mm) (see Jackson 1933:Plates 16-18).

Two recent advances in the study of Caddoan ceramics hold great promise for increasing our knowledge about prehistoric stylistic, technological, and functional changes in this material culture. First, compositional analyses using petrographic and chemical characterizations are now being used on samples of Caddoan ceramics (see Fischbeck et al. 1989; Steponaitis et al. 1995) to discern manufacturing techniques, source/regional distributions of particular wares, and functional characteristics of different kinds of vessels (Reese-Taylor 1994, 1995a). For example, recent analyses of the petrographic constituents in the pastes of Caddoan ceramic assemblages in the Sabine River, Cypress Creek, and Sulphur River basins has shown that there appear to be consistent paste differences (specifically in the percentages of alkali feldspars and quartz) between the ceramics in each of the river and creek basins (Figure 5). This is turn seems to reflect the local basin-specific production by Caddoan groups of ceramic vessels from locally available clays (Reese-Taylor 1995), with limited evidence for the exchange of vessels from one group to another in different basins. This type of analysis should prove of great utility in examining the archeological record in Northeast Texas (and

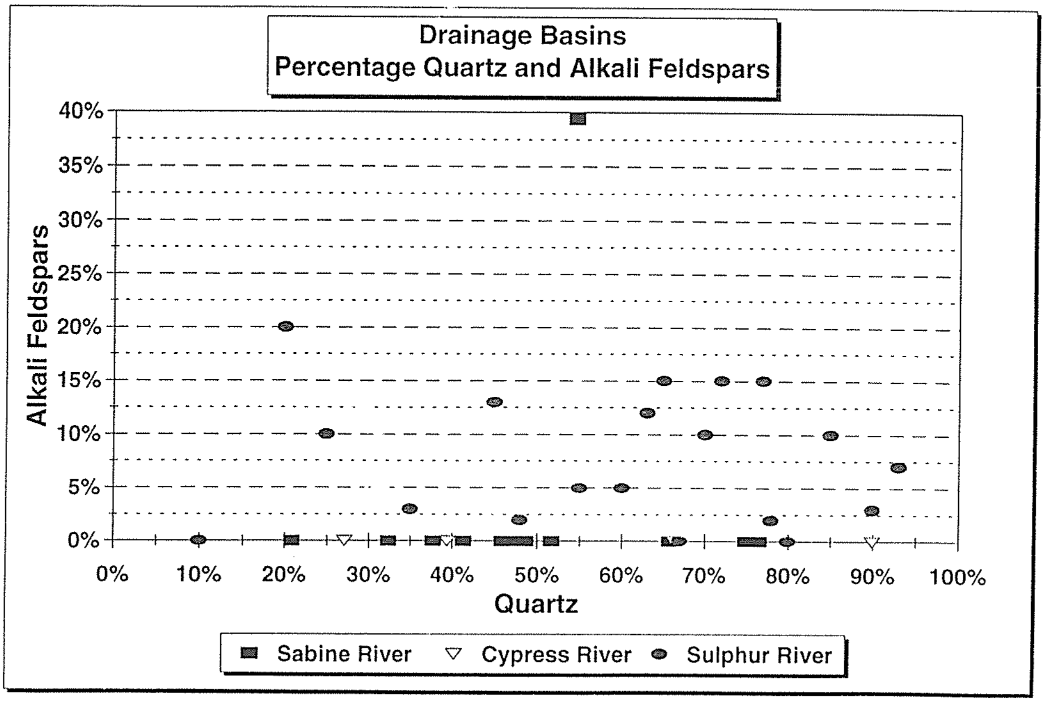


Figure 5. Petrographic Analysis of Quartz and Alkali Feldspars in Caddoan Ceramics from the Sabine, Cypress, and Sulphur River drainage basins (from Reese-Taylor 1995a).

adjacent regions) for considerations of cultural affiliation, and exchange between Caddo and non-Caddo groups, as well as for discerning manufacturing techniques, raw material use, source/regional distributions of particular wares, and specific functional characteristics of different kinds of vessels (Neff 1995; O'Brien et al. 1994).

Second, a very detailed analytical classificatory system of decorative motifs and patterns has been developed for Caddoan ceramics by Schambach (Schambach 1981; Schambach et al. n.d.) that has proved useful in detecting fine-scale temporal and stylistic changes (on the order of 20-30 years) in ceramic decoration among prehistoric Caddoan groups on the Red and Ouachita rivers in Arkansas and Louisiana (e.g., Schambach and Miller 1984; Kelley 1994). The system uses a hierarchical or paradigmatic (see Dunnell 1986) classification of decorative techniques and motifs (classes A-H, such as diagonal or vertical rectilinear incised [A], horizontal rectilinear and curvilinear designs [B], brushed [D], engraved [E], and applique [H], etc.) for rims and vessel bodies in combination with groups of similar designs within classes, called patterns. Figure 6 illustrates how the classification works with a sample of vessels from the Late Caddoan Cedar Grove site in southwestern Arkansas (Schambach and Miller 1984); for example, the Austin-Abraham vessels on the top row illustrate Class A rim and body decorations, while Austin 1 and Austin 2 represent different designs with the Austin pattern of vertical incising on short rims.

The definition of such stylistic attributes is well-suited to the recognition of comparable design, vessel, and rim sets across the Caddoan area. With this kind of specific and idiosyncratic information on prehistoric vessel decorations (element as well as placement), and forms, as well as the character of stylistic variation present at different times among related groups (e.g., Neiman 1995), we can confidently explore the nature of social relationships among Caddo groups "from the message and meaning ascribed to ceramic design" (Early 1995:4).

Southeast Texas

Prehistoric ceramics are common in inland and coastal sites throughout Southeast Texas (cf. Aten 1983; Bollich 1995). According to Aten (1983), ceramics were adopted by coastal hunter-gatherers about 2000 years B.P., and perhaps by 1500 years

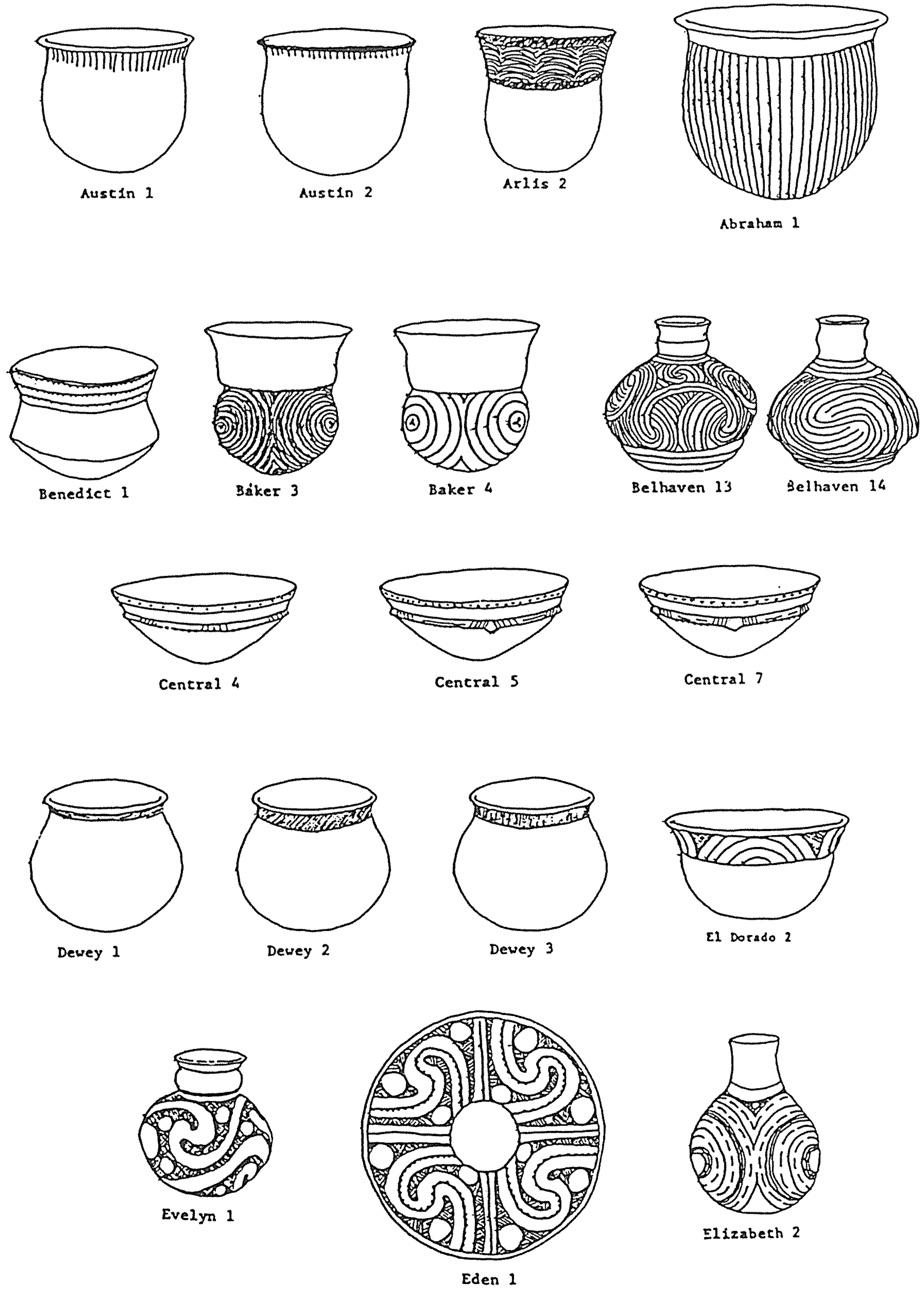


Figure 6. Class and Pattern Classification of Caddo Ceramics from the Cedar Grove Site, Lafayette County, Arkansas (after Schambach and Miller 1984).

ago in the Conroe-Livingston inland area; ceramics continued to be an important part of the material culture assemblage of these groups until at least A.D. 1700. Story (1990:256 and Figure 39) includes these coastal and inland groups under the rubric "Mossy Grove" as "a general cultural pattern and as a regional tradition that partly parallels development of the Caddoan tradition to the north. And, like the Caddoan tradition/culture, it encompasses the archeological remains of what were surely different ethnic (and possibly even linguistic) groups."

Recently compiled computer data bases for the region indicate that ceramics have been recovered in quantity from several hundred published surface-collected and excavated sites (Patterson 1993, n.d.). By far the dominant kind of ceramics in Southeast Texas is Goose Creek Plain (Aten 1983:231-232), an undecorated sandy paste ware that was manufactured across the region (Table 2). This ceramic occurs as relatively simple and small to medium sized jars, beakers, and bowls (Figure 7) with rounded bases and relatively straight (vertical) walls (Ellis 1994; Ricklis 1994; Weinstein 1991).

Aten (1983:206-245) has developed a useful ceramic typological system for prehistoric and early historic Southeast Texas ceramics, basing his approach on the type-variety system propounded by Phillips (1970) for the LMV. Ceramic pastes (i.e., untempered sandy paste, sand-tempered, bone-

Table 2. Ceramic Type Distributions

Pottery Type	COASTAL MARGIN West	COASTAL MARGIN Central	COASTAL MARGIN East	INLAND ZONE West	INLAND ZONE Central	INLAND ZONE East
Goose Creek Plain	7*	19	87	33	55	9
Goose Creek Incised	2	12	36	8	17	5
Goose Creek Red Film	-	4	11	-	-	-
Goose Creek Stamped	-	4	-	-	3	5
Conway	-	1	10	5	9	-
Rockport	-	-	-	4	2	1
Asphalt-coated 1	-	2	-	-	-	
Bone-temper	2	8	20	11	9	6
Shell-temper	-	1	11	-	-	-
San Jacinto Plain	6	13	61	7	12	7
San Jacinto Incised	1	8	32	2	3	5
Techefuncte	-	4	12	-	2	-
Marksville Stamped	-	-	-	-	-	1
Mandeville Plain	-	3	5	-	-	-
Caddoan	-	-	-	1	3	5

*Number of sites (Patterson 1993, n.d.). Based on a sample of 39,140 sherds from coastal margin sites and 29,437 sherds from inland Southeast Texas sites.

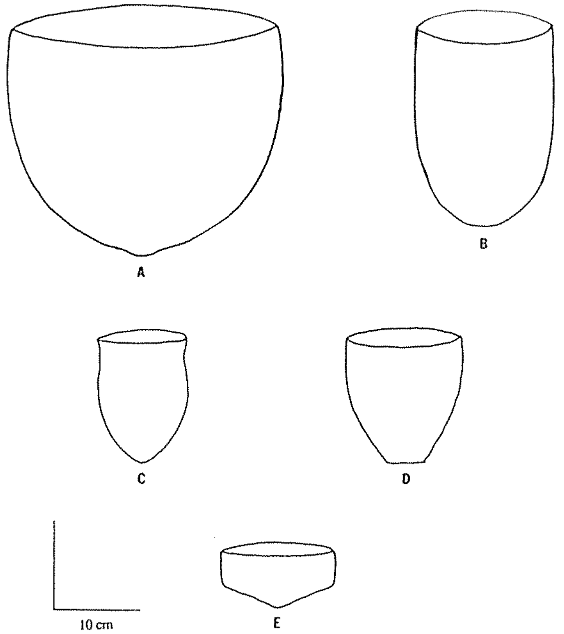


Figure 7. Vessel Forms from a probable Clear Lake period (ca. A.D. 100-425) site in Harris County, Texas (from Ring 1994:Figure 15).

tempered, and grog-tempered) are the key to the typological classification of Southeast Texas ceramics, since most of the vessels were apparently undecorated, but he also used decorative attributes (such as incising, stamping, red filming, etc.) to define specific varieties (Figure 8), including Goose Creek Incised, Goose Creek Red-Filmed, and others.

From this classificatory scheme, Aten (1983:Figure 14.1-14.3) has created a detailed ceramic seriation that charts temporal changes in pastes and vessel decorations. This ceramic seriation has recently been shown not to work that well for estimating the chronological placement of specific ceramic assemblages (Ellis and Ellis 1994; Ricklis 1994:213-215), probably in large measure because it is based on small sherd sample sizes, the limited stylistic variability in Southeast Texas ceramics, and slow rates of change in the use of different types of paste (which is probably tracking basic technological continuities in the manufacture and use of ceramics in the region). Nevertheless, it still has merit as a chronological tool (particularly in the absence of independently derived absolute dates), and is currently the best available synthesis of Southeast Texas ceramic change.

From Aten's (1983:Figure 14.1) Galveston Bay area seriation, by about A.D. 100 untempered sandy paste ceramics—plain (Goose Creek Plain) and stamped (Goose Creek Stamped)—and LMV Tchefuncte wares (with contorted pastes and poor wedging) were common, with low amounts of coarse-grained sand-tempered pottery (O'Neal Plain *variety Conway*) between about A.D. 250-425 (Aten 1983:287). Goose Creek Incised and Goose Creek Red-Filmed, although present earlier, became more common (perhaps combining for as much as 10 percent of particular site ceramic samples) between ca. A.D. 650-1000, after which Goose Creek ceramics are virtually replaced by plain and decorated grog-tempered wares.

Aten (1983) has defined these grog-tempered wares as Baytown Plain and San Jacinto Incised, and suggests they are most frequent in sites dating between A.D. 1000-1400+, after which they rapidly declined in popularity. More recently, Weinstein (1991:106) has proposed that Baytown Plain along the Upper Texas Coast be restricted to vessels having obvious and abundant grog temper in a clayey or silty paste matrix, as it is in the LMV

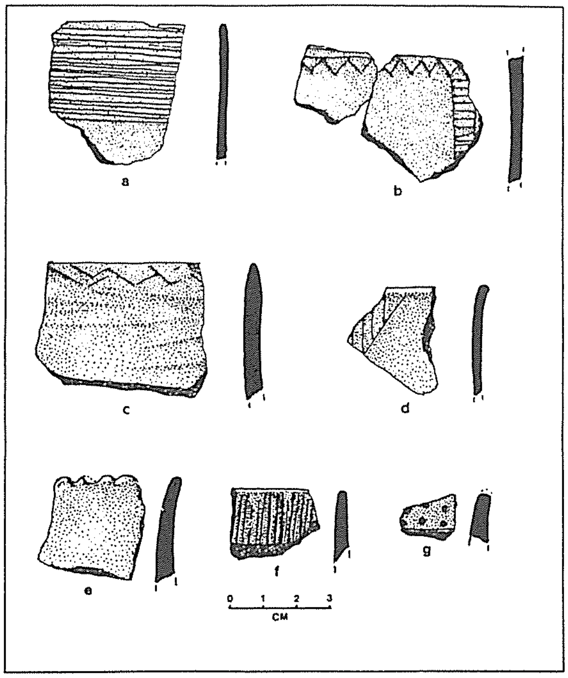


Figure 8. Decorated Sherds from the 1970s Excavations at the Mitchell Ridge (41GV66) site (from Ricklis 1994:Figure 7.21): a, multiple horizontal incised lines; b, multiple horizontal incised lines with secondary element of pendant triangles; c-d, pendant triangles as primary design element; e, nicked lip as primary design element; f, vertical brushing; g, decorated with small, round punctations.

classification, and that a San Jacinto Plain type be used for sandy paste sherds with only small amounts of finely-crushed grog. Weinstein (1991) further suggests that the Baytown Plain wares are not common in Southeast Texas other than between ca. A.D. 1300-1400, and that the clearly locally produced Goose Creek and San Jacinto jars and bowls dominate the ceramic assemblages up to about A.D. 1700. Analyses of vessel forms made during this period of grog-tempered ceramics (Figure 9) indicate that they were predominately straight-walled jars and wide-mouth bowls (Ellis 1994; Howard 1990; Ricklis 1994; Weinstein 1991).

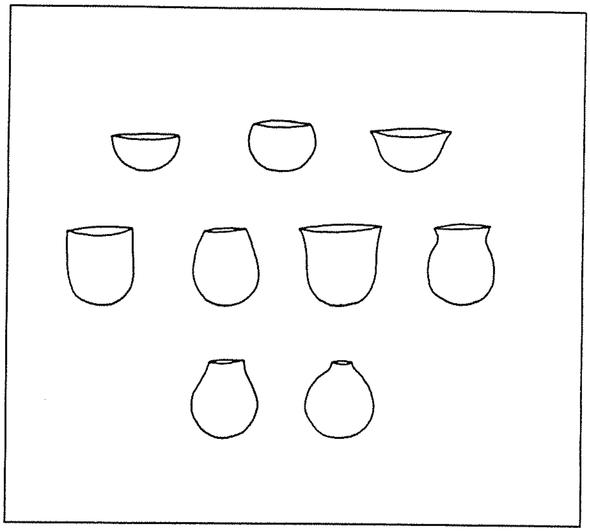


Figure 9. Galveston Bay Late Prehistoric Vessel Shapes from the Mitchell Ridge site (from Ricklis 1994:Figure 7.6).

Incised ceramics of several different styles and decorative motifs (Aten 1983:Figure 12.6) are particularly characteristic of the period between ca. A.D. 1000-1700 in both San Jacinto and Goose Creek ceramics. These include in approximate sequential order as follows: zoned incised-punctated designs, multiple horizontal incised lines, and diagonals, cross-hatching, engraved panels, and pendant triangles (Aten 1983:242). As Aten (1983:242) and Ricklis (1994:209) have pointed out, there are many parallels between coastal and inland Southeast Texas ceramic styles and decorative styles used in contemporaneous LMV Coles Creek and Plaquemine culture ceramics (Figure 10). Ricklis (1994) also identifies lip incising and scalloping as common decorative elements in the large (+26,000 sherds) Mitchell Ridge (41GV66) ceramic assemblage, which dates principally between ca. A.D. 1300-1600. He defines these decorative elements as Goose Creek Modified Lip and San Jacinto Plain Modified Lip types.

The period after A.D. 1000 in Southeast Texas is also marked by the occasional appearance of Caddoan ceramics, including kinds of engraved, incised, and brushed sherds being made and used by Early and Late Caddo groups in the Neches and Angelina River basins of Northeast Texas. Caddoan ceramics are quite abundant in the Conroe-Livingston area (Aten 1983:Figure 14.5), and Aten (1983:295) suggests from the ceramic analysis of four sites and three radiocarbon dates that there were two peaks in the frequency of Caddoan ceramics in the area (ca. A.D. 1000-1350, and after A.D. 1500).

Bone-tempered ceramics appear in some quantity in Southeast Texas after ca. A.D. 1400. As Patterson (this volume) notes, some of the ceramics in the western part of the region may be related to Toyah phase Leon Plain, but elsewhere in the region its sandy paste, and occasional incised designs, clearly relate it to the Mossy Grove ceramic tradition (e.g., Aten 1983:244). At about the same time as the peak in bone-tempered ceramics, Goose Creek Plain ceramics appear to replace the San Jacinto Plain and Baytown Plain, and by A.D. 1700 it accounts for more than ca. 94 percent of the ceramic assemblages. From then until about A.D. 1800, ceramics decline in frequency on Native American sites in Southeast Texas, although Goose Creek Plain continued to be manufactured and used by these groups (Aten 1983:289).

Alabama-Coushatta ceramics are also found after 1800 in their recently established Southeast Texas village sites. The Carl Matthews site in Polk County is probably the best-known Alabama-Coushatta archeological site in the region. The Alabama-Coushatta ceramics are principally sandy paste, deep flaring, Chattahoochee Roughened, *var. Chattahoochee* jars, with roughened or brushed bodies, and with applique and crimped fillets along the rim (Jurney and Perttula 1995), but cazuelas and hemipsherical bowls were also manufactured. In most particulars, Alabama-Coushatta ceramics are virtually identicial to the ceramics being made by their Creek Indian relatives in Alabama after 1780.

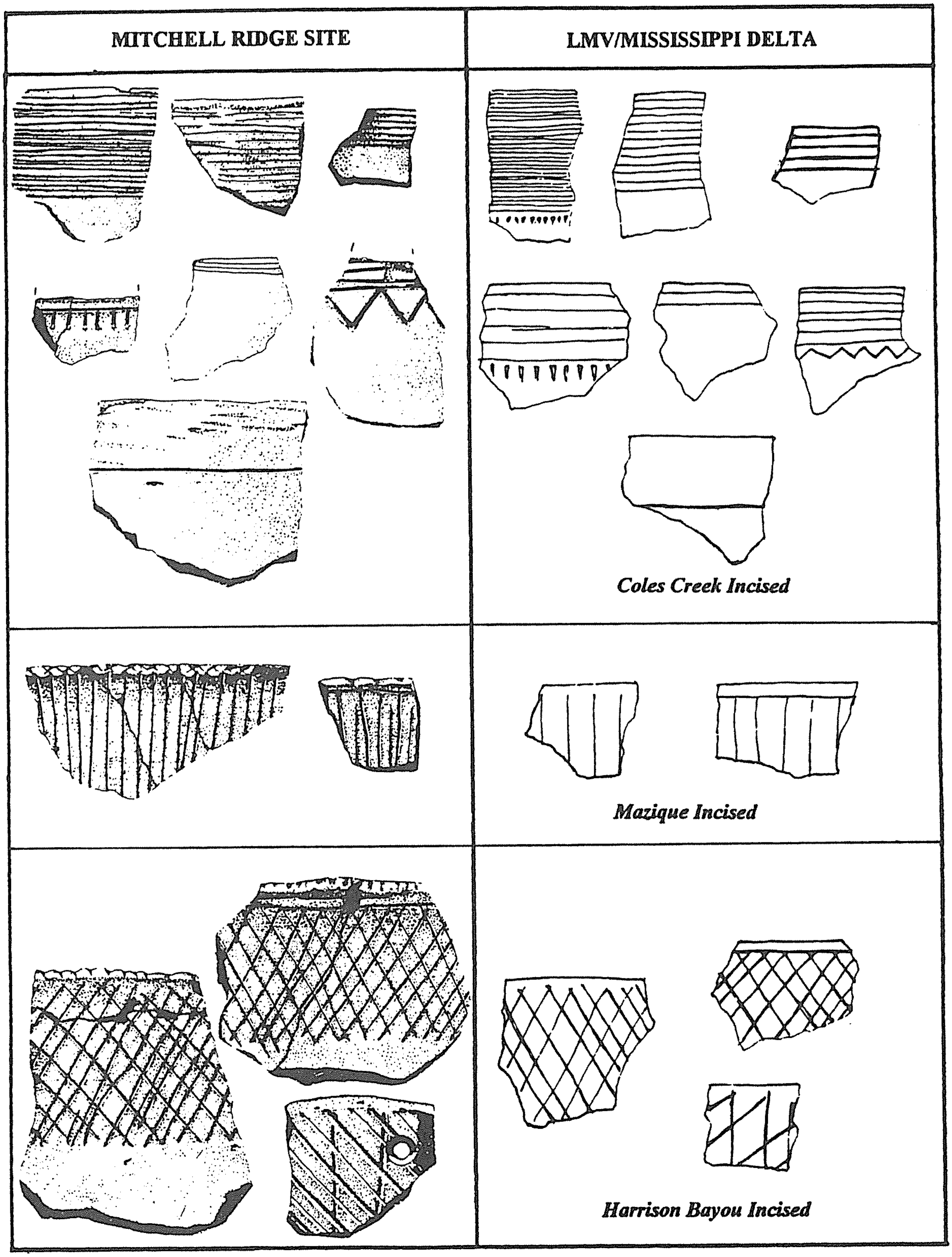


Figure 10. Similarities in decoration between Mitchell Ridge sherds and sherds from the Lower Mississippi Valley and Southern Louisiana (from Ricklis 1994:Figure 7.24).

East Central Texas

Sandy paste ceramics are apparently the earliest wares in the Trinity and Navasota River basins, being adopted by ca. 50 B.C. in Woodland or Early Ceramic period contexts (Fields 1993:119); these ceramics are quite comparable to the Goose Creek Plain ceramics noted in the southern part of Northeast Texas and across all of Southeast Texas. Thin shell-tempered and kaolin paste ceramics also appear in Early Ceramic contexts at several sites in the middle Trinity and Navasota River basins (McGregor and Bruseth 1987; Fields 1993).

By about A.D. 800, the early plain wares were replaced by grog, grit, and bone-tempered jars, simple bowls, and carinated bowls with punctated and incised decorations on vessel rims and bodies (Bruseth 1987:Table 8-17). The decorative elements are quite similar to those seen on Northeast Texas Caddoan utility wares, and the stylistic resemblances increase in ceramic assemblages dating after ca. A.D. 1000 (McGregor and Bruseth 1987:184; Fields et al. 1991).

At Richland Creek, dominant ceramic decorative styles between ca. A.D. 1000-1200 include horizontal incised lines with zoned punctates, random punctations, and diagonal incised lines, with incised and punctated sherds accounting for about 55 percent of the decorated sherds at Bird Point Island (Bruseth 1987:Table 8-17); engraved sherds represent only about 3 percent of the decorated sherd sample. Similar ceramic styles are evident in Late Prehistoric assemblages from a number of sites at the Jewett Mine (Fields et al. 1991). The later ceramics (dating after ca. A.D. 1300/1400) again bear strong resemblances to Caddoan ceramics from Northeast Texas, particularly from Frankston phase Caddoan groups residing in the upper Neches and Angelina River basins (cf. Shafer 1981; Fields 1981). Well represented are brushed, incised, engraved, neck-banded, and punctated vessels that compare well to the Poynor Engraved, Maydelle Incised, and Bullard Brushed types (Bruseth 1987:125-126; Fields et al. 1991:254-256).

Bruseth (1987:125-126) interprets the Caddoan-related ceramics at Richland Creek to be of local manufacture, but a product of "interaction with these eastern neighbors," with the possibility of some occupation by Caddo groups from East Texas after ca. A.D. 1300. Fields et al. (1991:258) conclude that the Jewett ceramics are "comparable to Caddoan pottery from East Texas proper, and there is no reason to suppose that most of the vessel ceramics were not deposited as a result of occupations by Caddoan groups." Detailed petrographic and chemical analyses of the pastes of Northeast Texas Caddo and East Central Texas ceramics (e.g., Reese-Taylor 1995a), in conjunction with the study of stylistic and functional attributes of both regional assemblages, should help to resolve the cultural and social affiliation of the Late Prehistoric ceramics from this region.

Other types of ceramic artifacts were made in Late Prehistoric times in East Central Texas. Ceramic pipes are present, although not nearly as common as on domestic Caddo sites in Northeast Texas, and the forms of the pipes are different from the long-stemmed or elbow pipes most common in the latter region (Fields et al. 1991:258 and Figures 43 and 93d; Bruseth 1987:123-124). Several small clay beads were found at Bird Point Island in a post-A.D. 1300 context (Bruseth 1987:Figure 8-4c-d).

North Central Texas

Daniel J. Prikryl and Timothy K. Perttula

Prehistoric ceramics began to be made and used by aboriginal peoples in North Central Texas after about A.D. 1000. Although it is possible that some small amount of grog, grit, and bone-tempered ceramics were being used as early as ca. A.D. 750 ± 100 at the Baggett Branch site (41DL149) in the upper Trinity River basin (Peter and McGregor 1988a; see also Story 1990), ceramics, however, become common only in archeological contexts in the region after about A.D. 1000.

A diverse range of prehistoric ceramic wares occur across the North Central Texas region, although with the exception of villages on the Red River (e.g., Lorrain 1967, 1969; Martin 1994; Price 1993; Witte 1935, 1936), and an occasional site on the middle Brazos (Wright 1995), the Elm Fork (Prikryl 1990; Ferring and Yates 1995), West Fork (Peter and McGregor 1988b), and East Fork of the Trinity River, in most cases ceramics are not a particularly abundant part of the material culture of the Late Prehistoric cultural groups in the region. For example, of 238 Native American sites reported by Prikryl (1990) on the Elm Fork, only 35 sites (14 percent) have yielded aboriginal ceramics. This rarity in ceramics is especially evident in comparison with that seen in contemporaneous Caddoan groups in Northeast Texas, and Jornada Mogollon Puebloan groups in West Texas, where ceramics are by far the most abundant artifact class. This must relate to the relatively minimal importance of the use and function of ceramic vessel containers in the cooking and storage of food stuffs, oils, and seed stock in the North Central Texas region.

As we discuss below, by far the most common kinds of ceramics found in ca. A.D. 1000-1300 archeological assemblages in North Central Texas are plain and decorated non-shell-tempered wares that resemble the ceramics found on Caddoan sites (Krieger [1946], and Harris [1936, 1945] before him, noted this characteristic of the ceramics from North Central Texas sites) in the Neches, Sabine, and Red River drainages in the Pineywoods and Post Oak Savannah (see Perttula, this volume). Plain mussel shell-tempered (also including fossil-shell and other calcareous aplastics) pottery is also well-represented in the North Central Texas region, principally on Plains Village archeological sites (i.e., the outmoded Henrietta focus or complex) that date after about A.D. 1250/1300. We discuss these ceramics in more detail later, but we turn first to a consideration of the pre-A.D. 1300 ceramics manufactured, and/or traded for, by aboriginal peoples in the prairies and savannah habitats of North Central Texas.

Caddoan grog-, bone-, and grog/bone-tempered decorated ceramics (incising, engraving, and punctated elements) are notable in prehistoric archeological sites dating before ca. A.D. 1300 along the East Fork of the Trinity River and the Blackland Prairie (i.e., Harris 1936, 1945; Krieger 1946:131; Ross 1966; Sorrow 1966; Martin and Bruseth 1988), on the Elm Fork (Prikryl 1990), in rock shelter and terrace sites in the middle Brazos River basin (Jelks 1962; Stephenson 1970; Brown et al. 1987; Story 1990; Wright 1995), and at the Cobb-Pool site at Joe Pool Lake in the drainage basin of the West Fork Trinity River (Peter and McGregor 1988b). Since there have been no petrographic or chemical compositional analyses of these Caddoan ceramics to be certain of their place of manufacture or source area, no general consensus has been reached about whether the Caddoan ceramics represent: (a) trade wares from Caddo groups in Northeast Texas, (b) locally-manufactured ceramic wares where vessel forms and decorative styles may have been borrowed or copied from nearby Caddoan communities, (c) the residues from actual settlement of Caddoan groups in North Central Texas, or (d) some combination of the above that may vary regionally and temporally. The occurrence of these Caddoan ceramics in the region speaks to important issues of local and extra-local trade and exchange between Caddoan horticulturists/agriculturists and hunter-gatherers, as well as to perceived expansions in the broad land use patterns of the social and politically complex Caddoan communities between ca. A.D. 1000-1300 (e.g., Story 1990; Perttula 1993; see also Fields, this volume); thus, ceramic sourcing studies of the North Central Texas Caddoan ceramics will be crucial for unravelling Late Prehistoric cultural change in the region.

Along the middle Brazos, the small numbers of Caddoan ceramics are represented by portions of vessels of Hickory Engraved and Holly Engraved from rockshelter deposits (e.g., Jelks 1962:Figure 24; Stephenson 1970:Plate 23), while sherds from Kiam Incised, Dunkin Incised, and Weches Fingernail-Impressed vessels have been recovered in pre-A.D. 1300 contexts at sites such as Chupik (Story 1990), Asa Warner (Wright 1995), and McDonald (Brown et al. 1987). These kinds of Caddoan sherds point to associations with earlier Caddoan settlements in the Neches River basin of Northeast Texas (e.g., Newell and Krieger 1949; Stokes and Woodring 1981). In the upper Trinity River basin, any specific Caddoan regional affiliations are more elusive, in part because of the small size of the sherds in the collection (which make typological identifications difficult at best), and limited descriptions or illustrations of the decorated sherds in site assemblages (i.e., Peter and McGregor 1988b). Based simply on geographical proximity, however, one should look to Caddoan groups in the upper Sabine and middle Red River for vessel form and stylistic comparisons with the upper Trinity ceramics. In this regard, it is worth mentioning that a Sanders Engraved vessel (a Caddoan carinated bowl form manufactured between ca. A.D. 1100-1300 in the upper Sabine and middle Red River areas) was recovered in a burial context at the Upper Rockwall site on the East Fork of the Trinity (Ross 1966:Figure 10e).

The relatively large ceramic assemblage from the Cobb-Pool site (n=721 sherds) gives a good sense of the character of the pre-A.D. 1300 ceramics in the upper Trinity River basin, even in the absence of sherd illustrations (Peter and McGregor

1988b:149-158). The site, essentially interpreted as a single component occupation dated between ca. A.D. 1000-1200, contains primarily grog-, quartz- or grog-quartz-tempered ceramics decorated on the body and rim with parallel incised lines or random to parallel rows of fingernail punctations; the incised and punctated sherds account for 85 percent of the decorated sherds (Peter and McGregor 1988b:Tables 9-12 and 9-17). The decorated sherds represent about 29 percent of the sherd assemblage. Engraving (8 percent), brushing (5 percent), and interior slipped (2 percent) round out the decorated ceramics from the site. What sets the Cobb-Pool ceramic assemblage apart from contemporaneous Caddoan sites in Northeast Texas is the amount of plain shell (or fossil shell [Ferring 1988]) or shell-quartz-tempered sherds from Cobb-Pool (129 sherds or 18 percent of the ceramic assemblage [Peter and McGregor 1988b:Tables 9-12 and 9-17]); as discussed above, plain shell-tempered ceramics are absent from Caddo archeological sites in Northeast Texas till after A.D. 1300. Plain shell-tempered pottery, however, also occurs on several East Fork Trinity River and Trinity River archeological sites that were primarily occupied before A.D. 1300 (see Ross 1966; Sorrow 1966; Martin and Bruseth 1988), as well as in a component at the Chicken House site on the Red River in Cooke County, Texas that may date between A.D. 1030 and A.D. 1280 (Prikryl 1994; see also Lorrain 1969). The earliest shell-tempered pottery from this site is from plain flat-based flowerpot-shaped vessels (Figure 11a-b).

Southwestern ceramics are rare in North Central Texas archeological sites prior to A.D. 1300. After A.D. 1300, small quantities of Jornada Mogollon brownwares, Chupadero black-on-white sherds, and Rio Grande polychromes have been found in sites on the upper Red River, the Clear Fork of the Brazos, and on the Elm Fork of the Trinity (see Krieger 1946; Prikryl 1990; see also Miller's discussion of West Texas Puebloan ceramics, below). This seems to reflect broad, regional

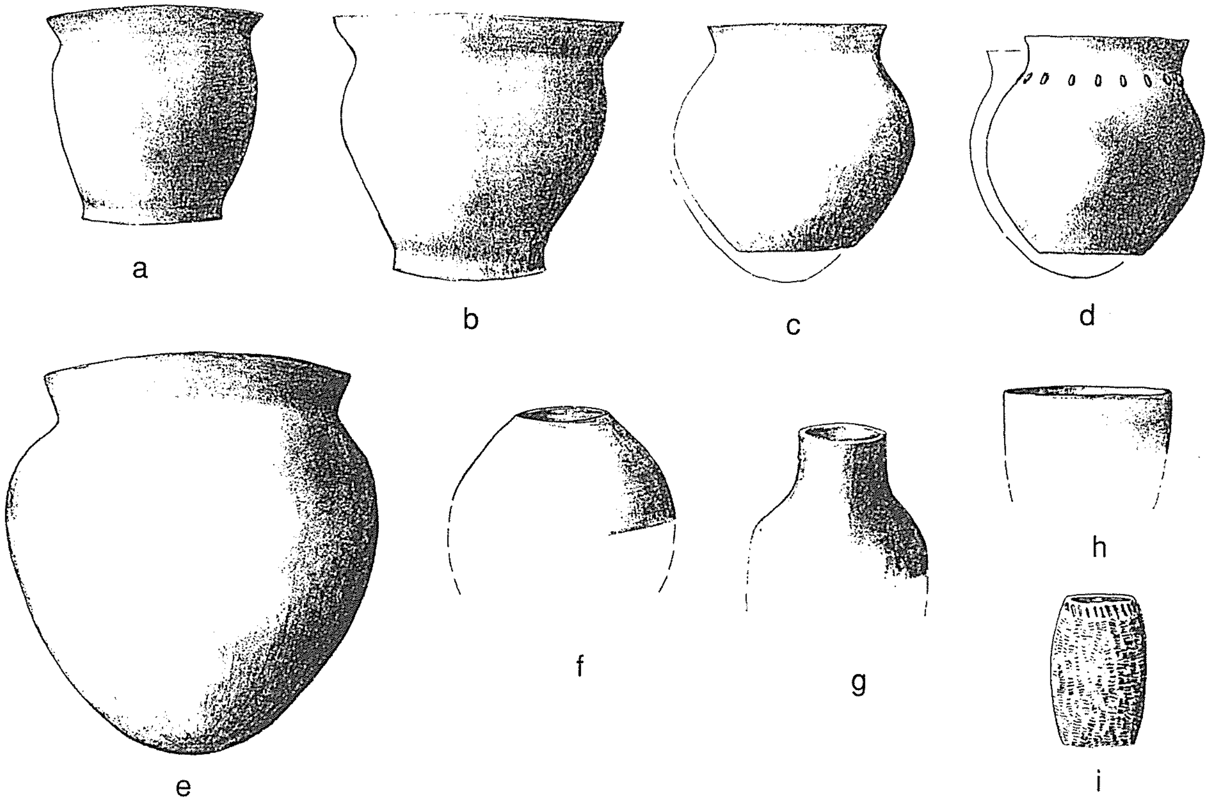


Figure 11. Shell-tempered Ceramic Vessel Forms from Plains Village sites on the Red River in North Central Texas: a-b, flower-pot jar; c, globular jar with flat or round disk base; d, globular jar with rim nodes; e, globular jar with rounded base; f, olla; g, bottle; h, deep bowl; i, hand-molded redware with roughened exterior.

changes in trade and exchange relationships between Puebloan groups and Plains Village peoples on the Southern Plains (see Spielmann 1991; Vehik and Baugh 1994).

Certainly the most notable Southwestern ceramic find on the earlier Late Prehistoric sites, is the stirrup-spout Arboles Black-on-White vessel recovered from the Lower Rockwall site on the East Fork of the Trinity (Lorrain and Hoffrichter 1968). This vessel was manufactured between A.D. 950-1050 (Lorrain and Hoffrichter 1968:56), and petrographic analyses by McIntrye and McGregor (1982) indicate that the basalt-tempered piece was manufactured among Puebloan groups along the upper Rio Grande in New Mexico.

Where prehistoric archeological sites have been radiocarbon dated in the North Central Texas region, plain shell-, fossil shell-, and calcareous-tempered (i.e., bone or crushed limestone) ceramic wares dominate ceramic assemblages dating from after ca. A.D. 1200/1300 to A.D. 1600. In most particulars—temper, vessel forms, and surface treatment—these wares strongly resemble Plains Village ceramics from Washita River phase sites (Richard Drass, 1994 personal communication to Daniel J. Prikryl), and sites at Lake Texoma on the Red River, in South Central Oklahoma (Bell 1984; Brooks 1989, 1994). Washita River phase ceramic assemblages have the following characteristics: (a) they are coiled and smoothed; (b) a variety of calcareous tempers were used, but crushed shell was preferred; (c) vessel forms are primarily globular and vase-like (or "flowerpot") jars with round or flat disk bases and outflaring rims; (d) decoration of these vessels is minimal, principally consisting of rows of nodes, applique fillets, lip tabs, as well as vessel body cord-marking; and (e) also present are small (7.5 cm in height), thick, barrel-shaped cups with corncob-roughened exteriors and interior surfaces that have a bright red/reddish-yellow staining (Bell 1984:318-320 and Figure 14.5).

In North Central Texas, this ware has been called Nocona Plain, as defined by Krieger (1946:110-111) primarily from the analysis of the ceramics from the Harrell site at the confluence of the Clear Fork of the Brazos and the main Brazos River in Young County. It is one of the key defining characteristics of the Late Prehistoric Henrietta focus (Krieger 1946:87-159), a rather nebulous archeological construct that groups together archeological remains along the upper Red River valley and tributaries, such as the Wichita, Little Wichita, and Pease rivers, and along the headwater areas of the Trinity and Brazos rivers.

As Krieger (1946:110-111) defined the plain shell-tempered pottery from the Harrell site, which represented 95 percent of the 597 sherds in the collection, it was primarily from rounded or globular jars with rounded bases, although deep bowls were also present. He did note that plain shell-tempered flowerpot jars with flat, extended bases occur in Henrietta archeological components on the upper Red River (Krieger 1946:111, 141). A few sherds had rows of nodes at the rim-body juncture, or vertical fingernail marks, crudely incised diagonal lines, and vertical striations on the rim, or impressions (stamped with a paddle or textile impressed?) on the body of the vessel. The jar rims were upright to outwardly flaring. Also present in the Harrell site ceramic assemblage were 16 sherds of a thick, molded ware from small bowls (4-8 cm in height) with a reddish-yellowish paste and heavily scored exterior surfaces, a sherd of southeastern New Mexico brownware, and a sherd from a Late Caddoan Poynor Engraved bowl (Krieger 1946:111).

Subsequent analyses of the ceramics found in Henrietta sites since Krieger's time basically confirm his descriptions (e.g., Lorrain 1967, 1969; Martin 1994) of these wares. Studies by Prikryl (1990, 1994) of the shell-tempered pottery from Elm Fork and Red River Plains Village components do indicate, however, that these post-A.D. 1300 ceramic assemblages are much more variable in vessel form, base shape, and temper inclusions than was recognized in Krieger's (1946) summary.

The variability within post-A.D. 1300 ceramic assemblages can be illustrated in several respects. For instance, limestone and limestone-shell tempered sherds amounted to 52 percent of the sherd assemblage from the 13th and 14th century Dillard site (41CO174) on the Red River, while contemporaneous sites nearby and upstream have more than 93 percent crushed mussell shell tempering (Lorrain 1967, 1969; Prikryl 1994). Furthermore, Prikryl's (1990:80) examination of sherds from the Ledbetter site (41DN5) showed that most of what had previously been considered shell-tempered ceramics by Stephenson (1949) were actually tempered with bone, crushed limestone, and fossil shell. Cord-marked globular jars, tempered with bone and grit, are also present in ceramic assemblages on the upper Red River. Krieger (1946:131) notes only a few cordmarked sherds from sites on the Red River at the confluence with the Little Wichita River, and these vessels are comparable to the Lindsay Cordmarked ceramics found on contemporaneous Washita River phases in South Central Oklahoma (Bell 1984; Brooks 1989, 1994). Finally, the kinds of vessels represented in these assemblages includes more than simply jars and deep bowls, namely: flat disk-based flowerpot-shaped jars, round and flat-based globular jars (some 40 cm in diameter and 60 cm in height [Lorrain 1969]), deep straight-walled bowls, ollas, short-necked bottles, and the thick molded bowls or mugs (Prikryl 1994) (see Figure 11).

The globular jars, probably cooking jars, are the most frequent vessel form in the post-A.D. 1300 ceramics on the Red River (Figure 12). They have an abundant calcareous temper (often leached out, creating a porous surface), thin body walls (4-8 mm), smoothed surfaces (particularly on the exterior of the vessel, with smoothing on interior surfaces

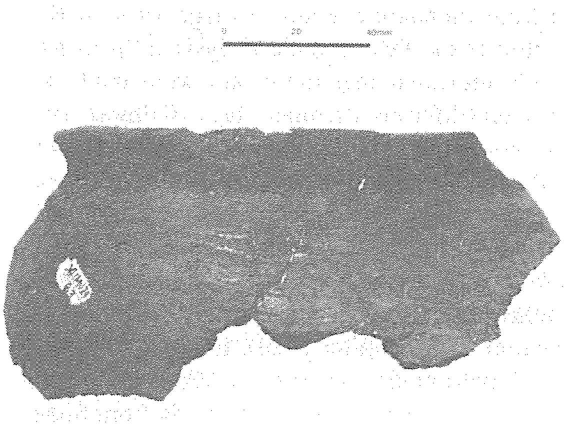


Figure 12. Flaring rim, globular jar.

limited mainly to smoothing over the coil lines), and they are almost always plain; 1-2 rows of nodes, strap and loop handles, and diagonal incising are rare decorative flourishes. Bases are predominantly flat disks (Figure 13c-e), although conical or semi-rounded jars are also known (see Figure 11e). Jar rim sherds are strongly everted or outflaring (Figure 13a-b).

The thick, untempered, hand-molded pottery (Figure 14) is present in post-A.D. 1200 Late Prehistoric sites in the upper Brazos and upper Red River locales; Lorrain (1967:200) called it Redware. The hand-molded pottery is from thick (10-20 mm) but small cylindrical mugs or bowls (see Figure 11i), 40-80 mm in diameter, with corn-cob-roughened exteriors and occasional random brushing marks. The interiors of the mugs or bowls are bright red and Lorrain (1967) and Bell (1984) have speculated that this is possibly from holding fire or perhaps they were used as cups that held an ochreous paint.

Lorrain (1967:200, 1969) also identifies a thin (2.7-3.5 mm), plain, blackware tempered with burned and crushed mussel shell from the prehistoric Coyote and Glass sites in the Spanish Fort area. An occasional bone, grit, or grog-tempered sherd may also be found in the Red River ceramic assemblages.

Other kinds of ceramic artifacts on post-A.D. 1200 Late Prehistoric Plains Village archeological sites in North Central Texas include pottery beads, pottery disks (spindle whorls?), clay figurine fragments (Krieger 1946:141), and long-stemmed pipes. The beads and disks are rarely found in archeological contexts, but the long-stemmed clay

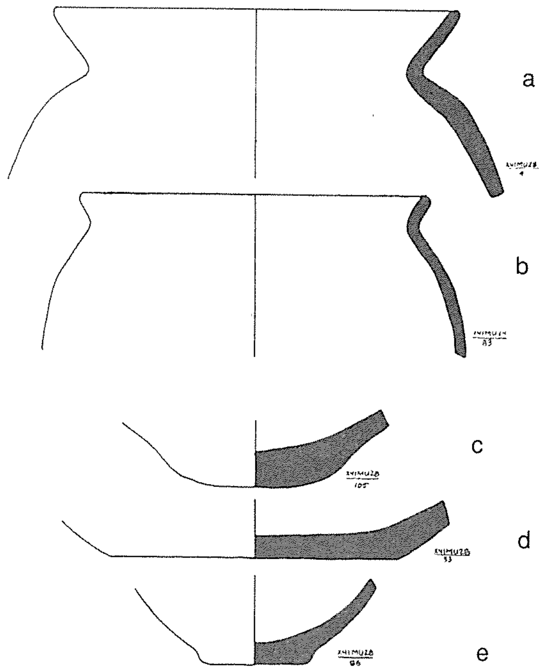


Figure 13. Rim and Base sherd profiles from shell-tempered ceramics from the Coyote and Glass sites, Montague County, Texas.

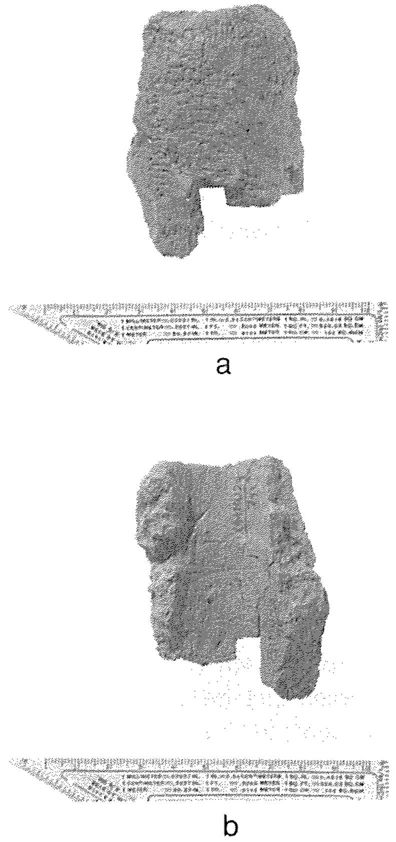


Figure 14. Hand-molded Redware vessel: a, showing corncob roughened exterior; b, interior.

pipes have been recovered in some quantity in 13th and 14th century contexts at sites on the Red River (Lorrain 1969; Martin 1994). These pipes have small-bore long-stems, and small bowls with simple rounded lips (Martin 1994:Figure 34), and they have a polished surface finish. Unlike the long-stemmed pipes from Caddoan sites (cf. Hoffman 1967), those on the Plains Village sites appear to have been tempered with shell, as well as bone and grit.

Historic aboriginal ceramics have been found in eighteenth century Norteño phase archeological sites, well-documented as related to the Wichita-speaking Wichita, Tawakoni, Taovayas, and Waco groups (cf. Newcomb 1993; Bell et al. 1967; Story 1985), in the upper Brazos, Trinity, and Red River basins in North Central Texas. The ceramics include pottery vessels, globular pottery beads, elbow pipes, and unbaked clay figurines.

Pottery sherds or vessels are not apparently common on Norteño sites, as aboriginal ceramics were being replaced by metal and tin containers supplied to the Wichita peoples by European and American traders. For instance, despite extensive excavations at sites such as Longest (Bell and Bastian 1967) or Vinson (Smith 1993), less than 300 sherds were recovered from either site, representing only a handful of vessels. Moreover, some of the vessels used by the Norteños were not manufactured by them, but were objects of trade from Puebloan or Caddoan groups (e.g., Krieger 1946). Caddoan vessels of the types Natchitoches Engraved, Simms Engraved, and Hudson Engraved (manufactured by Caddoan groups living several hundred miles downstream in the Great Bend area of the Red River) are particularly notable trade vessels, as were northern Rio Grande Puebloan ceramic wares.

Norteño ceramics in North Central Texas include small, plain, globular jars, usually shell-tempered, but also bone-tempered or with a combination of tempers (Gilmore 1967; Bell and Bastian 1967), as well as bowls, carinated bowls, and bottles. The plain jars have outflaring rims and flat disk bases, and resemble what has been called Nocona Plain on Late Prehistoric Plains Village sites in North Central Texas. Petrographic analysis of Spanish Fort sherds indicated that these jars were made from local fossiliferous Permian clays (Gilmore 1967). The non-jar vessel forms were usually decorated with incised and engraved lines, fingernail punctates, and brushing (Bastian 1967; Smith 1993), and the design elements clearly resemble Caddoan ceramics manufactured in Northeast Texas and Southwest Arkansas in the eighteenth century (e.g., Schambach and Miller 1984). However, Gilmore's (1967) petrographic analyses of Womack Engraved and Emory Punctated-Incised sherds from Spanish Fort sites suggests they were made of local Pleistocene clays or fossiliferous Permian clays.

Other plainwares in Norteño sites includes Leon Plain (see discussion of Leon Plain in Ricklis, this paper) and Goliad Plain from the Vinson site (Smith 1993:114-115, 117). Bastian (1967) also notes a highly polished, buff to dark brown, plain pottery (tempered with bone, grit, and shell) from the Upper Tucker site, while ridged or paddle-marked pottery was identified by Krieger (1946:163) from the Spanish Fort sites that is similar to paddle-marked pottery from Wichita sites in South Central Kansas and northern Oklahoma (Wedel 1959; Scott 1994).

The Wichita-speaking groups made distinctive ceramic elbow pipes (see Story 1985:Figure 4a-a'). They had smoothed or polished conical bowls, and slightly flaring thick-walled stems with short spurs at the heel, and were usually plain, although Womack Engraved motifs were added to pipe bowls from Red River Wichita sites (Bell and Bastian 1967; Bastian 1967). The pipes were tempered with a combination of grog, bone, or shell, and they had compact pastes.

Human and animal figurines of a distinctive reddish-brown clay are notable on Norteño archeological sites; for example, some 74 clay figurines or figurine fragments were recovered in excavations at the Longest site (Bell and Bastian 1967). In addition to figurines with human shape (Figure 15c), quadruped (horse?) and bird form figurines were made of baked or unbaked clay. Bell and Bastian (1967:95) suggest that the bird forms, subrectangular tablets (see Figure 15h-i), represent owls. They also note that some unbaked figurine fragments had irregularly placed holes in them, as if the holes could be used for the insertion of sticks. Forty-one similar figurines and fragments have been documented by Prikryl from sites on the Texas side of the Red River opposite the Longest site; these are in the Benton-Whiteside collection. The most common recognizable forms are horses (see Figure 15a-b,f). One horse head figurine fragment has an applique bridle, and other horse figurine fragments have incised lines which appear to distinguish manes. Other zoomorphic forms appear to represent dogs and birds (probably owls).

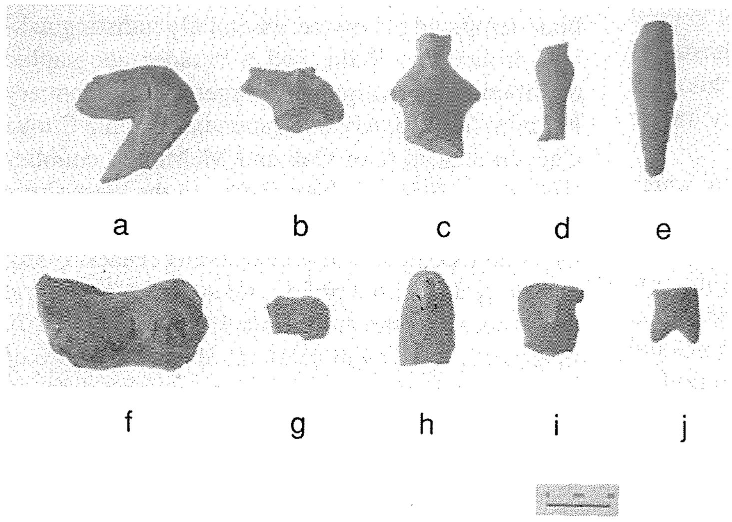


Figure 15. Figurines from Norteño sites on the Red River.

The Ceramics of the Toyah Horizon and the Rockport Phase as Indicators of Some Basic Sociocultural Patterns

Robert A. Ricklis

Beginning ca. A.D. 1250/1300, ceramics became a regular part of archeological assemblages in Central and southern Texas. In these regions, bone-tempered pottery, more often than not undecorated, appeared as part of a Late Prehistoric material culture which included: Perdiz arrowpoints, unifacial end scrapers, thin bifacially flaked knives, flaked chert drills/perforators made on blades and/or flakes, and a prismatic blade-core industry (e.g., Hester 1975, 1980; Prewitt 1981; Black 1986; Highley 1986; Johnson 1994; Ricklis and Collins 1995). This kind of pottery was manufactured by Toyah folk until late in the seventeenth century (Johnson [1994] dates the Toyah phase from A.D. 1300 to 1660), although a corrected radiocarbon date of A.D. 1770 ± 60 (Beta-70658) has recently been obtained from organic residue on the walls of a Leon Plain olla-like vessel from 41CV174 at Fort Hood (Abbott 1995:6-112).

On the central Texas coast, ceramics seem to have been made a slightly earlier appearance. Pottery in this area is generally made from sandy clays which are indistinguishable from much of the clayey sediments found in the Pleistocene Beaumont Formation, the region's geologic foundation. Sandy paste pottery has been found along the central coast associated with Scallorn arrowpoints (Story 1968), which are well-dated in Texas to ca. A.D. 700-1250/1300 (Prewitt 1981, 1985). Ceramic technology probably arrived in the region via the diffusion of ideas and techniques from the upper Texas coast (Campbell 1961), where the regional pottery of the Mossy Grove tradition (Story 1990) appeared some 2,000 years ago, probably in response to influences from still farther afield in the Lower Mississippi Valley area (Aten 1983). The earliest central coast pottery was thus usually a plain, sandy paste ware similar to the Goose Creek Plain pottery of the upper Texas coast (Story 1968; Ricklis 1990:Appendix A; Weinstein 1992).

At least by ca. A.D. 1250/1300, asphaltum was being applied as coating and/or decoration, judging from radiocarbon dates associated with asphaltum surface-treated sherds at the Mellon site (41RF21) (see Ricklis, this volume). Campbell (1961) suggested that asphaltum-painted designs (subsumed under the general typological designation of Rockport Black-on-Gray [see Suhm and Jelks 1962]) may have been inspired by the black-on-white decorations on Huastecan ceramics found along the Gulf coastal plain of Northeastern Mexico (see Hester, this volume). However, the designs on Rockport ware are not the same as those on Huastecan pottery, and asphaltum coating/decoration may have been an intra-regional development. The use of asphaltum as coating for baskets is well documented for the Late Archaic on the central coast (see Ricklis, this volume), and the transfer of this practice to an introduced ceramic technology would presumably not have involved any major shifts in behavioral patterns.

The origins of inland, bone-tempered wares (so-called Leon Plain [Suhm and Jelks 1962[) of the central and southern Texas Toyah phase or horizon are less clear. With very rare exceptions, pottery appears rather abruptly in the archeological record, in conjunction with Perdiz arrowpoints and the other elements of the Toyah techno-complex, and with an apparent emphasis on bison hunting (Prewitt 1981, 1985; Black 1986; Johnson 1994; see also discussions in Mallouf 1987; Huebner 1991; Ricklis 1992). The apparent lack of in situ evolution of the Toyah ceramic tradition (judging by the virtual absence of earlier pottery in the Toyah area) suggests introduction from some other area or areas, which to date have not been identified (Johnson [1994] suggests possible influences from the eastern margins of the greater American Southwest).

Leaving the question of origins aside, it is clear that by A.D. 1300 two broadly definable ceramic traditions were in place in Central and southern Texas. The Toyah ceramic tradition of bone-tempered pottery extended across a very large area, from West Central Texas, into the northern part of southern Texas and onto the inland part of the Gulf coastal plain (see Figure 1). The coastal Rockport ceramics are found in a narrow strip along the Gulf coast, from the Colorado River delta on the north to Baffin Bay on the south. The geographic distributions of these two prehistoric pottery traditions offer excellent opportunities to delineate major cultural patterns, to define the spatial boundary between the two, and by extension, to gain insight into how prehistoric hunter-gatherer populations interacted along a major cultural boundary. To facilitate discussion, it is worthwhile to summarize the salient characteristics of each of these two major pottery traditions.

Salient Features of Toyah Ceramics

Descriptions of Toyah ceramics have appeared in a number of publications in recent decades. A typological description of the Leon Plain type, originally thought to be restricted to Central Texas, may be found in Suhm and Jelks (1962). Later reports on sites in the northern part of South Texas presented additional descriptive data, which established that bone-tempered plainware, essentially indistinguishable from Leon Plain, had a broader geographic distribution than originally suggested. This pottery has been found in moderate abundance in the Choke Canyon area in Live Oak and McMullen counties (Hall et al. 1986; Highley 1986), to the west along the Rio Grande Plain (Hester 1975), as far south as the Hinojosa site in Jim Wells County (Black 1986), and along the coastal prairies inland from the central Texas coast (Hester and Parker 1970; Ricklis 1990). In general, the Toyah ceramics share a number of common attributes: (a) the range of vessel forms was limited, and included simple bowls, jars, and constricted-neck ollas; (b) most vessels were undecorated; (c) pots were usually tempered with more or less abundant amounts of crushed bone; and (d) vessel surfaces, especially exteriors, tended to be oxidized to various shades ranging from tan through pinkish-orange to reddish colors (Figure 16).

Most recently, LeRoy Johnson (1994:187-210) has presented a descriptive summary of Toyah pottery, based on examination of ceramics from the Buckhollow site in Kimble County in West Central Texas. Johnson (1994) identifies the following characteristics which he attributes to the pottery of what he calls "classic" Toyah culture:

(a) the various bowl, jar, and olla forms were constructed using thick coils or ropes of clay;

(b) pots were usually tempered with abundant crushed bone, so that the bone constitutes up to one-third of the prepared clay body;

(c) still-moist vessel interiors were often scraped with bundles of small sticks, creating striated surfaces;

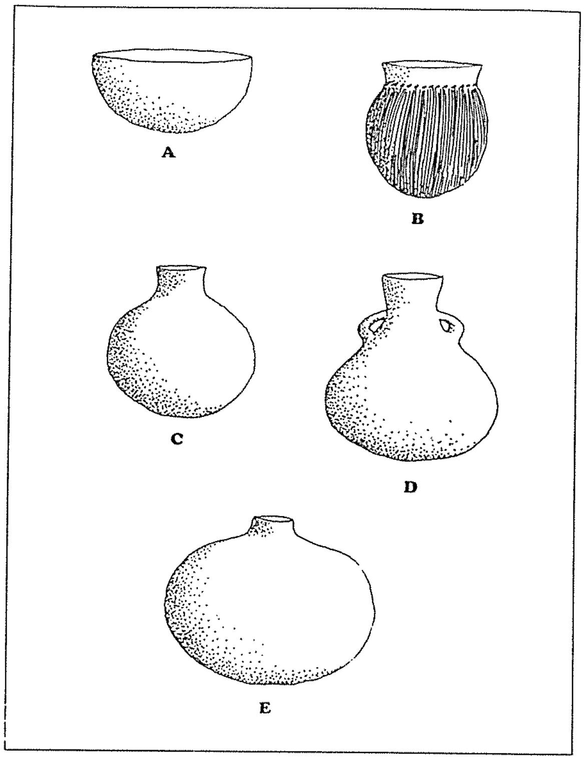


Figure 16. Selected examples of Toyah horizon bone-tempered pots, Central and southern Texas, based on vessel sections: a, bowl, Buckhollow site, 41KM16 (Johnson 1994); b, Jar with vertical brushing under horizontal rows of punctations, Mustang Branch site, 41HY209-T (Ricklis and Collins 1995); c-d, Ollas (d has pair of loop handles), 41LK201 (Highley 1986); e, Olla, Mellon site, 41RF21 (Ricklis 1990).

(d) vessel exteriors were well-smoothed and frequently burnished or floated; and

(e) most vessel surfaces were oxidized to various shades of pale pink or red.

Chemical analyses of residues scraped from the walls of five Toyah vessels at the Rush site (41TG346) provide significant insights into the use of the vessels. Stable carbon and nitrogen isotope data suggest "that a single type of food was not being prepared in all vessels" (Quigg and Peck 1995:148), but that bison bone grease/fat, mesquite bean/bison bone grease, and deer/bison bone grease were processed and cooked in broad ollas, large jars, and/or bowls.

Other characteristics of Toyah pottery include the occasional use of loop handles (e.g., Highley 1986; Ricklis 1990), and the presence on some pots of a thin red wash or slip (the so-called Doss Redware of Kelley [1947]; see also Hester and Hill [1971] and Highley [1986]). Also, it should be pointed out that not all Toyah pottery is devoid of other decorative elements. Black (1986) notes the occasional use of asphaltum decoration on sherds from the Hinojosa site, as did Hester and Parker (1970) for several bone-tempered sherds from the Berclair site in Goliad County. Although these sherds do not bear typical Rockport ceramic decorations, they do suggest that the practice of asphaltum painting was inspired from the nearby Rockport pottery tradition of the central Texas coast. Along the eastern margin of the Toyah area in Central Texas (see Figure 1), a fair number of pots had brushed exteriors, sometimes in conjunction with rows of punctations, both attributes reminiscent in a general way of certain pottery types further to the east in the Caddo area of eastern Texas (e.g., Suhm 1955; Ricklis and Collins 1995). Petrographic analyses of selected sherds from Toyah phase sites at Fort Hood and Hays County—focusing on types of temper, frequency of non-plastic inclusions, and porosity—has been able to sort out the ceramics made by Toyah groups from the grog-tempered, low porosity ceramics manufactured by Caddoan groups in Northeast Texas (Reese-Taylor 1995b; Reese-Taylor et al. 1995). Interestingly, asphaltum decorations and Caddo-like surface treatment are both found, respectively, near the eastern and southeastern margins of the Toyah area. This suggests external stylistic influences from adjacent cultural areas.

Rockport Ware

Although pottery has long been recognized as part of the later prehistoric material culture assemblage on the central Texas coast (e.g., Martin 1931; Sayles 1935), formal typological definitions were not forthcoming until Suhm and Jelks (1962) defined three types of Rockport ware: Rockport Plain, Rockport Black-on-Gray, and Rockport Incised. In general, Rockport vessels were recognized as: (a) thin-walled pots built by the coiling technique; (b) simple, rounded-base vessel forms such as bowls, jars, and constricted-neck olla or bottle-like shapes; and (c) were made of a sandy paste clay body. Rockport Plain was defined to include undecorated vessels of various shapes, although minor decorative elements in the form of lip notches or crenelations were included in the type. Rockport Incised referred to pots with simple geometric incised designs on the exterior rim section of vessels. Rockport Black-on-Gray included vessels with asphaltum surface treatment in the form of coating and/or painted decorations (straight or squiggly lines and/or dots).

In an examination of various technical, formal, and decorative attributes on 464 Rockport ware rimsherds from four central Texas coast sites, I was able to identify several key correlations of specific attributes which justified a revision of the Suhm and Jelks (1962) ceramic typology. The ceramic samples came from the Kirchmeyer site (41NU11) near Corpus Christi, the McGloin Bluff site (41SP11) on the north shore of Corpus Christi Bay, the Live Oak Point site (41AS2) on Copano Bay, and the Guadalupe Bay site (41CL2) on Guadalupe Bay, an arm of San Antonio Bay (see Figure 1). Ceramics from all four sites are housed at the Texas Archeological Research Laboratory, The University of Texas at Austin, where the analyses were conducted.

The revised Rockport ware typology includes a total of five types (Figure 17). These can be briefly summarized in terms of attributes, as follows (the reader is referred to Ricklis [1990: Appendix A] for more detailed discussions and data presentation):

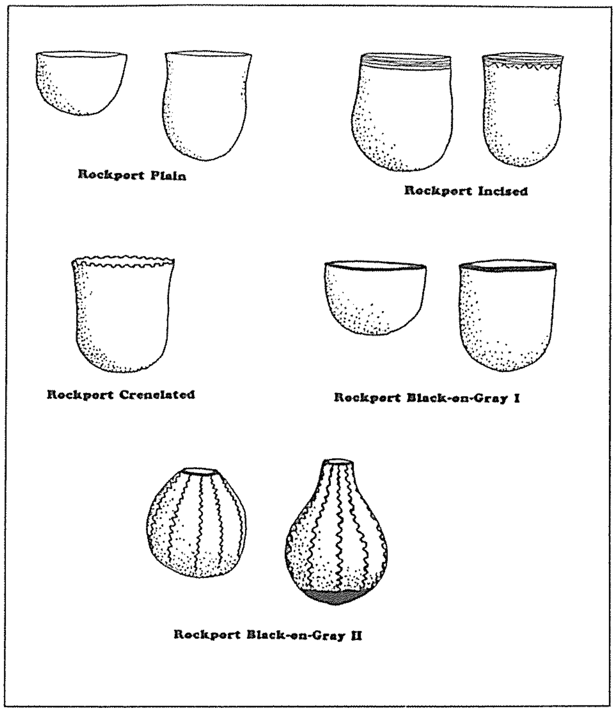


Figure 17. Five Rockport ware pottery types discussed in text. Vessel shapes are those most characteristic of each type, based on correlations between designs and rimsherd curvatures.

Rockport Plain. This type defintion remains essentially unchanged from that provided by Suhm and Jelks (1962), except that it does not include otherwise plain pots which bear lip crenelation. In the analyzed rim sherd sample, the great majority (89 percent) of the rim sherds were from wide-mouth vessels (bowls and jars), while only 11 percent represented small-mouth constricted neck or olla forms. Vessels of this type were occasionally tempered with sparse to moderate amounts of crushed bone. Pots were fired in variable atmospheres, so that some were oxidized to light buff or shades of pale orange or red, and others were reduced to various shades of gray. The exterior and/or interior surfaces frequently bear striations created by the use of a ribbed bivalve shell to scrape the still-wet clay (see Calhoun 1961).

Rockport Crenelated. These vessels, as already mentioned, are distinguished by the presence of small, square, or rectangular notches removed from the lip, which gives the rim an overall crenelated effect. A separate type designation is warranted because: (a) crenelation is in fact a distinctive decorative technique, and (b) all vessels were wide-mouth bowl or jar forms, indicating a correlation between this decorative element and specific Rockport vessel forms. Vessels occasionally contained sparse to moderate amounts of crushed bone temper, and they were fired in both oxidizing and reducing atmospheres. It is important to note that the type is very similar, if not virtually identicial, to crenelated-rim vessels from the Brazos River delta area of the upper Texas coast (Johnney Pollan, 1986 personal communication), and thus apparently represents an as yet undefined relationship, or exchange of stylistic ideas, with that area.

Rockport Incised. This type is unchanged from the definition by Suhm and Jelks (1962). It can be added, however, that all sherds of this type in the sample represent wide-mouth bowls or jars. As pointed out by Suhm and Jelks (1962), the incised designs are strongly reminiscent of those on Goose Creek Incised of the upper Texas coast, and it can be confidently assumed that the decorative motifs derive from that region, and indirectly from the Coles Creek-Plaquemine tradition of the Lower Mississippi Valley (see Aten 1983; Ricklis 1994; and discussions above on Southeast Texas ceramics;

see also Corbin 1974 for illustrations of the range of variations in geometric designs).

Rockport Black-on-Gray I. The ceramic analysis revealed distinct clusterings of key attributes in asphaltum coated/decorated pots, indicating that Rockport Black-on-Gray can be divided into two separate types. The diagnostic decorative element on Rockport Black-on-Gray I is a band of asphaltum paint along the lip, which was sometimes wide enough to extend 1-2 cm onto the exterior rim of the vessel. The lower portion of the vessel exterior was sometimes coated with asphaltum, but vessel interiors were nearly always left uncoated. Pots of this type were generally fired in an oxidizing atmosphere, but one that was often not well-controlled, since surface colors frequently are variable, ranging from light (oxidized) to gray or dark gray (reduced). Vessels were occasionally tempered with sparse to moderate amounts of crushed bone. Pots were most often bowls or jars; 91 percent of the sherds of this type were from wide-mouth vessels.

Rockport Black-on-Gray II. This type has several diagnostic attributes. Decoration consists of: (a) an asphaltum lip band, (b) vertical squiggly or wavy lines extending from the lip band to the basal portion of the pot, and sometimes (c) a circular patch of asphaltum on the base of the vessel (see Figure 17). In contrast to other Rockport types, the majority of vessels (76 percent of the analyzed sherds) were constricted neck olla or bottle-like forms. Virtually all pots of this type bore *interior* asphaltum coating. Vessels were consistently fired in a well-controlled oxidizing atmosphere, so that colors virtually always fall in the range from very light buff to pale orange or pale red. Finally, pots of this type were almost never tempered with crushed bone (none of the sherds in the analyzed sample were bone-tempered, and nearly all specimens examined from other Rockport sites are free of bone temper).

The combination of attributes in Rockport Black-on-Gray II pots suggests a specialized function for these vessels. Exterior asphaltum painting would seemingly not be practical on a pot which was to be used for cooking, since the asphaltum would melt; similarly, the asphaltum coating on the interior of virtually all pots of the type would hardly be desirable in cooking pots. At the same time, the common form for these pots—narrow-mouth ollas or bottle-like shapes—would be well suited for transport and/or storage of water or other liquids. Also, the interior asphaltum coating would serve to seal vessels used as water containers. Finally, the consistent lack of bone tempering may be another signature of non-cooking vessels, since the crushed bone occasionally found in other Rockport types may have served to lessen the effects of thermal shock. The sand inclusions found in Rockport Black-on-Gray II (and virtually all other Rockport ware) would perhaps not serve very well, alone, as a tempering agent in cooking vessels, since sand has a very different coefficient of expansion and contraction than does clay (Rice 1987:229).

Ceramics, Cultural Boundaries, and Sociocultural Relations in the Late Prehistory of Southern Texas

In addition to their importance as time markers, and as components of Late Prehistoric technology, Toyah and Rockport ceramics serve to delineate, with some accuracy, the geographic boundary between fundamentally different adaptive systems and, presumably, populations with divergent sociocultural traditions. Analyses of ceramic samples from a number of Rockport phase and Toyah horizon sites on Texas' central coastal prairie strongly suggest that inland folk ranged within about 40 km of the mainland shoreline, and that this was the inland margin of the area used by coastal people of the Rockport phase. Sites within about 40 km of the mainland shoreline yield, for the most part, ceramics which can be classified as Rockport ware, whereas sites farther inland have largely produced the bone-tempered plainware attributable to the Toyah horizon.

Since most Rockport phase sites on the coastal prairie, away from intensively occupied shoreline fishing camps, are small, with thin deposits and low artifact densities (see Ricklis, this volume), large ceramic samples are not available from any given site. Sizeable samples of rim sherds are not, therefore, available from these sites with which to conduct statistically reliable typological analyses. However, it is possible to distinguish samples of Rockport ware from Toyah pottery on the basis of key attributes which can be observed on even the smallest sherds.

As may be seen in Figure 18, in ceramic samples from shoreline sites, which clearly represent occupation by coastal groups, approximately 50 percent of the vessels bear asphaltum surface treatment, as coating and/or painted decoration (these data and all others, except from the Hinojosa site, are based on vessel counts, as represented by sherds which can be sorted into vessel groups based on attributes of color, hardness, surface treatment, and aplastic inclusions; the Hinojosa ceramic data are derived from a select sample of 100 individual sherds [Black 1986]). Additionally, Figure 19 shows percentages of sherd groups in samples from Rockport phase sites with no bone temper, and sparse, moderate, and profuse bone temper (using for the sake of comparison, Black's [1986] definitions of sparse, moderate, and profuse bone temper as representing, respectively, <5 percent, 5-25 percent, and >25 percent of the total volume of the sherd). The percentage breakdowns of asphaltum surface-treated pots versus pots without asphaltum, and pots with varying amounts of bone tempering, are thus effective "signatures" of coastal Rockport

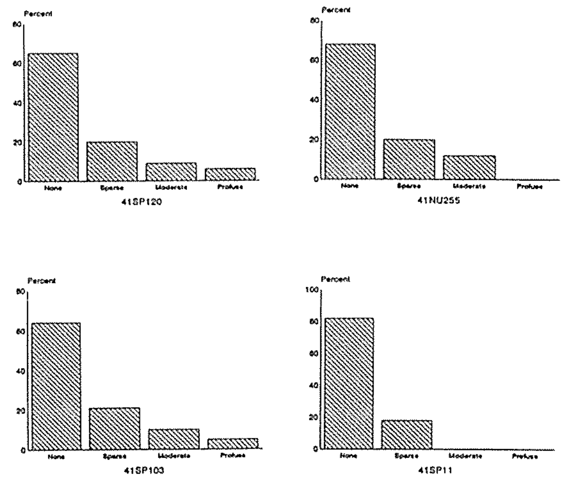


Figure 19. Percentages of vessels without bone temper (none), and sparse, moderate, and profuse bone temper from Rockport phase sites on or near bayshores. Sites 41SP103 and 41SP11 are on the northern shoreline of Corpus Christi Bay.

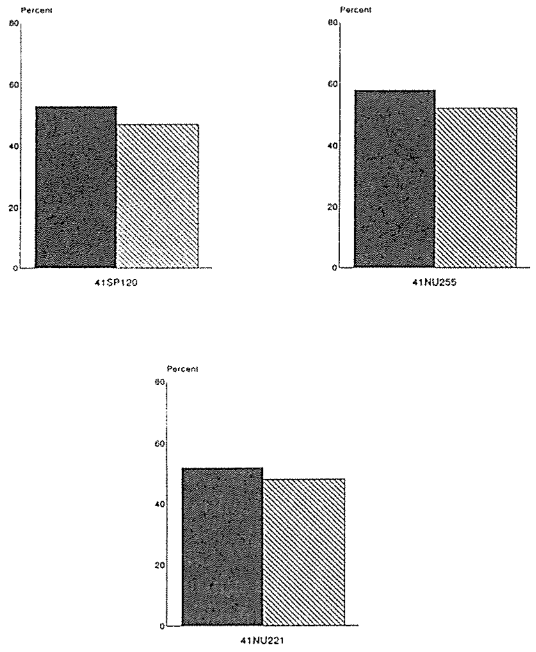


Figure 18. Percentages of vessels with asphaltum surface treatment (black) and without asphaltum surface treatment (hachured), Rockport phase sites on or within 5 km of bay/lagoon shorelines. Site 41SP120 is on the northeastern shore of Corpus Christi Bay, and 41NU221 and 41NU255 are near the head of Nueces Bay.

ware by virtue of the redundant similarities in the proportional representation of these attributes.

Ceramics from inland Toyah sites on the coastal plain show marked contrasts in terms of these basic attributes. The Hinojosa site (41JW8) in Jim Wells county, west of Corpus Christi, is an excellent point of departure for Rockport-Toyah comparisons, since: (a) the site is clearly attributable to the Toyah horizon, and (b) Black (1986) has quantified data on the key attributes which can be readily compared to the Rockport ceramic data. As shown at the top of Figure 20, in Black's (1986) "select" analytical sample of 100 sherds from Hinojosa, only 11 percent bear asphaltum surface treatment. The percentage breakdown of sherds without bone temper versus those with sparse, moderate, and profuse crushed bone is, respectively, 4 percent, 27 percent, 53 percent, and 16 percent (Figure 21). If the Hinojosa pottery can be taken to be more or less representative of coastal plain Toyah ceramics, then it can be concluded that even limited pottery samples, consisting perhaps of mostly small sherds, can be said to have markedly differing attribute signatures, according to whether they represent coastal or interior peoples and cultural-adaptive patterns.

In fact, the signatures for Rockport ceramics and for the Hinojosa Toyah pottery have proved to

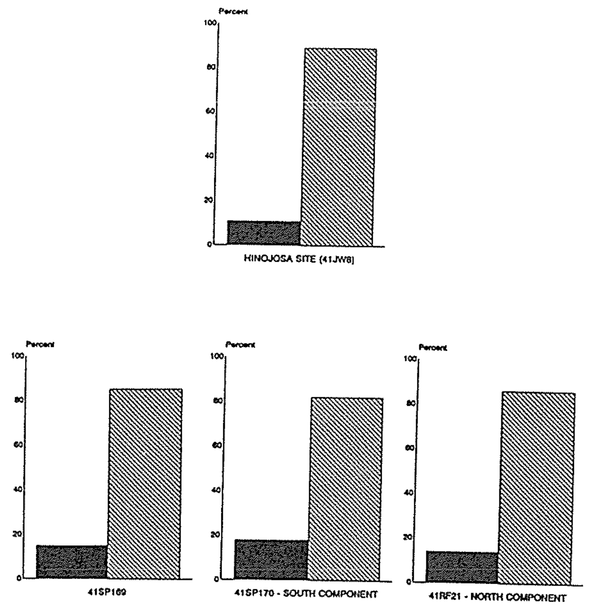


Figure 20. Percentages of ceramic sample with (black) and without (hachured) asphaltum surface treatment, four Toyah phase sites. The Hinojosa site is in Jim Wells County (data based on Black [1986]); 41SP169, 41SP170 (Aransas River), and 41RF21 (Copano Creek) are approximately 40 km from the mainland shoreline.

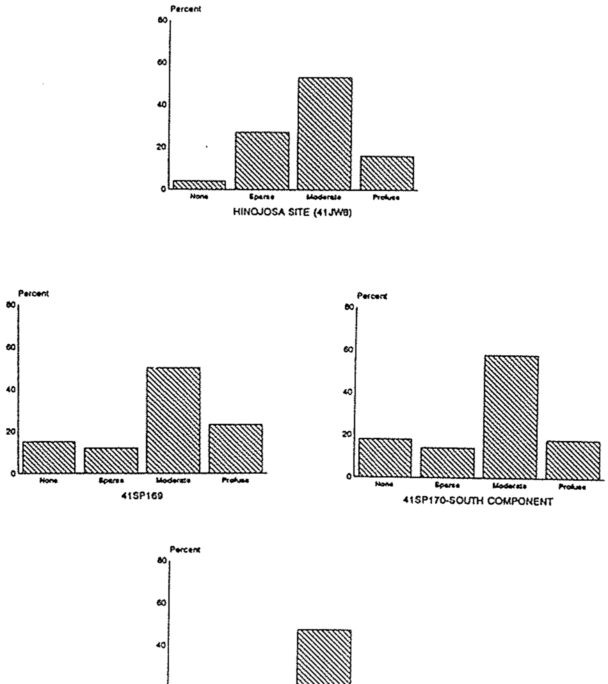


Figure 21. Percentages of ceramic samples with no (none) bone temper, and sparse, moderate, and profuse bone temper. Hinojosa site graph based on data in Black (1986); other sites are those indicated in Figure 20.

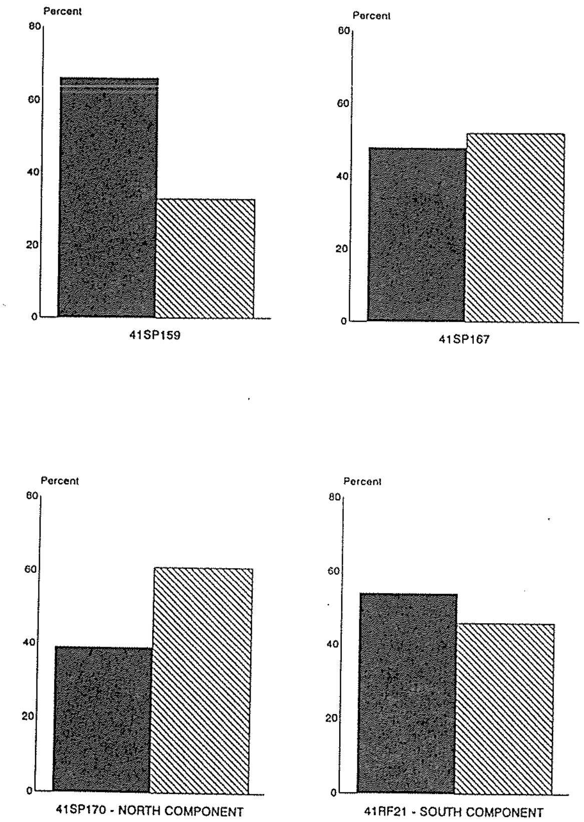


Figure 22. Percentages of vessels with (black) and without (hachured) asphaltum surface treatment, four Rockport phase sites approximately 40 km from the mainland shoreline. Sites 41SP159, 41SP167, and 41SP170 are near the Aransas River, and 41RF21 is near a branch of Copano Creek.

be discernible at various sites along the inland margin of the Rockport phase area, at just that point where one may expect to find a Late Prehistoric cultural boundary. As shown in Figures 22 and 23, small Rockport phase sites on the Aransas River (41SP159, 41SP167, and 41SP170-North component), all about 40 km from the mainland shoreline, have very similar proportional representations of the key attributes of asphaltum surface treatment and presence/ absence/quantity of bone tempering as found at unambiguous coastal sites in shoreline settings. By contrast, at sites 41SP169 and 41SP170-South component (see Figures 20 and 21), the attribute breakdowns mimic those from Hinojosa. Similarly, at the Mellon site (41RF21) in Refugio County, also located approximately 40 km inland from the mainland shoreline, spatially discrete Rockport and Toyah components could be identified on the basis of ceramic samples (see

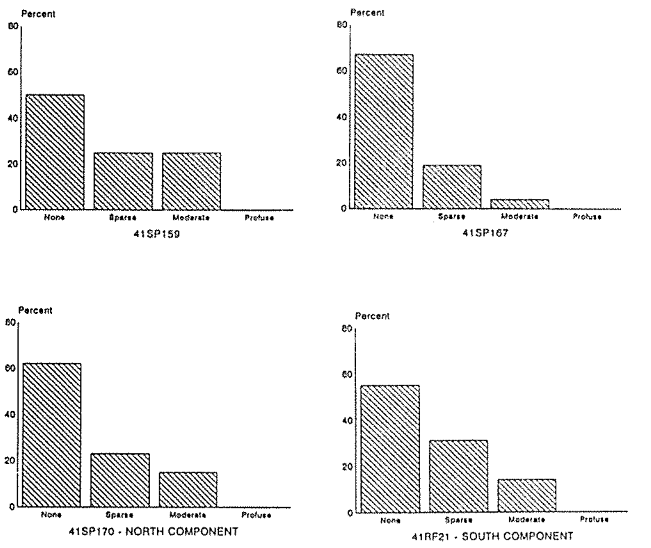


Figure 23. Percentages of vessels with no bone temper (none), and sparse, moderate, and profuse bone temper; sites are the same as represented in Figure 22.

Figures 20 and 21) in which the attribute breakdowns matched either those from shoreline sites or those presented for Hinojosa (Ricklis 1989, 1990:387-414).

These findings suggest, then, that both Rockport phase and Toyah horizon sites are identifiable on the coastal prairie in a zone about 40 km inland. That this in fact represents a major Late Prehistoric cultural/ethnic boundary is supported by ethnohistorical documentation which suggests that the inland margin of coastal Karankawa territory was this same distance from the coast. In the early nineteenth century, Mexican authorities identified the inland margin of a proposed Karankawa "reserve" at 10 leagues (25 miles, or 40 km) from the shoreline (Smithwick 1900:13). This also fits with recorded eighteenth century Spanish observations to the effect that the Karankawa preferred to operate close to the coast, and considered Mission Rosario at Goliad (38 km) from the mainland shoreline) too far inland for practical use (Ricklis 1990:576-578, in press).

With meaningful cultural distinctions thus made on the basis of the geographic distributions of diagnostic ceramic assemblages, it is possible to move to higher levels of interpretation regarding prehistoric behavioral patterns. It is most interesting, and probably significant, that at the Aransas River sites mentioned above, seasonality analyses of *Rangia cuneata* shells suggest that Toyah campsites were occupied during the fall-winter, and that Rockport phase sites saw spring-summer occupations. A seasonal, ecological complementarity in boundary zone use is suggested, with Toyah folk moving in small groups into the boundary zone to fill the void created as Rockport people tended to aggregate at large fall-winter fishing camps on the coast (see Ricklis 1990, and Ricklis, this volume).

At the Mellon site, the spatially discrete Rockport and Toyah components may represent simultaneous use of the site. Abundant bison and deer bones were found in test units and excavations across most of this small site, indicating that it was a locus for more or less intensive butchering/processing of large game (Ricklis 1989, 1990). The two components, which were both at the same level in the site and which both produced radiocarbon dates with intercepts falling at ca. A.D. 1250-1275, may reflect shared hunting and processing activities by coastal and interior peoples. Had the Rockport and Toyah occupations been sequential rather than simultaneous, it would seem likely that the respective components would have overlapped at the top of the small knoll on which the site is located. In fact, the north half of the site produced Toyah pottery, while the south half yielded Rockport ware; thus, the distribution of the two kinds of pottery was spatially segregated, and the two components adjoined at the virtual center of the site.

The fact that fundamental prehistoric behavioral patterns can be elucidated using ceramic analyses, in conjunction with other lines of information, has additional interpretive implications. It is unlikely that the Toyah-Rockport boundary zone could be identified using other kinds of material evidence, such as lithics, for example, since there is little difference between the lithics of the Rockport phase and the Toyah horizon. Both cultural expressions are characterized by abundant Perdiz arrowpoints, unifacial end scrapers, thin bifacial (sometimes beveled) knives, and a prismatic blade-core industry. Without the presence of the ceramics, a small Rockport phase hunting camp would be indistinguishable from a small Toyah campsite.

Following the almost universal assumption that most North American aboriginal pottery was manufactured by females, and that hunting technology was primarily the domain of males, it is possible that patterns of gender-related expressions of material culture operated at different scales. While Rockport ware pottery, as a material expression of both technology and style, is found within a remarkably narrow zone along the coast, the lithic techno-complex, which was apparently linked with bison hunting/processing, diffused over a very large area, from the Trans-Pecos (Mallouf 1987), through Central Texas (Prewitt 1981, 1985; Johnson 1994; Ricklis and Collins 1995), into southern Texas (Hester 1975; Black 1986; Highley 1986), and onto the central and upper Texas coasts (Ricklis 1992, 1994). While this may or may not reflect differences in the spatial scale of female vs. male inter-group relations, it does warn against assumptions concerning the utility of lithic data as an indicator of the geography of prehistoric sociocultural patterns. Regardless of the broader implications of the widespread distribution of a lithic package, the more localized ceramic expressions suggest that pottery is the more reliable indicator of social identity, and cautions against assumptions that lithic horizon styles or techno-complexes directly represent the distributions of cultural, ethnic, or linguistic groups.

Prehistoric and Protohistoric Ceramics from the Lower Plains, Caprock Canyonlands, and Texas Panhandle

Timothy K. Perttula and Christopher Lintz

Emerging material culture patterns suggest that the Texas Panhandle, Caprock Canyonlands, and Lower Plains regions have been a vascillating border area for at least three diverse ceramic wares or ceramic traditions. These include: (a) a cord-marked ware derived from the Plains (to the north, east, and northwest) which is found mostly in the upper Texas Panhandle but also in the lower plains of North Central Texas (e.g., Krieger 1946); (b) a medium-pasted plain brownware primarily found in the lower panhandle, the Caprock Canyonlands, and the Lower Plains that appears to have been derived from the Southwest (principally the Jornada Mogollon area); and (c) a thin, dark sandy to micaceous paste plain ware found throughout these regions in Protohistoric contexts (after ca. A.D. 1450), and apparently deriving from the north central portions of New Mexico (see general summaries in Hofman and Brooks 1989; Brooks 1989; Hofman 1989). The recognition of these three general ceramic wares oversimplifies the tremendous range of variability present in the ceramic assemblages found on aboriginal sites in these regions. For the most part, the gross delineation of ceramic types has been used as a crude temporal and cultural indicator, and we archeologists have a long way to go in recognizing and refining the temporal, spatial, and cultural significance of the ceramics used in these areas.

The earliest prehistoric ceramics manufactured in the upper Texas Panhandle appeared about ca. A.D. 400 (e.g., Couzzourt 1985, 1988). They are closely related to the Plains Woodland ceramics found in Kansas, Nebraska, Oklahoma, and Colorado (cf. Bozell and Winfrey 1994:Figure 2a-d; Vehik 1984) in that they are large, thick-walled, conical or conoidal-shaped vessels,[1] and have completely cord-roughened exterior surfaces with little to no rim or lip decoration. The small assemblage of sherds from such sites as Lake Creek (Hughes 1962) and Tascosa Creek (Couzzourt 1985, 1988) are dominated by these thick cord-roughened vessels, tempered with crushed rock (usually quartz and carbonate, but scoria-tempered [Hughes et al. 1978:102] and basalt-tempered [Quigg et al. 1993:149] wares are also known in parts of the Texas Panhandle) and bone. Diagonal incising is the only other apparent decorative element represented in these Texas Panhandle Woodland ceramic assemblages. Smooth-finished sherds with crushed plagioclase feldspar temper found associated with cord-marked Woodland vessels on these early sites have been tentatively identified as intrusive Mogollon brownwares, probably Alma Plain (Hughes 1991:26-27).

[1] A whole Woodland period pot of unknown provenience in the collections of the Panhandle-Plains Historical Museum stands 33 cm high with an orifice diameter of 33 cm. It has a conical base, and the vessel's maximum diameter is not at the rim, but farther down on the body; the walls are 8-9 mm thick at the rim. Stick impressions were present on the lip of the pot, and just below the rim were two parallel incised lines with punctations between the lines (A. J. Taylor, personal communication to Christopher Lintz, 1995).

In the Caprock Canyonlands, the earliest ceramics date from between about A.D. 200 and A.D. 1100, based on radiocarbon dates from the Deadman's Shelter (41SW23), Sam Wahl (41GR291), South Sage Creek (41KT33), and Kent Creek (41HL66) sites (Willey and Hughes 1978; Boyd et al. 1992, 1994; Cruse 1992; see also Boyd, this volume). The ceramics from these Palo Duro Complex sites appear to uniformly be Mogollon brownwares—including Jornada Brown, Middle Pecos Micaceous Brown, and Roswell Brown—and the petrographic analyses by Robinson (1992, 1994) suggest they were manufactured in the Middle Pecos valley in southeastern New Mexico. Eastern Jornada Mogollon occupations (the Querecho phase) dating towards the end of this period (ca. A.D. 950-1100) on the southwestern part of the Llano Estacado had locally-made brownwares as well as a few Puebloan tradewares (e.g., Corley 1965).

Locally-manufactured Plains Village (ca. A.D. 1100/1200-1450/1500) ceramics in the Texas and Oklahoma panhandles include the large globular-bodied Borger Cordmarked vessels in the Antelope Creek phase (see Krieger 1946:44; Suhm and Jelks 1962:15; Lintz 1984:333-335; J. Hughes 1991:32-33), and the cord-marked and distinctive rim/lip decorated ceramics from the Buried City complex along Wolf Creek (Hughes and Hughes-Jones 1987; D. Hughes 1991). These Late Prehistoric cord-marked ceramics are undoubtedly related to the earlier Woodland ceramic tradition in the region.

Across most of the Llano Estacado and Caprock Canyonlands, the few ceramics that are found on Late Prehistoric campsites include Jornada Mogollon El Paso brownwares, Puebloan polychromes, and Chupadero Black-on-white vessels from the Salinas Pueblo area along the Pecos River in eastern New Mexico (e.g., Johnson 1978:107, 1993, 1995; Krieger 1946:77-81; Holliday and Johnson 1990:45). However, along the southwestern edge of the Llano Estacado, relatively sedentary groups were manufacturing their own local brownwares and corrugated utility vessels (and then later indented brownwares [Collins 1969]), and were trading for painted Puebloan wares in the Mimbres, Salinas, northern Rio Grande, and Three Rivers areas of New Mexico (see summary in Baugh 1994).

Suhm and Jelks (1962:15) provide the most thorough description of Borger Cordmarked. This is an elongated to globular jar (made by coiling clay ropes) with short vertical to flaring rims (Figure 24), 20-30 cm in height with orifice diameters ranging between 14-22 cm. Crushed rock (usually quartz) and sand were used as temper, along with mica, bone, or other inclusions. The jars have convex bases, and generally thin walls, perhaps thinner near the base than the rim. The rim and body of the vessels are covered with fine vertically-placed cord impressions on the upper body which overlap considerably near the base (sometimes the cord impressions are smoothed over) from paddles used in shaping and welding the vessels, and rarely with incisions, punctations, and notches on the rim and lip; red, gray, and black washes or slips have also been documented in a few Antelope Creek phase ceramic assemblages.

In a sample of 272 rims from five Antelope Creek phase sites (McGrath, Black Dog Village, Two Sisters, Stamper, and Roy Smith), Lintz (1978:Figure 6) noted that: 65 percent were only plain or had cordmarking, 7 percent had diagonal punctations on the lip, 6.3 percent had pinched lip-rim junctures, and 6.6 percent had a single row of fingernail gouges around the rim; the other 7 percent of the rims were represented by dot-punctated lips and rims, diagonal incised lines, lip tabs, or had distinctive collared and cambered rims. Brushed bodies, fingernail punctates on the vessel shoulder, and parallel trailed lines on the body, are other rare decorative elements in the Antelope Creek ceramic medium. There is a relatively high percentages of decorated rims (particularly pinched rims, as well as the diagonal incising) in the ceramic samples from the Roy Smith, Stamper, and Two Sisters sites in the Oklahoma Panhandle. This suggests interaction between these Antelope Creek phase groups and the Buried City Complex, on Wolf Creek in the northeastern part of the Texas Panhandle, because rim decorated vessels with similar decorative elements are much more common in the Buried City Complex (cf. Hughes 1991; see below for discussion of Buried City Complex ceramics).

The general shape and form of the Borger Cordmarked vessels, and the soot-blackened and smudged exterior and interior surfaces, certainly indicate that these were cooking jars. Exactly what was being cooked in the jars is uncertain, as organic residues on the vessels have not been studied, but stable carbon isotope analysis of

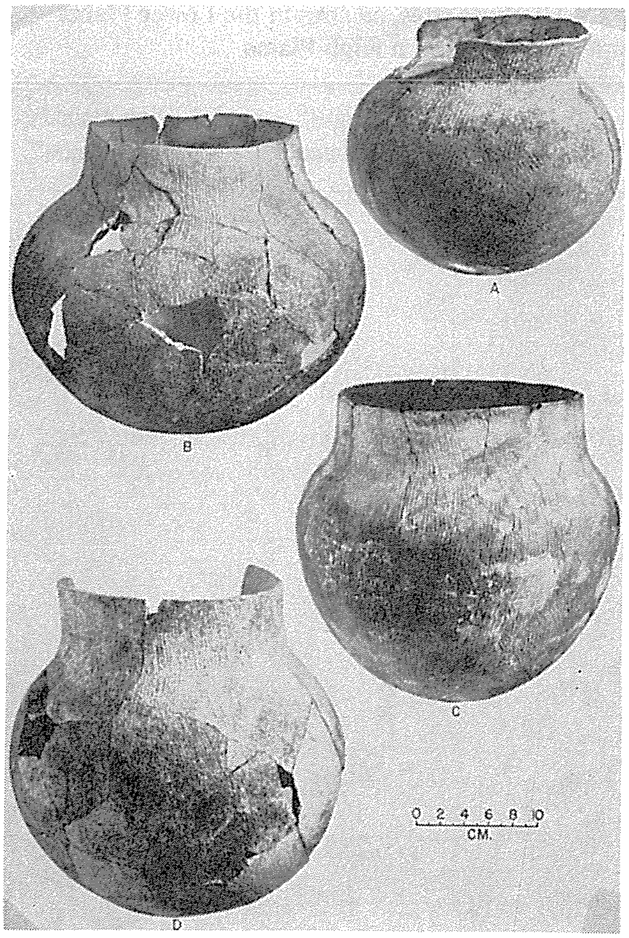


Figure 24. Borger Cordmarked Vessels from the Antelope Creek phase (from Suhm and Jelks 1962:Plate 8).

Antelope Creek phase human remains (Habicht-Mauche et al. 1994) suggests that maize, amaranth, and bison grease were cooked, heated, and/or boiled in these pots. In a few instances, whole or large fragmentary Borger Cordmarked vessels were placed in burial pits as grave goods (e.g., Couzzourt and Schmidt-Couzzourt 1988; Lintz 1986; Green 1986).

Other kinds of ceramics on Antelope Creek phase sites include a wide variety of Southwestern ceramic vessel sherds and Pecos-style and Taos Incised pipes, particularly Northern Puebloan types (Table 3) on late subphase (A.D. 1350-1500) components (Lintz 1991:93); locally made ceramic items include perforated and fired clay beads (Hughes et al. 1978:Figure 121-m), short tubular pipes, and perforated cord-marked pottery disks. Lintz (1984) also notes that ceramics from the Central and Southern Plains, as well as from the Caddoan area, are present as trade wares in small amounts. Lintz and Reese-Taylor's (1995) petrographic analysis of collared and non-collared rims in Antelope Creek phase, Buried City, and Upper Republican assemblages suggests that many of the collared rim vessels were made in the Panhandle, probably by the Buried City Complex groups, and do not represent tradewares from Central Plains Tradition groups. Miniature vessels (5-6 cm in height), unfired and not coiled, have been recovered from Spring Canyon (Duffield 1964), site 41MO7 (Green 1986:41), Saddleback (Holden 1934:39), Chicken Creek (Schmidt-Couzzourt 1983), and Coetas Ruin 55 (Studer 1934).

In the Buried City Complex, the locally-manufactured ceramics are the large globular or subconoidal jars, but unlike in the Antelope Creek phase, these vessels often have high and slightly flaring rims (D. Hughes 1991:Figures 25 and 26; Hughes and Hughes-Jones 1987:Figures 16 and 17; whole globular and subconoidal vessels with high and flaring rims found in a feed lot in Darrouzett, Texas appear to be related to the Buried City Complex [Jackson et al. 1982:108-109]). Again, a mixture of temper inclusions were used, including bone, caliche, sand, grog, shell, and scoria, with a fine quartz sand being most frequently employed as an aplastic.

Vessels were usually finished with a cord-marked paddle, with about 20 percent of the sherds from vessels with smoothed over cord impressions. The rims and lips of the Buried City ceramics were commonly decorated (i.e., not including rims with cord-marking, about 57 percent of the rims from Courson B [41OC27] were decorated in a variety of ways [Hughes and Hughes-Jones 1987]). This includes notched rims and notched lip tabs, nodes, fabric and corncob-impressed, brush-poked, pinched, incised or trailed, shell-impressed, applique fillets, and rows of punctated indentations; a few vessels had thin slips or washes. The pinched decorations—one to two rows of punctations and pinching along the neck and rim—appear to be the most common decorative element, and Hughes and Hughes-Jones (1987:Figure 17) call these ceramics Courson Pinched. Hughes and Hughes-Jones (1987) also believe that the rim treatment and decorative style of these pinched vessels resemble the Geneseo pottery

Table 3. Southwestern Ceramics on Antelope Creek phase sites, on sites in the Lower Plains and Caprock Canyonlands, and on the Southern High Plains

Ceramic Type	Antelope Creek[1]	Rolling Plains/ Caprock Canyonlands[2]	S. High Plains/ Llano Estacado[3]
Northern Puebloan Area			
Santa Fe Black-on-white	X		
Wiyo Black-on-white	X		
Galisteo Black-on-white	X		
Rowe Black-on-white	X		
Abiquiu Black-on-gray	X		
Agua Fria Glaze-on-red	X	X (?)	
Cieneguilla Glaze Yellow	X	X	
San Clemente Glaze Polychrome	X		
Largo Glaze Polychrome	X		
Largo Glaze Yellow	X		
Kuaua Glaze Polychrome	X		
San Lazaro Glaze Polychrome	X		
Rio Grande Glaze Polychrome I-VI	X	X	X
Tewa Polychrome		X	X
Pecos-style pipes	X	X	
Western Puebloan Area			
Kowina Black-on-white	X		
Jeddito Yellowware	X		
St. Johns Polychrome	X		X
Heshotauthla Polychrome	X		
Little Colorado Glaze I	X		
Gila Polychrome			X
Southern Puebloan or Jornada Mogollon Area			
Chupadero Black-on-white	X		X
Lincoln Black-on-red	X		X
El Paso Polychrome	X		X
El Paso Brownware			X
Jornada Brownware		X	X
Three Rivers Red-on-terracotta			X
Ochoa Indented Brown			X
Mimbres Black-on-white			X
South Pecos Brown		X	
Roswell Brown		X	
McKenzie Brown		X	
Middle Pecos Micaceous Brown		X	
Northern Chihuahuan Area			
Ramos Polychrome			X
Playas Red			X

1 Lintz 1991; Wedel 1982; Crabb 1968
2 Boyd, this volume; Boyd et al. 1989, 1993, 1994; Baugh 1992
3 Boyd et al. 1989; Johnson 1993, 1995; Quigg et al. 1993

of western Kansas (see Wedel 1959:575-576); in that the Geneseo Plain and Simple Stamped pottery is decorated with applied fillets as well as single and double rows of pinches and gouges, there are stylistic resemblances. However, the Geneseo ceramics from Kansas are smooth-surfaced (not cord-impressed), often have flat bases, and have loop handles (Scott 1994:71), ceramic attributes that are not characteristic of the Buried City Complex ceramic assemblages.

In contrast to the Plains Village cord-marked, globular jar ceramic traditions in the Canadian River basin of the Texas and Oklahoma panhandles, Puebloan ceramics are widely distributed on the Llano Estacado at this time (as are the New Mexican glazewares from the Galisteo Basin, although they appear to be concentrated in the Plains Village sites on the Canadian River [Spielmann 1983:Figure 6]), and local ceramic traditions appear to be absent except for those of the eastern extension of the Jornada Mogollon. Krieger (1946:77-81) had noted some 50 years ago that nearly all the ceramics found in dune areas, lake beds, and by springs on the Llano were manufactured by Jornada Mogollon and other Puebloan groups. Most recently, Johnson (1995) states that the most frequent Puebloan ceramics on the southern High Plains found in contexts dating between ca. A.D. 950-1450 include Chupadero Black-on-white, Three Rivers Red-on-terracotta, Jornada Brown, and El Paso Brownware (see Table 3). Ochoa Indented brownware, made by eastern Jornada Mogollon groups after ca. A.D. 1350, is also broadly distributed on the Llano Estacado, from the White River south to the Midland area (Johnson 1993:Figure 12.4).

These eastern Jornada Mogollon groups on the southwestern part of the Llano Estacado continued to manufacture plain brownwares, corrugated jars, and after A.D. 1350 the Ochoa Indented brownware. Northern Rio Grande tradewares became common after ca. A.D. 1300, and included polychromes, black-on-whites, black-on-reds, and yellow-glazed wares from the Salado, Upper Rio Grande, Salinas, and Three Rivers areas of New Mexico and Arizona, as well as Ramos Polychrome from northern Chihuahua (Casas Grandes) (Collins 1971). The Salt Cedar site in Andrews County, Texas, one of the more important eastern Jornada Mogollon sites on the Llano Estacado, had Puebloan tradewares such as Agua Fria Glaze-on-red, Chupadero Black-on-white, El Paso polychrome, and San Clemente Glaze A polychrome (Collins 1968).

The character of aboriginal ceramics found on campsites and villages across the Texas Panhandle and Llano Estacado, as well as in the Caprock Canyonlands and the Lower Plains, changed greatly after ca. A.D. 1450. The ceramic wares are, with few exceptions, dominated by Northern Rio Grande glazewares (glazes III-VI or C-F) and thin, dark plain utility wares of one sort or another,[2] most closely resembling Southwestern-style culinary pottery, particularly those made in the Pecos and Galisteo pueblos (see Habicht-Mauche 1987, 1988, 1991; Boyd and Reese-Taylor 1993; Baugh 1986, 1992; Baugh and Eddy 1987; Spielmann 1983). Red River Late Caddoan style ceramics are also present in small amounts, particularly in the Edwards phase sites in western Oklahoma.[3] These changes in the composition of ceramic assemblages appear to be related to the development of new and more intensive forms of economic interaction and exchange between the Pueblo farmers of the Rio Grande, the bison hunters of the southern High Plains, and horticultural villages communities on the Red, Washita, and Canadian rivers in western Oklahoma.

Spielmann (1983:268) concluded that the local manufacture of ceramics on the southern High

[2]Some Texas archeologists have referred to this kind of plain micaceous ceramics as "Apache pottery" (Hughes 1991; Holliday and Johnson 1990; Johnson 1987), which is an inappropriate ethnic and cultural appellation, if not downright inaccurate, given: (a) the difficulty in visually sorting it from utility wares produced at Pecos and Galisteo pueblos, and (b) the divergent findings from the petrographic and compositional studies conducted on these utility wares by Boyd and Reese-Taylor (1993), Peck (1993), and Habicht-Mauche (1987, 1988, 1991). The 1985 Southern Athapaskan Ceramics Conference had codified this as an Apachean ware, Llano Estacado Gray Ware (Baugh and Eddy 1987).

[3]Twenty-five sand and shell-tempered sherds (90 percent sand and 10 percent shell inclusions) from the Floydada Country Club site were identified as Caddoan because of the shell tempering and a similarity to Caddoan utility wares (Word 1991:77), but this is unlikely because Caddoan shell-tempered vessels along the Red River do not contain sand tempering.

Plains ceased after ca. A.D. 1450,[4] as the Llano Estacado bison hunters obtained the Rio Grande wares as their main source of ceramics in exchange for bison meat, hides, and related products. Through time (by ca. A.D. 1600) as the exchange system evolved, the Pecos and Picuris glazewares had replaced the glazewares produced for the market from the Galisteo and Tonque pueblos. In plotting the distribution of post-A.D. 1450 Rio Grande ceramic glaze wares, Spielmann (1983:Figure 6) also noted that they appeared to be concentrated on sites along the major waterways that originate in, and flow east out of, New Mexico, specifically along the White River and the Prairie Dog Town Fork, as well as Tierra Blanca Creek (a tributary of the Prairie Dog Town Fork) and the North Fork of the Red River. In major protohistoric Garza and Tierra Blanca Complex components such as Bridwell (41CB27), Montgomery (41FL17), Pete Creek (41CB1), and Blackburn (41RD20), Rio Grande glazewares may amount for as much as 75 percent of the ceramic assemblages (e.g., Baugh 1986:Table 4; Spielmann 1983); they may be lacking entirely from Tierra Blanca and Garza camps where micaceous utility wares are better represented along with smaller amounts of sandy-paste Edwards Plain and grog-tempered Little Deer Plain (see Baugh [1986:170-172] for definitions of these Southern Plains utility wares).

At the time of Spielmann's (1983) consideration of Puebloan-Southern Plains exchange systems, the thin, plain micaceous utility wares on Southern High Plains sites were considered to have also been manufactured by Puebloan groups, probably at Pecos Pueblo given their resemblances to Blind Indented Corrugated and Faint-Striated jars at Pecos Pueblo (Kidder and Shepard 1936). However, petrographic analyses of utility ware sherds—and variability in tempers, paste, textures and finish, vessel size, and color—from Garza, Tierra Blanca, and Wheeler phase sites by Habicht-Mauche (1987, 1988, 1991) suggested that these culinary ceramics were more likely to represent ceramics locally produced by High Plains bison hunters, but out of a shared Southwestern ceramic tradition (Habicht-Mauche 1987:184); nevertheless, a small percent of the utility wares were thought to have been actually obtained in trade from Rio Grande pueblos (Habicht-Mauche 1991:67).

Given these findings, the Southern Plains striated utility ceramics were assigned to a new type, Tierra Blanca Plain (Habicht-Mauche 1987:178-180, 1988:217-272), named after the protohistoric component at the Tierra Blanca site in Deaf Smith County, Texas. It is a thin (averaging 3-5 mm), coil-constructed ware of "small-to-medium globular to slightly elongated jars with everted rims and gently curving shoulders" (Habicht-Mauche 1987:180; Figure 25). The exterior surfaces, brownish gray to black in color, were smoothed to faintly striated, probably by scraping with a corn cob, and only rarely decorated with two to three parallel rows of fingernail punctations (see Figure 25d). The paste is slightly sandy, with silica-rich crushed rocks added as temper, and variable amounts of mica particles are also present as a paste constituent, but it is not considered by Habicht-Mauche (1987:178) as a "micaceous" ware.

The study of 17th century ceramic assemblages from the Headstream (41KT51) and Longhorn (41KT53) sites in the Double Mountain Fork of the Brazos River basin provide a different perspective on the character and place of aboriginal ceramics among bison-hunting groups living in the Caprock Canyonlands (Boyd et al. 1993). Puebloan redwares, glazewares, and matte paint wares accounted for 58 percent of the estimated 31 vessels at the two sites, probably originating mainly from Pecos Pueblo, but also from the Santa Clara (Tewa) and Salinas pueblos of the northern Rio Grande (Boyd and Reese-Taylor 1993; Peck 1993); Pecos-style tubu-

[4]Garza components at Lubbock Lake and Lott do provide clear evidence that locally-manufactured ceramics are part of the material culture assemblage of these Southern Plains bison hunters. At Lubbock Lake, the local ware is a thick, grit-tempered ceramic with brushing and corncob impressions (Johnson et al. 1977:Figure 4e; Johnson 1978:Figure 27x, 1987:115); Johnson (1987:115) indicates this ware has been found in protohistoric contexts in sites on the southern half of the Llano Estacado. The local ware at the Lott site is a bone-tempered ceramic manufactured from Triassic clays, and decorated with incised diagonals, parallel lines, and rows of punctations; vessel forms are bowls, jars, and carinated bowls (Runkles and Dorchester 1987). A sherd of thick grit temper, with brushing and corncob impressions, was also present in the Lott site ceramic assemblage (Group I in Runkles and Dorchester [1987]).

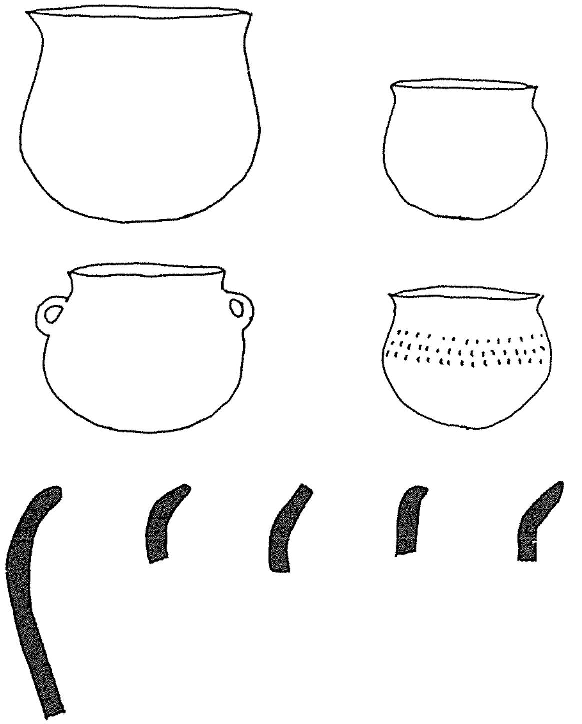


Figure 25. Protohistoric Tierra Blanca Plain vessel forms, decorations, and rim profiles on the Southern Plains (after Habicht-Mauche 1991).

lar pipes (Boyd et al. 1993:Figure 82) were also found at both sites.

Plain utility and micaceous utility vessels represent a minimum of 13 vessels at Headstream and Longhorn. Technologically and stylistically these wares cannot be distinguished from either Tierra Blanca Plain or the Pecos or Picuris Pueblo Faint Striated utility wares. However, based on the petrographic analysis of sherds from these Justiceburg Reservoir sites as well as the examination of petrographic data and ceramic thin sections from Pecos Pueblo and Tierra Blanca Plain, and X-Ray flourescence of paste composition, Boyd and Reese-Taylor (1993:374-375) conclude that: (1) the plain utility wares are from the same sources as the glazewares, most probably Pecos Pueblo, as they have the same variability in pastes and that (2) these culinary wares "probably represent Puebloan...rather than Plains-made wares." Thus, they question the utility of Tierra Blanca Plain if it refers to Southern Plains-made striated culinary wares or to a "widespread indigenous Plains ceramic tradition" (Boyd and Reese-Taylor 1993:375), and point out the need for further study of the compositional variability of Puebloan plain and striated utility wares

Although no Northern Rio Grande glazewares were recovered in the investigations at Palo Duro Reservoir in Hansford County, Texas, another interesting protohistoric (with three radiocarbon dates averaging A.D. 1550 and a TL date of A.D. 1655 ± 155) ceramic assemblage was recovered from 41HF8, Block C, along Palo Duro Creek in the northernmost part of the Texas Panhandle (Quigg et al. 1993). Reconstructable sections of three quartz sand-tempered vessels were found in Block C (Quigg et al. 1993:Figure 5.61), including: a small (14 cm orifice diameter) bean pot with smooth, non-striated exterior surfaces; a second smoothed-surface vessel with a vertical to outflating rim and constricted neck (12-13 cm orifice diameter); and a small, molded globular "cup" with flared lip and slightly restricted orifice.

Petrographic analyses indicate that these utility vessels were made in the Panhandle, using clays from outwash alluvial sediments with a fine quartz sand added as temper (Reese-Taylor 1993). It is notable that mica is lacking in the paste, whereas the Tierra Blanca Plain ceramics in contemporaneous Tierra Blanca, Garza, and Wheeler phase usually have small to moderate amounts of finely crushed mica in their pastes (Habicht-Mauche 1991:59).

Concluding Comments on Panhandle, Caprock Canyonlands, and Lower Plains Ceramics

Our understanding of prehistoric and protohistoric ceramic variability in the Lower Plains, Caprock Canyonlands, and Texas Panhandle regions has been hindered by the completion of few large archeological projects within the past 50 years. These types of projects can provide an opportunity to examine a suite of temporally and culturally distinct ceramic sites. However, there has been an uneven archeological emphasis on excavating mostly prominent Late Prehistoric village sites with abundant artifacts, including pottery, the recovery of mostly small and often culturally mixed ceramic assemblages from other time periods, and until recently, a tendency to utilize a lumpers (as opposed to a splitters) approach in studying ceramics with the primary goal of delineating gross temporal trends. Few attempts have been made to rigorously describe ceramic assemblages, using technological, petrographic, and chemical compositional analyses, to delineate the rich temporal and spatial variability of the regional prehistoric ceramic medium, and until such studies are completed, many important research problems focusing on prehistoric and protohistoric Southern High Plains lifeways will not be resolved.

Ceramics of the Jornada Mogollon and Trans-Pecos Regions of West Texas

Myles Miller

In contrast to the ceramic traditions of Central, southern, and eastern Texas described elsewhere in this paper which are stylistically related to ceramics produced by Lower Mississippi Valley cultures, we now turn towards the American Southwest and North Central Mexico (northern Chihuahua and Casas Grandes) for the ultimate derivation and inspiration of ceramic design and vessel form in the region of West Texas. For convenience, West Texas may be subdivided into the Jornada Mogollon and Trans-Pecos regions, although where one begins and the other ends, as well as any cultural connotations inherent in such divisions, remains mostly a matter of conjecture at this time. Simply for ease of presentation, we consider the Jornada Mogollon portion of West Texas as including the areas where ceramic production occurred, or else where ceramics are commonly found in abundance. This generally encompasses the basin and range physiographic zone west of a line drawn along the Guadalupe and Delaware Mountains, then roughly following the southern boundary of Culberson County to the Rio Grande, and extending southeast along the Rio Grande valley to a point near the town of Redford, several km east of Presidio (Figure 26).

The Hueco Bolson (along with the adjacent Tularosa and Mesilla Bolsons of South Central New Mexico) in the vicinity of El Paso can be considered the geographic "heartland" of El Paso Brownware production. Between the fifth and fifteenth centuries A.D., this region witnessed the development of a distinctive, indigineous ceramic tradition known as El Paso Brownware. In addition to this locally produced tradition, evidence of widespread interaction with the greater Southwest is demonstrated by the variety of ceramic types commonly found at West Texas archeological sites which derive from the Mogollon, Anasazi, and Casas Grandes regions of western and northern New Mexico, East Central Arizona, and northern Chihuahua.

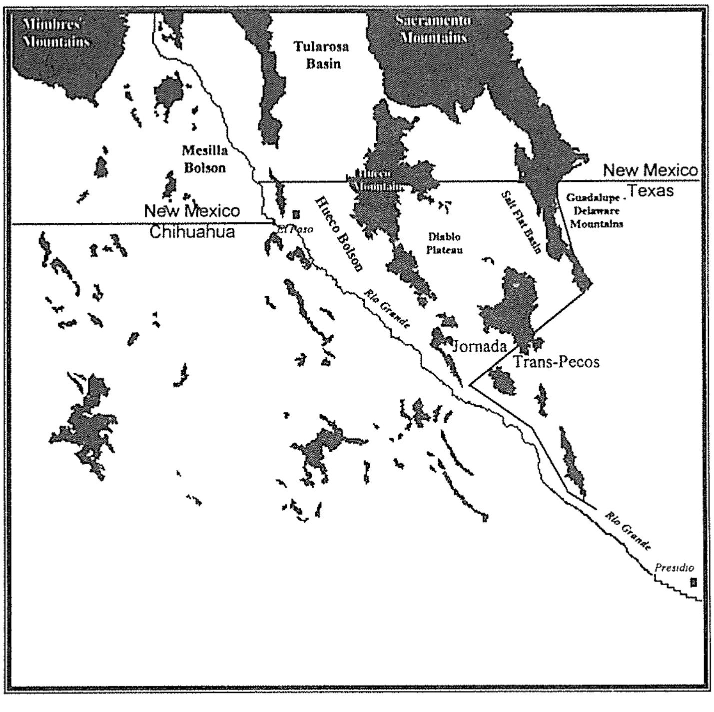


Figure 26. Jornada Mogollon and Trans-Pecos regions of West Texas and southern Mexico.

While the Hueco Bolson may be considered the heartland of Jornada Mogollon ceramic production, El Paso Brownware and other important Mogollon types such as Mimbres Black-on-white and Chupadero Black-on-white occur throughout West Texas and the Trans-Pecos (see Hedrick 1995). Mogollon ceramics have been reported from several small sites along the Diablo Plateau (Ackerly et al. 1987); the Fort Hancock and Sierra Blanca areas (Betancourt 1981; Edwards and Peter 1992; Glander et al. 1973; Hubbard 1991; Martin 1990; Miller 1992a; Miller et al. 1988a, 1988b; McConnel and Crim 1941; O'Laughlin and Martin 1992; Skinner et al. 1973, 1974; Walker and Trexler 1941); the Guadalupe Mountains (Bradford 1980; Ekland 1977; Phelps

1974; P. Katz 1978; S. Katz 1985; Katz and Katz 1975, 1979; Kenmotsu 1992; Roney 1983; Shafer 1970); the Salt Flat Basin (Banks 1977; Cliff and Fifield 1980; Foster and Kelley 1989; Katz and Lukowski 1981; Miller 1994; Rohrt and Skinner 1974); the Delaware Mountains (Miller 1994); and the Diablo Mountains (Cherry and Torrence 1973).

El Paso Brownware is also commonly found along the Rio Grande Valley for several hundred miles (Betancourt 1981; Johnson 1977; Kelley 1948). This includes the La Junta district at the confluence of the Rio Grande and Conchos rivers in the vicinity of Presidio (Beckes 1975; Kelley 1939, 1949, 1953, 1985; Kelley et al. 1940; Mallouf 1985; Shackleford 1951, 1955).

Production of El Paso Brownware ceramics probably took place in several of these areas, particularly at settlements presumably affiliated with agricultural economies in the Salt Flat Basin and the Rio Grande corridor. Several settlements in these areas have typical Jornada Mogollon ceramic assemblages, with the addition of arrow point technologies more closely resembling those of the Trans-Pecos region (Ackerly et al. 1987; Miller 1994). Verification of production zones outside the Hueco Bolson will require chemical compositional analysis such as that undertaken by Ekland (1977), and offers an intriguing study for the future. Also interesting is the relatively common occurrence of both Viejo and Medio period Chihuahuan ceramics in the southern part of the region (Skinner et al. 1973, 1974; Martin 1990; Miller 1992a; Hamilton n.d.).

The frequency of Jornada Mogollon ceramics declines markedly as one progresses east of the line dividing the Jornada Mogollon and Trans-Pecos regions. Sporadic occurrences of El Paso Brownware sherds have been noted in the Eagle Mountains south of Van Horn (Creel 1991; Howard 1994; Jackson 1932, 1937; Miller 1992b), at Granado Cave and Caldwell Ranch in the Rustler Hills north of Van Horn (Hamilton n.d.; Tanner 1949), a small number of rockshelters throughout the Big Bend region (Hilton 1986; Mallouf 1985), and even north into the Texas Panhandle (Boyd 1993; Johnson 1993, 1995; see also Boyd, this volume). It can be reasonably assumed that these occurrences resulted from interregional exchange networks rather than local production.

In the Jornada Mogollon region, El Paso Brownware ceramics are found at large pithouse and pueblo residential sites situated along the well-watered alluvial flanks of mountain chains, playa basins, and river valleys, as well as at virtually thousands of small, short-term settlements distributed throughout interior desert basins. Collections of 30,000 or more sherds have been recovered from sites such as Hueco Tanks Village (41EP2A), Hot Well Pueblo (FB6363), and Firecracker Pueblo (41EP25). While the larger samples occur on residential sites, small collections of sherds are commonly found distributed across interior basins.

Technologically, the El Paso ceramic tradition is characterized by a distinctive coarse-grained temper of crushed igneous rock, usually granite or syenite, with feldspar, quartz, and sometimes biotite mica being the primary non-plastic inclusions. Sherds often have a dark carbon streak, and surface colors range from dark red to light brown or tan, depending upon clay sources and firing conditions. Surface finishes are usually smoothed, wiped, or sometimes self-floated, and are uneven with numerous temper pits and drag marks clearly visible.

From the earliest typological descriptions (Lehmer 1948; Mera 1938, 1943; Runyan and Hedrick 1973; Stallings 1931), El Paso Brownware has been traditionally classified into three types based on stylistic and chronological criteria: an undecorated type known as El Paso Brown or Plain Brown, and two painted types designated El Paso Bichrome and El Paso Polychrome. It should be noted that the terms El Paso Bichrome and El Paso Polychrome are somewhat misleading. El Paso Bichrome is actually a monochrome, with a red (or rarely a black) pigment applied to the otherwise undecorated and unslipped, plain, brown vessel surface. Likewise, El Paso Polychrome should be considered a bichrome, with both red and black paint applied to the vessel surface. However, the original descriptive terms are here retained due to their primacy in the archeological literature.

Despite over four decades of archeological work, developmental ceramic chronologies for West Texas are still poorly known. The general ceramic/architectural phase sequence outlined in Lehmer's (1948) seminal study of the Jornada Branch of the Mogollon continues to be a standard reference, despite its publication date of over 40 years ago. Several modifications and refinements to the sequence have been proposed over the past 20 years, mostly through the pioneering work of Michael Whalen (1977, 1978, 1980, 1981, 1985) in the Hueco Bolson, and David Carmichael (1983, 1986) in the adjacent Tulorosa Basin of New Mexico. Despite these efforts, our understanding of chronological changes in vessel form and design style remain at a basic level, mostly revolving around the shift from El Paso Brown to El Paso Polychrome and their respective early and late variants—all of which have yet to be placed within a sound chronological framework.

Table 4. Radiocarbon-based chronological periods for El Paso Brownware and Historic Brownware production in West Texas

El Paso Brown	A.D. 200/600-1000/1100
El Paso Bichrome	A.D. 800/1000-1100/1250
El Paso Polychrome	
Early/Transitional variants	A.D. 1000/1100-1250
Classic Variants	A.D. 1250-1450
Protohistoric Brownware	A.D. 1450-1680
Ysleta/Socorro Brownware	A.D. 1680-1880

Several factors account for the lack of chronological control. First, West Texas and southern New Mexico lack the well-developed tree-ring chronologies and collections of whole vessels available from other regions of the Southwest. Stratified archeological deposits and sequences common to other areas of Texas are also rare. Therefore, ceramic dating in West Texas has mostly relied on cross-dating with extra-regional sequences. Only recently have ceramic types been directly correlated with series of chronometric dates from within the region itself. Another problem has to do with the confusion surrounding the dating of ceramic types and how these relate to the singular and irreconcilable issues of heuristic phase sequences and evolutionary changes in regional adaptive systems (Miller 1993). This observation then leads to an intuitively attractive proposition that it may simply be much more productive to abandon attempts to develop precise ceramic chronologies in terms of gross stylistic and morphological criteria, but rather focus on specific changes in production technology through time (Whalen 1994a).

Aside from these chronological and contextual problems which have hindered ceramic studies (and most other research) in West Texas, some advances have been made in the past few years. The dating of El Paso Brown and early/transitional El Paso Polychrome has been examined in the context of several site-specific radiocarbon studies (Whalen 1993, 1994b; Miller 1990), and a regional analysis of ceramic sequences and associated radiocarbon-dated contexts has been undertaken at Fort Bliss, Texas (Miller et al. 1994). Table 4 presents a *tentative* synthesis of these studies. Note that a certain degree of imprecision is evident for each type. This is a result of including some problematic dated contexts in the synthesis, as well as the inherent limitations of using series of radiocarbon age estimates to define chronological periods of less than 100-150 years.

The beginning dates for the appearance of ceramics, or the inception of ceramic production, in West Texas have yet to be resolved. Lehmer (1948:87-89) first established a date of A.D. 900 for the appearance of El Paso Brown and, by extension, the begining of the Mesilla phase in the Jornada Mogollon. The subsequent 45+ years of research have seen this beginning date continually pushed back, with published dates for the first appearance of El Paso Brown now ranging from A.D. 200 to A.D. 600 (Carmichael 1986; Hard 1983; Kauffman and Batcho 1988; Whalen 1980). The earliest dates have been obtained for sherd collections associated with small hearth/artifact scatters in active sand dune environments. Noting the many contextual ambiguities for artifacts in dynamic aeolian environments, some have justifiably questioned the association between the radiocarbon dated hearths and the brownware sherds scattered nearby (e.g., O'Laughlin et al. 1988). In any case, solid evidence exists for the widespread production of El Paso Brownware by at least A.D. 600, less securely by A.D. 400, or even A.D. 200. Regardless of which date proves accurate, ceramics appear late in West Texas relative to other areas of the Southwest.

For the first several hundred years, Jornada Mogollon region ceramic production is dominated by El Paso Brown. Vessel forms include predominantly neckless jars or *tecomates*, and hemispherical bowls (Figure 27), along with occasional ladles, cups, and necked forms (O'Laughlin 1985; Whalen 1977, 1978). Early and Late El Paso Brown are differentiated on the basis of subtle variations in rim form. Early El Paso Brown has contracting rim walls and pointed (or "pinched") lips, while the later variety dating to ca. A. D. 1000 or 1050 tends towards more uniform rim walls with flat or rounded lips. Recent studies have demonstrated how variations in these rim forms reflect increases in orifice diameter and vessel size, and therefore demonstrate a shift to the production and use of slightly larger, wider-mouthed vessels at ca. A.D. 1000.

Aside from minor changes in rim form and orifice diameter, many researchers have noted the otherwise almost complete lack of variation for most of the 500-700 year span of plain brownware production (Whalen 1993, 1994a, 1994b; Miller n.d.). It is easy to bemoan this lack of variation, particularly since it has been extremely difficult to identify chronological trends in brownware production, not to mention the inability to construct a ceramic seriation which could aid in site dating. Reed (1991), on the other hand, proposed that this should be viewed more as a function of a highly stable, successful adaptation to the semi-arid basin and range environments of West Texas, a position which, rather than viewing ceramics as simply a chronological device, integrates them into an overall conception linking ceramic technology and settlement adaptations. The lack of functional changes in rim and vessel form indicates that the role of ceramics in hunting and gathering adaptations may not have changed appreciably for most of the Mesilla phase, although this interpretation merits further research through more controlled technological analyses of El Paso Brownware temper, paste, strength, and thermal resistivity characteristics.

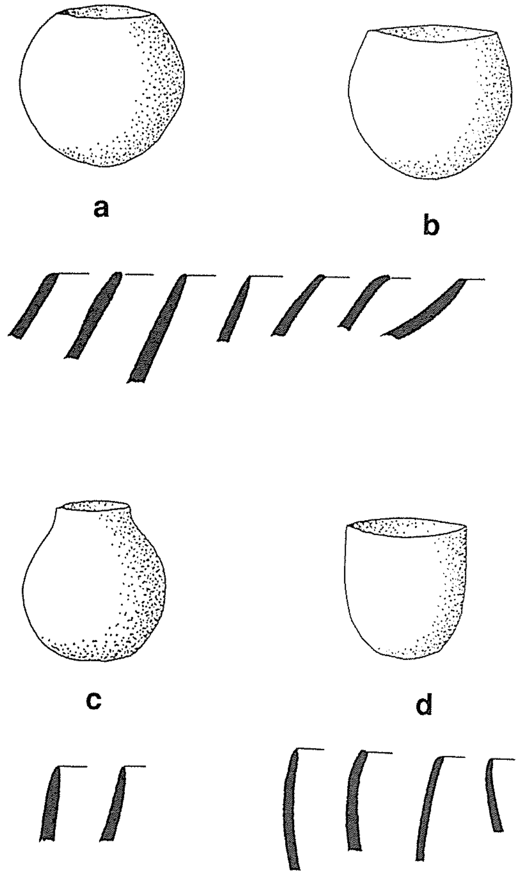


Figure 27. El Paso Brown vessel forms and rim profiles: a-b, neckless jar or tecomate; c, necked jar; d, bowl.

The period from A.D. 1000 to A.D. 1250 witnessed several developments in local ceramic production, as well as changes in the inventories of non-local ceramic types. Beginning sometime in the eleventh or early twelfth century, painted varieties of El Paso Brownware first appear. As seen in Table 4, there is no clear chronological division between the production dates for undecorated El Paso Brown and the two painted types: El Paso Bichrome and early variants of El Paso Polychrome. Instead, current evidence suggests that all three types were either produced contemporaneously, or represent a rapid development and sequential replacement of types within a relatively brief period of 100-150 years. At present, evidence for either position is equivocal. However, a notable aspect of this period is that the three traditional types as defined on the basis of decorative attributes all have nearly identical vessel forms. El Paso Bichrome and early/transitional El Paso Polychrome vessel forms continue the pattern of predominantly neckless jars and hemispherical bowls seen in El Paso Brown vessel assemblages, indicating that between A.D. 1000 and A.D. 1250 a relatively rapid change in decorative styles occurred with little concomitant change in vessel form and function.

El Paso Bichrome continues to pose problems for chronological placement, mostly due to the fact that very few chronometrically dated pure bichrome assemblages have been excavated or reported. Most El Paso Bichrome assemblages have been found in association with late El Paso Brown, Mimbres Black-on-white, and often the early/transitional variants of El Paso Polychrome, from components dating between ca. A.D. 1000-1250. A few incidences have been reported of crudely painted bichrome sherds recovered from sites or contexts dating as early as A.D. 600-800, but neither the dating nor the painting have been conclusively verified.

The few suitable El Paso Bichrome collections that have been studied show close similarities to El Paso Brown in terms of overall vessel and rim forms. The primary difference between the two types is the addition of red or black-painted designs on El Paso Bichrome. Some have questioned the existence of the black-on-brown variety. While red-on-brown designs are much more common, a few examples of true black-on-brown are known from several excavated collections. Designs are simple, consisting of single or double diagonal lines appended from the rim or a rim band. On larger sherds, the lines can sometimes be observed to form triangles and chevrons (Figure 28).

El Paso Polychrome first appears between A.D. 1000 and A.D. 1100. Early and transitional variants of El Paso Polychrome follow the basic vessel form trends established in the El Paso Brown series, and the design layouts of El Paso Bichrome. Again, the predominant vessel form is the neckless jar and hemispherical bowl, although necked jar forms also occur for the transitional variant during this period. Designs on early and transitional El Paso Polychrome are similar to those for El Paso Bichrome, with the addition of both black and red-painted parallel lines. Primary design layouts consist of diagonal red and black bands appended from the rim, or a rim band which form combinations of chevrons and triangles (see Figure 28). The transitional variant is notable for the first incidence of stepped fret designs which become common in later classic variants.

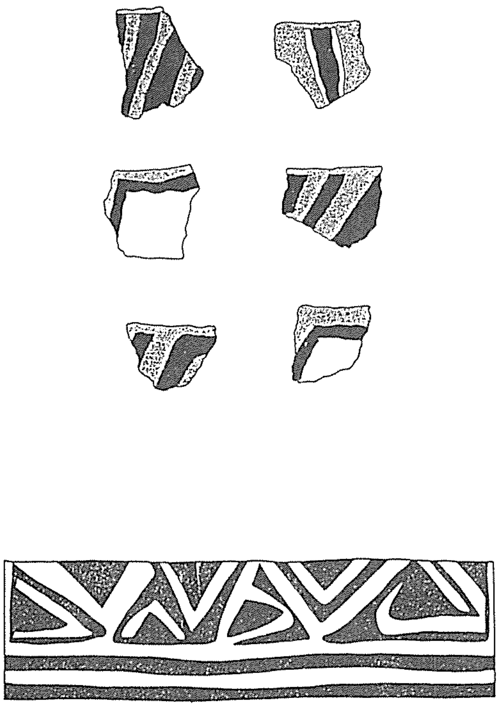


Figure 28. Early El Paso Polychrome designs on rim sherds and example of design band layout.

While two variants of El Paso Polychrome dating before A.D. 1250 have been recognized during recent analyses of several excavated collections, it is not yet possible to determine whether they represent functional and/or chronological variation or simply minor differences among site assemblages. The two variants are classified on the basis of a slightly greater proportion of necked jars and the occurrence of stepped fret design elements on the transitional variant. However, it is often difficult to distinguish necked and neckless jar forms using collections of small rim sherds, and stepped frets are generally rare. Therefore, the two variants can seldom be discriminated among sherd lots.

By A.D. 1250, there is virtually a complete replacement of Plain Brown and Bichrome types, as well as the early/transitional variant of El Paso Polychrome, with Classic El Paso Polychrome (Figure 29). This pattern is unique among Southwestern ceramic technologies, since no plain or corrugated utilitarian wares are produced in combination with the painted El Paso Polychrome ceramics. Instead, El Paso Polychrome is painted only on the upper half to two-thirds of the vessel. The lower portion of the vessel—the area most likely to come into contact with heating fires—was left undecorated. Therefore, El Paso Polychrome served multiple functions as both a utilitarian and non-utilitarian decorated ware.

Classic El Paso Polychrome jar forms include the characteristic everted rim, restricted orifice necked jar, or *olla*. Bowl forms include hemispherical shapes with somewhat larger orifice diameters and sizes than earlier variants. Some Classic El Paso Polychrome jars measure nearly one meter in height and have orifice diameters of nearly 35 cm, and represent some of the largest vessels ever produced in the Southwest. Unusual vessel forms include paired jars connected by a "stirrup" handle, jars with attached base supports, and a highly stylized bowl form with modeled stepped frets protuding from the rim (Figure 30).

Two variants of Classic El Paso Polychrome have recently been identifed; they are differentiated on the basis of subtle differences in wall thickness, rim form, and design elements. One variant is characterized by relatively thicker walls, and a slightly outcurved rim with a flat or rounded lip. The second variant tends towards thinner vessel walls, a greater degree of rim eversion and thickening with a rounded lip, and perhaps a slightly higher incidence of curvilinear design elements. While it would be tempting to classify these variants as early and late, analysis of chronometric data has found little differentiation among the two, and other archeological evidence suggests that they may represent slight functional differences associated with different settlement types rather than discrete chronological developments.

Unlike other Southwestern decorated ceramic traditions, painted El Paso brownwares have never developed a reputation for aesthetic achievement in terms of design elements and layout. It is the author's opinion that the complexity of design layouts on Classic El Paso Polychrome vessels has been unappreciated, perhaps due in part to the fact that so few whole vessels are available for study. Further, design layouts are constructed from a

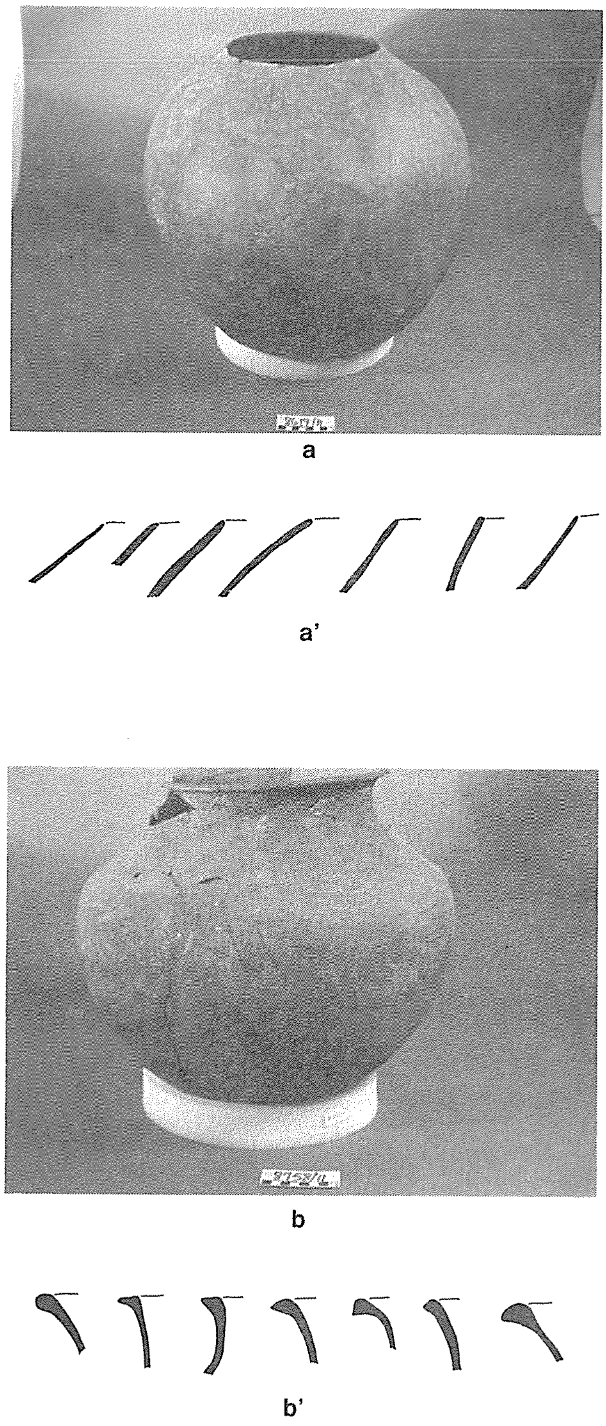
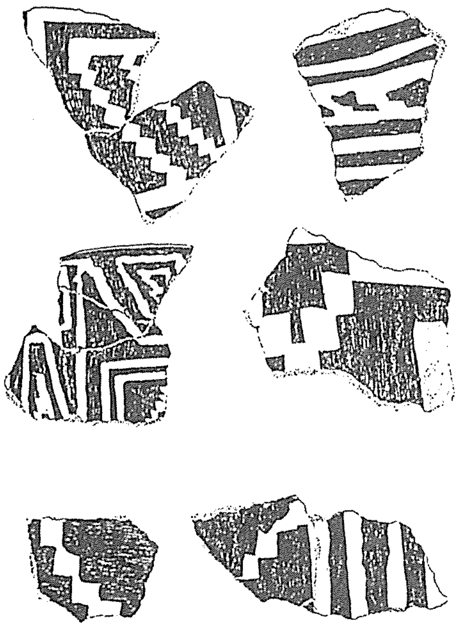


Figure 29. El Paso Polychrome: a, Early/Transitional El Paso Polychrome vessel; a', rim forms; b, Classic El Paso polychrome vessel; and b', rim forms. Photographs reproduced with the permission of Museum of Indian Arts and Culture, Laboratory of Anthropology, Santa Fe, New Mexico.

Figure 30. El Paso Polychrome stepped-fret bowl. Photograph reproduced with the permission of Museum of Indian Arts and Culture, Laboratory of Anthropology, Santa Fe, New Mexico.

limited set of elements, consisting primarily of alternating red and black parallel or interlocking bands, and stepped frets (Figure 31). Circles, combs, and crosses are sometimes present as secondary elements. More recent appraisals have observed that this restricted set of design elements is integrated into an extremely complex and dynamic series of band layouts between the rim and lower framing lines (Miller n.d.; Thomas O'Laughlin, personal communication, 1994).



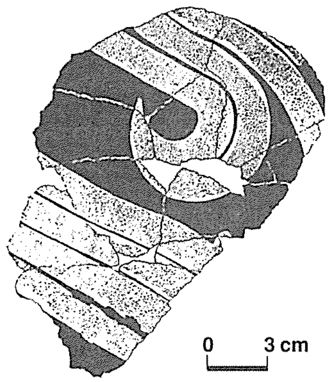


Figure 31. Classic El Paso Polychrome design elements.

While up to this point we have emphasized the indigenous El Paso Brownware tradition, it must also be noted that a variety of noteworthy ceramics occur in West Texas, including types such as Mimbres Black-on-white and Ramos Polychrome, which rank among the most remarkable of prehistoric North American ceramics. By far, the two most common non-local ceramic types are Mimbres Black-on-white and Chupadero Black-on-white.

Mimbres Black-on-white occurs on most pithouse sites in the area dating prior to A.D. 1150, usually in association with El Paso Brown, Bichrome, and early/transitional Polychrome variants. Mimbres ceramics are known for their fine design execution and highly stylized naturalistic representations of animals and humans. Figure 32 illustrates an example of a partial Mimbres Classic Black-on-white vessel with a naturalistic design motif from the North Hills I site (41EP355) in northeast El Paso. Chupadero Black-on-white is one of the most widely distributed ceramics throughout West Texas and New Mexico. It is also one of the longest-lived types, with dates reported from ca. A.D. 1150 to A.D. 1650.

Other important additions to the West Texas ceramic inventory originated in the Casas Grandes area of the North Central Mexican state of Chihuahua. Medio and Tardio period ceramics are commonly found in the area at pueblo sites dating between A.D. 1250 and A.D. 1450. Common types include the finely made Ramos Polychrome (Figure 33), with fine-line red and black designs and occasional effigy vessels, and Villa Ahumada Polychrome with relatively thick red and black designs

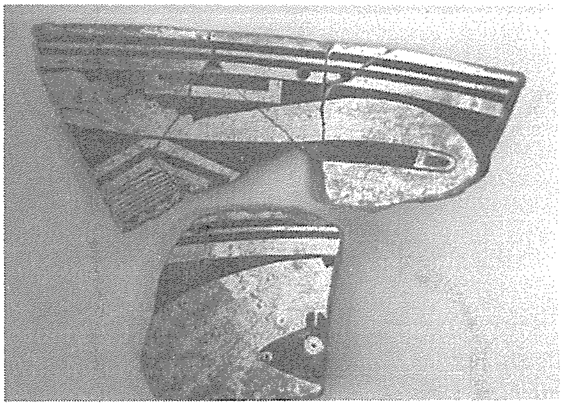


Figure 32. Mimbres Classic Black-on-white bowl with naturalistic motif from North Hills I site (41EP355).

painted over a chalky white slip. Playas Red is another common ceramic notable for a wide range of textured and modeled design elements. Although considered primarily of Chihuahuan origin, there is some evidence for local production of Playas Red variants across the Jornada Mogollon region (Bradley and Hoffer 1985; Creel et al. 1995).

Recent excavations and survey projects have also documented the presence of earlier Viejo period (ca. A.D. 700-1150) red-on-brown and polychrome types throughout the southern portion of West Texas. Viejo period ceramics, such as Mata Polychrome, Anchondo broad-line red-on-brown, Pilon, Leal, and Fernando narrow-line red-on-brown, and several Convento textured varieties, have been recorded at pithouse and rockshelter sites. Locations include several pithouse sites around El Paso (Miller 1989), the Rio Grande valley terraces and Alamo arroyo in the vicinity of Fort Hancock (Martin 1990; Miller 1992a), near Sierra Blanca (Skinner et al. 1973, 1974), and at Granado Cave near Van Horn where a whole Mata Polychrome vessel was found filled with cotton seeds (Hamilton n.d.; Mallouf 1985). The presence of these Viejo period ceramics now suggests a much longer period of contact between West Texas and Chihuahua than has previously been considered, and close similarities between the design trends of Viejo period ceramics and El Paso Bichrome and early El Paso Polychrome have been noted (Miller 1991a).

Finally, an assortment of other Mogollon and Anasazi types occur in West Texas, although these are much fewer in numbers than the types described above. White Mountain Redwares from East Central Arizona, including St. John's, Fourmile, Pinedale, and Heshotauthla Polychrome, occur at pueblo and some late pithouse sites. Salado Polychromes (Pinto, Gila, and Tonto Polychrome) are also sometimes found at pueblo sites in the region, as are Cibola whitewares from northern New Mexico and Arizona.

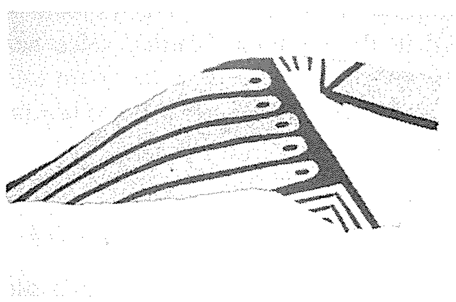


Figure 33. Ramos Polychrome sherd from Dona Ana County Airport site west of El Paso.

By most accounts, the prehistoric El Paso Brownware ceramic tradition comes to an end with the abandonment of El Paso phase puebloan settlements at A.D. 1450. The following 230 year period presents a rather blank picture for local ceramic traditions affiliated with various protohistoric groups, such as the Manso, Suma, and Jumano, who from Spanish accounts are known to have occupied the region. Several coarsely finished, sand-tempered sherds thought to be of historic origin were recovered from a possible Manso site (LA 26780) near the Dona Ana County Airport, 16 km west of El Paso (Batcho et al. 1984). Occasionally an odd sherd with a sand temper or an unusual surface treatment or color has been reported during survey or testing projects in the Hueco Bolson and elsewhere in the Trans-Pecos. However, these also have similarities to prehistoric Western Mogollon plainwares such as Alma Plain. To date, none of the unusual Jornada sherds has been conclusively identified as protohistoric in affiliation.

It is not until the Spanish Colonial/Post-Pueblo Revolt period after A.D. 1680 that a distinctive local ceramic tradition can again be recognized in West Texas. With the establishment of the Socorro and Ysleta missions by Pueblo Revolt refugees from North Central New Mexico came a new ceramic tradition known as Ysleta and Socorro Brownware (Peterson and Brown 1991). Ceramic production at Native American settlements affiliated with the missions, such as the Ysleta WIC site (41EP2840), offers several interesting contrasts to local prehistoric technologies (Miller and O'Leary 1992), including a greater level of standardization in vessel form, size, and symmetry. Also notable is the combination of the traditional *olla* jar form and carinated bowl forms similar to northern New Mexico Puebloan ceramics with new forms such as candlesticks and *platos* (flat plate-like vessels) imposed by Spanish consumers (Figure 34). This tradition continued until later historic times with the introduction of wheel-thrown commercial ceramic production in the 1800s.

Again, non-local types occur with some frequency, demonstrating participation in regional exchange networks, particularly along the Camino Real (see Palmer 1993). Tewa and Ogapoge Polychromes and Rio Grande Glazewares from

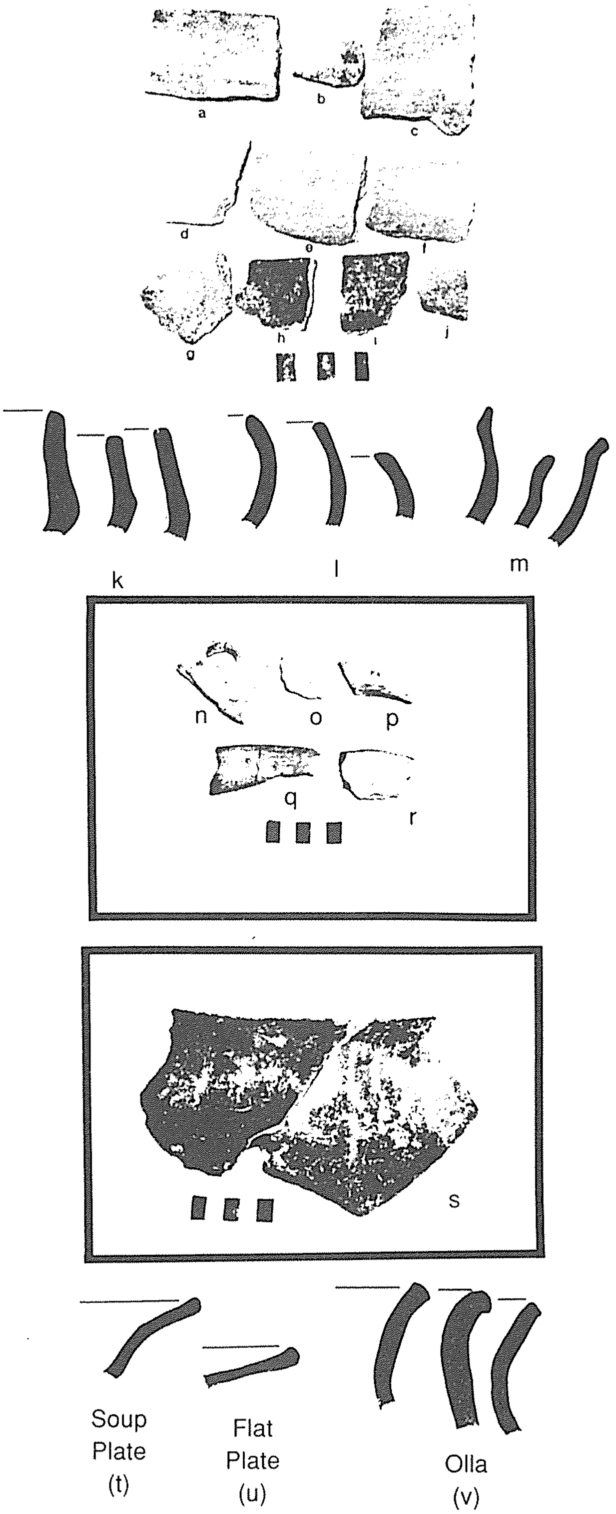


Figure 34. Ysleta Brownware carinated bowls, *platos*, and olla sherds from the Ysleta Clinic site (41EP2840): a-c, direct rim carinated bowls; d-f, direct rim hemispherical bowls; g-j, incurved bowls; k, direct carinated bowl rim profiles; l. incurved bowl rim profiles; m, flared bowl rim profiles; n-r, *plato* rims; s, olla rim; t, soup plate rim profile; u, flat plate rim profile; v, olla rim profiles.

northern and central New Mexican Pueblos have been found at several sites in the Rio Grande valley in the vicinity of El Paso (Figure 35). A notable addition to the ceramic inventory of this period are the porcelain-like *majolica* wares produced in Puebla, Mexico, and transported along the Camino Real as it passed through El Paso del Norte.

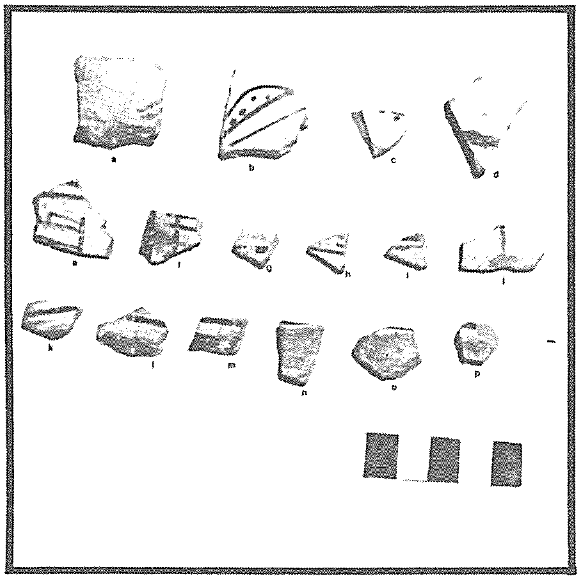


Figure 35. Tewa-Ogapoge Polychrome sherds from Ysleta Clinic Site (41EP2840): a, Tewa Polychrome bowl sherd; b-p, Tewa-Ogapoge Polychrome jar sherds.

Several ethnohistorically documented Spanish Colonial period groups produced ceramics in the La Junta District, including several affiliated with early mission settlements which predate the Pueblo Revolt occupation of the El Paso area (Kelley 1953, 1986). However, the ceramics of this area have not yet been fully described (but see Hoyt 1994; Cloud et al. 1994:86-102). Further reserach should be emphasized in the La Junta District, since here we have the potential to examine the entire range of ceramic production from prehistoric to late historic times in West Texas.

Summary of West Texas Ceramics

Despite more than 40 years of archeological research and 20 years of intensive cultural resource management survey and excavation projects, ceramic studies in West Texas are essentially still in their infancy. While other regions of the Southwest have moved on to issues of technological production within a wider framework of anthropological theory, ceramicists in West Texas are still wrestling with fundamental issues of typology, chronology, and context. Although these are worthwhile pursuits, it is perhaps time to broaden our perspectives, theoretical outlooks, and range of analytical tools (Miller 1991b).

Aside from their utility as relative chronological indicators, and for other traditional research avenues, more interesting is the potential information afforded by various technological aspects of El Paso Brownware production. As several passages in this section have noted, the El Paso Brownware tradition is one of the more distinctive in the American Southwest, although it is one that is often portrayed in a rather negative manner for, as noted by Stephen LeBlanc (1982), El Paso Polychrome represents "...one of the least aesthetically pleasing ceramics produced in the southwest." Aside from the aesthetic critiques, such viewpoints reflect our perception of the relatively unstandardized and unchanging technology of the region.

Rather than viewing ceramic production solely in aesthetic and typological terms, it would be more productive to examine ceramic technology within the context of the particular settlement and subsistence systems of the region. Only recently have we begun to reconsider the functional roles of ceramic technological variability in the context of highly mobile, hunter-gatherer settlement adaptations characteristic of most of West Texas (Miller 1990, n.d.; Poche 1995; Reed 1991; Whalen 1994a, 1994b). This will require a fundamental shift in how we perceive ceramic production, as well as the development of new analytical tools and methods.

I see great potential for an expanded application of geochemical and petrographic methods for identifying ceramic compositional groups and how they relate to production zones and resource locations (Bentley 1994; Burgett n.d.; Bradley and Hoffer 1985). These data offer several possibilities, including: refined models of production, use, exchange, and discard for mobile hunter-gatherer groups; as well as interactions between the Mimbres Valley, northern Chihuahua, the Jornada Mogollon, and the greater Trans-Pecos. Did El Paso Polychrome serve as the "tin can" of the Southwest as proposed by DiPeso et al. (1974), serving primarily as a cheap container for the exchange of goods? Or will more subtle functional implications be found upon closer examination?

Variations in temper selection and preparation, vessel wall strength, thermal shock resistance, and surface treatments may also furnish some insight into the role of ceramics in an essentially hunting and gathering economy (Whalen 1994a). How the role of ceramics changed in the context of later prehistoric agricultural development may also be examined, clarifying whether or not the application of necks to jar forms was a functional result of the increasing use of ceramics for the preparation of corn, in turn reflecting greater agricultural dependence after A.D. 1100 or A.D. 1250 (Seaman and Mills 1988; Hard et al. 1995). These questions offer intriguing research results for the future. Perhaps no other region of Texas, with the exception of the Caddoan area of Northeast Texas, offers such potential for ceramic studies.

SUMMARY COMMENTS

This review of the prehistoric and historic aboriginal ceramics made and used by aboriginal peoples in Texas barely scratches the surface in terms of truly characterizing the impressive stylistic, functional, and technological diversity of the many ceramic wares found across the state. As we discussed, ceramics were manufactured in Texas beginning as early as 500 B.C. in parts of Northeast Texas, and by A.D. 1200/1300 or so, ceramics were a very significant part of the material culture of aboriginal peoples in Southeast and coastal Texas, among Caddoan and Jornada Mogollon groups, and among the Plains Village communities in the Texas Panhandle and the North Central Texas prairies.

Differences and trends in the use of ceramics by these aboriginal peoples relate to the most basic issues of prehistoric and historic Native American cultural adaptations (see O'Brian et al. 1994), not simply to standard but less-compelling issues of chronology and cultural-temporal systematics. Thus, it is high time that Texas archeologists begin to truly take full advantage of the valuable research information to be gained by the comprehensive regional and site-specific study of ceramic style, function, and technology embedded in the diverse aboriginal ceramic assemblages found across the state in archeological contexts. Accordingly, we hope that this overview will bring renewed archeological attention to the prehistoric and historic aboriginal ceramics found in Texas, and that new methods of study— and most importantly new ways of thinking—result in refined understanding of the role of ceramics in Native American lifeways.

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REFERENCES CITED

Abbott, J. T. (editor)
1995 *NRHP Significance Testing of 57 Prehistoric Archeological Sites on Fort Hood.* Review Draft. Research Report No. 34, Archeological Resource Management Series. U.S. Army, Fort Hood.

Ackerly, N., R. Buck, D. Carlson, S. Carlson, S. DeAtley, G. Dean, M. Green, J. Ponczynski, J. Schuldenrein, D. Sick, J. Swartout, and J. Wilde
1987 *Interim Descriptive Report on Cultural Resources Found Along the All American Pipeline Right-of-Way Between Celeron MPM 11 and All American MPM 1285.* Cultural Resources Management Division, New Mexico State University, Las Cruces.

Aten, L.
1983 *Indians of the Upper Texas Coast.* Academic Press, New York.

Banks, K.
1977 Prehistoric Settlement in the Salt Basin, Texas. *Transactions of the 12th Regional Archaeological Symposium for Southeastern New Mexico and Western Texas*, pp. 1-14. El Paso.

Bastian, T.
1967 Native-Made Artifacts from Historic Sites. In *A Pilot Study of Wichita Indian Archeology and Ethnohistory*, assembled by R. E. Bell, E. B. Jelks, and W. W. Newcomb, pp. 184-196. Final report for Grant GS-964. National Science Foundation, Washington, D.C.

Batcho, D. G., D. L. Carmichael, M. Duran, and M. Johnson
1984 *Archaeological Investigations of Sites Located at the Southern Dona Ana County Airport, Santa Teresa, New Mexico.* Report No. 533. Cultural Resources Management Division, New Mexico State University, Las Cruces.

Baugh, T. G.
1986 Cultural History and Protohistoric Societies in the Southern Plains. In Current Trends in Southern Plains Archaeology, edited by T. G. Baugh, pp. 167-187. *Plains Anthropologist* 31(114), Part 2, Memoir 21.

1992 Protohistoric Cultural Manifestations on the Southern Plains: A Reconsideration of the Wheeler Phase and Garza Complex. In *Cultural Encounters and Episodic Droughts: The Protohistoric Period on the Southern Plains*, edited by E. Johnson, pp. 21-39. Quaternary Research Center Series Number 3. Lubbock Lake Landmark, Museum of Texas Tech University, Lubbock.

Baugh, T. G. *(Continued)*
1994 Holocene Adaptations in the Southern High Plains. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by K. H. Schlesier, pp. 264-289. University of Oklahoma Press, Norman.

Baugh, T. G. and F. W. Eddy
1987 Rethinking Apachean Ceramics: The 1985 Southern Athapaskan Ceramic Conference. *American Antiquity* 52(4):793-798.

Beckes, M. R.
1975 *Summary Report on an Archaeological Survey of Areas to be Affected by the Cibolo Creek Floodway Project, Presidio County, Texas*. Technical Bulletin No. 7. Texas Archeological Survey, Austin.

Bell, R. E.
1984 The Plains Villagers: The Washita River. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 307-324. Academic Press, New York.

Bell, R. E. and T. Bastian
1967 Preliminary Report upon Excavations at the Longest Site, Oklahoma. In *A Pilot Study of Wichita Indian Archeology and Ethnohistory*, assembled by R. E. Bell, E. B. Jelks, and W. W. Newcomb, pp. 54-118. Final report for Grant GS-964. National Science Foundation, Washington, D.C.

Bell, R. E., E. B. Jelks, and W. W. Newcomb (assemblers)
1967 *A Pilot Study of Wichita Indian Archeology and Ethnohistory*. Final Report for Grant GS-964. National Science Foundation, Washington, D.C.

Bentley, M. T.
1994 An INAA Study of Hot Well Village Clays and Affiliated Clay Sources Used in the Production of El Paso Polychrome. Paper presented at the Eighth Mogollon Conference, El Paso.

Betancourt, J.
1981 Quitman Mountains of Southern Hudspeth County. In *Five Archeological Investigations in the Trans-Pecos Region of Texas*, by J. Betancourt, D. Creel, P. R. Katz, P. D. Lukowksi, L. McNutt, and R. W. Ralph, pp. 27-82. Permit Series No. 6. Texas Antiquities Committee, Austin.

Black, S. L.
1986 *The Clemente and Herminia Hinojosa Site, 41JW8: A Toyah Horizon Campsite in Southern Texas*. Special Report No. 18. Center for Archaeological Research, The University of Texas at San Antonio.

Bollich, C. N.
1995 Native American Ceramics of the Sabine Lake Area. *Texas Archeological Stewardship Network Newsletter* 10(1):17-18.

Boyd, D. K.
1993 Archaeological Investigations at the Sam Wahl Site: Jornada Mogollon Influence in the Texas Southern Plains. Paper presented at the Ninth Jornada Mogollon Conference, Tularosa, New Mexico.

Boyd, D. K. and K. Reese-Taylor
1993 Petrographic Analysis of Ceramic Sherds and Clay Samples. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*, by D. K. Boyd, J. Peck, S. A. Tomka, and K. W. Kibler, pp. 339-378. Reports of Investigations, No. 88. Prewitt and Associates, Inc., Austin.

Boyd, D. K., M. D. Freeman, M. D. Blum, E. R. Prewitt, and J. M. Quigg
1989 *Phase I Cultural Resources Investigations at Justiceburg Reservoir on the Double Mountain Fork of the Brazos River, Garza and Kent Counties, Texas*. 2 Vols. Reports of Investigations No. 66. Prewitt and Associates, Inc., Austin.

Boyd, D. K., J. Peck, S. A. Tomka, and K. W. Kibler
1993 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*. Reports of Investigations, No. 88. Prewitt and Associates, Inc., Austin.

Boyd, D. K., J. Peck, S. A. Tomka, K. W. Kibler, and M. D. Freeman
1994 *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3*. Reports of Investigations No. 93. Prewitt and Associates, Inc., Austin.

Boyd, D. K., S. A. Tomka, C. B. Bousman, K. M. Gardner, and M. D. Freeman
1992 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1*. Reports of Investigations No. 84. Prewitt and Associates, Inc., Austin.

Bozell, J. R. and J. V. Winfrey
1994 A Review of Middle Woodland Archaeology in Nebraska. *Plains Anthropologist* 39(148):125-144.

Bradford, J. E.
1980 *Upper Dog Canyon Archaeology: Guadalupe Mountains National Park, Texas*. National Park Service, Southwest Cultural Resources Center, Santa Fe.

Bradley, R. J. and J. M. Hoffer
1985 Playas Red: A Preliminary Study of Origins and Variability in the Jornada Mogollon. In Proceedings of the Third Jornada Mogollon Conference, edited by M. S. Foster and T. C. O'Laughlin, pp. 161-178. *The Artifact* 23(1-2). El Paso Archaeological Society, El Paso.

Brewington, R. L., J. E. Dockall, and H. J. Shafer
1995 *Archaeology of 41MX5: A Late Prehistoric Caddoan Hamlet in Morris County, Texas*. Reports of Investigations No. 1. Center for Environmental Archaeology, Texas A&M University, College Station.

Brooks, R. L.
1989 Village Farming Societies. In *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*, by J. L. Hofman, R. L. Brooks, J. S. Hays, D. W. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein, pp. 71-90. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.
1994 Southern Plains Cultural Complexes. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 33-50. Smithsonian Institution Press, Washington, D.C.

Brown, D. O., R. P. Watson, D. Peter, and V. Rawn-Schatzinger
1987 McDonald Site - 41HI105. In *Archeology at Aquilla Lake: 1978-1982 Investigations*, Volume II, compiled by D. O. Brown, pp. 38-1 to 38-145. Research Report 81. Texas Archeological Survey, The University of Texas at Austin.

Bruseth, J. E.
1987 Ceramic Artifacts. In *The Bird Point Island and Adams Ranch Sites: Methodological and Theoretical Contributions to North Central Texas Archaeology*, edited by J. E. Bruseth and W. A. Martin, pp. 109-126. Richland Creek Technical Series, Volume II. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.
1995 The Development of Caddoan Polities Along the Middle Red River Valley of Eastern Texas and Oklahoma. In *The Native History of the Caddo: Their Place in Southeastern Archaeology and Ethnohistory*, edited by T. K. Perttula and J. E. Bruseth. MS in review for publication.

Bruseth, J. E. and T. K. Perttula
1981 *Prehistoric Settlement Patterns at Lake Fork Reservoir*. Texas Antiquities Permit Series, Report No. 2. Southern Methodist University and Texas Antiquities Committee, Dallas and Austin.

Burgett, G. R.
n.d. Compositional Analysis of Selected Ceramics from the Hueco Mountain Archaeological Project. In *Prehistoric Cultural Systems in the Northern Chihuahuan Desert: Archaeological Research in the Hueco Bolson of West Texas*, by G. R. Burgett, K. Poche, K. Faunce, M. Melton, D. Potter, B. Buck, F. Almarez, J. Leach, T. O'Laughlin, R. Holloway, and M. Newman. Cultural and Natural Resources Report Series, Directorate of Environment, Fort Bliss, Texas. In preparation.

Calhoun, C. A.
1961 Scored Pottery of the Texas Coastal Bend. *Bulletin of the Texas Archeological Society* 32:321-326.

Campbell, T. N.
1961 Origins of Pottery Types from the Coastal Bend Region of Texas. *Bulletin of the Texas Archeological Society* 32:331-336.

Carmichael, D. L.
1983 Archaeological Settlement Patterns in the Southern Tularosa Basin, New Mexico: Alternative Model of Prehistoric Adaptations. Unpublished Ph.D. dissertation, Department of Anthropology, University of Illinois, Urbana.
1986 *Archaeological Survey in the Southern Tularosa Basin of New Mexico*. Historic and Natural Resources Report No. 3. Environmental Management Office, Fort Bliss, Texas.

Cherry, J. and R. Torrence
1973 Archeological Reconnaissance in Victorio Canyon, Hudspeth and Culberson Counties, Texas. In *Victorio Canyon, A Natural Areas Survey, Part IV*, edited by D. Kennard, pp. 115-163. Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin.

Cliff, M. B. and T. Fifield
1980 *An Archaeological Evaluation of the Floodwater Diversion in the Three-Mile and Sulphur Draw Watershed, Culberson County, Texas*. Environmental Consultants, Inc., Dallas.

Cliff, M. B. and T. K. Perttula
1995 Preliminary Ceramic Typology for Cooper Lake. In *Archaeological Survey of Cooper Lake: Cultural Resources Studies for Cooper Lake, Hopkins and Delta Counties, Texas*, by D. H. Jurney, D. E. McGregor, W. A. Martin, M. Green, R. W. Moir, M. B. Cliff, and J. W. Saunders, pp. 573-612. Archaeology Research Program, Southern Methodist University, Dallas.

Cloud, W. A., R. J. Mallouf, P. A. Mercado-Allinger, C. A. Hoyt, N. A. Kenmotsu, J. M. Sanchez, and E. R. Madrid
1994 *Archeological Testing at the Polvo Site, Presidio County, Texas*. Report 39. Office of the State Archeologist, Texas Historical Commission, and U.S. Department of Agriculture, Soil Conservation Service, Austin.

Collins, M. B.
1968 The Andrews Lake Locality: New Archeological Data from the Southern Llano Estacado. Unpublished M. A. thesis, Department of Anthropology, The University of Texas at Austin.

Collins, M. B. *(Continued)*
1969 What is the Significance of the Southwestern Ceramics Found on the Llano Estacado? *Transactions of the Fifth Regional Archeological Symposium for Southeastern New Mexico and Western New Mexico*, pp. 45-63. Portales, New Mexico.
1971 A Review of Llano Estacado Archaeology and Ethnohistory. *Plains Anthropologist* 16(52):85-104.

Corbin, J. E.
1974 A Model for Cultural Succession for the Coastal Bend Area of Texas. *Bulletin of the Texas Archeological Society* 45:29-54.

Corley, J. A.
1965 Proposed Eastern Extension of the Jornada Branch of the Mogollon. *Transactions of the First Regional Symposium for Southeastern New Mexico and Western Texas*, pp. 31-36.

Couzzourt, J.
1985 Preliminary Report: Testing at the Tascosa Creek Site, Oldham County, Texas. *Transactions of the Twentieth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 65-142.
1988 Tascosa Creek Site. *Transactions of the Twenty-third Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 44-79.

Couzzourt, J. and B. A. Schmidt-Couzzourt
1988 Report on the 1969 Texas Archeological Society Field School at Blue Creek, Moore County, Texas Panhandle. MS on file, Panhandle Archeological Services-Texas, Canyon, Texas.

Crabb, M.
1968 Some Puebloan Trade Pottery from Panhandle Aspect Sites. *Bulletin of the Texas Archeological Society* 38:83-89.

Creel, D. G.
1981 Eagle Mountains of Southern Hudspeth County. In *Five Archeological Investigations in the Trans-Pecos Region of Texas*, by J. Betancourt, D. Creel, P. R. Katz, P. D. Lukowski, L. McNutt, and R. W. Ralph, pp. 169-191. Permit Series No. 6. Texas Antiquities Committee, Austin.

Creel, D., M. Williams, H. Neff, and M. Glasscock
1995 Neutron Activation Analysis of Black Mountain Phase Ceramics from Old Town and Other Sites in the Mimbres Area. Paper presented in the symposium "The Dynamics of Material Culture and Social Processes: The Interplay between Theory and Data in Mimbres Archaeology." Annual Meeting of the Society for American Archaeology, Minneapolis, Minnesota.

Cruse, J. B.
1992 *Archeological Investigations at the Kent Creek Site (41HL66): Evidence of Mogollon Influence on the Southern Plains.* Publication No. 6. Panhandle Archeological Society, Amarillo.

David, N., J. Sterner, and K. Garua
1988 Why Pots are Decorated. *Current Anthropology* 29:365-379.

Davis, D. R., Jr.
1991 *Prehistoric Artifacts of the Texas Indians.* Pecos Publishing Company, San Antonio.

DiPeso, C. C., J. B. Rinaldo, and G. J. Fenner
1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca, Volume 6, Ceramics and Shell.* Amerind Foundation, Dragoon, Arizona.

Driggers, W. G.
1985 A Report on the Analysis of the Ceramic Vessel Materials from the Benson's Crossing Site (41TT110), Titus County, Texas. Master's thesis, Department of Anthropology, The University of Texas at Austin.

Duffield, L. F.
1964 Three Panhandle Aspect Sites at Sanford Reservoir, Hutchinson County, Texas. *Bulletin of the Texas Archeological Society* 35:19-81.

Duffield, L. F. and E. B. Jelks
1961 *The Pearson Site: A Historic Indian Site in Iron Bridge Reservoir, Rains County, Texas.* Archaeology Series No. 4. Department of Anthropology, The University of Texas at Austin.

Dunnell, R. C.
1986 Methodological Issues in Americanist Artifact Classification. In *Advances in Archaeological Method and Theory, Volume 9*, edited by M. B. Schiffer, pp. 149-207. Academic Press, Orlando.

Early, A. M.
1995 Regional Change, Cultural Boundaries, and Worlds of Thought: New Approaches Towards Caddoan Ceramics. Paper presented in "Current and Future Directions in the Study of Caddoan Ceramics" symposium, 1995 Caddo Conference, Austin.

Early, A. M. (editor)
1993 *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site.* Research Series No. 43. Arkansas Archeological Survey, Fayetteville.

Edwards, S. K. and D. E. Peter
1992 *Archaeological Survey and Monitoring of JTF-6 Road Improvements, Sierra Blanca, Hudspeth County, Texas.* Geo-Marine, Inc., Plano.

Ekland, C.
1977 Neutron Activation Analysis of West Texas Ceramics: A Statistical Evaluation. *Bulletin of the Texas Archeological Society* 48:119-132.

Ellis, G. L. and L. W. Ellis
1994 Ceramic Cross-Dating at 41HR616: Quantifying Aten's Galveston Bay Area Seriation. In *Archeological Data Recovery Excavations at the Kingwood Site, 41HR616, Harris County, Texas*, by R. G. Moore, pp. 167-200. Report of Investigations No. 100. Moore Archeological Consulting, Houston.

Ellis, L. W.
1992 Technological Style in Upper Texas Coastal Ceramics: A Case Study from 41HR616, Harris County, Texas. M. A. thesis, The University of Texas at San Antonio.

1994 Ceramic Analysis. In *Archeological Data Recovery Excavations at the Kingwood Site, 41HR616, Harris County, Texas*, by R. G. Moore, pp. 97-165. Report of Investigations No. 100. Moore Archeological Consulting, Houston.

Ferring, C. R.
1988 Ceramic Petrography of Selected Sherds. In *Late Holocene Prehistory of the Mountain Creek Drainage*, edited by D. E. Peter and D. E. McGregor, Appendix 6. Joe Pool Lake Archaeological Project, Volume I. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

Ferring, C. R. and B. C. Yates
1995 *Holocene Archaeology and Geoarchaeology at Ray Roberts Lake, Northcentral Texas*. Review Draft. Institute of Applied Sciences, University of North Texas, Denton.

Fields, R. C.
1981 Analysis of the Native Ceramics from the Deshazo Site, Nacogdoches County, Texas. Master's thesis, The University of Texas at Austin.

1993 The Introduction of Ceramic Technology in the Middle Trinity River Basin. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 118-120. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Fields, R. C., E. F. Gadus, and L. W. Klement
1994 The Peerless Bottoms Site: A Late Caddoan Component at Cooper Lake, Hopkins County, Texas. *Bulletin of the Texas Archeological Society* 65:55-114.

Fields, R. C., L. W. Klement, C. B. Bousman, S. A. Tomka, E. F. Gadus, and M. A. Howard
1991 *Excavations at the Bottoms, Rena Branch, and Moccasin Springs Sites, Jewett Mine Project, Freestone and Leon Counties, Texas*. Reports of Investigations, No. 82. Prewitt and Associates, Inc., Austin.

Fischbeck, H. J., J. D. Rogers, S. R. Ryan, and F. E. Swenson
1989 Sourcing Ceramics in the Spiro Region: A Preliminary Study using Proton-Induced X-Ray Emission (PIXE) Analysis. *Midcontinental Journal of Archaeology* 14:3-17.

Foster, M. S. and J. C. Kelley
1989 Archeological Investigations in the Three-Mile and Sulphur Draw Watershed, Culberson County, Texas. *The Artifact* 27(3):1-90. El Paso Archaeological Society, El Paso.

Gilmore, K.
1967 A Microscopic Study of Certain Pottery Types and Clays in the Southern Plains. In *A Pilot Study of Wichita Indian Archeology and Ethnohistory*, assembled by R. E. Bell, E. B. Jelks, and W. W. Newcomb, pp. 221-230. Final report for Grant GS-964. National Science Foundation, Washington, D.C.

Glander, W. P., T. N. Sanders, and S. A. Skinner
1973 *Archaeological Resources at Milehigh, Hudspeth County, Texas*. Archaeology Research Program, Southern Methodist University, Dallas.

Green, F. E.
1986 *Report on Archaeological Salvage in the Sanford Reservoir Area*. Publication No. 4. Panhandle Archeological Society, Amarillo.

Gregory, H. F.
1973 Eighteenth-Century Caddoan Archaeology: A Study in Models and Interpretation. Unpublished Ph.D. dissertation, Department of Anthropology, Southern Methodist University, Dallas.

Habicht-Mauche, J. A.
1987 Southwestern-Style Culinary Ceramics on the Southern Plains: A Case Study of Technological Innovation and Cross-Cultural Interaction. *Plains Anthropologist* 32(116):175-189.

1988 An Analysis of Southwestern-Style Utility Ware Ceramics from the Southern Plains in the Context of Protohistoric Plains-Pueblo Interaction. Unpublished Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge.

Habicht-Mauche, J. A. *(Continued)*
1991 Evidence for the Manufacture of Southwestern-Style Culinary Ceramics on the Southern Plains. In *Farmers, Hunters, and Colonists: Interaction between the Southwest and the Southern Plains*, edited by K. A. Spielmann, pp. 51-70. University of Arizona Press, Tucson.

Habicht-Mauche, J. A., A. A. Levendosky, and M. J. Schoeninger
1994 Antelope Creek Phase Subsistence: The Bone Chemistry Evidence. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 291-304. Smithsonian Institution Press, Washington, D.C.

Hall, G. D., T. R. Hester, and S. L. Black
1986 *The Prehistoric Sites at Choke Canyon Reservoir, Southern Texas: Results of the Phase II Archaeological Investigations.* Choke Canyon Series 10. Center for Archaeological Research, The University of Texas at San Antonio.

Hamilton, D. L.
n.d. Granado Cave. MS in preparation, Department of Anthropology, Texas A&M University, College Station.

Hard, R. J.
1983 *Excavations in the Castner Range Archaeological District of El Paso, Texas*. Publications in Anthropology No. 11. El Paso Centennial Museum, The University of Texas at El Paso.

Hard, R. J., P. Graeber, J. Manasco, C. Tennis, and K. Thuesen
1995 Doña Ana Phase Ceramics and Cultural Evolution in the Southern Jornada Mogollon. *Bulletin of the Texas Archeological Society* 62:267-283.

Harris, R. K.
1936 Indian Campsites of the Upper Trinity River Drainage. *Bulletin of the Texas Archeological and Paleontological Society* 8:113-133.
1945 Bone Implement Burial, Collin County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 16:84-89.

Harris, R. K., I. M. Harris, J. C. Blaine, and J. Blaine
1965 A Preliminary Archeological and Documentary Study of the Womack Site, Lamar County, Texas. *Bulletin of the Texas Archeological Society* 36:287-365.

Hedrick, J. A.
1968 Plateau Station Area Survey. *The Artifact* 6(1):1-16. El Paso Archaeological Society.

Hedrick, J. A. *(Continued)*
1995 Native American Ceramics of the Trans-Pecos. *Texas Archeological Stewardship Network Newsletter* 10(1):13-16.

Hester, T. R.
1975 Late Prehistoric Cultural Patterns along the Lower Rio Grande of Texas. *Bulletin of the Texas Archeological Society* 46:107-125.
1980 *Digging Into South Texas Prehistory: A Guide for Amateur Archaeologists.* Corona Publishing Company, San Antonio.

Hester, T. R. and T. C. Hill, Jr.
1971 An Initial Study of a Prehistoric Ceramic Tradition in Southern Texas. *Plains Anthropologist* 16(52):195-203.

Hester, T. R. and R. Parker
1970 The Berclair Site: A Single Component in Goliad County, Texas. *Bulletin of the Texas Archeological Society* 41:1-24.

Highley, C. L.
1986 *Archaeological Investigations at 41LK201, Choke Canyon Reservoir, Southern Texas*. Choke Canyon Series 11. Center for Archaeological Research, The University of Texas at San Antonio.

Hilton, E. G.
1986 Survey of Texas Big Bend's Prehistoric Indians and Their Pottery: Circa A.D. 1000-1500. *The Artifact* 24(4):51-86. El Paso Archaeological Society, El Paso.

Hines, M. H.
1993 *National Register Testing at the Wind Canyon Site, 41HZ119, Hudspeth County, Texas*. Technical Reports No. 18. Prewitt and Associates, Inc., Austin.

Hofman, J. L.
1989 Protohistoric Culture History on the Southern Great Plains. In *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*, by J. L. Hofman, R. L. Brooks, J. S. Hays, D. W. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein, pp. 91-100. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Hofman, J. L. and R. L. Brooks
1989 Prehistoric Culture History—Woodland Complexes in the Southern Great Plains. In *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*, by J. L. Hofman, R. L. Brooks, J. S. Hays, D. W. Owsley, R. L. Jantz, M. L. Marks, and M. H. Manhein, pp. 61-70. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Hoffman, M. P.
1967 Ceramic Pipe Style Chronology Along the Red River Drainage in Southwest Arkansas. *The Arkansas Archeologist* 8(1):1-14.

Holden, T. C.
1934 A Study of the Pottery of Saddleback Ruin. M.A. thesis, Texas Technological College, Lubbock.

Holliday, V. T. and E. Johnson
1990 An Overview of the Cultural Chronology of the Lubbock Lake Landmark. In *Fifty Years of Discovery: The Lubbock Lake Landmark*, edited by V. T. Holliday and E. Johnson, pp. 19-54. Quaternary Research Center Series, Number 2. Museum of Texas Tech University, Lubbock.

Howard, E. B.
1930 Archaeological Research in the Gaudalupe Mountains. *Museum Bulletin* 21:188-213. University of Pennsylvania Museum, Philadelphia.

1932 Caves Along the Slopes of the Guadalupe Mountains. *Bulletin of the Texas Archeological and Paleontological Society* 4:7-19.

Howard, M. A.
1990 Ceramic Analysis. In *Prehistoric Hunter-Fisher-Gatherers on the Upper Texas Coast: Archaeological Investigations at the Peggy Lake Disposal Area, Harris County, Texas*, by E. F. Gadus and M. A. Howard. Reports of Investigations No. 74. Prewitt and Associates, Inc., Austin.

Hoyt, C. A.
1994 Ceramics of the La Junta de Los Rios region. Paper presented in the symposium "Archaeological and Documentary Investigations at La Junta de Los Rios, Presidio County, Texas, and Ojinaga, Mexico: An Update." 52nd Annual Plains Anthropological Conference, Lubbock.

Hubbard, R.
1991 *An Archeological Reconnaissance of the Hudspeth County Conservation and Reclamation District #1 Proposed Regulating Reservoir #3, Hudspeth County, Texas*. Texas Water Development Board, Austin.

Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343-358.

Hughes, D. T.
1991 Investigations of the Buried City, Ochiltree County, Texas: With an Emphasis on the Texas Archeological Society Field Schools of 1987 and 1988. *Bulletin of the Texas Archeological Society* 60:107-148.

Hughes, D. T. and A. A. Hughes-Jones
1987 *The Courson Archeological Projects: Final 1985 and Preliminary 1986*. Innovative Publishing, Inc., Perryton, Texas.

Hughes, J. T.
1962 Lake Creek: A Woodland Site in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 32:65-84.

1991 Prehistoric Cultural Developments on the Texas High Plains. *Bulletin of the Texas Archeological Society* 60:1-55.

Hughes, J. T., H. C. Hood, and B. P. Newman
1978 *Archeological Testing in the Red Deer Watershed in Gray, Roberts, and Hemphill Counties, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

Jackson, A. T.
1932 Report on Sites Visited and Conditions Found in the Trans-Pecos Region of Texas, April, 1932. MS on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

1933 Some Pipes of East Texas. *Bulletin of the Texas Archeological and Paleontological Society* 5:69-86.

1937 Exploration of Certain Sites in Culberson County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 9:146-192.

Jackson, B., J. Carlisle, and I. Colwell
1982 *Man in the Oklahoma Panhandle*. Mennonite Press, Newton, Kansas.

Jelks, E. B.
1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas*. Archaeology Series, No. 5. Department of Anthropology, The University of Texas, Austin.

Jelks, E. B. (editor)
1967 The Gilbert Site: A Norteño Focus Site in Northeastern Texas. *Bulletin of the Texas Archeological Society* 37:1-248.

Johnson, C. A. III
1977 *A Preliminary Appraisal of Cultural and Historical Resources Found Between Fort Quitman and Haciendita, Texas*. Publications in Anthropology No. 5. El Paso Centennial Museum, The University of Texas at El Paso.

Johnson, E. (editor)
1978 *Phase III—Analysis of Materials Recovered from the Lubbock Lake Site during Phase I and II*. Museum of Texas Tech University, Lubbock.

Johnson, E. (editor) *Continued)*
1987 *Lubbock Lake: Late Quaternary Studies on the Southern High Plains.* Texas A&M University Press, College Station.

1993 *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 1: The 1988 Work.* Quaternary Research Center Series Number 5. Lubbock Lake Landmark, Museum of Texas Tech University, Lubbock.

1995 *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 2: The 1989 and 1990 Seasons.* Quaternary Research Center Series Number 8. Lubbock Lake Landmark, Museum of Texas Tech University, Lubbock.

Johnson, E., V. T. Holliday, M. J. Kaczor, and R. Stuckenrath
1977 The Garza Occupation at the Lubbock Lake Site. *Bulletin of the Texas Archeological Society* 48:83-109.

Johnson, L., Jr.
1989 Classification of Stone Projectile Points by a Small Texan Folk Community: A Case Study. *The Texas Journal of Science* 41(2):193-203.

1992 Stealing Secrets from Dead Potters: A Plea for Painstaking Ceramic Sleuthing. *APR News and Views* 4(1):14-16.

1994 *The Life and Times of Toyah-Culture Folk As Seen from the Buckhollow Encampment, Site 41KM16, of Kimble County, Texas.* Office of the State Archeologist Report 38. Texas Department of Transportation and Texas Historical Commission, Austin.

Jurney, D. H. and T. K. Perttula
1995 Nineteenth Century Alibamu-Koasati Pottery Assemblages and Culinary Traditions. *Southeastern Archaeology* 14:17-30.

Katz, P. R.
1978 *An Inventory and Assessment of Archaeological Sites in the High Country of Guadalupe Mountains National Park, Texas.* Archaeological Survey Report No. 36. Center for Archaeological Research, The University of Texas at San Antonio.

Katz, P. R. and P. D. Lukowski
1981 Results of Archaeological Survey in the Salt Flat Locality of Northern Hudspeth County, Texas. In *Five Archeological Investigations in the Trans-Pecos Region of Texas*, by J. Betancourt, D. Creel, P. R. Katz, P. D. Lukowski, L. McNutt, and R. W. Ralph, pp. 1-26. Permit Series No. 6. Texas Antiquities Committee, Austin.

Katz, S. R.
1985 Country Cousins: The Late Prehistoric Period in the Southern Guadalupe Mountains. In *Views of the Jornada Mogollon*, edited by C. M. Beck, pp. 1-4. Contributions in Anthropology, Volume 12. Eastern New Mexico University, Portales.

Katz, S. R. and P. R. Katz
1975 A Summary of Recent Archaeological Investigations in Guadalupe Mountains National Park by the Department of Anthropology, Texas Tech University. *Texas Archeology* 19(2):11-15.

1979 A Status Report on Research into the Prehistory of Guadalupe Mountains National Park, Texas. In *Jornada Mogollon Archaeology: Proceedings of the First Jornada Conference*, edited by P. H. Beckett and R. N. Wiseman, pp. 359-370. New Mexico Historic Preservation Division, Santa Fe.

1981 Ring Middens of the Southern Guadalupe Mountains. In Archaeological Essays in Honor of Mark Wimberly, edited by M. S. Foster, pp. 203-208. *The Artifact* 19(3 and 4), El Paso Archaeological Society, El Paso.

Kauffman, B. and D. Batcho
1988 *Final Report of Archaeological Investigations Along El Paso Electric Company's 345 KV Caliente-Newman-Amrad Transmission System on Fort Bliss, Texas.* Historic and Natural Resources Report No. 4. Environmental Management Office, Fort Bliss, Texas.

Kelley, D. B. (editor)
1994 *The McLelland and Joe Clark Sites: Protohistoric-Historic Caddoan Farmsteads in Southern Bossier Parish, Louisiana.* Coastal Environments, Inc., Baton Rouge.

Kelley, J. Charles
1939 Archaeological Notes on the Excavation of a Pithouse Near Presidio, Texas. *El Palacio* 44(10):221-234.

1947 The Lehman Rock Shelter: A Stratified Site of the Toyah, Uvalde, and Round Rock Foci. *Bulletin of the Texas Archeological and Paleontological Society* 18:115-128.

1948 An Archeological Reconnaissance Along the Rio Grande between Redford and Fabens, Texas, Summer 1948. MS on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

1949 Archeological Notes on Two Excavated House Structures in Western Texas. *Bulletin of the Texas Archeological and Paleontological Society* 20:89-114.

1953 The Historic Indian Pueblos of the La Junta de los Rios. *New Mexico Historical Review* 27(4):257-295 and 28(1):21-51.

1957 The Livermore Focus: A Clarification. *El Palacio* 64(1-2):44-52.

1985 Review of the Architectural Sequence at La Junta de los Rios. In Proceedings of the Third Jornada Mogollon Conference, edited by M. S. Foster and T. C. O'Laughlin, pp. 149-160. *The Artifact* 23(1 and 2). El Paso Archaeological Society, El Paso.

1986 *Jumano and Patarabueye*. Anthropological Papers No. 77. Museum of Anthropology, University of Michigan, Ann Arbor.

Kelley, J. C., T. N. Campbell, and D. Lehmer

1940 *The Association of Archaeological Materials with Geological Deposits in the Big Bend Region of Texas*. Publication No. 10, West Texas Historical and Scientific Society Publication, and Bulletin Volume 21, No. 3, Sul Ross State Teachers College, Alpine.

Kenmotsu, N. A.

1992 A Summary of McKittrick Canyon Watershed, Guadalupe Mountains National Park, Culberson County, Texas. *The Artifact* 30(2):1-32. El Paso Archaeological Society, El Paso.

Kidder, A. V. and A. O. Shepard

1936 *The Pottery of Pecos, Volume 2*. Phillips Academy Papers of the Southwestern Expedition 7. Yale University Press, New Haven.

Krieger, A. D.

1946 *Culture Complexes and Chronology in Northern Texas with Extension of Puebloan Datings to the Mississippi Valley*. Publication No. 4640. The University of Texas at Austin.

LeBlanc, S. A.

1982 Temporal Change in Mogollon Ceramics. In *Southwestern Ceramics: A Comparative Review*, edited by A. H. Schroder, pp. 106-127. *The Arizona Archaeologist* 15.

Lehmer, D.

1948 *The Jornada Branch of the Mogollon*. Social Science Bulletin 17. University of Arizona, Tucson.

Lintz, C.

1978 The Panhandle Aspect and its Early Relationship with Upper Republican. In *The Central Plains Tradition: Internal Development and External Relationships*, edited by D. J. Blakeslee. Report 11. Office of the State Archeologist, The University of Iowa, Iowa City.

1984 The Plains Villagers: Antelope Creek. In *Prehistory in Oklahoma*, edited by R. E. Bell, pp. 325-346. Academic Press, Orlando.

Lintz, C. *(Continued)*

1986 *Architecture and Community Variability Within the Antelope Creek Phase of the Texas Panhandle*. Studies in Oklahoma's Past No. 14. Oklahoma Archeological Survey, Norman.

1991 Texas Panhandle-Pueblo Interactions from the Thirteenth Through the Sixteenth Century. In *Farmers, Hunters, and Colonists: Interaction between the Southwest and the Southern Plains*, edited by K. A. Spielmann, pp. 89-106. University of Arizona Press, Tucson.

Lintz, C. and K. Reese-Taylor

1995 Migrations, Trade, or Replicated Ceramics: Petrographic Study of Collared Rim Sherds from the Texas Panhandle. *Bulletin of the Texas Archeological Society* 67, in press.

Lorrain, D.

1967 Artifacts from Prehistoric Sites. In *A Pilot Study of Wichita Indian Archeology and Ethnohistory*, assembled by R. E. Bell, E. B. Jelks, and W. W. Newcomb, pp. 197-203. Final report for Grant GS-964. National Science Foundation, Washington, D.C.

1969 *Archaeological Excavations in the Fish Creek Reservoir*. Contributions in Anthropology Number 4. Department of Anthropology, Southern Methodist University, Dallas.

Lorrain, D. and N. Hoffrichter

1968 The Lower Rockwall Site, Rockwall County, Texas. Report submitted to the National Park Service by the Salvage Project, Southern Methodist University, Dallas.

Mallouf, R. J.

1985 A Synthesis of Eastern Trans-Pecos Prehistory. Unpublished Masters Thesis, Department of Anthropology, The University of Texas at Austin.

1987 *Las Haciendas, A Cairn-Burial Assemblage from Northeastern Chihuahua, Mexico*. Office of the State Archeologist Report 35. Texas Historical Commission, Austin.

Martin, D.

1990 Results of a Five Kilometer Archaeological Survey within the Boundaries of the Second Proposed Location for the Hudspeth County, Texas, Low-Level Radioactive Waste Disposal Authority. Report on file at the Texas Low-Level Radioactive Waste Disposal Authority, Austin.

Martin, E. R.

1994 The Dillard Site: A Late Prehistoric Plains Village Site in Cooke County, Texas. *Bulletin of the Texas Archeological Society* 62:105-200.

Martin, G. C.
1931 Texas Coastal Pottery. *Bulletin of the Texas Archeological and Paleontological Society* 3:53-56.

Martin, W. A. and J. E. Bruseth
1988 Wylie Focus Pits: A New Look at Some Old Features. *The Record, 50th Anniversary Edition*, Volume 42(3):20-35. Dallas Archeological Society, Dallas.

McClurkan, B. B.
1968 *Livingston Reservoir, 1965-1966: Late Archaic and Neo-American Occupations*. Papers of the Texas Archeological Salvage Project 12. Texas Archeological Salvage Project, The University of Texas at Austin.

McConnel, R. B. and J. J. Crim, Jr.
1941 Buried Hearths and Pottery in Alluvium of the Finlay Mountains, Texas. *Field and Laboratory, Contributions from the Science Departments*, No. 9, pp. 48-52.

McGregor, D. E. and J. E. Bruseth
1987 Artifact Chronology. In *Hunter-Gatherer Adaptations along the Prairie Margin: Site Excavations and Synthesis of Prehistoric Archaeology*, edited by D. E. McGregor and J. E. Bruseth, pp. 171-184. Richland Creek Technical Series, Volume III. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

McIntyre, A. J. and D. E. McGregor
1982 A Petrographic Analysis of a Southwestern Trade Vessel recovered in Rockwall County, Texas. In *Season One (1982) Mitigation of Prehistoric Archaeology in the Richland/Chambers Reservoir, Navarro and Freestone Counties, Texas: Interim Report*, edited by A. J. McIntyre, pp. 513-520. Archaeology Research Program, Southern Methodist University, Dallas.

Mera, H. P.
1938 *Reconnaissance and Excavation in Southeastern New Mexico*. Memoirs No. 51. American Anthropological Association, Menasha, Wisconsin.

1943 *An Outline of the Ceramic Developments in Southern and Southeastern New Mexico*. Technical Series Bulletin No. 2. Laboratory of Anthropology, Santa Fe.

Middlebrook, T.
1994 An Update of Archaeological Investigations at the Tyson Site (41SY92). *Journal of Northeast Texas Archaeology*, No. 3:1-36.

Miller, M. R.
1989 *Archaeological Excavations at the Gobernadora and Ojasen Sites: Dona Ana Phase Settlement in the Western Hueco Bolson*. Research Report No. 673. Center for Anthropological Research, New Mexico State University, Las Cruces.

1990 *Archaeological Investigations in the North Hills Subdivision, Northeast El Paso, Texas*. Research Report No. 1. Batcho & Kauffman Associates, El Paso.

1991a Transitional Period Ceramic Developments in the Southern Jornada Mogollon, A.D. 1100-1200. Paper presented at the symposium "Current Ceramic Research in the Jornada Mogollon," Eighth Jornada Mogollon Conference, El Paso.

1991b Jornada Mogollon Ceramic Research at the Crossroads. Paper presented at the symposium "Current Ceramic Research in the Jornada Mogollon," Eighth Jornada Mogollon Conference, El Paso.

1992a *Preliminary Statement of Findings for Archaeological Testing at Sites 41HZ491, 41HZ492, and 41HZ493, Hudspeth County, Texas*. Cultural Resources Report No. 163. Batcho & Kauffman Associates, El Paso.

1992b *Archaeological Survey in the Eagle Mountains: Archaeological Clearance Surveys of Access Corridors for the Proposed FAA Air Route Surveillance Radar 4 Facility on Eagle Peak, Hudspeth County, Texas*. Cultural Resources Report No. 150. Batcho & Kauffman Associates, El Paso.

1993 Ceramic Chronologies, Phase Sequences, and Evolutionary Adaptive Trends: A Clarification of the Transitional Period (Dona Ana Phase). Paper presented at the Ninth Jornada Mogollon Conference, Tularosa, New Mexico.

1994 Jornada Mogollon Residential Settlements in the Salt Flat Basin and Delaware Mountains of West Texas. In *Mogollon VII: Collected Papers of the 1992 Mogollon Conference Held in Las Cruces, New Mexico*, pp. 105-114. COAS Publishing and Research, Las Cruces.

n.d. *Time and Technology in Southern Jornada Mogollon Prehistory: A Chronometric Perspective*. Cultural and Natural Resources Report series. Directorate of Environment, Fort Bliss, Texas. In preparation.

Miller, M. R., T. Stuart, and W. Howell
1988a *Preliminary Archaeological Surveys and Documentation of Petroglyph Sites in Western Hudspeth County, Texas, Part II: Preliminary Archaeological Survey of a Proposed Low-Level Radioactive Waste Disposal Site in Western Hudspeth County, Texas*. Cultural Resources Report Number 37. Batcho & Kauffman Associates, El Paso.

Miller, M. R., T. Stuart, and W. Howell *(Continued)*
1988b *Preliminary Archaeological Surveys and Documentation of Petroglyph Sites in Western Hudspeth County, Texas, Part I: Preliminary Archaeological Survey and Documentation of Petroglyph Sites in Western Hudspeth County, Texas*. Cultural Resources Report Number 37. Batcho & Kauffman Associates, El Paso.

Miller, M. R., S. Decker, K. Shaw, and T. Stuart
1994 Chronological Developments in El Paso Polychrome Vessel Function and Design Styles. Paper presented at the Eighth Mogollon Conference, El Paso.

Miller, M. R. and B. O'Leary
1992 *The Ysleta Clinic Site: A Spanish Colonial Period Native American Settlement in the Lower Valley of El Paso, Texas*. Research Report No. 2. Batcho & Kauffman Associates, El Paso.

Neff, H.
1995 A Role for "Sourcing" in Evolutionary Archaeology. In *Evolutionary Archaeology: Methodological Issues*, edited by P. A. Teltser, pp. 69-112. University of Arizona Press, Tucson.

Neiman, F. D.
1995 Stylistic Variation in Evolutionary Perspective: Inferences from Decorative Diversity and Interassemblage Distance in Illinois Woodland Ceramic Assemblages. *American Antiquity* 60(1):7-36.

Newcomb, W. W., Jr.
1993 Historic Indians of Central Texas. *Bulletin of the Texas Archeological Society* 64:1-63.

Newell, H. P. and A. D. Krieger
1949 *The George C. Davis Site, Cherokee County, Texas*. Memoirs No. 5. Society for American Archaeology and the University of Texas, Menasha, Wisconsin.

O'Brien, M. J., T. D. Holland, R. J. Hoard, and G. L. Fox
1994 Evolutionary Implications of Design and Performance Characteristics of Prehistoric Pottery. *Journal of Archaeological Method and Theory* 1(3):259-304.

O'Laughlin, T. C.
1995 Early Formative Ceramic Assemblages in the Mesilla Valley of Southern New Mexico. In *Views of the Jornada Mogollon*, edited by C. M. Beck, pp. 54-67. Contributions in Anthropology, Volume 12. Eastern New Mexico University, Portales.

O'Laughlin, T. C. and D. L. Martin
1992 Archaeological Testing of Three Sites below the Rimrock of Diablo Plateau, Hudspeth County, Texas. *The Artifact* 30(1):1-81. El Paso Archaeological Society, Inc., El Paso.

Palmer, G. G. (editor)
1993 *El Camino Real de Tierra Adentro*. Cultural Resources Series No. 11. Bureau of Land Management, New Mexico State Office, Santa Fe.

Patterson, L. W.
1993 The Archeology of Inland Southeast Texas: A Quantitative Study. *Bulletin of the Texas Archeological Society* 61:255-280.

n.d. Archeology of the Southeastern Texas Coastal Margin: A Quantitative Study. MS on file with the author.

Peck, J.
1993 X-Ray Fluorescence Analysis of Ceramic Sherds and Clay Samples. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*, by D. K. Boyd, J. Peck, S. A. Tomka, and K. W. Kibler, pp. 379-387. Reports of Investigations, No. 88. Prewitt and Associates, Inc., Austin.

Perino, G.
1994 Archaeological Research at the Rowland Clark Site (41RR77), Red River County, Texas. *Journal of Northeast Texas Archaeology,* No. 4:3-42.

Perttula, T. K.
1992 *"The Caddo Nation": Archaeological and Ethnohistoric Perspectives*. University of Texas Press, Austin.

1993 The Development of Agriculture in Northeast Texas before A.D. 1600. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 121-146. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Perttula, T. K., B. D. Skiles, and B. C. Yates
1993 The Goldsmith Site (41WD208): Investigations of the Titus phase in the Upper Sabine River Basin, Northeast Texas. *Bulletin of the Texas Archeological Society* 61:139-191.

Peter, D. E. and D. E. McGregor, with contributions by B. C. Yates, G. J. Fritz, and J. E. Bruseth
1988a Site 41DL149. In *Late Holocene Prehistory of the Mountain Creek Drainage*, edited by D. E. Peter and D. E. McGregor, pp. 199-244. Joe Pool Lake Archaeological Project, Volume I. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

1988b Site 41DL148: The Cobb-Pool Site. In *Late Holocene Prehistory of the Mountain Creek Drainage*, edited by D. E. Peter and D. E. McGregor, pp. 131-198. Joe Pool Lake Archaeological Project, Volume I. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

Peterson, J. and D. O. Brown (editors)
1991 *El Valle Bajo: The Culture History of the Lower Rio Grande Valley of El Paso. Volume I: Lower Valley Prehistory.* Hicks and Company, Inc. and Archaeological Research, Inc., Austin and El Paso.

Phelps, A. L.
1974 An Analysis of the Ceramics of the Guadalupe Mountains National Park. *Bulletin of the Texas Archeological Society* 45:121-150.

Phillips, P.
1970 *Archaeological Survey in the Lower Yazoo Basin, Mississippi, 1949-1955.* Papers, Volume 60. Peabody Museum of American Archaeology and Ethnology, Harvard University, Cambridge.

Poche, K.
1995 Ceramic Technology and Hunter-Gatherer Adaptations to Semi-Arid Basin Environments: Ceramic Analysis for Project 91-07. In *Prehistoric Cultural Systems in the Northern Chihuahuan Desert: Archaeological Research in the Hueco Bolson of West Texas*, by G. R. Burgett, K. Poche, K. Faunce, M. Melton, D. Potter, B. Buck, F. Almarez, J. Leach, T. O'Laughlin, R. Holloway, and M. Newman. Cultural and Natural Resources Report Series, Directorate of Environment, Fort Bliss, Texas.

Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.
1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201-238.

Price, G. R. D.
1993 *Archeological Significance Testing at Sites 41MU60, 41MU61, 41MU62, and 41MU63, Montague County, Texas.* Texas Department of Transportation, Division of Highway Design, Austin.

Prikryl, D. J.
1990 *Lower Elm Fork Prehistory: A Redefinition of Cultural Concepts and Chronologies along the Trinity River, North-Central Texas.* Report 37. Office of the State Archeologist, Texas Historical Commission, Austin.
1994 A Reexamination of Shell-Tempered Pottery from the Red River, North Central Texas. Paper presented at the 52nd Annual Meeting of the Plains Anthropological Conference and the 65th Texas Archeological Society Meeting, Lubbock, Texas.

Quigg, J. M. and J. Peck
1995 *The Rush Site (41TG346): A Stratified Late Prehistoric Locale in Tom Green County, Texas.* Technical Report No. 816C. Mariah Associates, Inc., Austin.

Quigg, J. M., C. Lintz, F. M. Oglesby, A. C. Earls, C. D. Frederick, W. N. Trierweiler, D. Owsley, and K. W. Kibler
1993 *Historic and Prehistoric Data Recovery at Palo Duro Reservoir, Hansford County, Texas.* Technical Report No. 485. Mariah Associates, Inc., Austin.

Reed, H. E.
1991 Does Stability Imply Success or Stagnation? Paper presented at the Symposium "Current Ceramic Research in the Jornada Mogollon," Seventh Mogollon Conference, El Paso.

Reese-Taylor, K.
1993 Petrographic Analysis. In *Historic and Prehistoric Data Recovery at Palo Duro Reservoir, Hansford County, Texas*, by J. M. Quigg, C. Lintz, F. M. Oglesby, A. C. Earls, C. D. Frederick, W. N. Trierweiler, D. Owsley, and K. W. Kibler, pp. H-1 to H-13. Technical Report No. 485. Mariah Associates, Inc., Austin.
1994 Ceramic Production and Consumption Patterns in Early, Middle, and Late Caddoan Settlements from Rusk and Titus Counties, Texas. Paper presented at the 65th Annual Meeting of the Texas Archeological Society, Lubbock.
1995a Evidence of Resource Procurement and Manufacturing Techniques in Caddoan Ceramic Assemblages from the Sabine, Cypress, and Sulphur River Drainage Basins, Rusk and Titus Counties, Texas. *Journal of Northeast Texas Archaeology*, No. 5:9-27.
1995b Petrographic Analysis of Ceramic Thin Sections from Fort Hood, Texas. In *NRHP Significance Testing of 57 Prehistoric Archeological Sites on Fort Hood*, edited by J. T. Abbott, pp. E-1 to E-24. Review Draft. Research Report No. 34, Archeological Resource Management Series. U.S. Army, Fort Hood.

Reese-Taylor, K., J. Hageman, and R. A. Ricklis
1995 Preliminary Paste Analyses of Ceramics from the Mustang Branch (41HY209) and Barton Sites (41HY202). In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Reynolds, E. A.
1992 *Caddo Pottery Shape Typology and Standardized Measurements.* University Museum, University of Arkansas, Fayetteville.

Rice, P.
1987 *Pottery Analysis: A Sourcebook.* University of Chicago Press, Chicago.

Ricklis, R. A.

1989 Preliminary Observations on a Late Prehistoric Bison Processing Site (41RF21) on the Central Part of the Texas Coastal Plain. *Texas Archeology* 33(2):12-13.

1990 A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Coast: A Case Study in the Roots of Adaptive Change. Ph.D. dissertation, The University of Texas at Austin.

1992 The Spread of a Late Prehistoric Bison Hunting Complex: Evidence from the South-Central Coastal Prairie of Texas. *Plains Anthropologist* 37(140):261-273.

1994 *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island.* Coastal Archaeological Research, Inc., Corpus Christi.

in press *The Karankawa Indians of the Texas Coast: An Ecology Study of Cultural Tradition and Change.* University of Texas Press, Austin.

Ricklis, R. A. and M. B. Collins

1995 *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas.* Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ring, E. R., Jr.

1994 The Galena Sites (41HR61-41HR70): A Late Archaic to Late Prehistoric Complex in Harris County, Texas. *Bulletin of the Texas Archeological Society* 65:257-300.

Robinson, D. G.

1992 Petrographic Analysis of Nonlocal Plainwares. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1*, by D. K. Boyd, S. A. Tomka, C. B. Bousman, K. M. Gardner, and M. D. Freeman, pp. 221-227. Reports of Investigations No. 84. Prewitt and Associates, Inc., Austin.

1994 Petrographic Analysis of Plainwares from 41GR291. In *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3*, by D. K. Boyd, J. Peck, S. A. Tomka, K. W. Kibler, and M. D. Freeman, pp. 355-361. Reports of Investigations No. 93. Prewitt and Associates, Inc., Austin.

Rohrt, M. and S. A. Skinner

1974 *Archaeological Survey of Hitson, C&L, and Washburn Draws and Cornudas, North, and Culp Draws Watersheds, West Texas and Southeast New Mexico.* Research Report No. 51. Archaeology Research Program, Southern Methodist University, Dallas.

Roney, J. R.

1983 Prehistory of the Guadalupe Mountains. Unpublished Masters Thesis, Department of Anthropology, Eastern New Mexico State University, Portales.

Ross, R. E.

1966 *The Upper Rockwall and Glen Hill Sites, Forney Reservoir, Texas.* Papers of the Texas Archeological Salvage Project, No. 9. Texas Archeological Salvage Project, The University of Texas at Austin.

Runkles, F. A. and E. D. Dorchester

1987 The Lott Site (41GR56): A Late Prehistoric Site in Garza County, Texas. *Bulletin of the Texas Archeological Society* 57:83-115.

Runyan, J. W. and J. A. Hedrick

1973 Pottery Types of the Southwest Federations of Archaeological Societies (SWFAS) Area. *Transactions of the Eighth Regional Archaeological Symposium for Southeastern New Mexico and Western Texas*, pp. 19-44. Hobbs, New Mexico.

Sayles, E. B.

1935 *An Archaeological Survey of Texas.* Medallion Papers No. 17. Gila Pueblo, Globe, Arizona.

Scarborough, V.

1992 Ceramics, Sedentism, and Agricultural Dependency At A Late Pithouse/Early Pueblo Village. In *Research in Economic Anthropology*, Supplement 6, pp. 307-333. JAI Press, Inc., Westport, Connecticut.

Schambach, F. F.

1981 A Description and Analysis of the Ceramics. In *The Shallow Lake Site (3UN9/52) and its Place in Regional Prehistory*, by M. A. Rolingson and F. F. Schambach, pp. 101-176. Research Series No. 12. Arkansas Archeological Survey, Fayetteville.

Schambach, F. F. and J. E. Miller

1984 A Description and Analysis of the Ceramics. In *Cedar Grove: An Interdisciplinary Investigation of a Late Caddo Farmstead in the Red River Valley*, edited by N. L. Trubowitz, pp. 109-170. Research Series No. 23. Arkansas Archeological Survey, Fayetteville.

Schambach, F. F., J. C. Weber, and A. M. Early

n.d. Typology and Nomenclature for South Arkansas Ceramics: The Descriptive Classification. MS in progress, Arkansas Archeological Survey, Fayetteville.

Schiffer, M. B., J. M. Skibo, T. C. Boelke, M. A. Neupert, and M. Aronson

1994 New Perspectives on Experimental Archaeology: Surface Treatments and Thermal Response of the Clay Cooking Pot. *American Antiquity* 59(2):197-217.

Schmidt-Couzzourt, B.

1983 *The Chicken Creek Site: Archeological Testing in the Lake Meredith Recreation Area, Potter County, Texas.* U.S. Department of the Interior, Bureau of Reclamation, Amarillo.

Scott, F. W.

1994 Notes on Great Bend Aspect Ceramic Vessels in the KSHS Collections. *The Kansas Anthropologist* 15(1):70-87.

Seaman, T. J. and B. J. Mills

1988 El Paso Brownware Rim Analysis. In *Toward an Archeology of Landscapes: The Borderstar 85 Survey*, edited by T. J. Seaman, W. H. Doleman, and R. Chapman, pp. 169-182. Office of Contract Archeology, University of New Mexico, Albuquerque.

Shackleford, W. J.

1951 Excavations at the Polvo Site in Western Texas. Unpublished Masters Thesis, Department of Anthropology, The University of Texas at Austin.

1955 Excavations at the Polvo Site in Western Texas. *American Antiquity* 29(3):256-262.

Shafer, H. J.

1970 A Preliminary Report of an Archaeological Survey in the Guadalupe Mountains National Park by the Texas Archeological Society in June, 1970. *Texas Archeology* 14(3):10-17.

1981 Archeological Investigations at the Attaway Site, Henderson County, Texas. *Bulletin of the Texas Archeological Society* 52:147-178.

Skinner, S. A., P. P. Steed, and S. E. Bearden

1973 *Prehistory at Milehigh.* Archaeology Research Program, Southern Methodist University, Austin.

1974 Prehistory of Milehigh. *The Artifact* 12(1):1-84. El Paso Archaeological Society, El Paso.

Smith, J. E. II, with contributions by J. C. Blaine, K. Gilmore, R. K. Harris, and I. M. Harris

1993 The Vinson Site (41LT1): A Norteño Focus Indian Village in Limestone County, Texas. *Bulletin of the Texas Archeological Society* 64:65-162.

Smithwick, N.

1900 *The Evolution of a State, or Recollections of Old Texas Days.* Gammel Publishing Co., Austin.

Sorrow, W. M.

1966 *The Pecan Springs Site, Bardwell Reservoir, Texas.* Papers of the Texas Archeological Salvage Project No. 10. Texas Archeological Salvage Project, The University of Texas at Austin.

Spielmann, K. A.

1983 Late Prehistoric Exchange between the Southwest and Southern Plains. *Plains Anthropologist* 28(102), Pt. 1:257-272.

Spielmann, K. A. (editor)

1991 *Farmers, Hunters, and Colonists: Interaction between the Southwest and the Southern Plains.* University of Arizona Press, Tucson.

Stallings, W. S.

1931 *El Paso Polychrome.* Technical Series Bulletin No. 3. Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Stephenson, R. L.

1949 Archeological survey of Lavon and Garza-Little Elm reservoirs: a preliminary report. *Bulletin of the Texas Archeological and Paleontological Society* 20:21-62.

1970 Archeological Investigations in the Whitney Reservoir Area, Central Texas. *Bulletin of the Texas Archeological Society* 41:37-277.

Steponaitis, V. P., M. J. Blackman, and H. Neff

1995 Large-Scale Patterns in the Chemical Composition of Mississippian Pottery. MS submitted to *American Antiquity.*

Stokes, J. and J. L. Woodring

1981 Native-Made Artifacts of Clay. In *Archeological Investigations at the George C. Davis Site, Cherokee County, Texas: Summers of 1979 and 1980*, edited by D. A. Story, pp. 135-238. Occasional Papers No. 1. Texas Archeological Research Laboratory, The University of Texas at Austin.

Story, D. A.

1968 *Archeological Investigations at Two Central Gulf Coast Sites.* Report No. 13. Archeological Program, State Building Commission, Austin.

1985 The Walton Site: An Historic Burial in McLennan County, Texas. *Central Texas Archeologist*, Number 10:66-96.

1990 Cultural History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Studer, F. V.
1934 Texas Panhandle Culture Ruin No. 55. *Bulletin of the Texas Archeological and Paleontological Society* 6:80-96.

Suhm, D. A. and E. B. Jelks
1962 *Handbook of Texas Archeology: Type Descriptions.* Texas Archeological Society, Special Publication No. 1, and Texas Memorial Museum, Bulletin No. 4. Austin.

Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Tanner, R. W.
1949 The Caldwell Ranch Sites: A Distinctive Culture Complex in the Northeastern Trans-Pecos. Unpublished Ph.D. dissertation, Department of Anthropology, The University of Texas at Austin.

Thurmond, J. P.
1985 Late Caddoan Social Group Identifications and Sociopolitical Organization in the Upper Cypress Basin and its Vicinity, Northeastern Texas. *Bulletin of the Texas Archeological Society* 54:185-200.

1990 *Archeology of the Cypress Creek Drainage Basin, Northeastern Texas and Northwestern Louisiana.* Studies in Archeology No. 5. Texas Archeological Research Laboratory, The University of Texas at Austin.

Treece, A. C., C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas. Volume IV: Data Recovery Results from Ceramic Sites.* Technical Report 346-IV. Mariah Associates, Austin.

Turner, E. S. and T. R. Hester
1993 *A Field Guide to Stone Artifacts of Texas Indians.* Second Edition. Gulf Publishing Company, Houston.

Turner, R. L.
1995 Native American Ceramics of Northeast Texas. *Texas Archeological Stewardship Network Newsletter* 10(1):19-21.

Vehik, S. C.
1984 The Woodland Occupations. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 175-197. Academic Press, Orlando.

Vehik, S. C. and T. G. Baugh
1994 Prehistoric Plains Trade. In *Prehistoric Exchange Systems in North America*, edited by T. G. Baugh and J. E. Ericson, pp. 249-274. Plenum Press, New York.

Walker, K. F. and D. W. Trexler
1941 An Indian Camp Site in the Northern Finlay Mountains, Hudspeth County, Texas. *Fields and Laboratory: Contributions from the Science Department* No. 9:60-69. Southern Methodist University, Dallas.

Wedel, W. R.
1959 *An Introduction to Kansas Archeology.* Bulletin No. 174. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

1982 Further Notes on Puebloan-Central Plains Contacts in Light of Archaeology. in *Pathways to Plains Prehistory: Anthropological Perspectives of Plains Natives and Their Pasts*, edited by D. G. Wyckoff and J. L. Hofman, pp. 145-152. Oklahoma Anthropological Society, Memoir 3, and The Cross Timbers Heritage Association, Contributions 1. The Cross Timbers Press, Duncan, Oklahoma.

Weinstein, R. A.
1991 *Lido Harbor (41GV82): A Late Prehistoric Campsite and Extraction Locale, Galveston County, Texas.* Coastal Environments, Inc., Baton Rouge.

1992 *Archaeology and Paleogeography of the Lower Guadalupe River/San Antonio Bay Region: Cultural Resource Investigations Along the Channel to Victoria, Calhoun and Victoria Counties, Texas.* Coastal Environments, Inc., Baton Rouge.

Whalen, M. E.
1977 *Settlement Patterns of the Eastern Hueco Bolson.* Anthropological Paper No. 4. El Paso Centennial Museum, The University of Texas at El Paso.

1978 Ceramics and Chronology in the Hueco Bolson. In *Settlement Patterns of the Western Hueco Bolson*, edited by M. E. Whalen, pp. 58-70. Anthropological Paper No. 6. El Paso Centennial Museum, The University of Texas at El Paso.

1980 *Special Studies in the Archaeology of the Hueco Bolson.* Anthropological Paper No. 9. El Paso Centennial Museum, The University of Texas at El Paso.

1981 Origins and Evolution of Ceramics in Western Texas. *Bulletin of the Texas Archeological Society* 52:215-229.

1985 Dating the Past in Western Trans-Pecos Texas. *Bulletin of the Texas Archeological Society* 54:239-250.

1993 El Paso Plain Brown Rims as Chronological Markers? New Data on an Old Question. *The Kiva* 58(4):475-486.

1994a *Turquoise Ridge and Late Prehistoric Residential Mobility in the Desert Mogollon Region.* Anthropological Papers No. 118. University of Utah Press, Salt Lake City.

Whalen, M. E. *(Continued)*
1994b Ceramic Technology and the Dating of El Paso Brown Pottery. Paper presented at the Eighth Mogollon Conference, El Paso, Texas.

Willey, P. S. and J. T. Hughes
1978 The Deadman's Shelter Site. In *Archeology at Mackenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 149-197. Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Witte, A. H.
1935 Archeology of a Section of Upper Red River Drainage. *Bulletin of the Texas Archeological and Paleontological Society* 7:47-56.

1936 Kitchen Middens of the Upper Red River Drainage. *Bulletin of the Texas Archeological and Paleontological Society* 8:71-86.

Word, J. H.
1991 The 1975 Field School of the Texas Archeological Society. *Bulletin of the Texas Archeological Society* 60:57-106.

Wright, J. F., with contributions by B. H. Butler, R. L. Turner, and C. K. Chandler
1995 The Asa Warner Site (41ML46), McLennan County, Texas. MS submitted for publication in the *Bulletin of the Texas Archeological Society.*

PART II

THE REGIONAL ARCHEOLOGY OF TEXAS

The Archeology of Southeast Texas

Leland W. Patterson

ABSTRACT

The archeology of Southeast Texas is becoming increasingly better known with a rapid accumulation of data in the last 20 years. Evidence for human habitation of this region covers an interval of about 11,000 to 12,000 years. A broad-based hunting and gathering lifeway was practiced up to approximately A.D. 1800. Archeological data from Southeast Texas are especially valuable for the study of hunter-gatherer adaptations to a variety of ecological settings. While the partial nature of the archeological record precludes complete reconstruction of prehistoric lifeways, regional syntheses can still be made with significant detail.

INTRODUCTION

Much of the nature of the archeological record in Southeast Texas has been determined by the region being an interface between the Southern Plains and Southeast Woodlands. Technological characteristics in Southeast Texas archeological assemblages seem to have been influenced by traditions from adjacent regions. The effects of migrations of peoples and diffusion of technology must be considered here, as well as local innovation. There are also occasional examples of long-distance trade, especially during the Late Archaic period. Throughout this paper, distinctions are made between the inland and coastal margin subregions of Southeast Texas. These two subregions are somewhat culturally distinct, and the inland subregion has a much longer chronological record. Aten (1983) has detailed many of the aspects of the archeology of the coastal margin subregion. Story (1990) has included Southeast Texas in her detailed overview of the archeology of the Gulf coastal plain, from the coastline to Arkansas and eastern Texas.

Archeological data of Southeast Texas are now well-organized. There is a continuing bibliographic series (Patterson 1992a), and there are computerized data bases for published sites of the inland and coastal margins subregions (Patterson 1989a, 1989b). A quantitative summary of the inland subregion data base has been published (Patterson 1993a). A detailed synthesis of Southeast Texas for all geographic areas and time periods is being developed by the author. Southeast Texas has a large number of published site surface collections and excavated sites.

This paper considers the usual research topics that are applied to hunter-gatherers with a nomadic lifeway, such as subsistence patterns, mobility-settlement patterns, social organization, and technological traditions. The basic pattern of lifeways of conservative hunter-gatherers is characterized by generally slow change in artifact styles, only a few changes in basic technologies, and long continuities of subsistence and mobility-settlement patterns.

GEOGRAPHIC AND ENVIRONMENTAL SETTING

For this paper, Southeast Texas is defined as a 21 county area (Table 1). This regional definition includes data for an area from the Colorado River on the west to the Sabine River on the east, for about 200 km inland from the Gulf coastline. Previous studies have shown that it is especially important to consider together the archeology of Fort Bend and Austin counties, with the eastern part of Wharton County, as it seems to be an area where much mixing of technologies occurred, and it has a distinctive Late Archaic mortuary tradition.

The coastal margin of Southeast Texas is a zone about 25 km inland from the coast. It covers the area of influence of Gulf tidal flows on the salinity of streams, lakes, and bays. There is considerable variation in the ecology of this subregion, including woodlands, coastal prairie, lakes, wetlands, marine coastline, and barrier islands off the

Table 1. Sites in Southeast Texas Data Bases

County	no. of inland sites	no. of coastal margin sites	recorded sites
Austin	9	N.A.	80
Brazoria	4	12	183
Chambers	0	147	356
Fort Bend	22	N.A.	223
Galveston	0	7	137
Grimes	10	N.A.	403
Hardin	5	N.A.	16
Harris	120	30	751
Jefferson	1	0	67
Jasper	6	N.A.	123
Liberty	14	5	86
Montgomery	32	N.A.	127
Newton	0	0	88
Orange	2	2	84
Polk	11	N.A.	173
San Jacinto	5	N.A.	154
Tyler	2	N.A.	39
Walker	5	N.A.	123
Waller	5	N.A.	21
Washington	3	N.A.	64
Wharton	27	N.A.	88
Total	283	203	3386

N.A.=not applicable

coastline. The inland subregion of Southeast Texas also has significant ecological variation, including mixed woodlands, coastal prairies and dense piney woods. Even the piney woods habitat is not uniform, being dissected by oak-pine zones along major rivers (Figure 1). Dense piney woods occur in the northeastern part of this region. This band of piney woods extends over most of the eastern Gulf Coastal Plain (Larsen 1980:35) as a distinct ecological zone with a low productivity of food resources. The western part of Southeast Texas is well-known for nut trees, such as pecan. This part of the region seems to have had a high productivity of food resources. Principal vegetation zones of Southeast Texas are shown in Figure 1.

There are distinct adaptive and cultural patterns for the inland and coastal margin subregions, as characterized by differences in subsistence patterns, settlement patterns, and artifact types. Most coastal margin sites are brackish water *Rangia cuneata* shell middens, with some oyster shell middens found on the coastline in a saltwater marine environment. The general Galveston Bay area is especially well-known for *Rangia* shell middens. Most inland sites are sandy middens located near water sources, with some freshwater mussel shell middens found mainly in the western part of the region.

There are few data available concerning paleoclimates in Southeast Texas. Although periodic variations in average rainfall and temperature have occurred throughout the Holocene period, after 11,000 years B.P., there is little evidence for significant changes in floral and faunal communities during this time period. Faunal remains indicate that subsistence patterns appear to have been similar throughout the Holocene period. Some dry periods may be indicated by caliche (carbonate) deposits (Aten 1983:134). However, the presence of caliche at stratified sites is difficult to relate to climatic conditions because caliche occurs at different time periods at different sites in Southeast Texas, and many archeological sites in the region have no caliche at any time period. Pollen which would provide data on climatic change is generally not preserved at sites in this region.

While there seems to be much changing of river channels near the coast (Aten 1983:Chapter 8), channels of smaller inland streams appear to have been subject to less change. Many sites along inland streams have long periods of use that imply stability of stream channel locations. Thoms (1993:51) has noted that over most of the West Gulf coastal plain a sandy mantle, that typically contains most of the material evidence of past cultures, caps clay-rich soil horizons. For about 130 km inland, a sandy mantle typically caps the clay-rich Beaumont formation. It is common to find archeological sites with artifacts dating from 11,000-10,000 years ago on the surface of Beaumont clay, which is not thought to date later than 30,000 years ago (Aronow 1971:51). At many locations, about 20,000 years of geological deposits seem to be missing, possibly due to severe erosional events caused by extended heavy rainfall between 25,000 and 9000 B.P. (Aten 1983:133).

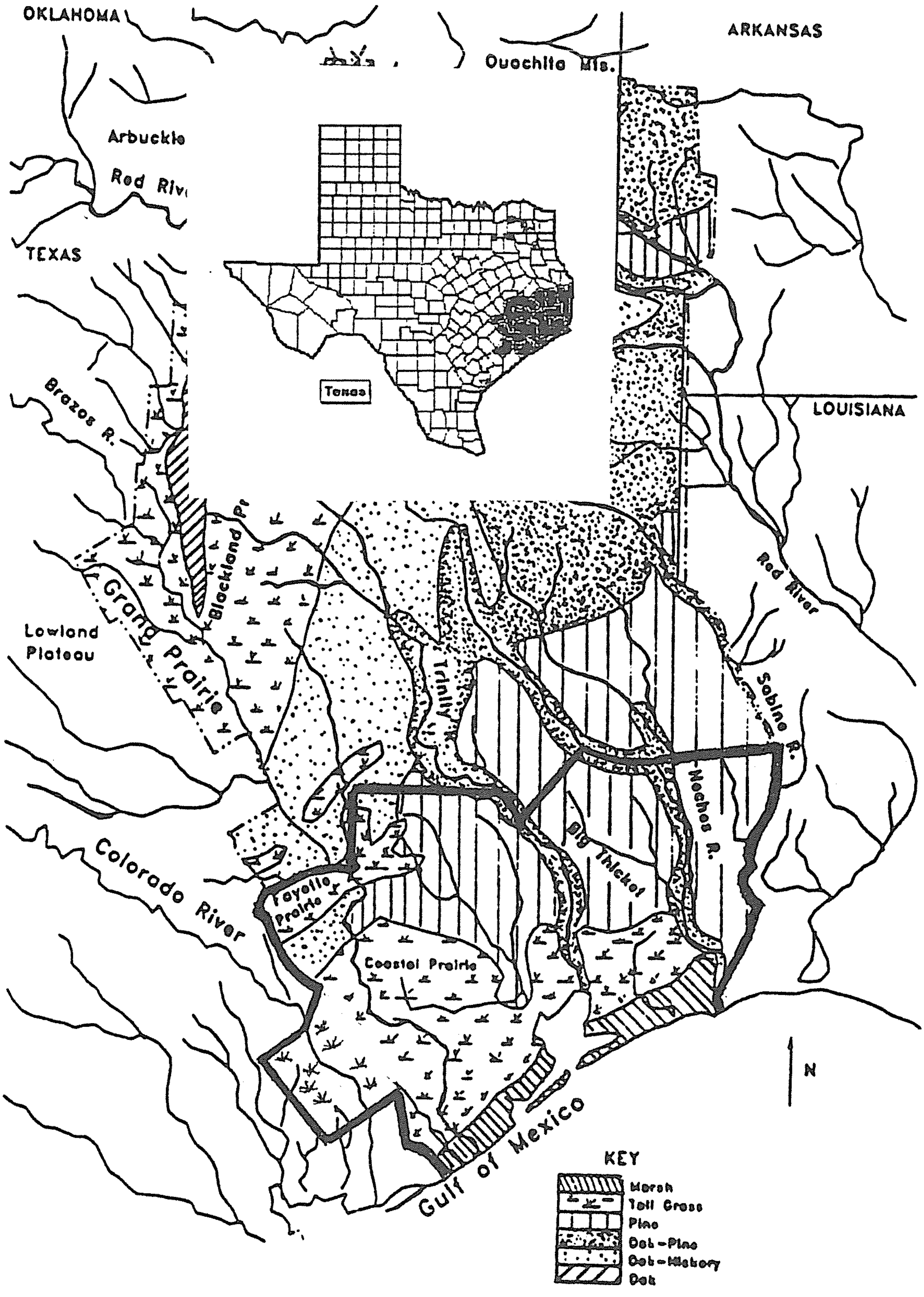

Figure 1. Vegetation Zones in Southeast Texas (adapted from Story et al. 1990:Figure 11). Inset shows 21-county area of Southeast Texas. Reprinted with the permission of the Arkansas Archeological Survey and the author.

Therefore, Southeast Texas is a poor area to look for archeological sites predating 12,000 B.P.

After the Pleistocene period, sea level on the Gulf of Mexico continued to rise. By 4500 years ago, sea level was probably within 4.6 m of its present level (Paine and Morton 1986:9). Sea level stabilized at its present level about 3500 years ago (Gagliano 1977:1). Coastal margin archeological sites older than 3500 B.P. would generally now be underwater. Therefore, a full chronological sequence for human occupation is only available for the inland portion of this region. There are some sites on the present coastal margin where rising sea level changed the site environment from freshwater to brackish water, with a corresponding change in human subsistence pattern, such as on upper San Jacinto Bay (Patterson and Marshall 1989).

THE REGIONAL DATA BASE

As shown in Table 1, over 3380 archeological sites have been recorded for Southeast Texas in the files of the Texas Archeological Research Laboratory (TARL), but only about 14 percent of these sites have been published. Unpublished site records seldom describe the nature of each site in much detail. Therefore, two computerized data bases for inland and coastal margin subregions have been developed (Patterson 1989a, 1989b) which are limited to published site reports. Quantitative summaries of the original 1989 data base for the inland subregion has been published (Patterson 1993a). As of early 1994, the current inland data base has 283 sites (101 excavated and 182 surface collections), and the coastal margin data base has 203 sites (56 excavated and 147 surface collections). As may be seen in Table 1, coverage of various counties is far from uniform. A typical prehistoric site excavation by the Houston Archeological Society is shown in Figure 2.

GENERAL REGIONAL CHRONOLOGY

Data on human habitation of Southeast Texas covers an interval of about 12,000 years, with time

Figure 2. A Houston Archeological Society Excavation Project, Site 41WH38, April 1994. Photograph by L. W. Patterson.

periods used here as follows:

Early Paleoindian	10,000-8000 B.C
Late Paleoindian	8000-5000 B.C.
Early Archaic	5000-3000 B.C.
Middle Archaic	3000-1500 B.C.
Late Archaic	1500 B.C.-A.D. 100
Early Ceramic	A.D. 100-600
Late Prehistoric	A.D. 600-1500
Protohistoric	A.D. 1500-1700
Historic Indian	A.D. 1700-1800+

Time periods are based more on artifact types than on any differences in lifestyles. A nomadic hunting and gathering lifestyle was practiced throughout all prehistoric time periods in this region. Time intervals used for Southeast Texas may be different than for adjacent regions, even though the same period names are used. For example, the time intervals used for the Archaic and Late Prehistoric periods are different in Central and Southeast Texas, and there is no Early Ceramic period in Central Texas.

The Early Paleoindian period is based on the dating of Clovis and Folsom points in other parts of Texas (see Meltzer and Bever, this volume). It is now known that several varieties of side-notched points also occur in Southeast Texas during the same time period as Folsom. The Late Paleoindian period represents the presence in Southeast Texas of Plains types of lanceolate points, even though several non-lanceolate point types were also used during this time period. The Late Paleoindian period in Texas corresponds to the Early Archaic period in the eastern U.S. In Southeast Texas, the Late Paleoindian period closes with the start of dominance of stemmed point types. The Archaic period in this region starts at the end of the Late Paleoindian period and ends at about A.D. 100 (Aten 1983:297). The Early Ceramic period begins with the adoption of pottery and ends with the approximate start of bifacial arrow points (Aten 1983:306) at A.D. 600, the onset of the Late Prehistoric period. More varied ceramics and other material culture items characterize the Late Prehistoric period, while the Protohistoric period dates from after inital contact between the Native Americans of Southeast Texas and European explorers, colonists and settlers, and archeological sites as early as the seventeenth century contain European trade goods (e.g., Ricklis 1994). The Historic Indian period ends between about 1800-1810 and 1840 with the more permanent European and Anglo-American settlement of the region, and the removal of the Native American groups.

TECHNOLOGICAL CHANGE AND CONTINUITY

The conservative hunter-gatherer lifeway in Southeast Texas is characterized by slow change in projectile point styles, and only a few major technological changes. Introduction of the bow and arrow and pottery were significant technological changes, but they do not appear to have had a major impact on lifestyle of Indians in the inland subregion. The use of pottery was more important on the coastal margin, judged by the large quantities of pottery at shell midden sites. The slow diffusion of pottery into Southeast Texas is an indication that conservative hunter-gatherers are not quick to adopt new technology. It is probably characteristic of the hunter-gatherer lifeway that a technological change is accepted only when it makes a significant contribution to efficiency and group survival. Some sophisticated traits of complex cultures would be of little value to the basic hunter-gatherer lifeway. Some examples of this technological continuity in the region are the use of the Gary-Kent dart point series for thousands of years, the long use of fired clayballs, and the gradual smooth trends in flake size distributions toward higher percentages of smaller size flakes in later time; the latter follows a gradual trend toward smaller-sized dart points.

SUBSISTENCE PATTERNS

Because of poor preservation of floral materials, subsistence patterns in Southeast Texas are known mainly through the study of faunal remains. Preservation of faunal remains is best at shell middens, both inland (McClure 1987), and on the coastal margin (Dillehay 1975). There is little evidence in this region for hunting of extinct megafauna, as was done by Paleoindians in some parts of North America. It appears that a broad-based subsistence pattern was practiced during all prehistoric time periods, even during the Paleoindian period (Patterson et al. 1987).

Tabulations of faunal remains for the inland (Patterson 1989a, 1990a) and coastal margin (Patterson 1989b) subregions show that Indians were practically omnivorous, utilizing a range of fauna from small animals, such as rat and rabbit, to large animals, such as deer and bison. The types of terrestrial fauna used by inland and coastal margin Indians are similar, but there are differences in aquatic species used in the two subregions because of local availablity. Deer and land turtle were important food resources throughout the region. Fish were a minor food resource in the inland subregion, and a major food resource on the coastal margin. The use of fish at coastal margin sites is underestimated by conventional screening at excavations. At 41CH161 on the coastal margin (Kindall and Patterson 1993), fine screening has yielded over 100,000 bone specimens, mainly of fish. Table 2 gives a summary of both terrestrial and aquatic faunal remains found at sites in inland and coastal margin subregions of Southeast Texas.

Aquatic faunal resources used in this region include shellfish, alligator, fish and water turtle. Freshwater shell middens are found in the western part of inland Southeast Texas, such as 41FB37 (Patterson and Hudgins 1987), but are not of the extensive nature of *Rangia* brackish water shell middens on the coastal margin (see also Ricklis, this volume). A few oyster shell middens occur on the coastline in marine saltwater environment. *Rangia cuneata* shell middens on the coastal margin can be quite large, some over 300 m in length (Duke 1981). The importance of *Rangia* shellfish in the diet should not be overestimated, as *Rangia* meat is not a rich food material. A consumption of hundreds of shellfish would be required to obtain daily minimum calorie and protein requirements (Dering and Ayers 1977:59). Judged by the low proportion of damaged shell at shell middens, meat was probably extracted by use of heat, rather than by mechanical opening of shell (Patterson, Ebersole, and Kindall 1991).

Nuts and acorns were widely available in parts of ths region, and were probably utilized when available. Quantities of nuts vary widely from year-to-year as mast conditions change.

Bison were present in Southeast Texas, but probably not continuously in prehistoric times. Bison had a limited geographic distribution and were not present in large herds (Patterson 1992c). They occupied the more open coastal prairie areas, but

Table 2. Summary of Faunal Remains

species	inland sites	coastal margin sites
terrestrial		
deer	39	38
land turtle	37	11
snake	9	8
rat	8	8
land bird	11	6
bison	17	8
rabbit	15	11
gopher	11	4
skunk	3	3
mouse	5	3
raccoon	6	6
opossum	10	6
badger	2	0
antelope	4	0
squirrel	3	3
beaver	5	0
bear	1	2
mink	1	0
muskrat	0	3
aquatic		
mussel	25	0
alligator	10	11
water bird	5	8
water turtle	9	23
gar	15	26
misc. fish	11	22
frog	8	3
catfish	9	16
drum	9	15
bass	4	0
Rangia	0	200+
Oyster	0	23
shark	0	1
redfish	0	1
sea trout	0	4
sheepshead	0	5

did not penetrate the Big Thicket or dense piney woods. There is some indication in the archeological record for an increased use of bison during the Late Prehistoric period (Patterson 1992c).

Agriculture was not practiced in Southeast Texas by aboriginal groups, even though the Caddo Indians practiced agriculture in adjacent Northeast Texas during the Late Prehistoric period. Agriculture may not have been a viable subsistence option for much of the region (O'Brien and Spencer 1976). Soils of the Gulf Coastal Plain are not well-suited for agriculture without use of modern farming methods.

MOBILITY-SETTLEMENT PATTERNS

Mobility-settlement patterns are considered here separately for the inland and coastal margin subregions. As Story (1990:260) notes, it is difficult to determine seasonality and duration of stay at inland campsites. Some aspects of mobility-settlement patterns for the inland subregion can be considered, however (Patterson 1991d). Inland sites are: (1) usually found near a water source (Patterson 1979), (2) the majority are multi-component (Patterson 1983) with much reuse, (3) they have well-defined intra-site areas, (4) there is little evidence of satellite activity sites and separate base camps, and (5) even at shell midden sites other kinds of subsistence activities are evident (McClure 1987).

Mobility-settlement patterns in inland Southeast Texas can be compared to two models proposed by Binford (1980), which represent extremes of the spectrum of mobility-settlement strategies. In one model, highly mobile hunter-gathers are called "foragers," with residential bases that are frequently moved and with other poorly defined subsistence activity locations. In the other model, less mobile hunter-gatherers are called "collectors," with well-defined residential bases and satellite locations that tend to be reused. Collectors are characterized by logistically organized subsistence activities, using special task groups. The characteristics of sites of inland Southeast Texas seem to fall within the two extremes of Binford's models. The lack of visible satellite activity fits the forager model, but the high reuse of sites fits the collector model. In Southeast Texas, there appears to have been a general foraging strategy, but on a highly scheduled basis. Thus, a single model of mobility-settlement should be used with caution. As Story (1990:269) notes, "Much of the success of hunters and gatherers surely rested in their ability to implement a number of different economic responses, to be able to adjust to the good as well as the bad times."

The reuse of sites in the inland subregion is indicated by large amounts of artifacts at many sites, and the high proportion (about 90 percent) of multi-component sites. The high reuse of sites demonstrates scheduling and restricted mobility even during the Paleoindian period, which is considered to have had a more mobile lifestyle. There are somewhat higher proportions of inland single component sites in the Early Ceramic and Late Prehistoric periods, showing a tendency for more dispersion and mobility. There is archeological evidence that inland Indians were more mobile in the Late Prehistoric (Patterson 1976:185), with less use of pottery and smaller sites.

The high proportion of multi-component shell midden sites on the coastal margin indicates scheduling of subsistence activities in this subregion, similar to the inland subregion. Indians of the coastal margin seem to have utilized a zone about 25-30 km wide along the upper Texas Coast (Patterson 1990c, 1993d). There are certain traits that can be used to distinguish the general boundary between inland and coastal margin sites (Patterson 1993d). Coastal margin type sites in the Galveston Bay area are usually *Rangia* middens with few lithics, with oyster shell tools, large quantities of pottery, and many bone tools. *Rangia* shell middens can be found up to 25 km inland from the coastline on streams with tidal flow, which causes increased salinity. Inland type sites are characterized by modest amounts of pottery, fired clayballs at some sites, much lithic material, but no shell tools; and in the Late Prehistoric, limited amounts of San Jacinto grog-tempered pottery, no Baytown Plain grog-tempered pottery, and concurrent use of the bow and arrow and spear. The large size of many coastal margin shell middens and the use of large quantities of pottery may indicate that coastal margin Indians were less mobile than their inland counterparts; coastal margin Indians may have had more plentiful food resources.

Aten (1981) has developed a correlation for the seasonality of *Rangia* collecting based on shell growth ring patterns. His correlation generally shows that *Rangia* collecting was a regularly scheduled warm weather activity that began in late spring and ended in mid-summer (Story 1990:260). This seasonality model is now under question, however. The actual dates for live *Rangia* samples from Trinity Bay do not give a good match with dates calculated by Aten's correlation (Patterson and Gardner 1993), and it has been noted that Aten's correlation is not suitable for mixed samples of *Rangia* collected during different months (Patterson, Ebersole, and Kindall 1991). The seasonality of subsistence activities on the coastal margin remains a subject for future research.

POPULATION DYNAMICS

Available data are not suitable for determining absolute population levels or short-term population changes. It is possible, however, to estimate the relative population levels in Southeast Texas for each broad time period. Therefore, short-term population changes due to factors such as disease, drought, or food shortage cannot be assessed, but long-term population trends can be studied. The relative population level is estimated by calculating a relative population factor (RPF). This is done by calculating the average number of sites per year for each time period. The calculation of RPF used here is the number of site components of a period, divided by the number of years in the period, multiplied by 100. Data from the mid-1992 data bases have been used, with relative population levels for the inland and coastal margin subregions shown in Figure 3. These graphs are similar to ones given previously for the inland (Patterson 1987, 1991d, 1993a) and coastal margin (Patterson 1987) subregions.

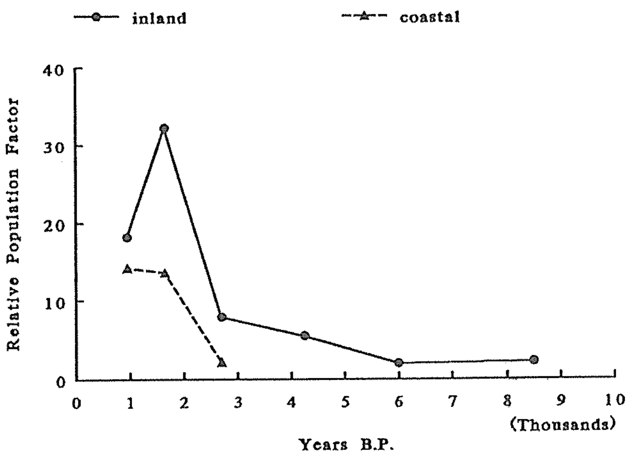

Figure 3. Relative Population Levels over Time in Southeast Texas.

The population growth rate of the inland subregion was low from the Late Paleoindian period to the early part of the Late Archaic. During the Late Archaic, the population growth rate accelerated rapidly, with rapid growth continuing in the Early Ceramic period. Population levels then decline in the Late Prehistoric period (see Figure 3). There seems to have been a decline in population level in Central Texas at about the same time (Prewitt 1985:Figure 6).

Factors that might be considered for the high population growth rate in the Late Archaic and Early Ceramic periods include: (1) a wetter and more productive climate, (2) increased hunting efficiency with early use of the bow and arrow, (3) adaptation to a greater range of food resources, and (4) migration of people into the region. The sharp increase in population in Southeast Texas occurred during the same time period of 800 B.C to A.D. 800 as also seems to have been the case throughout eastern North America (cf. Wenke 1990:565). The population decrease in the inland subregion during the Late Prehistoric appears to have been a response to over-population, perhaps aggravated by climatic deterioration. Story (1990:246) has noted a shift to a drier climate over the last 2000 years. A more mobile lifeway in Southeast Texas in the Late Prehistoric (Patterson 1976) was perhaps caused by over-population, which in turn could have resulted in a lower population level. It has been observed that in hunter-gatherer societies, fertility rates are suppressed significantly simply due to maternal mobility (Wenke 1990:262).

As shown in Figure 3, the population growth rate on the coastal margin increased rapidly from the Late Archaic into the Early Ceramic periods, similar to the inland subregion. On the coastal margin, however, the population growth rate leveled-off in the Late Prehistoric, instead of declining as in the inland subregion. This does not match Aten's (1983:Figure 17.1) hypothetical model or Patterson's (1986b:Figure 2) model based on an older, less detailed data set. On the coastal margin, the reponse to over-population and climatic deterioration was a leveling-off of population growth rates rather than a decline, probably due to the good availability of marine food resources. According to Cabeza de Vaca

(Hedrick and Riley 1974:40), coastal margin Indians were less hungry than inland Indians.

There are few *Rangia* shell middens on the coastal margin dated before 500 B.C., even though the sea level stabilized about 1500 B.C. (Aten 1983:158). Perhaps *Rangia* shellfish resources were not well-established until some time after sea level stabilization. Another possibility is that the coastal margin of Southeast Texas may have been fully occupied only after migration of people from Louisiana who were already fully using marine food resources. The low occupation of the coastal margin from 1500 to 500 B.C. implies that the coastal margin may not have had much use by earlier Indians at earlier coastline positions.

MORTUARY PRACTICES

Isolated burials without grave goods are common throughout Southeast Texas. There are two time periods in specific areas of the region, however, where organized burial practices occurred. In the western part of inland Southeast Texas, a Late Archaic mortuary tradition is found in the lower Brazos and Colorado River valleys and in the intermediate area. This tradition has been best described by Hall (1981) for the Allens Creek sites near the Brazos River. Organized burial practices actually started during the Middle Archaic at this site complex, but reached full development in the Late Archaic with the use of exotic grave goods. Types of exotic grave goods included: boatstones, bannerstones, stone gorgets, corner-tang knives, stingray spines, shark teeth, and marine shell beads and pendants. Other burial practices included the systematic orientation of burial direction, position of body, use of red ochre, and use of locally made grave goods, such as long-bone implements and bone pins. Many of the long-bone implements have incised patterns. Most burials are in extended supine position, with some extended prone and bundle burials also present. Burial direction is usually consistent at any one site, but varies from site to site. There are now 11 sites identified as related to this distinctive Late Archaic mortuary tradition in Austin (4), Fort Bend (4), and Wharton (3) counties (Patterson et al. 1993b:Table 11).

Exotic grave goods are evidence of long-distance trade in the Late Archaic. Large corner-tang knives are from the Edwards Plateau, marine shell ornaments are from still unidentified coastal areas, and ground stone items (beads, boatstones, bannerstones, gorgets) are made of materials from Arkansas. Widespread trade is known to have occurred in the Late Archaic, such as the Poverty Point exchange system (Webb 1982; Gibson 1995). Social status might be indicated by individuals buried with exotic grave goods, but a high degree of social organization in not indicated for these egalitarian hunter-gatherers. Higher social status is likely to have been given to shamans and "big men."

There is evidence of violence at several sites of the Late Archaic mortuary tradition. Evidence of violent death from projectile points has been noted at 41AU36 (Hall 1981), 41FB42 (Patterson et al. 1993a), 41WH14 (Hudgins and Kindall 1984), and 41WH39 (Vernon 1989). Hall (1981:308, 1988b) has proposed that violence was from inter-group conflict, and Patterson (1988b) has noted that intragroup conflict should also be considered. Another organized mortuary tradition is found on the coastal margin in the Galveston Bay area in the Late Prehistoric (Aten et al. 1976), Protohistoric, and Historic (Ricklis 1993, 1994) periods. Many of the burials were flexed or semi-flexed, with a variety of burial directions. At 41HR80 (Aten et al. 1976), grave goods included marine shell beads and pendants, bird bone flutes, bone dice, bone awls, fishhooks, projectile points, and a possible rattle. Red ochre was used with some burials. The Late Prehistoric mortuary tradition of the Galveston Bay area had a degree of organization similar to the inland Late Archaic mortuary tradition, except that not much long-distance trade was involved in the coastal margin tradition.

Ricklis (1993, 1994) describes four burial groups at 41GV66 on Galveston Island, with two groups containing Late Prehistoric burials, and two containing burials of the Late Prehistoric, Protohistoric, and early Historic Indian period. Grave goods of the Late Prehistoric group are typical of the mortuary tradition of the Galveston Bay area, including bone and shell beads, bird bone flutes, and perhaps a rattle. The Protohistoric and early Historic Indian burials are significant for understanding changes in Southeast Texas mortuary practices in that there are differences in body position (the bodies were extended in the grave pits), and some graves had structural enclosures placed around them. A wide variety of European trade goods were found with these latter burial groups, including glass trade beads, a hawk-bell, spike fragments, iron tools, hand-wrought square nails, and flat clear glass mirror fragments (Ricklis 1994:461-462). By contrast, most burials at inland sites after the Late Archaic contain no grave goods.

SOCIAL COMPLEXITY

A high degree of social complexity is shown by some of the mortuary traditions described above, particularly the large organized cemeteries at Late Archaic sites such as Allens Creek (Hall 1981), and then as a reemerging pattern in the Protohistoric and early Historic burial groups at Mitchell Ridge where there was a differential disposal of grave goods in cemeteries (Ricklis 1994). Increased social complexity has been associated with a more sedentary lifestyle resulting from high population level and sometimes from abundant food resources (Brown and Price 1985). During the Late Archaic, there was a rapidly rising population level in all parts of Southeast Texas, which should have led to decreased mobility, but the available archeological evidence suggests that the highest social complexity is evident only in the western zone. Perhaps the western zone had more abundant food resources that permitted a more sedentary lifestyle, which in turn may have created appropriate conditions for more complex social practices to develop.

It should be noted from artifact styles that there probably was more contact between different social groups in the western zone, than in the central and eastern parts of this region, which may have encouraged a higher degree of social organization. The Late Archaic mortuary tradition of western Southeast Texas has several traits usually associated with more complex organization and a sedentary lifestyle, including: high population density, energy invested in grave preparation, differences in burial due to grave wealth, long-distance trade, and evidence of violence (e.g., Brown and Price 1985:437).

The Late Archaic mortuary tradition ended during a period of rapid population increase, and perhaps also a deteriorating climate, but research attention in the region should also consider the relationship between changes in mortuary practices at this time and changing demographic, subsistence, and settlement patterns. Resulting higher mobility of lifestyle possibly disrupted long-distance trade, and minimized the survival value of higher social complexity. Brown and Price (1985:438) have observed that "decreased mobility retards flexible response to stress and engages more institutional structures as essential solutions."

BIOARCHEOLOGY

Data on bioarcheology for the central and western parts of Southeast Texas have been summarized by Reinhard et al. (1990). Burnett (1990) notes the general paucity of data for the eastern part of this region. Pathological conditions mentioned include classes of degenerative disease, metabolic disease, infectious disease, and dental disease. Most studies for this region simply itemize pathological conditions found on skeletal remains. Only Powell (1988) has integrated data to reach overall conclusions on Late Prehistoric adaptive success. Powell (1988:262) states that groups of the coastal plain had moderate success in buffering stress, although stress may have been experienced at random or seasonal intervals. Examples of average life expectency during the Late Archaic are 24 years at the Crestmont site and 32 years at Witte Group 2 (Vernon 1989:37). Examples of average life expectancy during the Late Prehistoric are 29 years at the Boys' School Cemetery and 39 years at Jamaica Beach (Aten et al. 1976:Table 13). Some individuals in the Late Archaic lived over 50 years (Black et al. 1992). Skeletons from the Late Archaic at 41FB3 (Patterson et al. 1993b) showed a generally good state of health at time of death.

HISTORIC INDIAN USE OF SOUTHEAST TEXAS

With a few exceptions, historic Indian sites in Southeast Texas are not well-connected with the ethnographic record (Story 1990:258). It is even more difficult to relate the ethnographic record to prehistoric Indian groups in this region, especially because of Late Prehistoric and historic movements of social groups. Aten (1983:Figure 3.1) shows reconstructed territories of native groups in the early eighteenth century, including Coco (Karankawa?), Tonkawa, Bidai, Akokisa, and Atakapa. However, the presence of the Tonkawa in Southeast Texas may be due to a rapid expansion from Central Texas in the seventeenth and eighteenth centuries (Newcomb 1993:27). Karankawa Indians of the Coco tribe are thought to have occupied the coastal margin of this region as far east as Galveston Island and the corresponding mainland (Aten 1983:Figure 3.1). Judged by the scarcity of Rockport pottery on sites east of the San Bernard River, the ethnic identity of the Coco, as being firmly affiliated with the Karankawa, may be in doubt, although a reasonable alternative is that the Coco lived farther down the coast in prehistoric times. The presence of any Karankawa in the western part of the coastal margin of Southeast Texas may be a rather late movement of some individuals of this ethnic group. The only site on the upper Texas coastal margin with much asphalt-coated pottery of the Rockport type is 41CH110 in Chambers County (Gilmore 1974:59), where asphalt-coated pottery started after A.D. 1350, but may actually be protohistoric in age.

Protohistoric and Historic Indian period sites (A.D. 1500-1800) are probably under-identified in this region, because few aboriginal artifact types changed from the Late Prehistoric to the Historic Indian period (Patterson 1993c). Only a few non-European artifact types are useful in identifying historic Indian sites. Arrow point types that seem to be found in Historic Indian period sites in Southeast Texas include Bulbar Stemmed and Guerrero (Hudgins 1986) types, although Bulbar Stemmed points from Mitchell Ridge were found in contexts dating between ca. A.D. 1440-1640 (Ricklis 1994), suggesting they also date to the Protohistoric period. Fresno and Cuney arrow points may date mainly after A.D. 1500 in Southeast Texas (see Hudgins 1986), but this is not clear. Loop handles for pottery have been found at 41WH8 (Hudgins 1986:Figure 16) and at 41CH161 (Kindall and Patterson 1993) which has a historic-era component. As of early 1994, the data bases for Southeast Texas have 13 published historic Indian sites in the inland subregion and 29 historic Indian sites in the coastal margin subregion.

Historic Indian period sites are usually identified by the presence of glass and metal artifacts, gunflints, and European types of pottery. In some cases, radiocarbon dates indicate historic Indian components when no trade goods are present, such as at 41WH19 (Patterson et al. 1987), with an uncorrected radiocarbon date on charcoal of A.D. 1585 ± 80 (SI-6455) from the excavated stratum nearest the surface. At 41WH8 (Hudgins 1984), historic artifacts included glass scrapers, a Spanish coin with a date of 1738, loop handles for pottery, and a projectile point made from an iron keyhole plate. Glass beads have been found at a few Indian sites in both the coastal margin and inland subregions, including 41PK69 (Ensor and Carlson 1988); 41CH20, 41CH53 and 41CH103 (Ambler 1970:29); 41CH161 (Kindall and Patterson 1993); Mitchell Ridge (41GV66) (Ricklis 1993, 1994); as well as 41CH110 and 41LB4 (Aten 1983:268). Most of the Native American sites with glass beads are from the Galveston Bay area. Ricklis (1993, 1994) has found historic Indian burial groups at the Mitchell Ridge site on Galveston Island, identified by European trade goods, including several thousand glass beads, a brass bell, iron tool fragments, and flat glass. Glass trade beads here are assignable to the early to late-eighteenth century, perhaps ca. 1720-1770 (cf. Ricklis 1994:461). In the northern part of Southeast Texas, a variety of Euro-American trade goods can be found at early nineteenth century Alabama/Coushatta historic Indian sites (Perttula 1992:23, 1994).

Fullen (1978) has described the El Orcoquisac Archeological District as follows: 41CH57 includes Joseph Blancpain's trading post, Village de Atakapas (1754), the first location of the Spanish Presidio San Agustin de Ahumada (1756-1766), and the first location of Mission Nuestra Senora de La Luz (1756-1759). Site 41CH54 is the second location of Mission de La Luz (1759-1771), and 41CH22 is the Orcoquisac Rancheria associated with the mission. Site 41CH53 is the second location of the presidio. Many other Historic Indian, Spanish, and French sites mentioned in the historical record have not yet been located. Newcomb (1961) and Aten (1983) may be consulted for more details on historic Indians in this region. The diary of Cabeza de Vaca (Covey 1961; Hedrick and Riley 1974) provides the main ethnographic description of the lifestyle of Indians in Southeast Texas.

European settlement of Southeast Texas did not seriously disrupt the lifeway of Indians until after 1700. The first half of the eighteenth century was the period in which the fur trade and mission system, as well as the first effects of epidemic diseases, began to seriously disrupt and stress the native culture and social systems (Aten 1983:322) This is clearly seen in the archeological record at the Mitchell Ridge site, where the burial data suggests population declines and group mergers

(Ricklis 1994), as well as the increasing importance of Native American participation in the fur trade. By the time heavy settlement of Texas began in the early 1800s by Anglo-Americans, the indigenous Indian population was greatly diminished. Alabama/Coushatta Indians in Southeast Texas are migrants, displaced from the east in the late eighteenth to early nineteenth centuries (Newcomb 1961:25), but they lived through the 1840s in several large villages in the lower Trinity and Neches River basins.

PROJECTILE POINT CHRONOLOGIES

Chronologies of projectile points in Southeast Texas are summarized in Table 3. Chronologies previously given for arrow points (Patterson 1991a) and dart points (Patterson 1991b) in Southeast Texas are used here with some later refinements. Suhm and Jelks (1962) and Turner and Hester (1985, 1993) have given descriptions of most point types found in Texas. Principal prehistoric projectile point types used in Southeast Texas are shown in Figures 4 and 5.

EARLY PALEOINDIAN PROJECTILE POINTS (12,000-10,000 B.P.)

Although there are no radiocarbon dates for Clovis in Southeast Texas, it is presumed that this is the earliest point type found in this region. Haynes et al. (1984) date Clovis between 12,000-11,000 B.P. in the western U.S., extending to as late as 10,500 B.P. at some sites in the eastern U.S. The context of Clovis points is not well-defined in Southeast Texas, but there are some sites where Clovis is found in multi-component contexts: 41HR343 (Patterson et al. 1993c), 41HR731 (Patterson et al. 1993d), Doering (Wheat 1953), and 41HR571 (Patterson 1986). Clovis points have been found over a stretch of several km along McFaddin Beach near Beaumont (Long 1977), and a recent meeting of collectors revealed over 60 Clovis points from this location (Banks 1992; see also Turner and Tanner 1994). Huebner (1988) reported on a Clovis point found on the beach of Bolivar Pennisula in Galveston County, west of McFaddin Beach (see also Meltzer and Bever, this volume).

Prehistoric occupations in Southeast Texas become more apparent between 11,000-10,000 B.P.

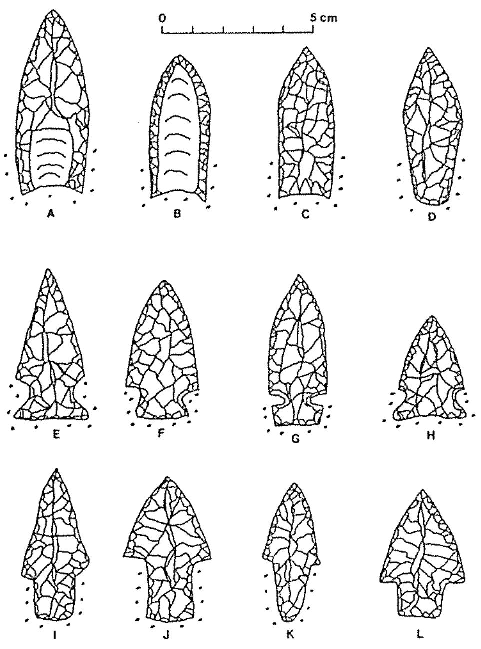

Figure 4. Early Projectile Points: a, Clovis; b, Folsom; c, Plainview; d, Angostura; e, Early side-notched; f, Early corner-notched; g, Big Sandy; h, San Patrice; i, Early stemmed; j, Carrollton; k, Wells; l, Bulverde. Dots show ground edges.

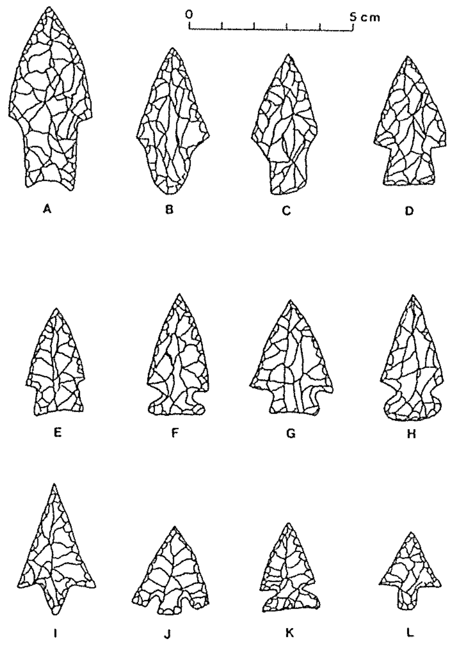

Figure 5. Later Projectile Points: a, Pedernales; b, Gary; c, Kent; d, Yarbrough; e, Darl; f, Ensor; g, Ellis; h, Palmillas; i, Perdiz; j, Catahoula; k, Scallorn; l, Alba.

Table 3. Projectile Point Chronologies in Southeast Texas

Point type	Early Paleo	Late Paleo	E. Arch	M. Arch	L. Arch	Early Ceramic	Late Prehistoric
Clovis	X						
Folsom	X						
Midland	X						
Early SN	X	X					
Dalton	X	X					
Big Sandy	X	X					
San Patrice	X	X					
Plainview		X					
Scottsbluff		X					
Angostura		X					
Meserve		X					
Early CN		X					
Early Stemmed		X	X				
Bell			X				
Trinity			X	X			
Wells			X	X			
Carrollton			X	X			
Morrill			X	X			
Bulverde				X			
Lange				X			
Pedernales				X	X		
Williams				X	X		
Travis				X	X		
Large Gary				X	X		
Large Kent				X	X		
Morhiss				X	X		
Ponchartrain					X		
Darl					X	X	
Yarbrough					X	X	
Ensor					X	X	
Ellis					X	X	
Fairland					X	X	
Palmillas					X	X	
Marcos					X	X	
small Gary					X	X	X
small Kent					X	X	X
unifacial arrow points					X	X	X
bifacial arrow points							X

SN=side-notched; CN=corner-notched

The Plains tradition is represented in Southeast Texas at this time by a few Folsom and Midland points. Folsom is dated to 11,000-10,000 B.P. (Largent et al. 1991). The rarity of Folsom and Midland points in the region may be due to the limited availability of bison in this region during this time period (cf. Munson (1990:Figure 3).

Single Folsom points have been found at 41WH19 (Patterson et al. 1987), 41HR624 (Patterson, Marriott, and Marriott 1990), 41HR343 (Patterson et al. 1993c), and McFaddin Beach (Banks 1992). Three Midland points were found at 41HR571 (Patterson 1986:Figure 2), although they were originally classified as Plainview-like because no Midland point had previously been reported in this region. A few Midland points at other sites (Patterson et al. 1993c, 1993d) does not change the view that they are rare in the region. A Folsom point was found in the same excavation level as an Early Side-Notched point at 41WH19 (Patterson et al. 1987), with an associated uncorrected radiocarbon date on charcoal of 9920 ± 530 B.P. (AA-298).

Several other projectile point types were also present in Southeast Texas during the same time period as Folsom. These include Dalton, and side-notched San Patrice, Big Sandy, and Early Side-Notched types. Big Sandy and Dalton points are not common, although Dalton points are frequent north of Southeast Texas (Story 1990:Figure 27), and date from as early as 10,500 B.P. (Goodyear 1982) to 9500 B.P. (Morse and Morse 1983:71). Big Sandy points are common in the Southeast Woodlands, with a date as early as 10,500 B.P. in northern Alabama (Boyd 1992). They continued in use until about 8000 B.P. (Justice 1987:61). Dalton points have been found in Southeast Texas at McFaddin Beach (Long 1977), and a few other places (Patterson et al. 1993c, 1993d) in Harris County. Big Sandy points have been found in this region at three sites in Harris County (Patterson et al. 1987, 1993c, 1993d). San Patrice and Early Side-Notched point types are both common in Southeast Texas (Patterson 1989a, 1990a). Story (1990:202) provisionally dates the San Patrice point to 10,300-9300 B.P. As noted above, there is a radiocarbon date of 9920 ± 530 B.P. from a level with Early Side-Notched points at 41WH19 (Patterson et al. 1987).

San Patrice and Early Side-Notched points often occur together (Webb et al. 1971; Patterson et al. 1987). One variant of the Early Side-Notched point has been classified as Keithville (Turner and Hester 1993:134), but this variant does not even apply to all side-notched points at the type site (Webb et al. 1971). There are considerable data to indicate that San Patrice and Early Side-Notched were the principal point types used in Southeast Texas during the Early Paleoindian period.

LATE PALEOINDIAN PROJECTILE POINTS (10,000-7000 B.P.)

This period is characterized by unfluted lanceolate points. Big Sandy, San Patrice, and Early Side-Notched points continued into the early part of this period, but these side-notched point types were generally replaced by corner-notched points. A small proportion of Early Stemmed points were also present. Most specimens were ground on basal edges, similar to points from the Early Paleoindian period.

Late Paleoindian point types of the Southern Plains tradition found in Southeast Texas include Plainview, Scottsbluff, Meserve, and Angostura. Plainview points have been found in Late Paleoindian contexts at 41WH19 (Patterson et al. 1987) and 41HR315 (Patterson 1980). Scottsbluff points are not common in Southeast Texas, but are found frequently farther north (Story 1990:210). Most Scottsbluff points found in this region are from surface collections (Hudgins and Patterson 1983; Patterson and Hudgins 1991), but there is an excavated specimen from 41HR5 in Harris County (Wheat 1953).There are excavated Angostura points in possible Late Paleoindian contexts at 41FB42 (Patterson et al. 1993a) and 41FB223 (Patterson et al. 1994).

A few Early Stemmed points occur at 41WH19 (Patterson et al. 1987) and 41HR315 (Patterson 1980). Perhaps these represent the start of development of stemmed point styles. The change from side-notched to corner-notched point types occurred throughout the Southeast Woodlands during Late Paleoindian times (Fagan 1991:310). Site 41PK69 also has early notched points (Ensor and Carlson 1988:Tables 18 and 19).

EARLY ARCHAIC PROJECTILE POINTS (7000-5000 B.P.)

Projectile points of the Early Archaic period in Southeast Texas include Bell, Carrollton, Morrill, Trinity, Wells, and miscellaneous Early Stemmed varieties. The Bell point is the only type in this period closely associated with the Southern Plains. Bell points are occasionally found in the western and central parts of Southeast Texas, generally made of exotic Edwards chert types. Most specimens of other points types during this period are made of local chert types.

Use of lanceolate and notched point styles ended at the start of the Early Archaic in Southeast Texas, with the dominance of stemmed point forms. Bell (Prewitt 1981) and Morrill (Turner and Hester 1985:129) points are placed in this period using Central and Northeast Texas chronologies. The only excavated examples of Trinity points in Southeast Texas are from 41HR315 (Patterson 1980:Table 3), although Turner and Hester (1985:154) place this point type in the Middle Archaic. Carrollton and Wells point types are most common in the Early Archaic period in this region, but seem to extend into the early part of the Middle Archaic (Patterson 1980). There is an uncorrected radiocarbon date on freshwater mussel shell of 6490 ± 120 B.P. (I-15333) in an excavation level with a Carrollton point at 41FB37 (Patterson 1988).

A variety of Early Stemmed point types, all with ground stem edges, from the Early Archaic occur at 41WH19 (Patterson et al. 1987) and 41FB223 (Patterson et al. 1994). The practice of stem grinding was commonly used in Southeast Texas until the early part of the Middle Archaic, although a few point specimens with ground stem edges have also been found in this region as late as the Late Archaic period (Patterson et al. 1987).

MIDDLE ARCHAIC PROJECTILE POINTS (5000-3500 B.P.)

As noted above, Wells, Carrollton, Morrill, and perhaps Trinity point types continue into the early part of the Middle Archaic in this region. Other projectile points found in Southeast Texas during the Middle Archaic include: Bulverde, Lange, Pedernales, Williams, Travis, and probably the Gary-Kent series. Bulverde points have been found in Middle Archaic context at 41HR315 (Patterson 1980) and 41FB42 (Patterson et al. 1993a).

The Pedernales point is found in both Middle and Late Archaic deposits. Examples from Middle Archaic contexts have been recovered at 41AU37 (Hall 1981), 41AU1 (Duke 1982:Figure 2), and 41FB34 (Patterson 1989d), which has an uncorrected radiocarbon date of 5210 ± 110 B.P. (I-15510) on freshwater mussel shell in excavated context. The Pedernales point has been found in Late Archaic components at 41FB3 (Patterson et al. 1993b), 41FB42 (Patterson et al. 1993a), and 41AU1 (Duke 1982:Figure 2).

The Gary-Kent series of straight and contracting stem points seems to start in the Middle Archaic in this region at sites such as 41AU37 (Hall 1981) and 41HR315 (Patterson 1980). These point types continue through the Late Archaic, Early Ceramic, and Late Prehistoric periods, but tend to be smaller in the Early Ceramic and Late Prehistoric periods (Ensor and Carlson 1991; Keller and Weir 1979; Patterson 1980). Gary and Kent points are grouped as a series because of morphological overlaps and frequent co-ocurrence at the same sites.

LATE ARCHAIC AND EARLY CERAMIC DART POINTS (3500-1400 B.P.)

Dart point types of the Late Archaic and Early Ceramic have been grouped together because several types occur in both periods (Patterson 1989d). These include: Gary, Kent, Darl, Yarbrough, Ensor, Ellis, Fairland, Palmillas, and Marcos. The Ponchartrain point is a minor type from Louisiana that is found in Southeast Texas during the Late Archaic. As noted above, the Pedernales point may continue into the early part of the Late Archaic in this region. The chronologies of Marcos and Fairland points are not well-established in Southeast Texas. Gary and Kent are the dominant point types in this region during these time periods.

Gary, Kent, Darl, Yarbrough, Ensor, Ellis, and Palmillas dart points often occur together (Patterson 1990a). Story (1990:256) thinks that Yarbrough, Darl, and Godley points types may be variations of a general style. My opinion is that Yarbrough, Darl, and Palmillas point types may be variants that developed from the Gary-Kent series. The Godley point has been classified as a Yarbrough variant in my data bases. The use of bone dart points was fairly common during the Early Ceramic period on the coastal margin (Aten 1983:262), and reflects the lack of lithic materials in this subregion.

LATE PREHISTORIC DART POINTS (1400-500 B.P.)

On the coastal margin of Southeast Texas, use of the spear was generally discontinued during the Late Prehistoric (Aten 1983:306), in favor of use of the bow and arrow. The spear and spearthrower (atlatl) continued to be used during the Late Prehistoric in the inland subregion along with the bow and arrow, however (Aten 1967; Keller and Weir 1979; Ensor and Carlson 1991; Patterson 1980; Patterson et al. 1987; Wheat 1953). Small Gary and Kent dart points are the principal types found in the Late Prehistoric in inland Southeast Texas, as well as a few Ensor and Ellis specimens. Further east, Indians of the central and eastern part of the Gulf coastal plain are also known to have used both the spear-spearthrower and bow and arrow weapon systems (see Hudson 1976).

UNIFACIAL ARROW POINT CHRONOLOGY (est. 4000-500 B.P.)

Introduction of the bow and arrow is generally viewed as started about A.D. 600 in Central (Prewitt 1981) and Southeast (Aten 1983:306) Texas, using bifacial arrow points. With this model, however, no explanations are given on how this introduction occurred, or why no initial time period is apparent that allows for a lengthy local adoption of this new technology. I have proposed (Patterson 1982, 1992b) that use of the bow and arrow started in Southeast Texas at about the end of the Middle Archaic, using unifacial arrow points that were mainly marginally retouched flakes. Odell (1988) has reached a similar conclusion for the start of the bow and arrow in the Central U.S. The bow and arrow seems to have diffused from Northeast Asia into the North American arctic, and then diffused progressively south through the New World (Patterson 1973, 1982, 1992b). In Southeast Texas, unifacial arrow points are estimated to start at about 4000 B.P. and continue through the Late Prehistoric (Patterson 1992b:Table 1), based on estimated chronologies at several sites with excavated data, or from surface collections in apparent single component contexts. Unifacial arrow points appear to be associated with a small prismatic blade technology (Patterson 1973). I have further proposed that the start of bifacial arrow points in Southeast Texas at about A.D. 600 represents the common use of these types of tools, rather than the adoption of the bow and arrow.

BIFACIAL ARROW POINT CHRONOLOGIES (A.D. 600-1500+)

Four major arrow point types were in use in Southeast Texas during the Late Prehistoric, including Alba, Catahoula, Perdiz, and Scallorn. No serial sequence for these point types is apparent in this region (Patterson 1991a), although there is a definite Scallorn-Perdiz temporal sequence in adjacent Central Texas (Prewitt 1981), and Perdiz occurs in post A.D. 1250/1300 contexts in Central Texas (Johnson 1994), South Texas, North Central Texas and Northeast Texas. The lack of a chronological sequence for major arrow point types in Southeast Texas is best understood by the geographic distribution of these point types (Patterson 1991a, 1993a). The Scallorn arrow point appears to have been introduced into Southeast Texas from Central Texas, and Alba and Catahoula points are thought to have been introduced into Southeast Texas from Louisiana. These suppositions are based on the east-west distribution frequencies of these point types in Southeast Texas (Patterson 1993a).

I have also argued that Perdiz may have been introduced in Southeast Texas about this time (Patterson 1991a). The lack of a chronological sequence for major arrow point types in Southeast Texas is the result of a mix of diffusion and local innovation of point types. Use of Perdiz points continued in Southeast Texas until after A.D. 1500 (Patterson et al. 1987).

GEOGRAPHIC DISTRIBUTIONS OF PROJECTILE POINT TYPES

Quantitative distributions of projectile point types within western, central, and eastern parts of Southeast Texas have been published for the inland subregion (Patterson 1993a). Southeast Texas shares projectile point types also found in several adjacent regions. There are technological influences from the Southern Plains (Central Texas), and the Southeast Woodlands (Louisiana and farther east) during all time periods (Table 4). Projectile point types in Southeast Texas that are related to those found in

Table 4. Periods of Point Types in Southeast Texas

	Point type*	Geographic Affinity
Paleoindian		
	Clovis	general U.S.
	Folsom	Southern Plains
	Midland	Southern Plains
	Plainview	Southern Plains
	Scottsbluff	Southern Plains
	Angostura	Southern Plains
	Meserve	Southern Plains
	Early Side-Notched	Southeast Woodlands
	Dalton	Southeast Woodlands
	Big Sandy	Southeast Woodlands
	San Patrice	Southeast Woodlands
	Early Corner-Notched	Southeast Woodlands
	Early Stemmed	Southeast Woodlands
Early Archaic		
	Bell	Central Texas
	Trinity	Northeast Texas
	Wells	shared with Northeast Texas
	Carrollton	shared with Northeast Texas
	Morrill	Northeast Texas
Middle Archaic		
	Bulverde	Central Texas
	Lange	Central Texas
	Pedernales	Central Texas
	Williams	Central Texas
	Travis	Central Texas
	Gary	Southeast Woodlands
	Kent	Southeast Woodlands
Late Archaic-Early Ceramic		
	Morhiss	Central Texas coast
	Ponchartrain	Louisiana
	Darl	Northeast and Central Texas
	Yarbrough	Northeast Texas
	Ellis	Northeast Texas
	Ensor	Central Texas
	Fairland	Central Texas
	Marcos	Central Texas
	Palmillas	South Texas
	unifacial arrow points	diffusion from northwest (?)
Late Prehistoric		
	Perdiz	indigenous (?)
	Alba	Louisiana
	Catahoula	Louisiana
	Scallorn	Central Texas

* Placement represents time period when use started (see Table 3 for temporal intervals)

adjacent regions do not necessarily reflect any influences of specific social groups. Justice (1987) shows wide geographic distributions of many projectile point types that far exceeds social territories.

LITHIC PROCUREMENT

Lithic procurement patterns in Southeast Texas are tied to the proximity of lithic source locations. Chert sources are concentrated in the western part of the region, and petrified wood sources are concentrated in the eastern part of the region. Large chert cobbles (up to 15 cm in length) can be found in the Colorado River drainage system, generally north of Eagle Lake, just outside of the western edge of the region. Smaller chert cobbles (generally less than 5 cm in length) and some petrified wood can be found in the Brazos River valley. Some small chert cobbles occur in streams in eastern Wharton County. Small pieces of chert, petrified wood, and fine-grained quartzite are present north of Houston. Petrified wood occurs in the Trinity River drainage system. Types of lithic materials at archeological sites generally reflect the geographic locations of various lithic sources. In western and central parts of Southeast Texas, sites contain mainly chert artifacts, with limited use of petrified wood. In the east, there is a predominant use of petrified wood, as shown by the large Kyle collection (Kindall and Patterson 1986).

In general, lithic procurement in Southeast Texas does not appear to be "embedded" in seasonal subsistence rounds (cf. Binford 1979). At sites remote from lithic sources, there are few indications of heavy use of stone tools or limited amounts of debitage that would indicate that lithic procurement was an activity within seasonal subsistence rounds, or perhaps by trade. On the contrary, there are many large sites that are 40 to 80 km from lithic sources that have large amounts of finished lithic artifacts and debitage, and only light use of most utilized flakes; examples are 41HR182 (Patterson 1985) and 41HR315 (Patterson 1980). Lithic procurement seems to have been by planned trips outside of seasonal subsistence movements.

Coastal margin sites contain only small amounts of lithic materials, with shell and bone tools often used instead of stone tools. This indicates either restricted access of coastal margin Indians to inland lithic sources, or cultural choices that minimized lithic procurement.

Exotic lithic materials from the Edwards Plateau are found in small quantities at sites in Southeast Texas. This may indicate limited down-the-line trading in raw materials and projectile points from Central Texas, or some inter-band movements of a few individuals. In the Late Prehistoric, there may have been some scavenging at earlier sites for reworkable lithic materials, such as suggested by Ricklis and Cox (1993:457) for sites on the central Texas Gulf coastal plain. Good quality heat-treated flakes from dart point manufacture suitable for arrowpoint manufacture would have been available at earlier sites.

There is a trend toward higher percentages of smaller size flakes (Patterson 1980:Figure 19; Patterson et al. 1987:Figure 20) and smaller dart points in later time periods. While there may be a technological trend toward smaller size dart points, it is possible that higher population levels in later time periods restricted access to lithic sources, resulting in use of more lithic sources with smaller size pieces of raw material.

LITHIC MANUFACTURING

Most inland sites in this region have significant quantities of debitage from lithic manufacturing, but a low quantity of cores. Primary reduction of raw materials was done mainly at lithic source locations, with flake blanks and early stage preforms taken to campsites for projectile point manufacture. Arrow and dart point preforms in various stages of completion or failure also show that bifacial projectile points were manufactured at campsites, rather than at lithic sources. Use of flake blanks to manufacture dart points at campsites allowed good material to be selected at the source, and reduced transportation weight and volume. Heat-treatment of chert to improve knapping quality was extensively used in all time periods, but it is not clear whether heat-treatment was generally done near lithic sources or at campsites. Heat treatment near lithic sources would have been efficient, with only successfully heat-treated materials being transported to campsites.

Quartzite hammerstones are often found at campsites, and limestone hammerstones for soft percussion are found occasionally, imported from the Edwards Plateau. Antler billets and antler pressure flaking tools are rarely preserved, but were probably a significant part of the toolkit for projectile point production. There was usually a low level of manufacture of formal unifacial tool types at campsites.

LITHIC TOOL TYPES AND FUNCTIONS

Other than projectile points, the dominant type of stone tool in Southeast Texas was the utilized flake, usually selected casually from bifacial reduction debitage. There is evidence that formal unifacial tools (Figure 6) were used in the Paleoindian period, in the form of the Albany scraper (Patterson 1991c), large scrapers, combination scraper-gravers, and miscellaneous large bifacial tools (Patterson et al. 1987). During all time periods, however, the utilized flake was the dominant tool type. After the Paleoindian period, formal types of unifacial tools occur only in small quantities at most sites, usually made from thin bifacial thinning flakes. These include scrapers, denticulates, notched tools, perforators, and gravers. A few bifacial perforators (drills) are sometimes found at sites in this region.

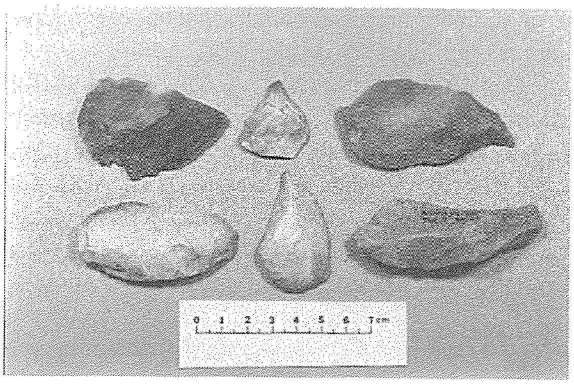

Figure 6. Paleoindian lithic unifacial tools.

Examples of edge wear patterns from scraping, cutting, and planing functions can be found on utilized flakes, consistent with edge wear patterns illustrated by Tringham et al. (1974). Some types of stone tool use do not give much edge wear, especially when working soft materials such as meat (Patterson 1984). There is little evidence from stone tool types to indicate that any sites were being used as specialized activity locations.

CERAMIC TYPES, CHRONOLOGIES, AND GEOGRAPHIC DISTRIBUTIONS

The use of pottery did not start uniformly throughout Southeast Texas. It diffused into this region from adjacent regions, especially from the east along the coastal margin. Aten (1983:297) states that pottery was present at the Texas-Louisiana border on the coastal margin by about 70 B.C., in the Galveston Bay area by about A.D. 100, in the western part of the coastal margin of this region by about A.D. 300, and in the Conroe-Livingston inland area by about A.D. 500. The use of pottery in the inland subregion of Southeast Texas appears to have diffused from the coastal margin. The chronologies of various pottery types in Southeast Texas are best known in the Galveston Bay area, where Aten (1983:Figure 14.1) has established a detailed chronological sequence. Aten (1983:206-245) has given a detailed description of each pottery type found in Southeast Texas.

Pottery was introduced at the start of the Early Ceramic period, when there was a high regional population level. The high population may have resulted in restricted mobility, and a more sedentary lifestyle with longer stays at campsites. Since pottery is not easily transported, the use of pottery may have been more advantageous with a more sedentary lifestyle. As noted below, the use of pottery decreased in the Late Prehistoric period in the inland subregion when there was a higher degree of mobility.

Goose Creek sandy paste pottery was used throughout Southeast Texas and somewhat farther north in the Early Ceramic, Late Prehistoric, and early part of the Historic Indian periods (see Perttula et al., this volume). A minor variety, Goose Creek Stamped, occurs only in the Early Ceramic period (Aten 1983:Figure 14.1). Winchell and Ellis (1991) have considered the possibility of a more detailed chronological sequence for Goose Creek pottery, based on types of surface finish, but no definite regional chronological sequence has been established based on the frequency of this attribute.

On the basis of geographic distribution of sandy paste pottery, Story (1990:256) has proposed a Mossy Grove cultural tradition. This designation is problematical, because it is based mainly on a single technological trait, while Southeast Texas is rather heterogeneous with regard to other technological traits. There is a smaller amount of Goose Creek pottery in the western zone than in the central and eastern parts of this region, which is consistent with Aten's (1971:Figure 10) model of slow diffusion of pottery down the Texas coast from Louisiana to Corpus Christi Bay.

Grog (crushed sherd)-tempered pottery was used in the Late Prehistoric and Protohistoric periods. The varieties of grog-tempered pottery are San Jacinto Plain, and Baytown Plain, *variety Phoenix Lake*. San Jacinto pottery has relatively low amounts of small size temper, while Baytown Plain has large amounts of sherd pieces as temper, often visible on surfaces, and a clayey or silty paste (see Weinstein 1991). Both Goose Creek and San Jacinto wares have small percentages of incised varieties, but studies have shown only a limited temporal significance for incised design motifs. Grog-tempered pottery is more common on the coastal margin than in inland Southeast Texas (Patterson 1990b). The reported amounts of San Jacinto grog-tempered pottery in the inland subregion are probably over-stated due to identification difficulties (Aten 1983:239). Baytown Plain grog-tempered pottery is found only on the coastal margin (Aten 1983:241), but is often classified together with San Jacinto Plain.

Aside for Goose Creek Stamped, three other minor pottery types were used only during the Early Ceramic period: Tchefuncte (Plain and Stamped), Mandeville, and O'Neal Plain, *variety Conway* (Aten 1983:Figure 14.1). Mandeville and Tchefuncte types are characterized by contorted paste and poor coil wedging. Mandeville has sandy paste like Goose Creek, and Tchefuncte paste has little sand. There is a question as to whether or not Mandeville and Tchefuncte ceramics are separate types or simply represent different clay sources. Conway pottery is like Goose Creek except that coarse-grained sand has been added as temper.

Bone-tempered pottery types are not common in Southeast Texas, but occur sporadically in time and space, in the Early Ceramic, Late Prehistoric, and Protohistoric periods (Patterson 1993b; Aten 1983:Figure 14.1). Bone-tempered pottery found in the western part of this region during the Late Prehistoric (Patterson and Hudgins 1989) may be related to Leon Plain pottery of Central Texas (Suhm and Jelks 1962). Bone-tempered pottery seems to occur only in the inland subregion during the Early Ceramic period. Rockport Plain and Asphalt Coated pottery are types from the Central Texas coast (see Ricklis, this volume), found at only a few sites in Southeast Texas during the Late Prehistoric and Protohistoric periods.

The functional uses of pottery have not been well-defined in this region, but possibilities include cooking, food storage, and water storage. The common occurrence of sherds with drilled repair holes implies that much of the pottery may have been used for food storage, where a water-tight container was not required. A large proportion of pottery in the inland subregion was poorly fired, which might indicate that cooking was not its major use since a durable vessel would have been desired for cooking. Pottery was better fired in the coastal margin subregion, and probably this attests to more cooking use, such as boiling to process shellfish and fish.

FIRED CLAYBALLS

Fired clayballs (Figure 7) are found at some inland sites in this region. This artifact has a wide geographic distribution, but the frequency of sites with clayballs is low. There are 34 sites with clayballs in the inland data base as of mid-1992. Typically, clayballs vary from 15 to 76 mm in diameter, with an average weight of 6 g. The number of clayballs at a site varies from a few to many thousands (Patterson 1989e). At some sites clayballs are mixed with pieces of caliche that appear to have had the same function as clayballs.

The probable function of clayballs was for roasting of food materials, although heat-treatment of chert is another possibility. Hudgins (1993) has conducted experiments for meat roasting with hot clayballs with good results. Hot clayballs retain heat longer than hot coals from a wood fire. The relatively low frequency of sites with clayballs

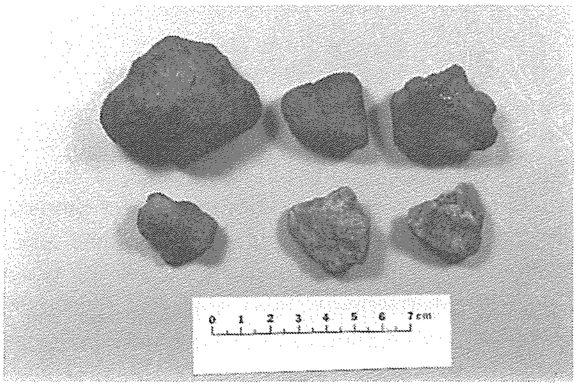

Figure 7. Fired clayballs from a site in Southeast Texas

indicates that cooking with clayballs was not a generally prefered method. Meat can be cooked easily with an open fire, but some types of plant materials are probably better processed by roasting over clayballs. It has been proposed (Patterson 1989e) that sites with clayballs represent specialized processing of plant foods on a seasonal basis. Poor preservation of floral remains precludes identifying the types of plant materials that were processed. Fired clayballs occur from the Late Paleoindian through the Late Prehistoric periods (Patterson et al. 1987, Patterson et al. 1993a).

GROUNDSTONE ARTIFACTS

Mano-metate sets and grinding slabs of local sandstone are occasionally found at sites in this region. Possible uses of grinding tools include processing of plant materials and grinding of decorative pigments. At 41FB3 (Patterson et al. 1993b), grinding slabs were used to produce powdered red ochre to include with burials. Ground stone artifacts made of exotic materials include boatstones, gorgets, bannerstones, and beads, often found as grave goods in Late Archaic burials in the western part of Southeast Texas (Hall 1981). Duke (1989) has documented bannerstones found in this region.

BONE AND ANTLER ARTIFACTS

Preservation of bone and antler is generally not good in Southeast Texas, but artifacts made of these materials are occasionally found. Bone tools are most common at coastal margin sites, where preservation is good in shell middens, and where bone tools were often used instead of stone tools. Bone tool types include awls, projectile points, fishhooks, pins, and needles. Long-bone implements have been found at several sites. Hall (1988a) has concluded that pointed long-bone implements were used as awls, but that specimens with blunt ends had other functions, such as use for hairpins, head scratchers, or sweat scrapers. Bone beads are occasionally found, mainly as grave goods (Hall 1981). Antler is not preserved as well as bone. A few antler pressure flaking tools (Vernon 1989) and projectile points (Aten et al. 1976:40) have been found. Bone and antler tools were probably used more than the archeological record indicates.

SHELL ARTIFACTS

Marine shell beads and pendants occur at inland Late Archaic (Hall 1981) and Late Prehistoric coastal margin (Aten et al. 1976) burial sites. Oyster shell tools were used on the coastal margin as a substitute for stone tools (Aten 1983:264; Patterson 1990c), for cutting and scraping. The distribution of oyster shell tools is an indicator of the geographic settlement pattern of coastal margin Indians (Aten 1983:Figure 16.1).

SUMMARY COMMENTS

This paper has summarized the long period of hunter-gatherer lifestyle in Southeast Texas, as reconstructed from current data. This lifestyle appears to have been a successful adaptation for a period of about 11,000 years, characterized by a continuity in settlement pattern type and slow technological change. Future research in this region will result in more refined interpretations of various research topics and models. However, due to the rapid destruction of archeological resources by erosion and modern activities, the most important research goal should be to obtain good representative samples of the archeology of all geographic areas and time periods in Southeast Texas. Research on specific problems can be done as suitable data become available. Much more research needs to be done outside of the Cultural Resource Management regulatory process, to ensure better coverage of archeological resources on private lands.

REFERENCES CITED

Ambler, J. R.

1970 *Additional Archeological Surveys of the Wallisville Reservoir Area, Texas.* Report No. 6. Texas Archeological Salvage Project, The University of Texas at Austin.

Aten, L. E.

1967 *Excavations at the Jameson Site, Liberty County, Texas.* Report No. 1. Houston Archeological Society.

1981 Determining Seasonality of *Rangia cuneata* from Gulf Coast Middens. *Bulletin of the Texas Archeological Society* 52:179-200.

Aten, L. E. *(Continued)*
1983 *Indians of the Upper Texas Coast*. Academic Press, New York.

Aten, L. E., C. K. Chandler, A. B. Wesolowsky, and R. M. Malina
1976 *Excavations at the Harris County Boys' School Cemetery*. Special Publication No. 3. Texas Archeological Society, San Antonio.

Aranow, S.
1971 Quaternary Geology. In *Groundwater Resources of Chambers and Jefferson Counties, Texas*, edited by J. B. Wesselman, pp. 34-53. Report No. 133. Texas Water Development Board, Austin.

Banks, L.
1992 The McFaddin Beach Site. *Texas Archeology* 36(2):9.

Binford, L. R.
1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255-273.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

Black, W.M., L.W. Patterson, and R. Storey
1992 Burials with Marine Shells at 41WH44, Wharton Co., Texas. *Houston Archeological Society Journal* 102:20-24.

Boyd, C.
1992 Current Research, Alabama. *Southeastern Archaeological Conference Newsletter* 34(1):1.

Brown, J. A. and T. D. Price
1985 Complex Hunter-Gatherers: Retrospect and Prospect. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. D. Price and J. A. Brown, pp. 435-442. Academic Press, Orlando.

Burnett, B. A.
1990 The Bioarcheological Synthesis of the Eastern Portion of the Gulf Coastal Plain. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 385-418. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Cohen, M. N.
1977 *The Food Crisis in Prehistory*. Yale University Press, New Haven.

Covey, C. (translator and editor)
1961 *Cabeza de Vaca's Adventures in the Unknown Interior of America*. Collier Books, New York.

Dering, P. and D. Ayers
1977 *Archeological Investigations in the Village of Oyster Creek, Brazoria County, Texas*. Report No. 42. Anthropology Laboratory, Texas A&M University, College Station.

Dillehay, T. D.
1975 *Prehistoric Subsistence Exploitation in the Lower Trinity River Delta, Texas*. Research Report No. 51. Texas Archeological Survey, The University of Texas at Austin.

Duke, A. R.
1981 41HR74-A Harris County Shell Site on Lower San Jacinto Bay. *Houston Archeological Society Newsletter* 70:18-30.
1982 The Goebel Site (41AU1). *Houston Archeological Society Journal* 73:22-25.
1989 Additional Bannerstones from Texas. *Houston Archeological Society Journal* 95:12-15.

Ensor, H. B. and D. L. Carlson
1988 *The Crawford Site (41PK69), Central Trinity River Highlands, Polk County, Texas*. Contract Reports in Archeology, Report No. 4. Texas State Department of Highways, Austin.

Ensor, H. B. and D. L. Carlson (editors)
1991 *Alabonson Road: Early Ceramic Period Adaptations to the Inland Coastal Prairie Zone, Harris County, Southeast Texas*. Reports of Investigations No. 8. Archeological Research Laboratory, Texas A&M University, College Station.

Fagan, B. M.
1991 *Ancient North America*. Thames and Hudson, New York.

Fullen, W. L.
1978 El Orcoquisac Archeological District, Wallisville Reservoir, Texas. *Houston Archeological Society Newsletter* 59:5-12.

Gagliano, S. M.
1977 *Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf*. Cultural Resource Management Studies, Interagency Archeological Services, Washington, D.C.

Gibson, J. L. (editor)
1995 Exchange in the Lower Mississippi Valley and Contiguous Areas at 1100 B.C. *Louisiana Archaeology* 17:1-299.

Gilmore, K.
1974 *Cultural Variation on the Texas Coast: Analysis of an Aboriginal Shell Midden, Wallisville Reservoir, Texas*. Research Report No. 14. Texas Archeological Survey, The University of Texas at Austin.

Goodyear, A. C.
1982 The Chronological Placement of the Dalton Horizon in the Southeastern United States. *American Antiquity* 47:382-395.

Hall. G. D.
1981 *Allens Creek: A Study in the Cultural Prehistory of the Lower Brazos River Valley, Texas.* Research Report No. 61. Texas Archeological Survey, The University of Texas at Austin.

1988a Long Bone Implements from Prehistoric Sites in Texas: Functional Interpretations Based on Enthnographic Analogy. *Bulletin of the Texas Archeological Society* 59:157-176.

1988b Evidence of Conflict in Prehistoric Texas: A Response to Patterson. *Houston Archeological Society Journal* 91:16-19.

Hayden, B.
1977 Stone Tool Functions in the Western Desert. In *Stone Tools as Cultural Markers*, edited by R. V. S. Wright. Humanities Press, Newark, New Jersey.

Haynes, C. V., D. J. Donahue, A. J. T. Jull, and T. H. Zabel
1984 Application of Accelerator Dating to Fluted Point Paleoindian Sites. *Archaeology of Eastern North America* 12:184-191.

Hedrick, B. C. and C. L. Riley
1974 *The Journey of the Vaca Party.* University Museum Studies No. 2. Southern Illinois University, Carbondale.

Hudgins, J. D.
1986 A Historic Indian Site in Wharton County, Texas. *Bulletin of the Texas Archeological Society* 55:29-51.

1993 Cooking with Clayballs. *The Cache*, Volume 1:47-52. Office of the State Archeologist, Texas Historical Commission, Austin.

Hudgins, J. D and S. M. Kindall
1984 Peikert Site. *Houston Archeological Society Journal* 80:9-22.

Hudgins, J. D. and L. W. Patterson
1983 Scottsbluff Point, Site 41WH19. *Houston Archeological Society Journal* 75:1.

Hudson, C.
1976 *The Southeastern Indians.* University of Tennessee Press, Knoxville.

Huebner, J. A.
1988 A Clovis Point from 41GV101, Galveston County, Texas. *Houston Archeological Society Journal* 92:8-9.

Jeter, M. D. and G. I. Williams, Jr.
1989 Ceramic Using Cultures, 600 B.C.-A.D. 700. In *Archeology and Bioarcheology of the Lower Mississippi Valley and Trans-Mississippi South in Arkansas and Louisiana*, by M.D. Jeter, J. C. Rose, G. I. Williams, Jr., and A. M. Harmon, pp. 111-170. Research Series No. 37. Arkansas Archeological Survey, Fayetteville.

Johnson, L.
1994 *The Life and Times of Toyah-Culture Folk As Seen from the Buckhollow Encampment, Site 41KM16, of Kimble County, Texas.* Report 38. Office of the State Archeologist, Texas Historical Commission, Austin.

Justice, N. D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States.* Indiana University Press, Bloomington.

Keller, J. E. and F. A. Weir
1979 *The Strawberry Hill Site.* Publications in Archeology, Report No. 13. Texas State Department of Highways, Austin.

Kenmotsu, N. A. and T. K. Perttula (editors)
1993 *Archeology in the Eastern Planning Region, Texas: A Planning Document.* Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Kindall, S. M. and L. W. Patterson
1986 The Andy Kyle Archeological Collection, Southeast Texas. *Houston Archeological Society Journal* 86:14-21.

1993 Excavations at 41CH161, Chambers County. *Houston Archeological Society Journal* 106:1-9.

Largent, F. B., M. R. Waters, and D. L. Carlson
1991 The Spatiotemporal Distribution and Characteristics of Folsom Projectile Points in Texas. *Plains Anthropologist* 36(137):323-341.

Larson, L. H.
1980 *Aboriginal Subsistence Technology on the Southeastern Coastal Plain during the Late Prehistoric Period.* University Presses of Florida, Gainesville.

Long, R. L.
1977 *McFaddin Beach.* Pattillo Higgins Series of Natural History and Anthropology No. 1. Lamar University, Beaumont.

McClure, W. L.
1987 Faunal Analysis of 41FB37. *Houston Archeological Society Journal* 89:1-6.

Meltzer, D. J.
1993 Is There a Clovis Adaptation? In *From Kostenki to Clovis*, edited by O. Soffer and N. D. Praslov, pp. 293-310, Plenum Press, New York.

Moore, W. E.
1989 *Archeological Bibliography for the Southeastern Region of Texas*. Special Report 31. Office of the State Archeologist, Texas Historical Commission, Austin.

Munson, P. J.
1990 Folsom Fluted Projectile Points East of the Great Plains and Their Biogeographical Correlates. *North American Archaeologist* 11(3):255-272.

Newcomb, W. W., Jr.
1961 *The Indians of Texas from Prehistoric to Modern Times*. University of Texas Press, Austin.

1993 Historic Indians of Central Texas. *Bulletin of the Texas Archeological Society* 64:1-63.

O'Brien, M. J. and C. Spenser
1976 The Upper Texas Coast: Environmental Variables and Human Adaptation. *The Texas Journal of Science* 27(4):453-463.

Odell, G. H.
1988 Addressing Prehistoric Hunting Practices Through Stone Tool Analysis. *American Anthropologist* 90:335-355.

Paine, J. G. and R. A. Morton
1986 *Historical Shoreline Changes in Trinity, Galveston, West and East Bays, Texas Gulf Coast*. Geological Circular 86-3. Bureau of Economic Geology, University of Texas at Austin.

Patterson, L. W.
1973 Some Texas Blade Technology. *Bulletin of the Texas Archeological Society* 44:89-111.

1976 Technological Changes in Harris County, Texas. *Bulletin of the Texas Archeological Society* 47:171-188.

1979 Archeological Surveys and Settlement Patterns on the Upper Texas Coast. *Houston Archeological Society Newsletter* 65:2-8.

1980 *The Owen Site, 41HR315: A Long Occupation Sequence in Harris Co., Texas*. Houston Archeological Society, Report No. 3.

1982 Initial Employment of the Bow and Arrow in Southern North America. *La Tierra* 9(2):18-26.

1984 Experimental Meat Cutting with Stone Tools. *La Tierra* 11(3):17-20.

1985 A Long Occupation Sequence at Site 41HR182, Harris Co., Texas. *Houston Archeological Society Journal* 81:11-20.

Patterson, L. W. *(Continued)*
1986 Site 41HR571, A Long Prehistoric Sequence in Harris Co., Texas. *Houston Archeological Society Journal* 85:15-18.

1987 Prehistoric Population Dynamics in Southeast Texas. *Bulletin of the Texas Archeological Society* 57:117-121

1988a Radiocarbon Dates from 41FB37, Fort Bend Co., Texas. *Houston Archeological Society Journal* 91:20-21.

1988b Intergroup Conflict in Prehistoric Texas. *Houston Archeological Society Journal* 90:8-10.

1989a A Data Base for Inland Southeast Texas Archeology. *Houston Archeological Society, Report* No. 6.

1989b An Archeological Data Base for the Southeastern Texas Coastal Margin. *Houston Archeological Society, Report* No. 7.

1989c Early Dates for the Pedernales Point. *La Tierra* 16(1):28-30.

1989d Chronological Placement of Late Archaic and Early Ceramic Dart Points in Southeast Texas. *Houston Archeological Society Journal* 94:14-15.

1989e Additional Comments on Fired Clayballs. *Houston Archeological Society Journal* 94:24-26.

1990a Relationships of Certain Dart Points in Southeast Texas. *Houston Archeological Society Journal* 96:1-4.

1990b The Distribution of Coastal Margin Pottery Types in Southeast Texas. *Houston Archeological Society Journal* 97:14-19.

1990c Excavations at the J. D. Wells Site (41HR639), Harris Co., Texas. *Houston Archeological Society Journal* 97:1-7.

1991a Arrow Point Chronologies in Southeast Texas. *Houston Archeological Society Journal* 101:6-11.

1991b Dart Point Chronologies in Southeast Texas. *Houston Archeological Society Journal* 101:1-5.

1991c Relationships of Early Notched Projectile Points in Southeast Texas and the Greater Southeast Woodlands. *Houston Archeological Society Journal* 100:14-20.

1991d Mobility-Settlement Patterns and Population Dynamics of Inland Southeast Texas. *Houston Archeological Society Journal* 99:16-21.

1992a *Bibliography of the Prehistory of the Upper Texas Coast, No. 8*. Houston Archeological Society, Special Publication.

1992b Current Data on Early Use of the Bow and Arrow in Southern North America. *La Tierra* 19(4):6-15.

1992c Prehistoric Bison in Southeast Texas. *Houston Archeological Society Journal* 102:14-19.

1993a The Archeology of Inland Southeast Texas: A Quantitative Study. *Bulletin of the Texas Archeological Society* 61:255-280

Patterson, L. W. *(Continued)*
1993b Bone-Tempered Pottery in Southeast Texas. *Houston Archeological Society Journal* 105:2-5.
1993c Identifying Historic Indian Sites in Southeast Texas. *Houston Archeological Society Journal* 106:23-26.
1993d The Boundary Between Inland and Coastal Margin Settlement Patterns in Southeast Texas. *Houston Archeological Society Journal* 107:14-18.

Patterson, L. W. and C. R. Ebersole
1992 Site 41CH290, A Multi-Component Shell Midden, Chambers Co., Texas. *Houston Archeological Society Journal* 102:25-29.

Patterson, L. W., C. R. Ebersole, and S. M. Kindall
1991 *Rangia* Shellfish Utilization: Experimental Studies. *Houston Archeological Society Journal* 101:26-29.

Patterson, L. W. and K. M. Gardner
1993 Additional *Rangia* Seasonality Studies. *Houston Archeological Society Journal* 105:28-30.

Patterson, L. W. and J. D. Hudgins
1987 Test Excavations at Site 41FB37, Fort Bend Co., Texas. *Houston Archeological Society Journal* 88:1-8.
1991 The Kovar Site, 41WH69, Wharton Co., Texas. *Houston Archeological Society Journal* 99:1-5.

Patterson, L. W., J. D. Hudgins, R. L. Gregg, and W. L. McClure
1987 *Excavations at Site 41WH19, Wharton County, Texas.* Houston Archeological Society, Report No. 4.

Patterson, L. W., J. D. Hudgins, R. L. Gregg, S. M. Kindall, W. L. McClure, and R. W. Neck
1993a *Excavations at the Ferguson Site, 41FB42, Fort Bend County, Texas.* Houston Archeological Society, Report No. 10.

Patterson, L. W., J. D. Hudgins, R. L. Gregg, S. M. Kindall, and W. L. McClure
1994 *Excavations at the Joe Davis Site, 41FB223, Fort Bend County, Texas.* Houston Archeological Society, Report No. 11.

Patterson, L. W., W. M. Black, W. L. McClure, R. Storey, and S. Patrick
1993b *Excavations at the Bowser Site, 41FB3, Fort Bend County, Texas.* Houston Archeological Society, Report No. 9.

Patterson, L. W., J. D. Lockwood, R. L. Gregg, and S. M. Kindall
1993c The Lockwood Collection (41HR343), Harris Co., Texas. *Houston Archeological Society Journal* 104:16-24.

Patterson, L. W., J. D. Lockwood, R. L. Gregg, and S. M. Kindall *(Continued)*
1993d Prehistoric Sites 41HR354, 730, 731, 732, Harris Co., Texas. *Houston Archeological Society Journal* 104:25-30.

Patterson, L. W., K. Marriott, and L. Marriott
1990 Site 41HR624, Another Long Sequence in Harris Co., Texas. *Houston Archeological Society Journal* 96:21-26.

Patterson, L. W. and M. A. Marshall
1989 Some Archeological Sites on Upper San Jacinto Bay. *Houston Archeological Society Journal* 94:1-8.

Perttula, T. K.
1992 The Early 19th Century Archeology of the Alabama-Coushatta Indians in Texas. *Heritage* 10(2):20-24. Texas Historical Foundation, Austin.
1994 Material Culture of the Koasati Indians of Texas. *Historical Archaeology* 28(1):65-77.

Powell. J. F.
1988 Stress and Survival: Models of Adaptive Success in the Texas Late Prehistoric. *Bulletin of the Texas Archeological Society* 58:249-266.

Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.
1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:210-238.

Reinhard, K. J., B. W. Olive, and D. G. Steele
1990 The Bioarcheological Synthesis of the Western Portion of the Gulf Coastal Plain. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, K. J. Reinhard, and B. W. Olive, pp. 419-424. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Ricklis, R. A.
1993 Investigations at the Mitchell Ridge Site, 41GV66. *CRM News and Views* 5(1):4-5. Department of Antiquities Protection, Texas Historical Commission.
1994 *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island.* Coastal Archaeological Research, Inc., Corpus Christi.

Ricklis, R. A. and K. A. Cox
1993 Examining Lithic Technological Organization as a Dynamic Cultural Subsystem: The Advantages of an Explicitly Spatial Approach. *American Antiquity* 58(3):444-461.

Story, D. A.
1990 Cultural History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coastal Plain,* by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Story, D. A. , J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard
1990 *The Archeology and Bioarcheology of the Gulf Coastal Plain.* 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Suhm, D. A. and E. B. Jelks
1962 *Handbook of Texas Archeology: Type Descriptions.* Texas Archeological Society, Special Publication No. 1 and Bulletin No. 4, Texas Memorial Museum, Austin.

Thoms, A. V. (editor)
1993 *The Brazos Valley Slopes Archeological Project.* Reports of Investigations No. 14. Archeological Research Laboratory, Texas A&M University, College Station.

Tringham, R., G. Cooper, G. Odell, B. Voytek, and A. Whitman
1974 Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. *Journal of Field Archaeology* 1:171-196.

Turner, E. S. and T. R. Hester
1985 *A Field Guide to Stone Artifacts of Texas Indians.* Texas Monthly Press, Austin.
1993 *A Field Guide to Stone Artifacts of Texas Indians.* Second Edition. Gulf Publishing Co. , Houston.

Turner, E. S. and P. Tanner
1994 The McFaddin Beach Site on the Upper Texas Coast. *Bulletin of the Texas Archeological Society* 65:319-336.

Vernon, C. R.
1989 *The Prehistoric Skeletal Remains from the Crestmont Site, Wharton County, Texas.* Studies in Archeology 1. Texas Archeological Research Laboratory, The University of Texas at Austin.

Webb, C. H.
1982 *The Poverty Point Culture.* Geoscience and Man, Volume 17. Louisiana State University, Baton Rouge.

Webb, C. H. , J. L. Shiner, and E. W. Roberts
1971 The John Pearce Site (16CD56): A San Patrice Site in Caddo Parish, Louisiana. *Bulletin of the Texas Archeological Society* 42:1-49.

Weinstein, R. A.
1991 *Lido Harbor (41GV82): A Late Prehistoric Campsite and Extraction Locale, Galveston County, Texas.* Coastal Environments, Inc. , Baton Rouge.

Wenke, R. J.
1990 *Patterns in Prehistory.* Second Edition. Oxford University Press, New York.

Wheat, J. B.
1953 *The Addicks Dam Site.* Bulletin 154:143-252. Bureau of American Ethnology, U. S. Government Printing Office, Washington, D. C.

Winchell, F. and L. W. Ellis
1991 The Ceramics of the Alabonson Road Site. In *Alabonson Road: Early Ceramic Period Adaptation to the Inland Coastal Prairie Zone, Harris County, Southeast Texas,* edited by H. B. Ensor and D. L. Carlson, pp. 49-99. Report of Investigations No. 8. Archeological Research Laboratory, Texas A&M University, College Station.

Prehistoric Occupation of the Central and Lower Texas Coast: A Regional Overview

Robert A. Ricklis

ABSTRACT

The prehistoric human occupation of the central and lower Texas coastlines is reviewed in light of recently acquired archeological and environmental information. Greatest attention is devoted to the central coast, which has seen more systematic research that the lower coast. A relatively long series of radiocarbon dates is now available for this area, permitting the development of a basic chronology of adaptive change for the long-lived Archaic, as well as the subsequent Late Prehistoric period. The chronological data suggest that shoreline occupation over the long term was not continuous through time, but tended to fall into three distinct time intervals that likely correlate with the emergence of biotically rich estuaries during periods of stable Holocene sea level. Although understanding of the chronology of occupation and adaptive changes for the lower coast is limited by a paucity of systematic research, some important work has also been accomplished within the framework of cultural resource management projects.

INTRODUCTION

In 1960, T. N. Campbell published an archeological synthesis of the central and lower coasts (Campbell 1960). At that time, it was possible to identify, for the central Texas coast, basic Archaic and Late Prehistoric (or, as then termed, "Neo-American") cultural patterns involving human occupation of the shoreline and exploitation of shellfish and fish resources. Chronology was strictly relative, since no radiocarbon dates had yet been obtained in the area, and a cultural sequence could be defined only on the basis of the stratigraphic positions of identifiable artifact assemblages.

Based upon previous excavations at a few key sites such as Kent-Crane (41AS3), Johnson (41AS1), and Live Oak Point (41AS2) on Copano Bay, and Webb Island (41NU1) in upper Laguna Madre, Campbell (1947, 1952, 1956, 1958a, 1960) suggested a bipartite chronology in which an Archaic Aransas focus preceded a Neo-American Rockport focus. The former was characterized by shoreline shell middens yielding a variety of stone dart point forms (later assignable mainly to the Kent and Ensor types as defined by Suhm and Jelks [1962]), various bone tools, including awls and pins with engraved geometric decorations, and a suite of shell tool forms consisting of perforated oyster shells, conch columella gouges, bi-pointed columella sections, adzes cut and ground from conch whelk body whorls, and knives/scrapers of edge-flaked sunray venus clamshells. The Aransas focus was also negatively defined by the absence of arrow points and ceramics.

The Rockport focus, linked with the historic Karankawa Indians of the region (Campbell 1960), was identified on the basis of several arrow point types and more or less abundant sandy paste ceramics, often decorated and/or coated with asphaltum, a natural tar which washes up on Gulf of Mexico beaches. On the basis of the virtually consistent presence of sand in ceramic clay bodies, and the occasional use of geometric incised line decorations below vessel rims, Campbell (1961) suggested that central coast ceramic technology diffused from the upper Texas coast.

Subsequent work on the central coast provided additional insight into questions of prehistoric chronology and adaptive patterns (see summary review in Shafer and Bond 1985). Dee Ann Story's 1967 work at two sites in the region (Story 1968) was the first professional excavation since the earlier work reviewed and reported by Campbell. At the Anaqua site (41JK8) on the lower Lavaca River, Story identified an important Late Prehistoric component with plain, sandy paste ceramics similar to upper coast

Goose Creek Plain (Suhm and Jelks 1962), in apparent association with Scallorn and Granbury (Scallorn preforms?) arrowpoints. At the Ingleside Cove site (41SP43) on Corpus Christi Bay, Story's excavations revealed stratified deposits, with a Late Archaic shell midden overlain by a midden pertaining to the Late Prehistoric Rockport manifestation. These excavations provided the first radiocarbon dates for the central coast: four samples (3 scallop shell, 1 wood charcoal) were assayed, and appeared on the basis of uncorrected dates to place the terminal Archaic component at ca. A.D. 1100-1250 (see Story 1968:40).

In 1974, James E. Corbin published a relative chronology for the central coast, based mainly upon a seriation of dart and arrow point types. For the Archaic, he suggested that the known dart point types were too varied, and spanned too long a time, to fit the relatively tight temporal requirements of a "focus" (Corbin 1974). On this basis, Corbin suggested that the term Aransas Complex was more appropriate, since the concept of a "complex" did not imply a clearly bounded spatial and temporal cultural expression. In a slightly later paper, Corbin (1976) suggested that Archaic occupation of the coast probably began ca. 2000 B.C., with the establishment of modern sea level. For the Late Prehistoric, Corbin's seriation suggested a chronology of several arrow point types, with Scallorn and Fresno preceding Perdiz, which was in turn followed during the period of European contact by the Bulbar Stemmed type.

At the time of Campbell's 1960 article, the lower coast was even more poorly investigated than was the central coast. The archeological record, known primarily from sites in the Rio Grande delta area, in fact consisted only of surface-collected artifacts which could be related in part to materials from northern Tamaulipas, Mexico. It was recognized that a long Archaic occupation, characterized by triangular and subtriangular dart points, preceded an Neo-American one with unstemmed arrow points and a regional shell industry. Later work has been intermittent, and the lower coast remains poorly known.

THE CENTRAL TEXAS COAST

The central coast, as here defined, includes the shoreline zone (including the barrier islands), and the coastal plain to a point approximately 40-50 km inland from the mainland strandline, between the Colorado River on the north and the northern margins of Baffin Bay on the south (Figure 1). The rationale for this geographic definition is twofold. First, this is the area of the Late Prehistoric Rockport phase, which can be quite accurately delimited on the basis of the distribution of a distinctive artifact assemblage. Second, while there is internal environmental variability, the area is unified by the presence of five similar, major bay estuarine systems protected by a continuous barrier island chain, in contrast to the prograded Brazos-Colorado River delta to the north and the un-embayed shoreline of the lower coast.

The following discussion presents, first, a brief overview of what is currently known about the evolution of the central coast as an exploitable environment. This is followed by a summary of the current archeological data base, presented chronologically from the Early Archaic through the Late Prehistoric, along with discussions of fundamental long-term patterns of human adaptive change.

The Paleoindian stage is not treated here, for two reasons. First, the period is represented along the coast only by sporadic surface finds of time-diagnostic early and late Paleoindian dart point types (see Hester 1980a); to date, no intact subsurface Paleoindian components have been found at excavated sites (though the reader may refer to Lewis [1988, 1994] for discussions of a Late Pleistocene faunal assemblage with possible evidence of human presence, on Petronila Creek southwest of Corpus Christi). Second, the scattered Paleoindian artifacts found within the modern central coast area do not pertain to a contemporaneous coastal occupation, since the terminal Pleistocene shoreline was situated a considerable distance seaward of the present coast, due to lower global sea level. When and if intact, subsurface Paleoindian components are found in the region, they will represent terrestrial/riverine, rather than coastal, adaptations.

The Holocene Evolution of the Central Coast Environment

The central coast is part of the broad Gulf Coastal Plain (Fenneman 1938), a nearly flat physiographic unit that rises very gradually from the coast to the interior. The surface geology consists of sandy clays and clayey sands deposited by major fluvial-deltaic systems during the

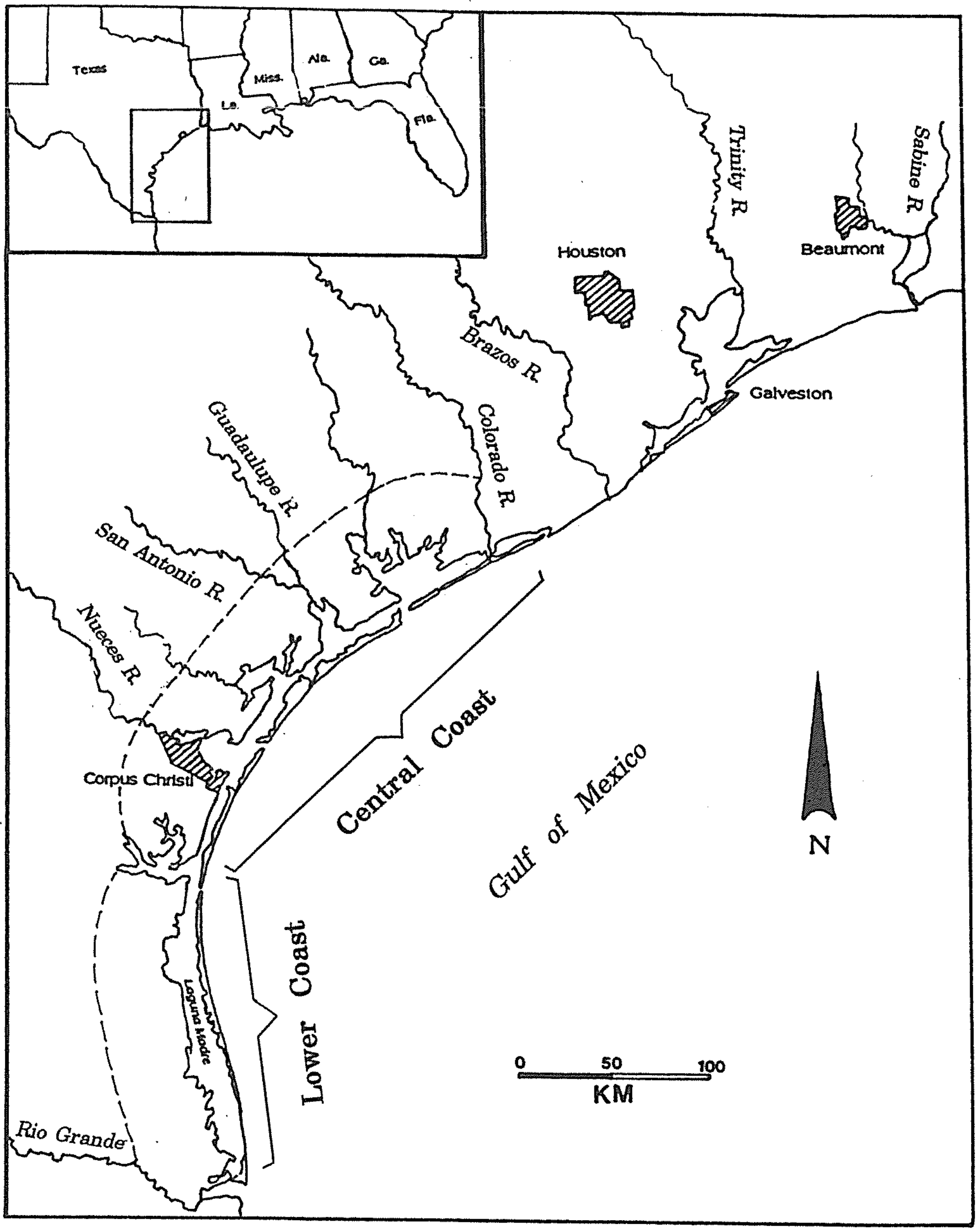

Figure 1. Map of the Texas Coast delimiting the central and lower coastal zones.

Pleistocene interglacials. The most recent geological unit is the Beaumont Formation, a thick accumulation of Pleistocene clays and sands that is the geological foundation of the present coastline. The Ingleside unit of the Beaumont is a long, narrow deposit of sandy clays, representing a Pleistocene barrier or strandplain; this overlies the main part of the Beaumont Formation along the modern strandline (Brown et al. 1976; Solis 1981).

During the last glacial maximum, ca. 20,000 B.P., sea level was as much as 100 meters lower than at present, since much of the global water supply was locked in massive continental ice sheets and extensive montane glaciers. At that time, coastal streams downcut deeply into the Beaumont Formation. After ca. 18,000 B.P., global warming resulted in rapid sea level rise, so that by ca. 9000 B.P. the river valleys along the central Texas coast were inundated by transgressive marine waters, thus creating the prototypes of the modern bay systems (Byrne 1975; Brown et al. 1976; McGowen et al. 1976).

Although there is not complete agreement on the timing of Holocene sea level rise, there is a general consensus that marine transgression was stepwise, with periods of rapid rise interrupted by intervals of markedly slowed rise, slight regression, or sea level stillstand (Curray 1960; Nelson and Bray 1970; Frazier 1974; Paine 1991; Anderson and Thomas 1991). The more recent geologic studies have suggested that sea level rose relatively rapidly prior to 9000-8000 B.P., and then between 7000 and 6000 B.P. (Frazier 1974; Paine 1991). Paine (1987, 1991) has suggested a rapid rise to an approximately 1-meter highstand between ca. 4400 and 2600 B.P., and recent work by Anderson et al. (1992) has suggested final rise and inundation of river valleys ca. 4000 B.P. There is general agreement that modern stable sea level was established around 3000 B.P., give or take a few centuries (Frazier 1974; Brown et al. 1976; McGowen et al. 1976; Paine 1991; Anderson et al. 1992).

The modern coastal environment began to emerge with the establishment of stillstand ca. 3000 B.P. With a stable sea level, wave action and longshore drift deposited sand and shell offshore, and disconnected Middle Holocene transgressive barriers began to coalesce to form the modern, continuous chain of regressive barrier islands, which probably approximated their present form by 2500-2000 B.P. (e.g., Brown et al. 1976). The development of the mature barrier chain created a series of highly protected lagoons and estuarine embayments, and ongoing sedimentation resulted in the extensive back-barrier shallows of the modern estuarine environment. The emergence of broad, quiet-water shallows played a key role in estuarine ecology, since vegetated shallows and marshes provide important nutrients for the rich aquatic food chain, as well as crucial nursery and spawning grounds for fish (e.g., Odum et al. 1974; Perret et al. 1980; Reagan 1985; Matlock 1990). Thus, the modern central coast environment is characterized by highly productive, shallow-water, estuaries protected from the high-energy wave action of the open Gulf by a continuous barrier chain.

The terrestrial environment is varied according to local soil and hydrological conditions. For the most part, the barrier islands are treeless and characterized by stabilized sand dunes which support various grasses, and are fringed on their land sides with salt marsh plant communities. Sandy soils on the mainland shore support dense mottes of live and blackjack oak (Jones 1983). Farther inland are the coastal prairies, essentially flat upland areas covered with grasses and scattered clumps of mesquite and, on sandy soils, live oak (Jones 1983). Faunal species include various reptiles, amphibians, mammals, and birds (see Blair 1950), and bison were present in significant numbers on the coastal prairie in Late Prehistoric and Early Historic times, as indicated by archeological and historical documentation (see Ricklis 1990, 1992a; Huebner 1991).

THE CHRONOLOGY OF HUMAN OCCUPATION ON THE CENTRAL TEXAS COAST

A Brief Consideration of Taxonomy

In light of chronological data acquired in recent years, it is apparent that the cultural history of coastal adaptation in the region was both longer and more complex than can be adequately represented by a simple bi-partite chronology involving an undifferentiated Aransas focus and a Late Prehistoric Rockport focus. While Campbell's early work identified the broadest outlines of regional chronology and described major artifact classes, it is now clear that the Archaic occupation of the region has far greater time depth than once assumed, and that distinct periods of occupation with concomitant adaptive changes would be masked by the continued use of a single taxonomic label for the entire Archaic period. Thus, the Aransas focus, or as it has more recently been termed, the Aransas complex (Corbin 1974; Shafer and Bond 1985; Steele and Mokry 1985; Prewitt et al. 1987), should be set aside in favor of a chronological perspective which fits the currently available empirical evidence.

Recently, Weinstein (1992, 1994) has suggested a chronology of "phases" for the central coast. This chronological construct is not employed here. Most of Weinstein's phases are largely conjectural, insofar as distinctive artifact assemblages remain poorly defined and/or cannot be placed within definable temporal or geographic limits on the basis of the available archeological evidence. In some cases, entire phases are based only on a single projectile point type which has yet to be found in a securely dated context. As Johnson (1987) has correctly pointed out, a "phase" must represent, at the very least, a well-defined spatial-temporal unit of archeological culture and, at best, a strongly inferred sociocultural entity. At present, these criteria can be met only by the Late Prehistoric Rockport phase, which is geographically discrete and which is in large part, if not entirely, the archeological correlate of the ethnically and linguistically distinct Karankawa groups who inhabited the central coast region in Early Historic times (Newcomb 1961, 1983; Ricklis 1990, in press).

Radiocarbon Dating on the Central Coast

Most of the radiocarbon dates now available from discrete site components in the region are derived from assays on estuarine shell species found within shell middens. It is, therefore, important to point out that shell samples provide reliable results which are useful in placing site components within a chronological framework. This fact has been discussed elsewhere (Ricklis and Cox 1991; Ricklis 1993), and the present article is not the place for a detailed reiteration of these findings. Suffice it to say that paired samples of shell and wood charcoal, when extracted from the same cultural depositional unit or feature, produce virtually identical results, once the radiocarbon ages on shell are corrected for the delta ^{13}C fraction (Table 1, dates nos. 7-13, which all came from a single, stratigraphically discrete deposit of densely packed shell). Similar results were recently obtained on oyster shell and hearth charcoal samples from a discrete zone of Late Prehistoric archeological deposits at the Mitchell Ridge site (41GV66) on Galveston Island: when the shell assays were corrected for ^{13}C, the radiocarbon ages were statistically identical to those obtained on the charcoal samples (Ricklis 1994a:107). To such specific results in paired charcoal-shell samples can be added the fact that multiple dates on shell samples from within stratified depositional sequences produce internally consistent results.

All radiocarbon dates from the central coast that can be determined with confidence to have come from stratigraphically discrete contexts are shown in Table 1. The radiocarbon data are additionally reflected in Table 2, which lists discrete stratigraphic components at shoreline sites and shows their age ranges as indicated by one or more corrected and calibrated radiocarbon assays. These data do not include three early dates from possibly mixed stratigraphic contexts: two dates on shell from 41JK35, reported by Weinstein, were extracted from 10 cm arbitrary levels which may have cross-cut more than a single stratigraphic zone (Weinstein 1994:159-160); the third date comes from a hand-excavated test unit at 41NU266 on Nueces Bay, where there is some reason to believe that shells from the oldest stratigraphic component were mixed with materials from an overlying stratum (Ricklis 1995a). Because of the uncertain contexts of these dates, they are not listed in Table 1 or incorporated into the following discussion. Unless otherwise indicated, all radiocarbon age ranges on shell presented below are corrected for the ^{13}C fraction and dendrochronologically calibrated at 1-sigma of error. Since charcoal dates are not significantly altered by ^{13}C correction, they have been calibrated directly from the uncorrected assay results.

THE EARLY ARCHAIC

The earliest demonstrable human occupation and exploitation of the central coast shoreline, as noted above, can now be placed considerably earlier than once assumed. Numerous sites are currently assignable to the Early Archaic period, prior to the establishment of modern sea level stillstand and the emergence of the modern estuarine environment. Two major periods of Early Archaic occupation are indicated: ca. 7500-6800 B.P., and ca. 5800-4200 B.P.

Evidence for Shoreline Occupation, ca. 7500-6800 B.P.

Occupation during this time interval is well established on the basis of radiocarbon dates on discrete stratigraphic components at several sites in the Nueces Bay area (Figure 2). Cultural components consist of thin but dense lenses or strata of oyster shells (*Crassostrea virginica*), resting at the base of Holocene silty cumulic soils which rest unconformably on eroded surfaces of the Pleistocene Beaumont Formation (Figures 3 and 4). At 41SP136 and 41SP153, both situated on upland margins overlooking the north shore of Nueces Bay, three corrected and calibrated age ranges on oyster shell and one on scallop shell fall into this period (see Tables 1 and 2). At a third site, 41NU266 on the uplands overlooking the south shore of Nueces Bay, similar oyster strata at several different locations produced age ranges falling

Table 1. Radiocarbon data from discrete occupational strata, central Texas coast. Calibrations based on Stuiver and Pearson (1986) and Stuiver and Reimer (1993). Asterisk next to corrected age indicates that correction for ^{13}C is estimated at +400 years, based on numerous AMS assays for ^{13}C on various estuarine shell species (see text). Excludes data from ambiguous (possibly mixed) stratigraphic contexts (see text).

No.	Site	Reference	Assay No.	Material	Uncorrected ^{14}C age BP	Age BP corrected for ^{13}C	Age BP, calibrated 1-sigma range with intercept(s) in parentheses
1	41RF21	Ricklis 1993	TX-6126	charcoal	750 ± 100	—	742-660 (683)
2	41RF21	Ricklis 1993	TX-6125	bison bone	450 ± 70	790 ± 70	768-675 (698)
3	41RF21	Ricklis 1993	TX-6127	bison bone	390 ± 130	760 ± 130	790-576 (685)
4	41SP43	Story 1968	TX-520	charcoal	780 ± 40	—	725-680 (691)
5	41SP120	Ricklis 1993	TX-7306	quahog	480 ± 70	910 ± 70	928-738 (880, 865, 823, 813, 796)
6	41SP120	Ricklis 1993	TX-7305	scallop	510 ± 60	910 ± 60	926-741 (880, 865, 823, 813, 796)
7	41SP120	Ricklis and Cox 1991	TX-6387	charcoal	950 ± 110	—	970-730 (915)
8	41SP120	Ricklis and Cox 1991	TX-6920	charcoal	950 ± 80	—	943-751 (915)
9	41SP120	Ricklis and Cox 1991	TX-6925	whelk	580 ± 70	980 ± 70	960-793 (926)
10	41SP120	Ricklis and Cox 1991	TX-6919	scallop	630 ± 70	1020 ± 70	982-915 (938)
11	41SP120	Ricklis and Cox 1991	TX-6639	charcoal	1030 ± 130	—	1060-790 (943)
12	41SP120	Ricklis and Cox 1991	TX-6926	quahog	610 ± 70	1030 ± 70	990-919 (934)
13	41SP120	Ricklis and Cox 1991	TX-6924	oyster	760 ± 50	1160 ± 50	1161-996 (1064)
14	41SP43	Story 1968	TX-522	scallop	710 ± 40	1110 ± 40*	1062-970 (953, 902, 900)
15	41SP43	Story 1968	TX-521	scallop	820 ± 50	1220 ± 50*	1235-1067 (1165)
16	41SP43	Story 1968	TX-523	scallop	820 ± 50	1220 ± 50*	1235-1067 (1165)
17	41SP120	Ricklis 1993	TX-7312	whelk	770 ± 60	1180 ± 70	1217-974 (7 intercepts between 1168-1082)
18	41SP120	Ricklis 1993	TX-7313	scallop	950 ± 60	1370 ± 60	1338-1270 (1298)
19	41SP149	Ricklis 1993	TX-7304	*R. cuneata*	1060 ± 70	1440 ± 70	1407-1296 (1341, 1323, 1312)
20	41CL3	This paper	Beta-77683	oyster	—	1640 ± 60	1569-1418 (1531)
21	41SP43	Ricklis 1990, 1993	TX-5982	scallop	1180 ± 70	1580 ± 70*	1546-1395 (1509)
22	41NU266	Ricklis 1995a	Beta-80016	*R. cuneata*	1250 ± 50	1670 ± 50	1611-1522 (1545)
23	41SP43	Ricklis 1990, 1993	TX-6062	quahog	1230 ± 60	1659 ± 60	1682-1514 (1545)
24	41SP43	Ricklis 1990, 1993	TX-5893	quahog	1260 ± 70	1660 ± 70*	1689-1515 (1552)
25	41SP43	Ricklis 1990, 1993	TX-5891	quahog	1450 ± 70	1850 ± 70*	1873-1711 (1816)
26	41JK24	Weinstein 1994	Beta-57911	oyster	—	1720 ± 60	1712-1551 (1685, 1669, 1617)
27	41SP153	Ricklis and Cox 1991	TX-7084	oyster	1400 ± 70	1760 ± 70	1816-1749 (1695, 1645, 1634)
28	41CL3	This paper	Beta-77684	oyster	—	1810 ± 60	1816-1626 (1715)
29	41CL2	Weinstein 1992	UGA-6151	oyster	1403 ± 88	1756 ± 88	1818-1559 (1694, 1646, 1633)
30	41NU268	Ricklis 1995a	Beta-80008	*R. cuneata*	1590 ± 60	1910 ± 60	1891-1752 (1862, 1852, 1835)
31	41CL4	Weinstein 1992	UGA-6150	*R. cuneata*	1559 ± 86	2006 ± 86	2060-1873 (1955)
32	41CL3	This paper	Beta-77685	oyster	—	2160 ± 60	2303-2051 (2138)
33	41SP136	Ricklis 1993	TX-7303	oyster	1880 ± 60	2230 ± 60	2340-2155 (7 intercepts between 2308-2184)
34	41CL3	This paper	Beta-77686	oyster	—	2450 ± 60	2713-2569 (2468)

Table 1 (Continued)

No.	Site	Reference	Assay No.	Material	Uncorrected ^{14}C age BP	Age BP corrected for ^{13}C	Age BP, calibrated 1-sigma range with intercept(s) in parentheses
35	41JK35	Weinstein 1994	Beta-57915	*R. cuneata*	—	2470 ± 70	2736-2357 (2706, 2638, 2600, 2597, 2492)
36	41NU267	Ricklis 1995a	Beta-80012	oyster	2170 ± 50	2580 ± 50	2752-2716 (2742)
37	41CL3	This paper	Beta-77687	oyster	—	2610 ± 60	2764-2727 (2748)
38	41AS3	Cox and Smith 1989	TX-5564	quahog	2210 ± 60	2610 ± 60*	2773-2740 (2752)
39	41CL2	Weinstein 1992	UGA-6152	oyster	2244 ± 89	2611 ± 89	2837-2611 (2748)
40	41NU46	Smith n.d.	TX-5300	charcoal	2800 ± 70	—	2985-2845 (2925, 2914, 2882)
41	41NU46	Smith n.d.	TX-5302	charcoal	2880 ± 90	—	3204-2875 (2993)
42	41NU46	Smith n.d.	TX-5301	charcoal	2750 ± 320	—	3337-2469 (2854)
43	41NU266	Ricklis 1995a	Beta-80005	oyster	2610 ± 60	2990 ± 60	3258-3069 (3203, 3192, 3162)
44	41SP177	Ricklis 1993	Beta-47105	oyster	2450 ± 60	2840 ± 60	3156-2873 (2859)
45	41SP120	Ricklis and Cox 1991	TX-6948	quahog	2445 ± 80	2890 ± 80	3157-2948 (3006)
46	41SP177	Ricklis 1993	Beta-47104	oyster	3100 ± 70	3470 ± 70	3835-3642 (3757, 3753, 3720, 3709, 3703)
47	41SP148	Ricklis 1993	TX-7314	oyster	3380 ± 60	3780 ± 60	4266-4086 (4154)
48	41SP120	Ricklis 1993	TX-7311	quahog	3560 ± 80	3970 ± 80	4533-4353 (4484)
49	41SP136	Ricklis 1993	Beta-46301	charcoal	4090 ± 80	—	4822-4451 (4560)
50	41SP153	Ricklis 1993	TX-7310	scallop	3810 ± 80	4190 ± 90	4861-4568 (4826, 4749, 4661, 4657)
51	41SP156	Ricklis 1993	TX-6881	scallop	3770 ± 50	4210 ± 70	4859-4614 (4829, 4747, 4731)
52	41NU268	Ricklis 1995a	Beta-80009	*R. flexuosa*	3920 ± 70	4260 ± 70	4865-4636 (4835)
53	41SP153	Ricklis 1993	TX-7309	charcoal	4090 ± 270	4080 ± 270	4962-4229 (4799, 4794, 4596, 4561)
54	41NU267	Ricklis 1995a	Beta-80013	oyster	3990 ± 50	4370 ± 50	4986-4862 (4873)
55	41NU266	Ricklis 1995a	Beta-80006	*R. flexuosa*	4030 ± 60	4380 ± 60	5036-4863 (4964, 4947, 4875)
56	41SP148	Ricklis 1995a	TX-7037	oyster	4020 ± 70	4410 ± 70	5245-4871 (4986)
57	41NU266	Warren 1993	Beta-53198	human bone	—	4430 ± 60	5243-4873 (5024, 5016, 4989)
58	41SP15	Ricklis and Cox 1991	TX-6963	scallop	4030 ± 70	4430 ± 70	5257-4875 (5040, 5014, 4992)
59	41SP153	Ricklis and Cox 1991	TX-7083	oyster	4110 ± 70	4500 ± 70	5298-4991 (7 intercepts between 5256-5059)
60	41KL71	Smith 1984	SMU-1057	charcoal	4204 ± 60	—	5295-4994 (5257, 5183, 5127, 5111, 5084)
61	41NU281	Ricklis 1995b	Beta-80019	*R. flexuosa*	4340 ± 50	4750 ± 50	5581-5332 (5565, 5540, 5474)
62	41SP156	Ricklis and Cox 1991	TX-7081	oyster	4380 ± 90	4750 ± 90	5592-5325 (5560, 5531, 5472)
63	41NU184	Ricklis 1993	TX-5303	*R. flexuosa*	4390 ± 70	4790 ± 70*	5633-5336 (5575, 5517, 5489)
64	41NU221	Ricklis 1988, 1993	TX-5265	*R. flexuosa*	4410 ± 90	4810 ± 90*	5647-5336 (5582, 5501, 5498)
65	41NU221	Ricklis 1988, 1993	TX-5263	*R. flexuosa*	4450 ± 90	4850 ± 90*	5724-5474 (5594)
66	41NU221	Ricklis 1988, 1993	TX-5264	*R. flexuosa*	4630 ± 90	5030 ± 90*	5919-5654 (5851, 5832, 5761, 5741, 5739)
67	41NU266	Warren 1993	Beta-53072	oyster	4500 ± 70	4900 ± 70*	5716-5589 (5641, 5619)
68	41JK24	Weinstein 1994	Beta-57912	oyster	—	4940 ± 70	5736-5638 (5724, 5700,

Table 1 (Continued)

No.	Site	Reference	Assay No.	Material	Uncorrected ^{14}C age BP	Age BP corrected for ^{13}C	Age BP, calibrated 1-sigma range with intercept(s) in parentheses
							5655)
69	41SP153	Ricklis 1993	TX-7038	oyster	4610 ± 70	4990 ± 70	5888-5650 (5732)
70	41NU281	Ricklis 1995b	Beta-80017	*R. flexuosa*	4640 ± 50	5050 ± 50	5895-5730 (5854, 5829, 5723)
71	41NU266	Warren 1993	Beta-53073	oyster	5580 ± 70	5980 ± 70*	6888-6737 (6847, 6829, 6796)
72	41SP136	Ricklis 1993	TX-7302	oyster	5680 ± 110	6070 ± 110	7159-6798 (6945, 6913, 6897)
73	41SP153	Ricklis 1993	Beta-57043	oyster	5700 ± 80	6110 ± 80	7167-6857 (7139, 7007)
74	41SP153	Ricklis 1993	TX-7082	oyster	5830 ± 90	6210 ± 90	7189-7010 (7169)
75	41NU266	Ricklis 1995a	Beta-80007	oyster	5860 ± 70	6270 ± 70	7220-7035 (7178)
76	41NU266	Ricklis 1995a	Beta-80014	oyster	5970 ± 50	6380 ± 50	7360-7215 (7238)
77	41NU266	Ricklis 1995a	Beta-80009	oyster	6060 ± 60	6390 ± 60	7371-7216 (7262)
78	41NU266	Warren 1993	Beta-53647	oyster	6030 ± 50	6430 ± 50	7381-7237 (7359, 7322, 7315, 7285)
79	41NU266	Ricklis 1995a	Beta-80015	oyster	6090 ± 50	6500 ± 60	7395-7290 (7384)
80	41SP153	Ricklis and Cox 1991	TX-7024	scallop	6180 ± 120	6550 ± 120	7509-7299 (7431)
81	41NU281	Ricklis 1995b	Beta-80018	oyster	6190 ± 60	6600 ± 60	7525-7390 (7469, 7468, 7432)

between 7381 and 6737 B.P. (Warren 1993; Ricklis 1995a; Table 1 herein). Finally, an oyster shell midden at 41NU281, exposed by construction activities on the uplands overlooking the Nueces River delta, produced an age range of 7525-7390 B.P. (Ricklis 1995b).

Aside from the fact that estuarine shellfish were obviously exploited, very little is known of this period. Excavations have been too limited to produce much useful archeological information. A scant amount of chert debitage and a chert core from 41SP153, and a few utilized flakes from 41NU266, are the only lithic artifacts documented from excavated components of the period. However, surface finds of Early Archaic points resembling the Uvalde type (Figure 5), and an excavated specimen of the Gower type from 41SP154 on Nueces Bay (found in a somewhat later component where it may represent re-use and subsequent loss/discard [Ricklis 1993:33-36]), may eventually prove to pertain to this early period. Interestingly, the edge-flaked sunray venus clamshell knife/scraper, common at later sites (Figure 6), is now well documented for this period. Two specimens were recovered at 41SP153 in unquestionable context within the earliest basal shell stratum there (Ricklis 1993), and a third specimen was recently excavated from within a discrete dense Early Archaic oyster stratum at 41NU266 (Ricklis 1995a).

Aside from shellfish (mainly oysters), faunal remains are almost entirely lacking from Early Archaic components. Probably, this is in large part the result of the complete decay of bone. On the other hand, fish otoliths, which are remarkably resistant to decay in the silty soils of the area, are nearly absent; the only specimen, representing a spotted seatrout, comes from 41NU266 (Ricklis 1995a). Fishing may not yet have played a significant role in the subsistence economy. This is an important question which will be addressed only by extensive future excavations of site components of the period.

Shoreline occupation, ca. 5800-4200 B.P.

Better documentation is available for this period of Early Archaic coastal occupation, although much important work remains to be done. Sites are considerably more numerous than for the previous

Table 2. Chronological data from central Texas coast sites: corrected and calibrated age ranges from discrete strata. Asterik indicates that 1-sigma range (B.P.) includes combined ranges on multiple assays on a single stratigraphic component.

General Locale, Site	Stratum	1-sigma age range	Reference
Nueces Bay/Nueces River delta			
41SP15	Dense oyster and scallop, 50-60 cm bs, on eroded Beaumont clay	5257-4875	Ricklis and Cox 1991
41SP136	Dense oyster, 50-60 cm bs, on eroded Beaumont clay	7159-6798	Ricklis and Cox 1991
	Dense oyster, 35-45 cm bs, within silty cumulic soil	4822-4451	Ricklis and Cox 1991
	Dense oyster, 20-30 cm bs, within silty cumulic soil	2340-2155	Ricklis and Cox 1991
41SP148,			
Unit 1	Dense oyster, 56-70 cm bs, base of silty cumulic soil on Beaumont surface	5245-4871	Ricklis 1993
Unit 2	Dense oyster, 35-50 cm bs, base of silty cumulic soil on Beaumont surface	4266-4086	Ricklis 1993
41SP149	Thin (5 cm) but dense *Rangia cuneata*, 10-20 cm bs, within silty cumulic soil	1407-1296	Ricklis 1993
41SP153,			
Unit 1	Dense oyster and scallop, 70-90 cm bs, base of silty cumulic soil, on eroded Beaumont clay	7509-6857*	Ricklis 1993
	Moderately dense oyster, 60-68 cm bs, within silty cumulic soil	5298-4991	Ricklis 1993
	Dense oyster and *R. cuneata*, 20-30 cm bs, within sility cumulic soil	1816-1749	Ricklis 1993
Area 2	Dense oyster and scallop, 50-60 cm bs, within sility cumulic soil	5888-4568*	Ricklis 1993
41SP156	Dense oyster and scallop, 30-40 cm bs, base of silty cumulic soil	5592-4614*	Ricklis 1993
41SP177	Moderate oyster, some scallop, 40-80 cm bs, in sand stratum with scattered shell hash	3156-2873	Ricklis 1993
41NU184	Dense *R. flexuosa*, 30-50 cm bs, base of silty cumulic soil	5633-5336	Ricklis & Gunter 1986
41NU221	Dense *R. flexuosa*, some oyster, 50-70 cm bs, base of silty cumulic soil	5919-5336*	Ricklis 1988, 1993
41NU266,			
Area 1	Moderate to dense oyster, 310 cm bs, within silty cumulic soil	5716-5589	Warren 1993
	Moderate to dense oyster, 350 cm bs, base of silty cumulic soil	6888-6737	Warren 1993
Area 2	Moderate to dense oyster, base of silty cumulic soil	7381-7237	Warren 1993
Locus 1	Thin oyster lens, 170 cm bs, at base of colluvial soil, on Beaumont surface	7360-7215	Ricklis 1995a
	Dense *R. cuneata* lens, 20 cm bs, within colluvial soil	1611-1522	Ricklis 1995a
Locus 2	Oyster lens, 95 cm bs, at base of silty cumulic soil, on Beaumont surface	7395-7290	Ricklis 1995a
Locus 3	Dense oyster lens, 60 cm bs, at base of cumlic soil, on Beaumont surface	7371-7035*	Ricklis 1995a
	R. flexuosa lens, 40 cm bs, within cumulic soil	5036-4863	Ricklis 1995a
	Oyster lens, 20 cm bs, within cumulic soil	3258-3069	Ricklis 1995a

Table 2 (Continued)

General Locale, Site	Statrum	1-sigma age range	Reference
41NU267	Oyster lens, 80-90 cm bs, within cumulic soil	2752-2716	Ricklis 1995a
	Oyster shells, 130-140 cm bs, within cumulic soil	4986-4862	Ricklis 1995a
41NU268	Dense rangia lens, 10-20 cm bs, *R. flexuosa* component	4865-4636	Ricklis 1995a
	Dense rangia lens, 10-20 cm bs, *R. cuneata* component	1891-1752	Ricklis 1995a
41NU281	Oyster midden, base of silty cumulic soil	7525-7390	Ricklis 1995b
	R. flexuosa midden, base of silty cumulic soil	5855-5730	Ricklis 1995b
	R. flexuosa lens, base of cumulic soil, resting on Beaumont surface	5581-5332	Ricklis 1995b
Oso Creek			
41NU46	Bottom occupation stratum, estuarine fish remains, hearths	3337-2845*	Smith n.d.
Ingleside Cove			
41SP43	Dense shell midden, 20-60 cm bs, in fine sand cumulic soil	1235-970*	Story 1968
	Dense shell midden, 20-60 cm bs, in fine sand cumulic soil	1816-1395*	Ricklis 1990, 1993
41SP120, South Block	Shell lens, 90-100 cm bs (mainly quahog and oyster), 20 cm above base of fine sand cumulic soil	3157-2948	Ricklis and Cox 1991
	Dense shell midden, 30-60 cm bs (oyster, scallop, quahog, whelk, and other species), within fine sand cumulic soil	1161-730*	Ricklis and Cox 1991
North Block	Discrete shell lens, 100-110 cm bs (quahog, oyster, whelk), within fine sand cumulic soil	4533-4353	Ricklis 1993
	Dense shell midden, 15-80 cm bs (oyster, scallop, whelk, quahog and other species), within fine sand cumulic soil	1338-741*	Ricklis 1993
Copano Bay			
41AS3	Base of dense shell midden, 60 cm thick, within cumulic soil resting on Beaumont clay	2764-2727	Cox and Smith 1989
San Antonio/Guadalupe Bay			
41CL2	Dense oyster and *R. cuneata* stratum, 20-40 cm bs, in cumulic soil profile	1818-1559	Weinstein 1992
	Dense oyster stratum, 70-80 cm bs, in cumulic soil profile	2837-2611	Weinstein 1992
41CL3	Very dense oyster stratum, 5-130 cm depth, on and within cumulic fine sand soil	2764-1418*	This paper
41CL74	Discrete *R. cuneata* lens, 60-70 cm bs, within alluvium on natural levee	2060-1873	Weinstein 1992
Lavaca River delta			
41JK24	Dense oyster stratum, 30-40 cm bs, on Pleistocene clay at base of cumulic soil	5736-5638	Weinstein 1994
	Dense oyster stratum, 15-25 cm bs, within cumulic soil profile	1712-1557	Weinstein 1994

Table 2 (Continued)

General Locale, Site	Statrum	1-sigma age range	Reference
41JK35	*R. cuneata* lens, 80-93 cm bs, within cumulic soil profile	2736-2357	Weinstein 1994
Baffin Bay			
41KL71	Oyster lens at base of cumulic soil profile	5295-4994	Smith 1984

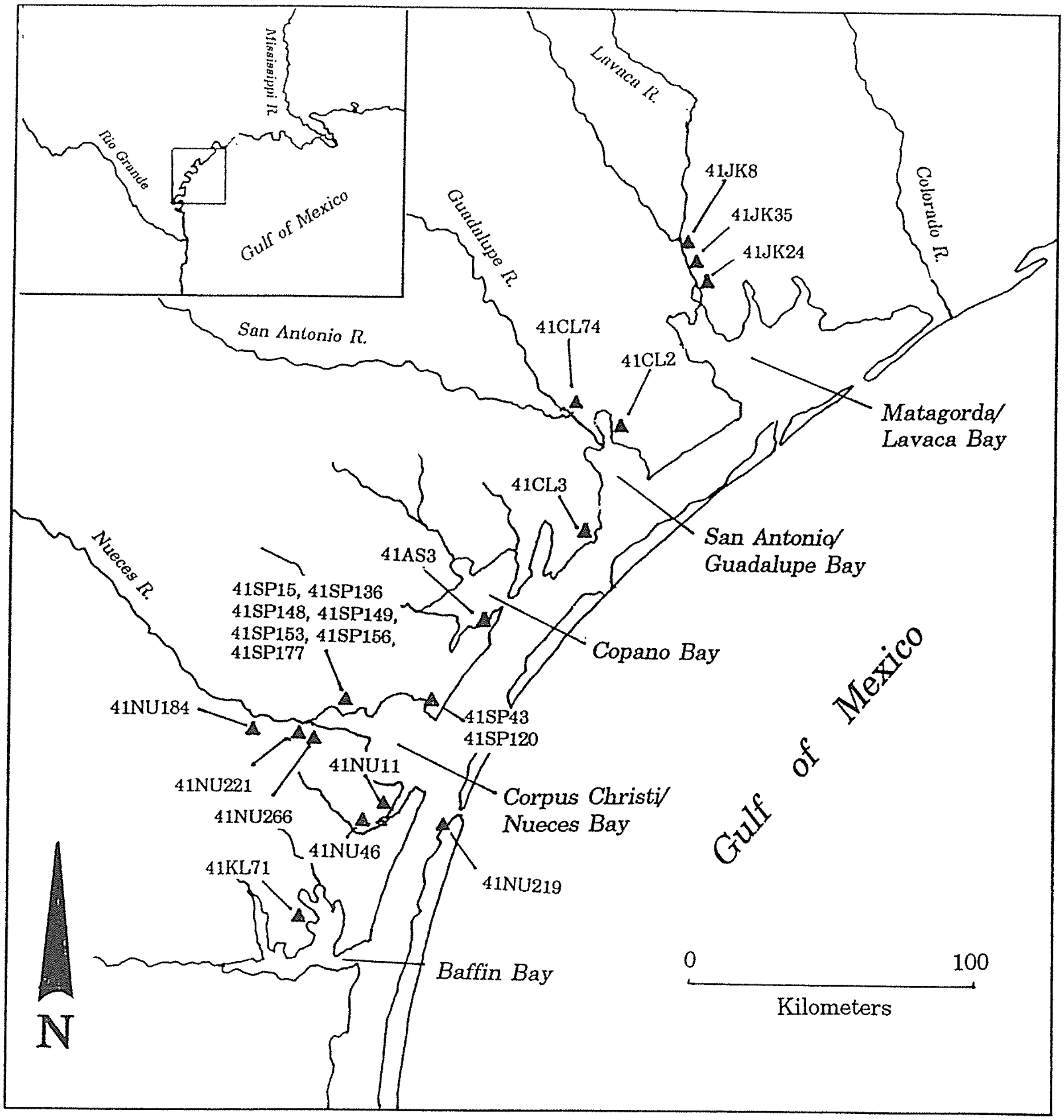

Figure 2. Map of the central coast area, showing locations of sites discussed in text.

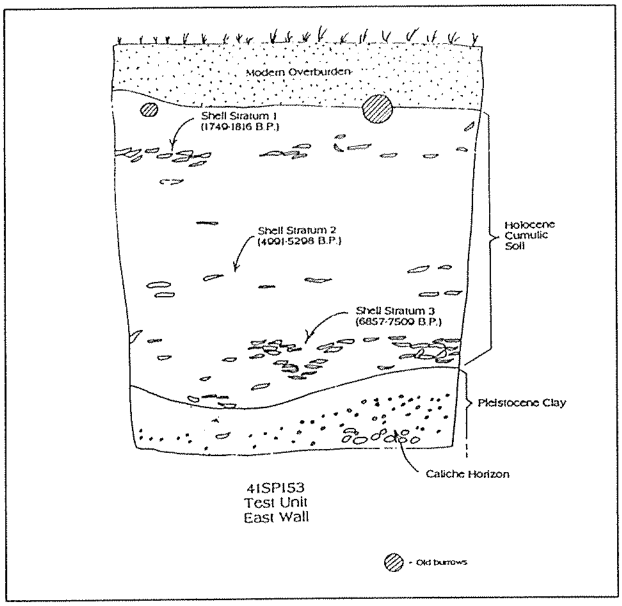

Figure 3. Excavation profile, 41SP153, north shore of Nueces Bay, showing three discrete shell strata within Holocene cumulic silty soil.

Figure 4. Early Archaic oyster shell stratum (partially removed) at 41NU266, south shore of Nueces Bay, dated to ca. 7400-7000 B.P. Note that shells rest on surface of light-colored Beaumont (Pleistocene) clay, at base of Holocene cumulic silty soil.

part of the Early Archaic period. As of this writing, 15 discrete stratigraphic components can be assigned to the latter part of the Early Archaic period on the basis of 24 individual radiocarbon assays (see Tables 1 and 2, and Figure 7). Sites include: 41NU184 (Ricklis and Gunter 1986), 41NU221 (Ricklis 1988), 41NU266 (Warren 1993; Ricklis 1995a), and 41NU267 (Ricklis 1995a), all along the lower Nueces River/delta; several sites on the northern shore of Nueces Bay (41SP15, 41SP136, 41SP148, 41SP153, and 41SP156 [Ricklis 1993; Ricklis and Cox 1991]); one site (41KL71) on the north shore of Baffin Bay (Smith 1984); an early component at 41SP120 on Ingleside Cove (Ricklis 1993); and the basal shell stratum at 41JK24, overlooking the Lavaca River delta (Weinstein 1994).

All components of this period are once again more or less thin (5-25 cm thick) shell deposits, usually consisting of oyster (though brackish-water *Rangia flexuosa* shells predominate in what were probably more river-influenced areas at 41NU184 and 41NU221). Artifacts are not abundant, and some sites have produced only shells and occasional chert flakes and fish otoliths. However, there is some variability in both thickness of deposits and density of artifacts, which suggests an as yet poorly understood, corresponding variability in the intensity and/or duration of occupations along the central coast. At the McKinzie site (41NU221), for example, a fairly extensive and relatively thick (15-20 cm) shell deposit, with three radiocarbon age ranges falling between 5919 and 5336 B.P., yielded hundreds of chert flakes, utilized flakes, a chert end-side scraper, and five chert dart points (2 Bell, 1 Early Triangular, 1 Tortugas, and 1 unstemmed, rounded-base form). This component also produced two shell implements, one a perforated oyster shell, the other an edge-modified oyster shell (Ricklis 1988).

Although relatively extensive excavations (24 m^2 units) at the Means site (41NU184) produced only chert debitage, at least a dozen Early Triangular dart points (see Turner and Hester 1993) have been surface collected from that part of the site where a dense *Rangia flexuosa* midden was exposed by cultivation. This site also produced a post mold pattern representing a small arc-shaped hut wall or windbreak, 3.2 meters across (Ricklis and Gunter 1986). A cluster of *Rangia flexuosa*, possibly associated with the structure, yielded a corrected and calibrated age range of 5592-5325 B.P.

Several artifacts, in addition to chert debitage, were recovered from a discrete shell stratum at 41SP156 on the north shore of Nueces Bay (Ricklis 1993), with age ranges spanning the time interval between 5592 and 4614 B.P. A Gower point from this stratum, mentioned above, may predate the dated shell deposit, although its position securely embedded within dense shell suggests it was (re)used by the people responsible for deposition of the shells. The distinctive barb section of an Andice point (see Figure 5f) probably pertains to this stratum; while it was found on the surface of a machine cut which transected the site, it appeared to have eroded from the dated shell stratum.

Chert debitage and an Early Triangular dart point (see Figure 5h) were excavated from deep colluvial soil at 41NU267 near the south shore of Nueces Bay. The level which produced the Early Triangular point also contained oyster shells yielding a corrected and calibrated radiocarbon age range of 4986-4862 B.P. (Ricklis 1995a). Finally, a Bell dart point from the Swan Lake site (41AS16), although collected from the surface, is believed to have eroded from a wave-reworked Early Archaic shell midden at that site (Prewitt et al. 1987; Prewitt and Paine 1988).

Limited subsistence data are available for this time period. Fish otoliths have been recovered from several site components (41NU184, 41NU221, 41NU267, 41SP156, and 41SP148). Species

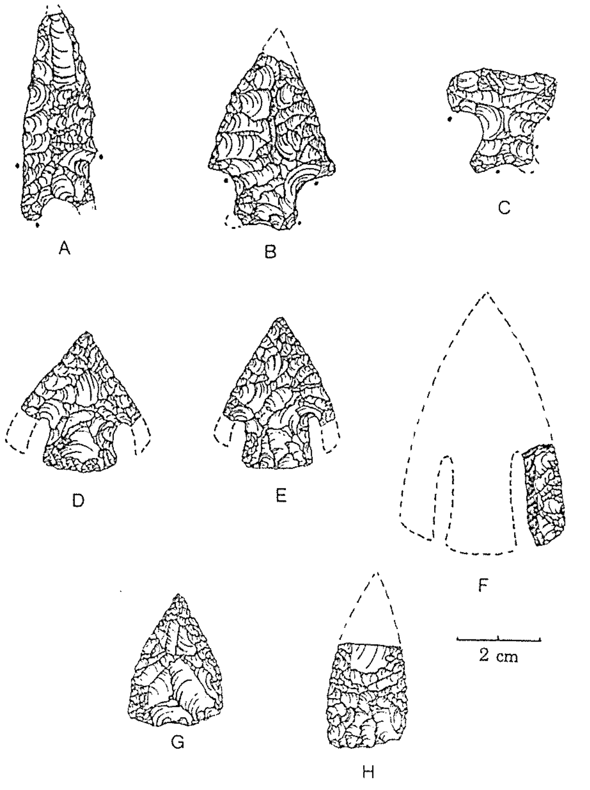

Figure 5. Early Archaic dart points from the central coast: a, Gower point, 41SP156; b-c, Uvalde-like points, surface, north shore of Nueces Bay (c has reworked medial break); d-e, Bell points (d is from discrete shell midden stratum, 41NU221, radiocarbon dated to 5919-5336 B.P.; e is surface find, north shore of Nueces Bay); f, Andice barb fragment, probably eroded from dense oyster stratum radiocarbon dated to 5592-4614 B.P.; g-h, Early Triangular (g is from same stratum as Bell point, 41NU221; h is from level at 41NU267 dated to 4986-4862 B.P.).

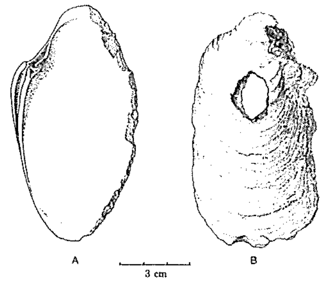

Figure 6. Shell tool forms: a, edge-flaked sunray venus clamshell knife or scraper; b, perforated oyster shell.

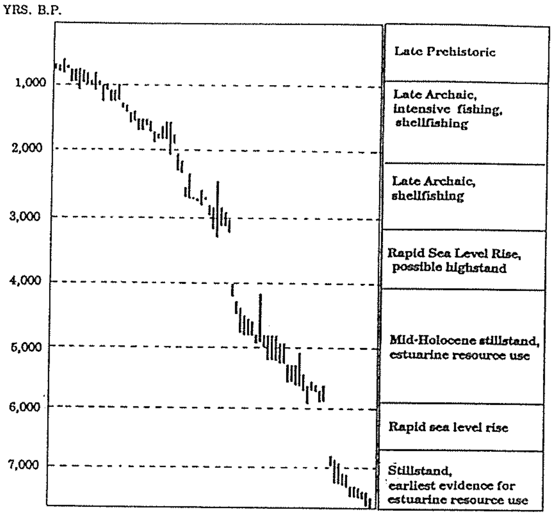

Figure 7. Chart showing 1-sigma calibrated age ranges on radiocarbon-assayed sample from the central Texas coast (shown in order presented in Table 1). Note discontinuities at ca. 6800-5800 and 4200-3100 B.P.

represented are black drum (*Pogonias cromis*), spotted seatrout (*Cynoscion nebulosus*), redfish (*Sciaenops ocellata*), Atlantic croaker (*Micropogon undulatus*) and catfish (*Aureus felis*?). Though not abundant at any site (the largest n=32, is from the McKinzie site [41NU221]), it is clear that procurement of estuarine fish was part of the subsistence economy by this time. Although relevant deposits are generally still too old to contain preserved bone, it can be assumed that hunting was carried out, since dart points are present. At 41NU267, faunal bone was preserved within well-drained, colluvial fine sand, and bones of fish, deer and rodents were recovered using fine-mesh screens (Ricklis 1995a).

There are some limited seasonality data available for this period as well. Seasonality analysis of oyster shells from several sites on the north shore of Nueces Bay suggest that most shellfish gathering took place in the winter through early spring (Cox and Cox 1993; Cox 1994). Since this time of year, when plant foods were scarce and game was low in body fat, would have been potentially stressful for prehistoric hunter-gatherers, shellfish may have served as an important seasonal "back-up" source of calories and protein. Seasonality analysis of fish otoliths from the McKinzie site (Ricklis 1988) suggests that fishing was carried out mainly in the fall through winter/early spring.

The increased number of sites during this time interval may indicate an overall growth in population, in keeping with a postulated population increase in much of Texas during the Archaic period (Story 1985). However, it should be noted that most of the components of both Early Archaic periods rest on an eroded Beaumont (Pleistocene) surface, and that much evidence for the earlier of the two periods may simply have been removed by Early to Middle Holocene erosion. Future geoarcheological research, designed to place occupations within the context of a dynamically changing terrestrial landscape, will be required for a firm understanding of long-term relative population trends in the region.

THE MIDDLE ARCHAIC: AN APPARENT HIATUS IN SHORELINE OCCUPATION

One of the striking characteristics of the available radiocarbon data is a virtual lack of dense shell deposits dating to the interval between ca. 4200 and 3100 B.P. (see Figure 7). This probably is not the result of a sampling bias, since the lack of dates is directly reflected in the actual physical stratigraphies at various sites, where physical evidence for occupation between strata dated to before 4200 B.P. and after 3100 B.P. is not present. Occupational strata have been identified within intact, cumulic soil profiles at 23 sites (producing a combined total of 47 discrete, radiocarbon-dated strata), yet no single component falls into the time interval in question (see Table 2). The sole possible exception is a light scatter of oyster shell at the bottom of 41SP177 on the north shore of Nueces Bay, with oyster shells dated to an age range of 3835-3643 B.P. (Ricklis 1993:36-44). However, the sparse shell rests within a well-sorted massive deposit of fine sand which may represent an old beachline, since the site is within 1.2 meter of modern sea level. Thus, the dated oyster shells may have been deposited naturally. Even if the shells represent human activity, occupation must have been quite ephemeral, judging by the absence of artifacts and faunal bone, both of which are abundant higher in the deposit, where far more abundant oyster shell has yielded an age range of 3156-2843 B.P.

Future research should be conducted with an eye to locating components dating to between 4200 and 3100 B.P. However, even if such are found, the present data base is sufficiently large to suggest that they will be few relative to the numerous site components dating earlier and later in time. This time interval appears to have seen relatively little occupation of the shoreline, the ecological implications of which are discussed further on.

THE LATE ARCHAIC, ca. 3100-950 B.P.

The beginning of the Late Archaic on the central coast, as here defined, corresponds to the approximate time at which sea level stabilized at its modern position, ca. 3000 B.P. Beginning at about this date, there is a continuous series of radiocarbon-dated site components at shoreline locations (see Tables 1 and 2 and Figure 7). Major sites are considerably larger than the known sites of the Early Archaic, have thicker middens, and yield a greater range and quantity of artifacts, all of which suggests more frequent and/or intensive occupations than previously, and perhaps a higher regional population density.

There is evidence for a significant intensification of estuarine resource use during the two millennia of the Late Archaic, a trend probably keyed to increasing biotic productivity in coastal estuaries. Beginning ca. 3000 B.P., shellfish gathering appears to have become, once again, a more or less important subsistence activity. Faunal preservation is generally good for the Late Archaic, and it is clear that fishing was carried out, along with hunting of game, most significantly white-tailed deer. By ca. 2000 B.P., there was a marked increase in the importance of fishing, as indicated by dramatic increases in the numbers of fish otoliths and bones per unit volume of midden deposit.

The largest investigated sites of the Late Archaic are located near the seaward ends of bays. The Kent-Crane site (41AS3), on the eastern margin of Copano Bay (see Figure 2), extends along the top of a shoreline bluff for nearly 1 km. This site consists of a massive and dense shell midden containing shells of a variety of moderate-to-high salinity mollusks; the most common species are oyster, scallop, sunray venus (*Macrocallista nimbosa*), quahog (*Mercenaria campechensis*), and lightning whelk. At the time of the site's original excavation in the early 1940s, the midden was in places as much as 1.8 meters thick (Campbell 1952). During recent testing, a sample of quahog shell was extracted from the base of the midden for radiocarbon dating. This produced an uncorrected age of 2210 ± 60 years (Cox and Smith 1989), which corrects and calibrates to a 1-sigma age range of 2773-2740 B.P. (Ricklis and Cox 1991). Since this dates the very bottom of the midden, it can be postulated that the site saw initial occupation at this time.

The Mustang Lake Site (41CL3; see Figure 2) is located on the mainland shore of Mustang Lake, a small lagoon separated from San Antonio Bay by Late Holocene spit accretion under conditions of modern, stable sea level. Recent survey and testing here (Ricklis 1994b) showed that a dense oyster shell midden extended along the shoreline for approximately 2 km. Testing under the author's direction in 1988 and again in 1994 revealed a very dense shell deposit with a thickness of 1.3 meters. Shell, bone, and lithic artifacts were found throughout the deposit, but sandy paste pottery sherds were present only in the top 20 cm. A radiocarbon date from the base of the midden indicates that initial occupation began at the same time as at Kent-Crane: shells from the basal level produced an age range of 2764-2727 B.P. Four other radiocarbon assays on samples from various excavation levels show that the midden continued to accumulate at a more or less constant rate until at least ca. 1400 B.P. (Figure 8). However, the presence of a Scallorn arrow point in the 10-20 cm level suggests that occupation actually continued somewhat later, since the type dates to ca. 1250-600 B.P. in Texas (Prewitt 1981, 1985; Turner and Hester 1993). The Scallorn point and sandy paste potsherds may have been associated with *Rangia cuneata* clamshells which were most abundant in the top 10 cm, and which are, as yet, undated.

One of the most extensive and productive known locales of Late Archaic occupation is at Ingleside Cove on the northeastern shore of Corpus Christi Bay. Two sites have been reported here, 41SP43 (Story 1968; Ricklis 1990, in press), and 41SP120 (Ricklis 1988, 1990, 1993, in press). These sites (see Figure 2) were actually parts of a single continuous cultural deposit which extended for several hundred meters along the top of the bluff overlooking the shoreline, prior to segmentation by modern residential construction. At both 41SP43 and 41SP120, dense Late Archaic shell middens rest within a fine sand cumulic soil (Figure 9). The

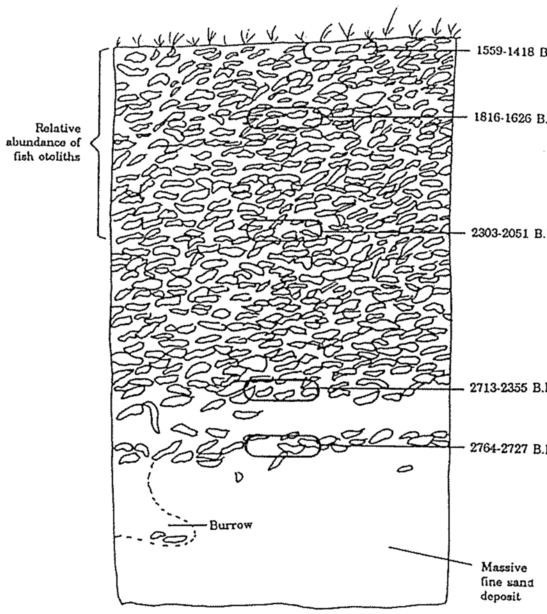

Figure 8. Excavation profile, Mustang Lake Site (41CL3), San Antonio Bay area. Shows thick and dense oyster shell midden, and locations of oyster samples extracted for radiocarbon assay, with corrected and calibrated 1-sigma age ranges. Note that abundant fish otoliths are confined to the upper 60 cm of the deposit.

most abundant shell species are oyster, scallop, lightning whelk, quahog, sunray venus, and cross-barred venus (*Chione cancellata*). Overlying the Late Archaic shell deposits at both sites is an extensive deposit of Late Prehistoric cultural materials. Fish bones and otoliths have been found in profusion in both Late Archaic and Late Prehistoric components; the most common species are black drum, redfish, spotted seatrout, and Atlantic croaker. Also present are bones of white-tailed deer and, less commonly, other mammals and birds (see Story 1968; Ricklis 1990, in press). A relatively long list of radiocarbon dates (8 from 41SP43 and 14 from 41SP120) clearly indicates that the major occupation of the sites began shortly after 2000 B.P.

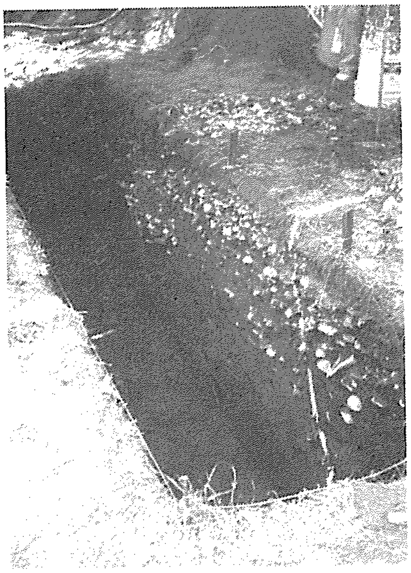

Figure 9. Dense Late Archaic shell midden at 41SP120 on Ingleside Cove, Corpus Christi Bay.

The earliest Late Archaic occupation evidenced at Ingleside Cove is represented by a thin but stratigraphically discrete lens of oyster and quahog shell at 41SP120 (Ricklis and Cox 1991). This lens was found near the base of the cumulic sandy soil at a depth of 1 m, and produced a corrected and calibrated radiocarbon age range on quahog shells of 3157-2948 B.P. Higher in the soil, usually at depths ranging between 30 and 80 cm, are dense shell midden deposits which, on the basis of 18 radiocarbon assays, place the main Late Archaic occupation in the first millennium A.D. (see Table 2). The terminal Archaic, represented by a stratigraphically discrete deposit of particularly dense shell at 41SP120, is securely dated to ca. 950 B.P. (A.D. 1000) on the basis of seven radiocarbon assays (3 charcoal and 4 shell) with 1-sigma age ranges spanning the time interval between 1161 and 743 B.P. (and with six of the seven calibrated intercept points clustering tightly between 943 and 915 B.P.). Four Late Archaic dart points (2 Catan and 2 Matamoros) were found resting within the dated deposit (Figure 10); arrow points were absent.

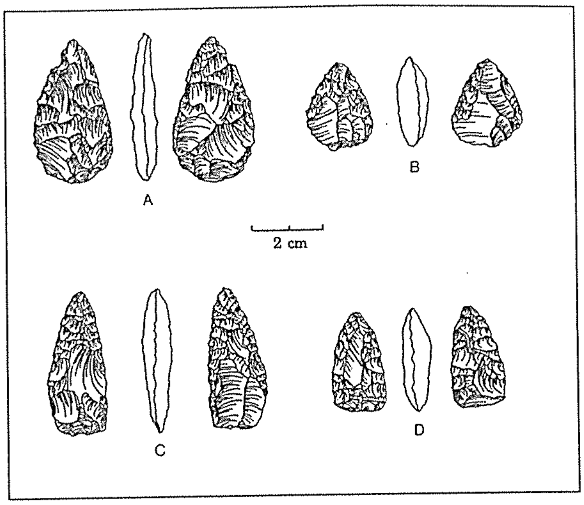

Figure 10. Dart points from terminal Archaic stratum, 41SP120, dated to ca. A.D. 1000: a-b, Catan points; c-d, Matamoros points.

Subsistence patterns during the Late Archaic involved a dramatic increase in fishing ca. 2000 B.P. This trend is best indicated by the relative abundances of otoliths in midden deposits, since otoliths are resistant to decay under most conditions and thus will not be under-represented for early time periods. As may be seen in Figure 11, the numbers of otoliths per cubic meter of excavated deposit in the Corpus Christi Bay area shows a dramatic increase after ca. 2000 B.P. Similarly, in the thick midden at Mustang Lake on San Antonio Bay, otoliths show by far the greatest abundance in the upper 60 cm; radiocarbon dating of shells from the 55-60 cm level produced an age range of 2303-2052 B.P. (Figure 12).

The increased economic importance of fishing at this time can probably be linked to the emergence of the modern estuarine environment. After the attainment of modern stable sea level ca. 3000

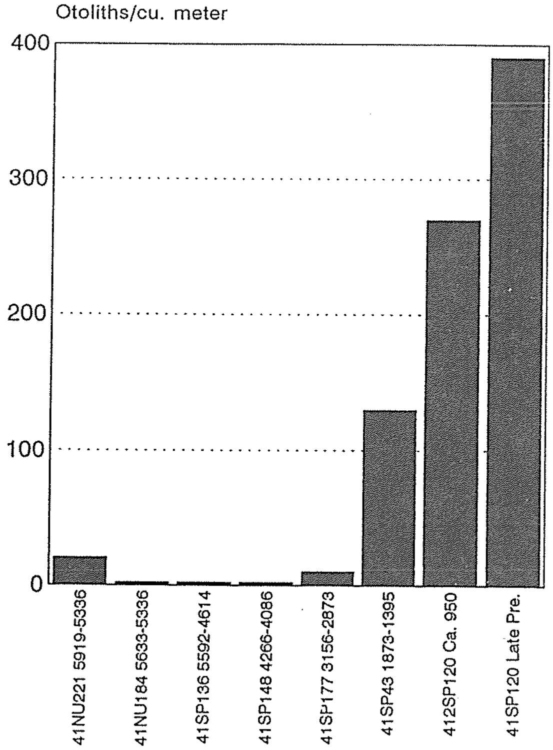

Figure 11. Bar graph showing numbers of fish otoliths per cubic meter of excavated site deposit, sites on Nueces and Corpus Christi Bays. Note dramatic increase in abundance after ca. 2000 B.P.

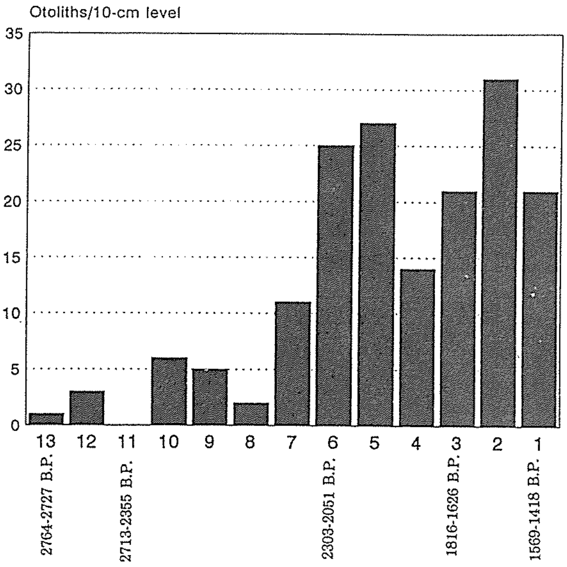

Figure 12. Bar graph showing numbers of otoliths per 10 cm excavation level, Mustang Lake site (41CL3). Note marked increase in level 6, from which oyster shell yielded a corrected and calibrated 1-sigma radiocarbon age range of 2303-2052 B.P.

B.P., continuous barrier islands formed, seemingly reaching essentially their modern configuration ca. 2500-2000 B.P. Concomitantly, broad back-barrier vegetated shallows emerged, providing extensive spawning/nursery grounds for the economically important fish species which have historically abounded in central coast bays and lagoons (e.g., Perret et al. 1980; Reagan 1985; Matlock 1990; Sutter et al. 1986; Lorrio and Perret 1980). The emergence of such broad, vegetated shallows led to a considerable increase in estuarine fish carrying capacity, and human populations shifted to greater economic focus on fish procurement.

There is some evidence to suggest that major shoreline fishing camps such as 41SP120 and Mustang Lake were most intensively occupied during the fall through winter/early spring as part of a basic settlement pattern involving cool-weather shoreline occupation and warm-season riverine hunting camps. This pattern, better documented for the Late Prehistoric period, is discussed below.

The Late Archaic artifact assemblage consists of a rather wide array of items of stone, bone, and shell. Several types of flaked stone dart points pertain to the period (Figure 13). At the Kent-Crane site, most dart points can be assigned to either the Kent or Ensor types, and an examination of the information presented by Campbell (1952) indicates that Kent points are more commonly found in the lower part of the midden, while Ensor points are better represented in the upper part. Since the base of the midden dates to ca. 2700 B.P., the Kent points fall at or somewhat later than that date. Kent points (and one specimen each of the Godley and Marcos types), were found eroding from the oyster midden at 41SP177, which produced a calibrated age range of 3156-2873 B.P. The Ensor points at Kent-Crane are presumably contemporaneous with specimens from Central Texas, dated between ca. 1750 and 1400 B.P. (Prewitt 1981, 1985). Small, thick, unstemmed dart points assignable to the Catan and Matamoros types (see Figure 10) are well-dated to ca. 950 B.P. at 41SP120, and presumably these types are representative of the terminal Archaic period in the region. There is no hard evidence to indicate, as sometimes suggested, that these types persisted into the Late Prehistoric period. Other lithic items (e.g., knives, scrapers, Clear Fork gouges, and Olmos Bifaces [see Turner and Hester 1993]) are known from probable Late Archaic contexts (e.g., Campbell 1947, 1952; Story 1968; Steele and Mokry 1985), but are never abundant, most likely because shell was used as a surrogate tool material at shoreline sites, which were at considerable distances from riverine chert sources (see discussion in Ricklis and Cox 1993).

The shell tool industry during the Late Archaic shows a fair degree of diversity. Perforated oyster shells and edge-flaked sunray venus clamshell knives/scrapers, documented for the Early Archaic, continued to be made. A range of conch shell tools, on the other hand, seems to appear only during the Late Archaic (Early Archaic sites have yet to produce conch tools or conch fragments which could be interpreted as tool-manufacturing debris). Adzes (Figure 14) were manufactured from body whorls of large lightning whelks (see Mokry 1980). Bi-pointed conch columellae, or central spires, are quite common in Late Archaic deposits (Campbell 1952; Story 1968; Ricklis 1990); these may be awls or perforators, or perhaps were used as fishing gear (i.e., spear points or gorges). Conch shells were used as hammers (Figure 15a), and gouges (Figure 15b-c) were fashioned from the stout columellae of large lightning whelks and Florida Horse conches (*Pleuroploca gigantea*).

Bone artifacts (Figure 16) are well documented for the Late Archaic. Awls were made from deer long bone splinters and ulnas, and deer ulnas were also used as possible flint-flaking tools (e.g., Corbin 1963; Hester 1980b:121). Bone pins with engraved geometric designs are documented from several

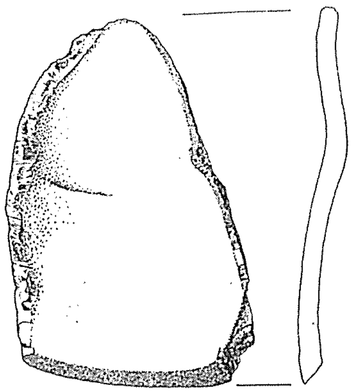

Figure 14. Whelk shell body whorl adze. Surface find, north shore of Nueces Bay.

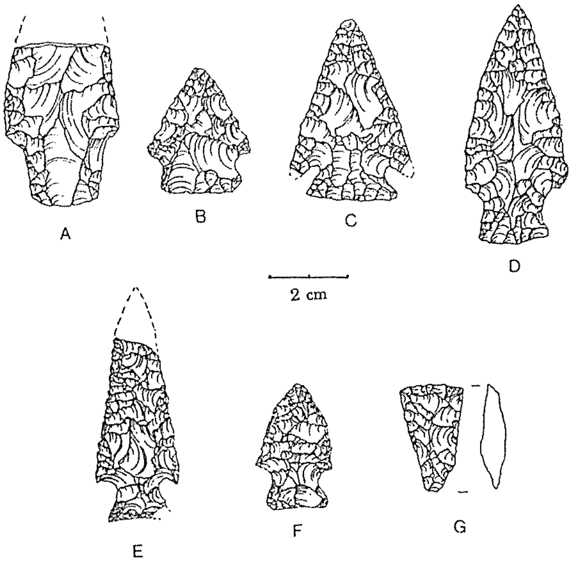

Figure 13. Late Archaic dart points and Olmos Biface, central coast: a, Kent; b, Ellis; c, Marcos; d, Godley; e-f, Ensor; g, Olmos Biface. A, c-d, and g are from 41SP177, b is from 41SP153, and e and f are from 41SP156. All sites on the north shore of Nueces Bay.

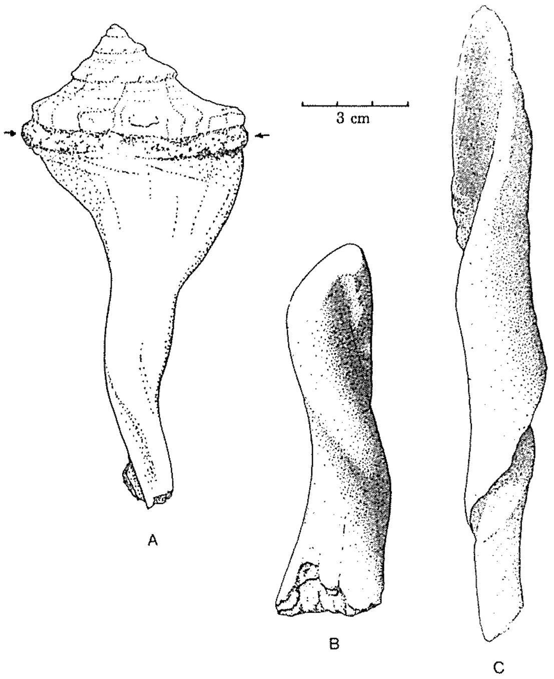

Figure 15. Whelk shell tools, central coast: a, hammer (arrows point to battered edge); b, whelk columella gouge; c, Florida Horse conch columella gouge. A is from 41SP43 on Ingleside Cove, Corpus Christi Bay, and b and c are from the Mustang Lake site (41CL3), San Antonio Bay area.

sites, including Kent-Crane (Campbell 1952), 41SP120, and 41CL3 (see Figure 16b-c). Small cylindrical bird bone beads are also part of the assemblage.

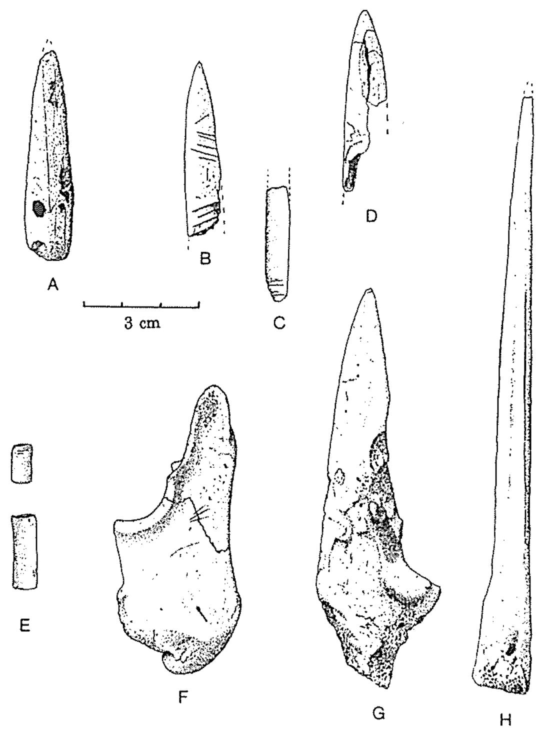

Figure 16. Late Archaic/Late Prehistoric bone artifacts, central coast: a, bone point with asphaltum hafting mastic on base; b-c, engraved bone pins; d, antler point, e, bird bone beads; f, deer ulna flaking tool; g, deer ulna awl; h, deer metapodial awl. C is from the Mustang Lake site; all others are from 41SP120.

There is clear evidence for the use of basketry in the Late Archaic in the central coast. Basketry-impressed burned clay nodules have been recovered at the Tucker site (41NU46) near Corpus Christi, from a stratum with hearth charcoal dated to ca. 3000 B.P. (Smith n.d.; three charcoal dates from this stratum are listed in Table 1: no. 40-42). Fragments of asphaltum with basket impressions are reported from the Johnson and Kent-Crane sites on Copano Bay (Campbell 1947, 1952; Cox and Smith 1989), from the Late Archaic midden at 41SP120 (Ricklis 1990), and from the preceramic levels of the midden at Mustang Lake (Ricklis 1994b). In all cases, baskets appear to have been woven using a basic twinning technique.

As a final note concerning the Late Archaic, it should be mentioned that cemeteries are present, perhaps for the first time in the region. As discussed elsewhere (Story 1985; Hall 1995), the use of cemeteries may have accompanied the emergence of well-defined group territories, a systemic response to growing regional population density. The cemeteries known from the coast range in size from a few clustered interments to large cemetery sites containing the remains of hundreds of individuals. Unfortunately, radiocarbon dates are not available from cemeteries which were clearly used by coastal populations; several dates were obtained on burials at the Blue Bayou Site (41VT94), but stable isotope analysis on human bone suggested that the population subsisted on a non-coastal diet (Huebner and Comuzzie 1991).

Limited bioarcheological analyses have been carried out on skeletal samples from the central coast. Late Archaic/Late Prehistoric populations were relatively tall and robust for Native Americans (Comuzzie et al. 1986; Powell 1989), which are physical characteristics generally attributed to the Early Historic Karankawa Indians of the region. An examination of skeletal material from 41NU2 on Oso Bay at Corpus Christi showed that approximately 24 percent of the burial population had suffered from endemic treponematosis, a chronic condition which may have been transmitted to such a large proportion of the population during periods of seasonal group aggregation (Jackson et al. 1986).

THE LATE PREHISTORIC, ca. 950-250 B.P. (A.D. 1000-1700)

Several changes mark the beginning of the Late Prehistoric period. As elsewhere in Texas (Suhm et al. 1954; Hester 1975, 1980b; Prewitt 1981, 1985), relatively thick and heavy stone dart points give way to light, thin arrow points, signaling the replacement of the dart and atlatl by the bow and arrow. Ceramics, although possibly in very limited use in the terminal Archaic (see Ricklis and Cox 1991), become common during this period. On the basis of changes in major artifact form/types, as well as probable shifts in subsistence patterns, the Late Prehistoric can be divided into two subperiods (discussed below chronologically in terms of calendar years, due to temporal proximity to the Early Historic period).

THE INITIAL LATE PREHISTORIC, A.D. 1000-1250/1300

The beginning date for this period is based on findings at 41SP120, where the terminal Archaic is well-dated to ca. A.D. 1000, and an initial Late Prehistoric component has produced two dates on shells, from a discrete stratigraphic unit, with calibrated ages of 928-738 and 926-741 B.P., or A.D. 1022-1212 and A.D. 1024-1209 (Ricklis 1993:51). Profuse fish bones and otoliths were found in association with the dated shells, as were a number of triangular arrow points morphologically assignable to the Fresno type (Suhm and Jelks 1962; Turner and Hester 1993; Figure 17). Scattered fragments of deer bone indicate some importance for hunting at this time.

In the northern part of the central coast region, the side/corner-notched Scallorn arrow point type (Figure 18d) appears to mark this time period. Scallorn points have been recovered at Mustang Lake (41CL3) (Ricklis 1994b) and 41CL2 (Weinstein 1992) in the San Antonio Bay area, and in abundance at the Kendrick's Hill site (41JK35; Weinstein 1994, and 1994 personal communication) and the Anaqua site (41JK8; Story 1968), both on the lower Lavaca River estuary. At Anaqua, the Scallorn points were apparently in association with plain, sandy paste pottery.

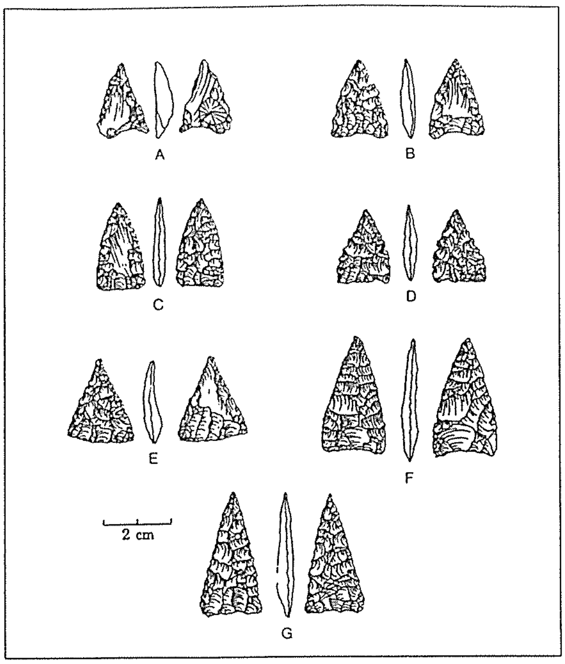

Figure 17. Fresno arrow points, 41SP120. Found in association with shells radiocarbon dated to ca. A.D. 1000-1250.

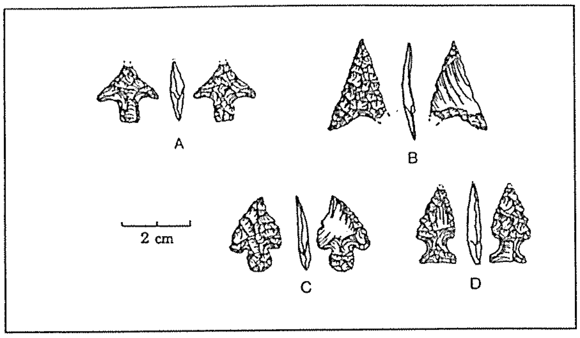

Figure 18. Various Late Prehistoric arrow points from the central coast: a, Alba-like; b, Starr, c, Bulbar stemmed; d, Scallorn. A-c are from 41SP120; d is from the Mustang Lake site (41CL3).

Ceramics seem to have undergone a discernible, intra-regional evolution. Weinstein (1992:94) suggests that plain, sandy paste pottery similar to the Goose Creek ceramics of the upper Texas coast are earlier than asphaltum-coated/decorated ceramics. As already mentioned, this kind of pottery was found by Story (1968) at the Anaqua site in association with Scallorn arrow points, so it presumably is earlier than the asphaltum-treated Rockport ceramics commonly associated with the later Perdiz arrow point type. An analysis of attributes of decoration and surface treatment of Rockport ceramics from 41SP120, according to depths within the excavated deposit, suggested in a preliminary way that Rockport Black-on-Gray decorated wares were somewhat later than plain pottery, and that the common vertical squiggle designs found on Rockport pottery increased in "popularity" with time (Ricklis 1990:Appendix A).

THE FINAL LATE PREHISTORIC, ca. A.D. 1250/1300-1700

Beginning around A.D. 1250 or 1300, a distinctive artifact assemblage emerges on the central coast. The diagnostic traits of the assemblage are a lithic industry consisting of arrow points, mainly of the Perdiz type (Figure 19), small unifacial end scrapers, thin bifacial knives which are sometimes alternately beveled, small elongate chert drills, and a prismatic blade-core technology (Figure 20). Ceramics include bowls, jars, and constricted-neck ollas, often coated and/or decorated with asphaltum (Figure 21d-h). Other kinds of decoration include geometric incised designs below rim exteriors (Rockport Incised [see Figure 21a-b), and lip modification in the form of neatly executed square notches which give a crenelated effect to vessel rims (see Figure 21c). Cylindrical ceramic smoking pipes, sometimes bearing asphaltum decoration, are also present. Additionally, Rockport phase components have produced bone artifacts such as points, awls, deer ulna flaking tools, and small cylindrical bird bone beads. Shell tools include edge-flaked sunray venus clamshell knives/scrapers and whelk shell adzes (Ricklis 1990).

Judging from the distribution of Rockport pottery, the Rockport phase can be geographically defined with a fair degree of accuracy. In a survey of the Matagorda Bay-lower Colorado River area, Fritz (1975) found that Rockport ware sherds, with characteristic asphaltum surface treatment, were common around Matagorda Bay but gave way to plain sandy paste and/or grog-tempered ware, similar to the pottery of the upper Texas coast, in the Colorado River delta area. The southern limit of Rockport ware is essentially the northern shore of Baffin Bay; several sites there have produced fairly abundant Rockport sherds, whereas only a few sherds have been reported from sites on the southern shore of the bay (see Hester 1969a; Smith 1984). The inland extent of Rockport pottery is only about 40 km from the mainland shoreline. Sites farther inland are invariably characterized by a predominance of bone-tempered plainware diagnostic of the inland Toyah phase or horizon (e.g., the Berclair site in Goliad County [Hester and Parker 1970], the Hinojosa site in Jim Wells County [Black 1986], and the Burris site in Victoria County [J. Huebner, 1989 personal communication]). Significantly, a survey along the Aransas River in northern San Patricio County showed that Late Prehistoric sites with Rockport

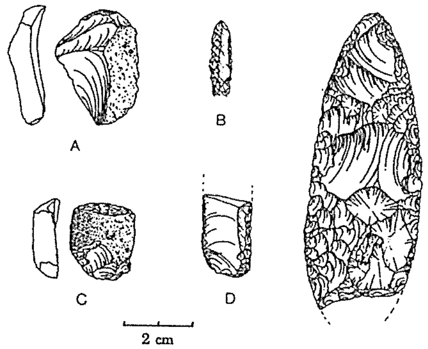

Figure 20. Rockport phase lithics (all from 41SP120): a, c, unifacial end scrapers; b, chert drill/perforator; d, fragment of trimmed prismatic blade; e, bifacial knife.

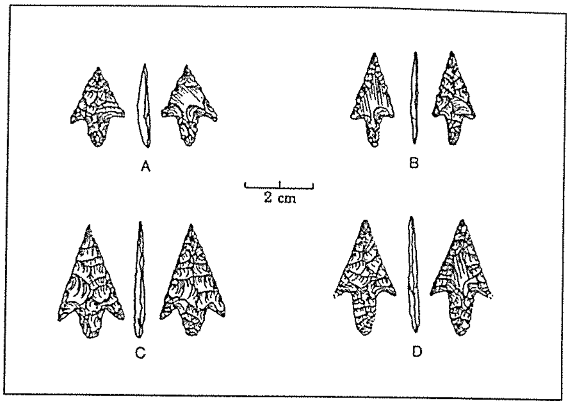

Figure 19. Examples of Perdiz arrow points from Rockport phase components (all four specimens from 41SP120).

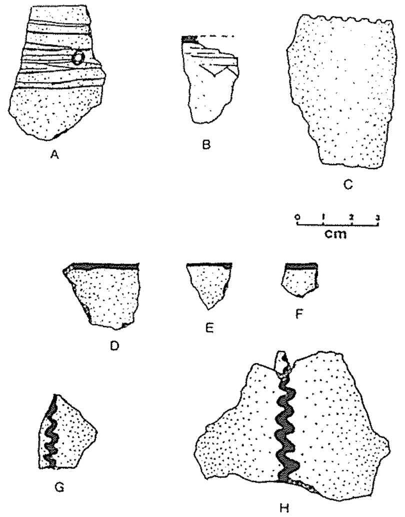

Figure 21. Examples of Rockport phase ceramics: a-b, Rockport Incised; c, Rockport Crenelated; d-h, Rockport Black-on-Gray.

pottery, and sites with predominantly bone-tempered plainware, were both present at a point about 40 km from the mainland strandline. Similarly, at site 41RF21 in Refugio County, also approximately 40 km from the mainland shoreline, both Rockport and Toyah components were identified on the basis of spatially discrete concentrations of Rockport and bone-tempered plainware sherds (Ricklis 1989, 1990, in press).

In terms of adaptive patterns, it is clear that fishing continued to be of major importance during the Rockport phase, since Rockport materials have been found in association with abundant fish remains at numerous sites (e.g., Story 1968; Smith 1984; Ricklis 1988, 1990, in press; Weinstein 1992). Major fishing camps are found on the mainland shorelines of bays and lagoons, as well as on the landward sides of barrier islands. Fishing may have, in fact, reached its greatest economic importance at this time, judging by the peak in fish otolith density at 41SP120 during the Late Prehistoric (see Figure 11).

It is perhaps significant that no major, dense, shell middens have yet to be reported for discrete Rockport phase components. At Ingleside Cove, Rockport phase middens were found at both 41SP120 and 41SP43 that overlie Late Archaic shell middens; the Rockport deposits contained abundant fish remains and artifacts, but only scattered shell debris. Similarly, at 41CL2 on Guadalupe Bay, abundant Rockport phase materials were found to overlie an earlier, dense shell midden (Weinstein 1992, and 1992 personal communication). Major Rockport phase components have been identified at the Kirchmeyer site (41NU11) on Oso Bay (Headrick 1993), and at the Packery Channel site (41NU219) at the north end of Padre Island (Warren 1984; author's personal field observations), where only scattered shell debris is present. Hypothetically, fishing may have become sufficiently productive to render shellfish gathering a very minor subsistence activity, a possibility which merits future investigation.

Around A.D. 1250/1300, bison hunting appears to have become a significant subsistence activity among central coast groups, as it did in inland Texas. Numerous small Rockport phase hunting camps have been documented within about 40 km of the mainland shoreline, primarily along the uplands overlooking stream valleys (e.g., Carlson et al. 1983; Ricklis 1988, 1990, in press). Fish and shellfish remains are generally scarce or absent at these sites, where the predominant faunal remains are bones of deer and bison. Where faunal samples are adequate for determination of the relative importance of various taxa, bison is found to have provided the greatest bulk of useable meat weight, with white-tailed deer as an important secondary meat source (Ricklis 1990, in press).

The repeated presence of Perdiz arrow points at Rockport phase riverine camps with bison bone (Ricklis 1990:281-285) suggests that these sites date to or after ca. A.D. 1250/1300, the generally accepted time of the appearance of the type across much of Texas (Prewitt 1981, 1985; Mallouf 1987; Turner and Hester 1993; Johnson 1994; Ricklis and Collins 1995). This inference is supported by three radiocarbon dates from the Mellon site (41RF21), located on a tributary of Copano Creek in Refugio County. Here, dense deposits of bison and deer bone (Figure 22) were found in association with Rockport ware pottery sherds and both Perdiz and Scallorn arrow points (Ricklis 1989, 1990, in press). Assays run on two samples of bison bone and a sample of associated charcoal produced 1-sigma calibrated age ranges of 742-660, 768-675, and 790-576 B.P., or A.D. 1208-1290, A.D. 1182-1275, and A.D. 1160-1374. The respective intercept points of the three dates are A.D. 1267, 1252, and 1265. The fact that both Scallorn and Perdiz arrow points were found in close association with the dated bones and charcoal suggests that Perdiz points were quickly replacing the older Scallorn type at this time.

Figure 22. Concentration of bison and deer bone, Mellon site (41RF21), on branch of Copano Creek, Refugio County. Corrected and calibrated radiocarbon dates on bone and charcoal place this feature at ca. A.D. 1250-1300.

In fact, the Rockport phase lithic assemblage (see Figures 19 and 20) differs little from that seen in the contemporaneous inland Toyah phase (Prewitt 1981) or horizon (Black 1986). Perdiz is the predominant arrow point type in both assemblages, and both assemblages contain more or less abundant unifacial chert end scrapers, bifacial (sometimes alternately beveled) knives, and prismatic blades (see Hester and Shafer 1975 for a discussion of blade-core technology in the Rockport phase). The only difference between the two lithic assemblages is in the respective forms of flaked stone drills or perforators: Toyah drills are made on flakes or blades in which the proximal end has an expanded configuration because it is left unworked, whereas Rockport phase drills, although also made on flakes or small blades, are elongate or cylindrical in shape. Blades and scrapers from Rockport phase sites tend to be smaller than many Toyah counterparts, but this probably reflects the use of small-size raw materials in a region with limited lithic resources (see Ricklis and Cox 1993). A similar diminution of lithic forms is noted at the Toyah horizon Hinojosa site, where the small size of stone tools is attributed to a local scarcity of useable cherts (Black 1986).

The available evidence strongly suggests that Rockport phase people were adopting most of the items of a widespread lithic technological package, at about the same time it appeared across much of Texas. This seems to reflect a correlation between the appearance of abundant bison on the coastal prairies—part of a general and widespread increase in bison populations in Texas (e.g., Dillehay 1974; Huebner 1991)—and the adoption of a techno-complex well-suited to the procurement of large game and the processing of meat and hides (cf. Hester 1975; Black 1986; Mallouf 1987; Creel 1991; Ricklis 1992a).

Settlement and subsistence patterns during the Rockport phase involved, to some significant degree, shifting seasonal emphases, with occupation of shoreline fishing camps during the fall through winter-early spring, and later spring through summer residences at hunting camps commonly located along the upland margins of stream valleys (Ricklis 1988, 1990, 1992b, in press). Seasonality analyses of fish otoliths from large shoreline sites (41NU11, 41SP43, 41SP120, 41CL3) place most fish deaths in the fall through early spring, a pattern which appears to have emerged at least as far back as the latter part of the Late Archaic. Winter or very early spring occupations are also suggested at 41SP120 and 41CL3 by seasonality analyses of oyster and Rangia *cuneata* shells. Conversely, analyses of *Rangia cuneata* seasonality (see Aten 1981; Carlson 1988), as well as of fish otoliths, point to spring-summer occupations at small prairie-riverine campsites. Additionally, it has been hypothesized that, since the large shoreline sites are relatively few and the small prairie-riverine sites are more numerous, that there was a seasonal aggregation of population at major fishing camps, and a spring-summer dispersal into smaller groups at hunting camps along the edges of stream valleys.

This pattern had significant ecological correlates (Ricklis 1988, 1990, 1992b, in press). The largest economically important fish species, redfish and black drum, tend to aggregate in large numbers during their respective fall and winter-early spring spawning seasons, thus providing the kind of predictable and concentrated food resources required to support relatively large human groups. On the other hand, by mid-spring, various plant species found along stream floodplains and upland prairies emerged as exploitable food resources, and important game animals such as white-tailed deer and bison increased rapidly in body weight and fat content. Since many plant foods were widely distributed across the landscape, and since game tended to be mobile and/or dispersed, the spring-summer camps were probably occupied for relatively short periods of time within a more or less highly mobile warm-season settlement pattern. Available ethnohistoric documentation appears to support these inferences of seasonal settlement and resource-use strategies; archival sources suggest that the Early Historic Karankawas resided during the fall and winter in large shoreline camps of 400-500 or more people, but camped along stream courses during the spring and summer, in bands averaging about 55 individuals (Ricklis 1990, 1992b, in press).

LONG-TERM ENVIRONMENTAL AND HUMAN ADAPTIVE CHANGE ON THE CENTRAL COAST

It is possible to construct a model of long-term human response to a dynamically evolving Holocene coastline. A striking aspect of the archeological chronology is the clustering of radiocarbon dates from shoreline sites into the three major periods discussed above. As was seen in Figure 7, age ranges derived from stratigraphically discrete occupation components cluster between 7500-6800 B.P., 5800-4200 B.P., and after 3100 B.P. The absence of dated, clearly discrete, occupational components ca. 6800-5800 B.P. and 4200-3100 B.P. suggest two time intervals, each lasting about a millennium, during which there was little shoreline occupation, or at least a significant reduction of occupation to the extent that it is not clearly represented in the current radiocarbon chronology. Assuming that prehistoric peoples would exploit a rich estuarine environment when and where it was available, we may infer that the two intervals of reduced shoreline occupation reflect a corresponding reduction in the exploitable biomass of central coast estuaries.

Estuaries are one of the most productive types of environments, rivaled in primary biotic productivity only by tropical rainforests (Odum 1971; Whittaker 1975). They are, however, ecosystemically fragile, insofar as high primary productivity and a rich food chain depend on certain crucial conditions. High photosynthesis occurs in extensive, shallow sunlit waters with relatively low turbidity. Extensive shallows are also crucial in that they supply large amounts of organic nutrients through decay of aquatic vegetation and marsh plants (Odum et al. 1974). When the geometry of shallow-water estuaries is significantly altered, such that the nutrient-rich shallows are destroyed or greatly reduced in area, there are corresponding negative effects on the biotic productivity of the entire ecosystem. On the Texas coast, for instance, artificial destruction of shoreline shallows has been shown to reduce populations of shrimp—a major primary consumer and an important link in the estuarine food chain—by 80 percent and more (Mock 1966). Similarly, it has been documented that destruction of shoreline salt marshes through either draining or flooding has resulted in reductions of molluscan and crustacean populations by as much as 90 percent (Cooper 1974). Inundation of nutrient-rich brackish water marshes by transgressive high-salinity waters has severe detrimental effects on brackish marsh ecosystems (Pezeshki et al. 1987).

In light of these basic principles of estuarine ecology, it may be highly significant that the periods of relatively intensive human shoreline occupation correspond to postulated times of relatively stable sea level during the Holocene (Figures 23 and 24). Under stable sea level conditions, ongoing bay-bottom sedimentation produces extensive shallows along bay margins (e.g., Dalrymple et al. 1993), of the sort conducive to high photosynthesis and establishment of widespread shoreline vegetation communities. At the same time, deposition of river-borne sediments creates broad, prograding deltas which support extensive and nutrient-rich marshes. High photosynthesis rates and a rich supply of organic nutrients support high primary consumer populations (e.g., crustaceans, molluscs), which in turn provide the ecological basis for a high fish biomass. Additionally, the same vegetated shallows which provide nutrients also offer ideal conditions for fish spawning and nursery grounds for economically important species such as black drum, redfish, spotted seatrout, and Atlantic croaker (Perret et al. 1980; Lorrio and Perret 1980; Reagan 1985; Matlock 1990; Sutter et al. 1986).

During times of Holocene marine transgression, when sea level may have risen three meters or more per century (Anderson and Thomas 1991), sea level changes would have outpaced bay sedimentation, greatly reducing the area of, if not effectively destroying, critical shoreline shallows and deltaic marshes. Overall photosynthesis rates would have been reduced, both by a general deepening of bay waters and by increased turbidity, as protective barriers were breached and/or submerged and bays became exposed to high-energy wave action from the open Gulf. Concomitantly, average salinities would have increased,

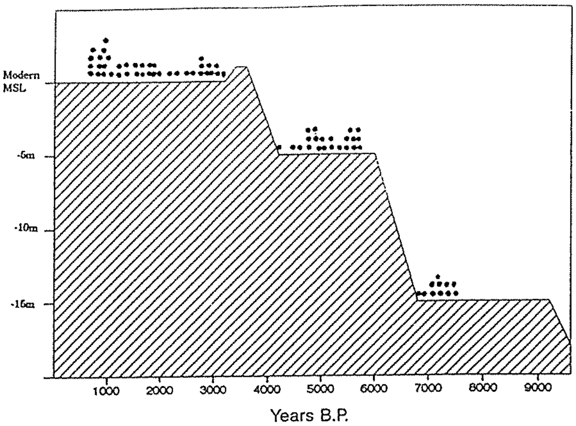

Figure 23. Diagram showing stepwise pattern of Holocene sea level rise on the Texas coast (based on Frazier 1974, as modified by Paine 1991), showing mid-points of calibrated 1-sigma age ranges from archeological sites (black dots). Note that radiocarbon dates cluster during periods of postulated sea level stillstand. Timing of Paine's postulated highstand is narrowed somewhat to reflect the archeological data (see discussion in text).

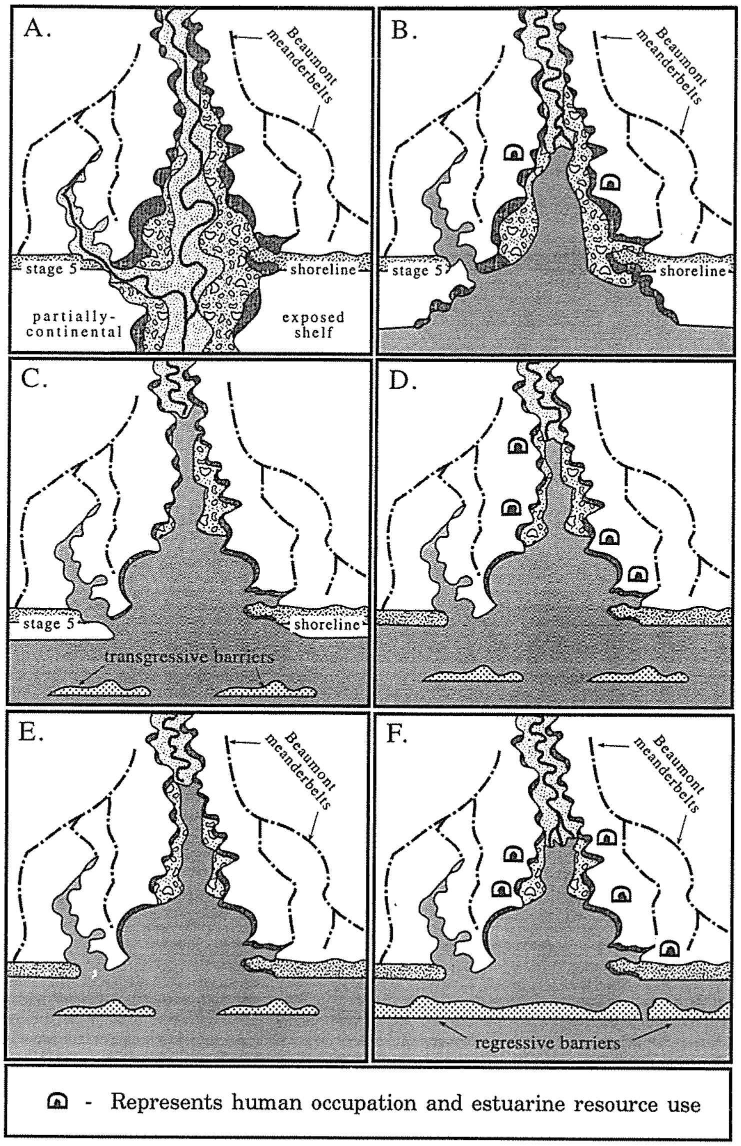

Figure 24. Schematic diagrams illustrating suggested relation between discontinuous sea level rise/stillstand, and periods of human occupation indicated by radiocarbon data, central Texas coast estuaries: A, before 9000 B.P; B, stillstand ca. 7500-6800 B.P.; C, rapid sea level rise after ca. 6800 B.P.; D, stillstand, ca. 5800-4200 B.P.; D, rapid rise and possible highstand, ca. 4200-3100 B.P.; F, modern stillstand, after ca. 3100 B.P. (from Ricklis 1995a, modified from Blum et al. 1995).

as estuaries came under greater marine influence, resulting in reductions of economically important low-to-moderate salinity molluscs (e.g., oysters, *Rangia*). In short, the bays of the Texas coast would have more nearly approached the biotic conditions of the open ocean, which is well known to be far less productive than protected shallow-water estuaries (Odum 1971; Whittaker 1975; Perlman 1980).

There is general agreement that modern stable sea level was attained on the Texas coast by ca. 3000 B.P., give or take a few hundred years (Frazier 1974; Brown et al. 1976; Paine 1991; Anderson et al. 1992). It is almost certainly relevant that the final period of human shoreline occupation and estuarine resource use begins at this time, since modern sea level stillstand resulted in the formation of the continuous chain of barrier islands, and the extensive shallow-water environment, which has historically been a rich source of shellfish and fish resources. As already observed, the archeological data strongly suggest a marked increase in fishing around 2000 B.P., which was probably an adaptive response to increased fish biomass made possible by the emergence of highly extensive, protected shallows behind the modern barriers.

There is also a growing body of geologic evidence which suggests a period of rapid sea level rise just prior to the establishment of the modern stillstand. Paine has presented evidence for a rapid rise to an approximately 1-meter highstand after ca. 4400 B.P. (Paine 1987, 1991; Prewitt and Paine 1988). Anderson and others have posited a rapid sea level rise ca. 4000 B.P., based largely on seismic data from the Sabine-Trinity River paleochannel offshore from the present upper Texas coastline (Anderson et al. 1992). The timing of this period of rapid sea level rise corresponds well with the hiatus in the archeological chronology of shoreline occupation, at ca. 4200-3100 B.P.

Although the details of earlier Holocene sea level rise remain less well-defined, there is consensus among geological researchers that marine transgression along the Texas coast was a discontinuous, stepwise process, with episodes of rapid rise interrupted by periods of stillstand, markedly slowed rise, or even slight reversal (Curray 1960; Nelson and Bray 1970; Frazier 1974; Paine 1991; Anderson et al. 1992). It can be postulated, therefore, that the major periods of Early Archaic occupation, ca. 7500-6800 B.P. and 5800-4200 B.P., correspond to times of high estuarine biotic productivity during periods of sea level stillstand. The apparent hiatus in occupation between ca. 6800 and 5800 B.P. may match a period of rapid sea level rise, since some researchers have suggested stillstand during the eighth millennium B.P. followed by marine transgression ca. 7000-6000 B.P. (Frazier 1974, as modified by Paine 1991; see Figures 23 and 24).

While ongoing interdisciplinary studies will help to better define the interrelations between stepwise sea level rise, biotic productivity, and human adaptation, it is highly probable that the cultural history of the central coast region was keyed to fundamental biophysical processes inherent in the dynamic evolution of the Holocene coastline. The region's suitability for human occupation was seemingly not a long-term constant, but fluctuated in response to local and regional changes which were linked with environmental change at the global scale.

THE LOWER TEXAS COAST

The lower Texas coast (see Figure 1) can be environmentally divided into two major subareas. From the southern shore of Baffin Bay to the middle of Willacy County, the coastal zone is part of the South Texas sand sheet, an area in which Pleistocene sediments of the Beaumont Formation are blanketed with Holocene sands, the result of deposition of surplus shoreline sand by prevailing southeasterly winds. This area, which is characterized by a hummocky terrain of stabilized sand dunes supporting short grasses and mottes of live oak (Brown et al. 1977), is virtually unknown archeologically. A few poorly documented sites are recorded around ephemeral ponds; these have produced sparse, surface-collected materials in the forms of scattered chert debitage, occasional projectile points, lumps of burned clay, marine shell fragments, and rare pottery sherds (Hester 1969a; Bousman et al. 1990; site files, Texas Archeological Research Laboratory [TARL], The University of Texas at Austin).

Paleoindian materials have been documented at the La Paloma Mammoth site (41KN78), located in clayey sand alluvium of the ancient Palo Blanco River in the northwestern part of the sand sheet (R. Suhm 1980). Several dart points, including one possibly fluted, lanceolate specimen, were found in possible association with bones of mammoth and *Bison antiquus*. Three radiocarbon assays on bone collagen and apatite fractions date the animals to the tenth millennium B.P. Unfortunately, the dart points were recovered from backdirt piles, so direct association with the Pleistocene fauna is problematical.

To the south of the sand sheet is the Rio Grande deltaic plain, a dry, subtropical area which includes all of Cameron County, southern Willacy County, and eastern and southern Hidalgo County (Figure 25). Several physiographic zones are included within the area. Geologically, the mainland is comprised of both Pleistocene fluvial-deltaic sediments and Holocene fluvial-deltaic sediments deposited at the mouth of the Rio Grande. Upland vegetation consists of various grasses, prickly pear cactus, and clumps of mesquite, spiny hackberry, and other thornbrush species (Johnston 1955, 1963). The area is bounded on the south by the Rio Grande and its modern floodplain and delta. Prior to environmental alterations associated with modern land-use practices, the delta area supported extensive fluvial woodlands containing arboreal species such as elm, ash, hackberry, mesquite, and palmetto palms. The mainland strandline is a complex interdigitation of Pleistocene and Holocene fluvial-deltaic sediments, clay dunes, and wind tidal flats. Eolian sedimentation during the Holocene deposited the shoreline clay dunes, many of which have been shown to contain archeological deposits (Prewitt 1974). Offshore is Padre Island, which formed between ca. 3400 and 2000 B.P., subsequent to establishment of modern sea level stillstand. The island is virtually treeless, and is characterized by stable and active sand dunes. Between the mainland and Padre Island is lower Laguna Madre, a shallow-water lagoon rich in fish resources. Because the Rio Grande discharges from a prograded deltaic lobe directly in the Gulf of Mexico, lower Laguna Madre receives little fresh water through stream discharge, and thus tends toward hypersalinity and supports little in the way of economically useful shellfish species (Brown et al. 1980).

Archeological research in the delta area was initiated in the first half of this century by A. E. Anderson, an avocational archeologist who made extensive surface collections from over 350 sites in Cameron and Willacy counties (Anderson 1932;

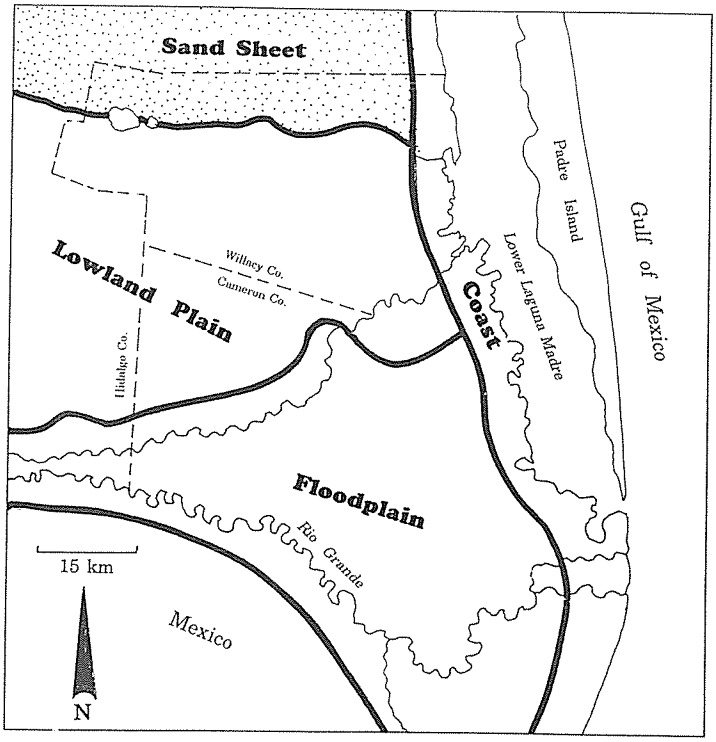

Figure 25. Map of the Rio Grande delta area, lower Texas coast, showing resource zones as defined in Bousman et al. (1990). Upland Plain, located to the west in Hidalgo County, is beyond the left margin of the map.

notes and collections on file at TARL). Anderson's collections are a remarkable record of prehistoric material culture in the area, containing numerous small, triangular and subtriangular dart and arrow points, tiny circular unifaces, and bifacially flaked, pin-like drills, a wide range of shell tools and ornaments, and pottery sherds from the Huastecan area of northeastern Mexico. The Huastecan sherds are few relative to the size of the collection, and probably represent some sort of exchange between local folk and people living to the south in the Huasteca (Mason 1935; MacNeish 1958; Campbell 1960; Hester 1980b:160). The abundant shell artifacts include conch adzes and columella gouges, edge-flaked sunray venus clamshells, and various bead and pendant forms made from conch columellae and body whorl sections.

Based upon examination of Anderson's collection, E. B. Sayles (1935) assigned archeological materials from the delta area to the Brownsville phase, which he characterized as a coastal cultural expression with a specialized shell industry. Later, R. S. MacNeish (1958) suggested a separate designation, the Barril complex, for relatively late cultural materials immediately to the south in northeastern Tamaulipas. He also suggested that both the Brownsville and Barril complexes were preceded by an aceramic Repelo complex, though he believed the latter to be better represented south of the Rio Grande.

The Brownsville complex, which may pertain largely to the Late Prehistoric period, ca. A.D. 1000 and later (Hester 1980b:160), is apparently confined to the area of the Rio Grande delta. The Complex is marked by the aforementioned shell assemblage, small lithic tools, and unstemmed arrowpoint types (e.g., Cameron and Starr [see Turner and Hester 1993]). Discrete cemeteries are known for the Brownsville complex (Hester 1969b, 1980b).

Little is known of the antecedents of the Brownsville complex (Mallouf et al. 1977; Day et al. 1981; Bailey 1990). Numerous sites have been documented in Cameron and southern Willacy counties, and many have produced a few lithic artifacts, including an occasional triangular or subtriangular dart point. Radiocarbon dates from discrete occupation components are scarce, however. In part, this probably reflects the sparse nature of cultural debris on most of the investigated sites, but it is presumably also due to a scarcity of hearth charcoal and a general dearth of other dateable organic material such as shell. Several dates are reported by Bailey and Bousman (1990) from sites along a major west-to-east trending drainage ditch in Hidalgo and Willacy counties. At 41HG128, chert flakes were recovered in possible association with Late Prehistoric charcoal ranging in age from 480 to 120 B.P. A human burial at 41WY113 produced a date on bone collagen of 1088 B.P., and most of the artifacts at the site apparently date to after 1260 B.P. (Bousman et al. 1990:138-139). Collins, Hall, and Bousman (1989) report much older dates of 3622 B.P. and 3215 B.P. from 41HG118 near the inland margin of the greater delta area; assays were run on the organic fraction of Holocene cumulic soils which were believed to be contemporaneous with non-diagnostic cultural materials. These researchers point out the potential of dates derived from soils in an area nearly devoid of other dateable materials. Finally, recent testing at the Horse Island site (41CF29) on the lower Laguna Madre mainland shoreline resulted in the recovery of a human burial which produced a calibrated age range on human bone of 1352-1261 B.P. (Eling et al. 1993).

The poor understanding of areal chronology is matched by a general lack of insight into synchronic patterns of prehistoric resource use and settlement patterns. Although various researchers have noted that sites are situated in different topographical settings and environmental zones (Prewitt 1974; Mallouf et al. 1977; Bousman et al. 1990), the relatively small number of excavations, and only sparse data on subsistence and seasonality, provide little empirical basis for inferences concerning intra-regional variations in subsistence activities at different sites within different ecological zones. It seems clear from the available ethnohistorical data that the native peoples of the delta area subsisted by hunting, plant gathering, and fishing (Salinas 1990), and there is nothing in the known archeological record to suggest otherwise. Thus, it can be assumed that prehistoric groups were more or less mobile, establishing temporary/seasonal camps within proximity to economically useful resources.

Recently, Tomka and Bousman (1990) identified several resource zones within the area (see Figure 25), and ranked them according to biotic productivity. These different zones are: (a) the Rio Grande floodplain and delta, (b) the coast, (c) the lowland plain, (d) the upland plain, and (e) the sand sheet. Since these zones are based primarily on assumed productivity, they differ in some ways from earlier sets of environmental zones based largely on geomorphic criteria (Mallouf et al. 1977; Day et al. 1981; Hall et al. 1987).

Tomka (1990) has suggested that different resource zones would have seen variable intensity of occupation according to the spatial concentration and predictability of biotic resources. He presents three alternative models of prehistoric land use, based on assumptions that: (a) hunter-gatherers in the area were more or less highly mobile in their settlement and subsistence patterns, and (b) resource zones would have been used according to the optimal availability of highly ranked food resources. Tomka further suggested that mobility would have operated within one of three hypothetical patterns of group territoriality, as follows:

1. Groups moved about within a single large territory. In this model, intra-areal territorial boundaries did not exist; people moved throughout the Rio Grande deltaic plain with free access to any of the several resource zones.
2. Rio Grande territorial groups. Here, each of several groups operated within its own territory. Territories were elongate and parallel, ran north-south, and each provided direct access to the Rio Grande floodplain along its southern edge. Only the easternmost territory provided access to the coast.
3. Coastal territorial groups. Again, there were several parallel, elongate territories, but in this case, they ran east-west, so that each provided free access to the coast. Only the southernmost territory included the Rio Grande and its wooded floodplain and delta.

Tomka and Bousman (1990) attempted to test the three models using lithic data from sites in three of the five resource zones (the sand sheet, the upland plain, and the lowland plain). They based their analyses on 12 lithic artifact categories, which they postulated would be differentially distributed within the region according to patterns of lithic material transport that reflected movement of goods and people according to one or another of the territoriality models. The working assumption was that, since lithic raw material sources were found only on the upland plain at the inland margin of the delta region, the kinds of lithics on sites in different locales would have to reflect established mobility patterns, since raw material would have been unavailable in most places. Each of the 12 lithic categories was assigned an expected value for a given resource zone, and its actual representation at a site was then determined to be greater or lesser than the expected value. Ideally, one of the three territorial models would be supported when the actual values matched those predicted according to the spatial parameters of the model.

None of the spatial models was either clearly confirmed or negated by the lithic data, however, suggesting that either (a) none of the territorial models reflect the actual spatial organization of prehistoric adaptive patterns, or that (b) the distribution of lithic materials is not a reliable indicator of prehistoric patterns of settlement and biotic resource procurement. It may be relevant to note that the distributions of lithic artifacts on Late Prehistoric sites along the central Texas coast do not conform in a patterned way to basic settlement and subsistence patterns as defined on the basis of independent criteria; the movement of lithic materials through the system apparently did not depend on the mobility patterns involved in the procurement of biotic subsistence resources (Ricklis and Cox 1993).

Regardless of the utility of lithic analyses for defining patterns of biotic resource procurement, the environmental zones defined by Tomka and Bousman may eventually provide the most useful basis for elucidating prehistoric subsistence and settlement patterns. Definition of these basic patterns in the Rio Grande delta area will depend upon data on subsistence and seasonality from a number of sites within each resource zone.

Recent findings at the Horse Island site (41CF29) on the Laguna Madre mainland shoreline (Eling et al. 1993) suggest that analyses of marine fish otoliths can provide crucial information on the seasonality of fishing on the lower coast. Eling examined 100 black drum otoliths from test excavations at the site, and found that most fish died during the late fall through spring. Relatively little fishing seems to have taken place during the summer-early fall part of the annual cycle. More data from other sites in the area will be required to determine if this was a recurrent seasonal pattern along the lower coast. It is interesting that Early Historic Spanish documents suggest that native peoples in northern Tamaulipas engaged in fishing mainly during the winter, when inland plant resources were of low seasonal productivity (Salinas 1990:117). Additional archeological seasonality studies may show that coastal fishing was an important winter subsistence focus, as it apparently was to the north along the central Texas coast.

Another point which emerges from ethnohistorical research is that the Rio Grande delta was a rich biotic zone that supported a relatively high human population density. Even as late as the middle of the eighteenth century, after native populations had generally been reduced by Old World epidemic diseases, the area may have been home to as many as 15,000 people (Salinas 1990:138). It remains to be determined whether indigenous populations were as highly mobile as assumed by Tomka (1990), or whether the rich resource zones of the delta proper and the Rio Grande and its floodplain woodlands, along with the productive fisheries of lower Laguna Madre, sustained relatively large groups for significantly long segments of the annual cycle. Conceivably, populations may have aggregated seasonally during the cooler months in these zones, and then dispersed into smaller bands to gather plant foods and hunt during the summer, as suggested by the very limited ethnohistorical data.

Sites in Cameron County tend to exhibit higher densities of cultural debris than sites situated further from the Rio Grande delta (M. B. Collins, 1990 personal communication). It may be that most professionally investigated sites show low densities of material, and thus suggest relatively short-term occupations by highly mobile groups, only because they are located in marginal areas which have fortuitously been investigated within the framework of cultural resource management projects (e.g., the various sites reported in inland Willacy and Hidalgo Counties along artificial drainage ditches [see Day et al. 1981; Collins et al. 1989; Bousman et al. 1990]). Indeed, Hester (1969b:163) has suggested that sizeable cemeteries in the southern part of the region, in proximity to the Rio Grande, may represent coastal-riverine occupations by groups that practiced only limited mobility and buried their dead repeatedly at favored locations. Systematic investigations of sites in more highly productive resource zones on the lower Texas coast may then give a significantly different picture of aboriginal adaptive patterns than is presently available from the archeological record of the region.

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REFERENCES CITED

Anderson, A. E.
1932 Artifacts of the Rio Grande Delta Region. *Bulletin of The Texas Archeological and Paleontological Society* 4:29-31.

Anderson, J. B. and M. A. Thomas
1991 Marine Ice-Sheet Decoupling as a Mechanism for Rapid, Episodic Sea-Level Change: The Record of Such Events and their Influence on Sedimentation. *Sedimentary Geology* 70:87-104.

Anderson, J. B, M. A. Thomas, F. P. Siringan, and W. C. Smyth
1992 Quaternary Evolution of the East Texas Coast and Continental Shelf. In *Quaternary Coasts of the United States: Marine and Lacustrine Systems*, edited by C. H. Fletcher III and J. F. Wehmiller, pp. 253-265. Special Publication 48. Society of Sedimentary Geology, Tulsa, Oklahoma.

Aten, L. E.
1981 Determining Seasonality of *Rangia Cuneata* from Gulf Coast Shell Middens. *Bulletin of the Texas Archeological Society* 52:179-200.
1983 *Indians of the Upper Texas Coast.* Academic Press, New York.

Bailey, G. L.
1990 Archeological Background. In *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 19-23. Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Bailey, G. L. and C. B. Bousman
1990 Site Descriptions. In *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Result of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 51-89. Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Blair, W. F.
1950 The Biotic Provinces of Texas. *Texas Journal of Science* 2(1):93-117

Black, S. L.
1986 *The Clemente and Herminia Hinojosa Site, 41JW8: A Toyah Horizon Campsite in Southern Texas*. Special Report No. 18. Center for Archaeological Research, The University of Texas at San Antonio.

Blum, M. D., J. M. Durbin, and R. A. Ricklis
1995 Geoarchaeological Investigations. In *Environmental and Human Adaptative Change on the Nueces Bay Shoreline: Phase I Archaeological Data Recovery, Koch Refinery Middle Plant, Nueces County, Texas*, edited by R. A. Ricklis, pp. 94-116. Draft MS on file, Coastal Archaeological Research, Inc., Corpus Christi.

Bousman, C. B.
1990 Paleoenvironments and Human Diets. In *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 91-103. Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Bousman, C. B., S. A. Tomka, and G. L. Bailey
1990 *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations.* Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Brown, L. F., Jr., J. L. Brewton, J. H. McGowen, T. J. Evans, W. L. Fisher, and C. G. Groat
1976 *Environmental Geologic Atlas of the Texas Coast: Corpus Christi Area.* Bureau of Economic Geology, The University of Texas at Austin.

Brown, L. F., Jr., J. H. McGowen, T. J. Evans, C. G. Groat, and W. L. Fisher
1977 *Environmental Geologic Atlas of the Texas Coastal Zone: Kingsville Area.* Bureau of Economic Geology, The University of Texas at Austin.

Brown, L, F., Jr., J. L. Brewton, T. J. Evans, J. H. McGowen, W. A. White, C. G. Groat, and W. L. Fisher
1980 *Environmental Geologic Atlas of the Texas Coastal Zone: Brownsville-Harlingen Area.* Bureau of Economic Geology, The University of Texas at Austin.

Byrne, J. R.
1975 Holocene Depositional History of Lavaca Bay, Central Texas Coast. Ph.D. dissertation, Department of Geology, The University of Texas at Austin.

Campbell, T. N.
1947 The Johnson Site: Type Site of the Aransas Focus of the Texas Coast. *Bulletin of the Texas Archeological and Paleontological Society* 18:40-75.

1952 The Kent-Crane Site: A Shell Midden on the Texas Coast. *Bulletin of the Texas Archeological Society* 23:39-77.

1956 Archeological Materials from Five Islands in the Laguna Madre, Texas Coast. *Bulletin of the Texas Archeological Society* 27:7-46.

1958a Archeological Remains from the Live Oak Point Site, Aransas County. *Texas Journal of Science* 10(4):423-442.

1958b Probable Function of Perforated Oyster Shells found in Aransas Focus Sites. *Texas Archeology* 2:7.

1960 Archeology of the Central and Southern Sections of the Texas Coast. *Bulletin of the Texas Archeological Society* 29:145-175.

1961 Origins of Pottery Types from the Coastal Bend Region of Texas. *Bulletin of the Texas Archeological Society* 32:331-336.

Carlson, D. L.
1988 *Rangia Cuneata* as A Seasonal Indicator for Coastal Archeological Sites in Texas. *Bulletin of the Texas Archeological Society* 58:201-214.

Carlson, D. L., D. G. Steele, and H. L. Bruno
1983 *Archeological Investigations at the Allison Site (41NU185), Nueces County, Texas.* Reports of Investigations No. 1. Archeological Research Laboratory, Texas A&M University, College Station.

Collins, M. B., G. D. Hall, and C. B. Bousman
1989 Archaeological Applications of Geochronological Techniques in Southern Texas. *La Tierra* 16(1):14-27.

Comuzzie, A. G., M. Marek, and D. G. Steele
1986 Analysis of Human Skeletal Remains from the Palm Harbor Site (41AS80), a Mortuary Site on the Central Gulf Coast of Texas. *Bulletin of the Texas Archeological Society* 55:213-249.

Corbin, J. E.
1963 Archeological Materials from the Northern Shore of Corpus Christi Bay, Texas. *Bulletin of the Texas Archeological Society* 34:5-30.

1974 A Model for Cultural Succession for the Coastal Bend Area of Texas. *Bulletin of the Texas Archeological Society* 45:29-54.

1976 The Archaic of the Texas Coast. In *The Texas Archaic: A Symposium*, edited by T. R. Hester, pp. 91-97. Special Report No. 2. Center for Archaeological Research, The University of Texas at San Antonio.

Cox, K. A.
1994 Oysters as Ecofacts. *Bulletin of the Texas Archeological Society* 62:220-247.

Cox, K. A. and S. A. Cox
1993 Oyster Analysis at White's Point. In *A Model of Holocene Environmental and Human Adaptive Change on the Central Texas Coast: Geoarchaeological Investigations at White's Point, Nueces Bay, and Surrounding Area*, by R. A. Ricklis, pp. 81-122. Coastal Archaeological Studies, Inc., Corpus Christi.

Cox, K. A. and H. A. Smith
1988 Kent-Crane Revisited. *La Tierra* 15(3):24-38.

Creel, D. G.
1991 Bison Hides in Late Prehistoric Exchange in the Southern Plains. *American Antiquity* 56(1):40-49.

Dalrymple, R. W., A. D. Chamrad, and T. W. Box
1992 Estuarine Facies Models: Conceptual Basis and Stratigraphic Implications. *Journal of Sedimentary Petrology* 62(6):1130-1146.

Day, D. W., J. Laurens-Day, and E. R. Prewitt
1981 *Cultural Resources Surveys and Assessments in Portions of Hidalgo and Willacy Counties, Texas.* Reports of Investigations No. 15. Prewitt and Associates, Inc., Austin.

Dillehay, T. D.
1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19:180-196.

Eling, H. H., Jr., S. A. Turpin and J. F. Powell
1993 *Limited Test Excavations at the Horse Island Site, 41CF29, Cameron County, Texas.* Technical Series 32. Texas Archeological Research Laboratory, The University of Texas at Austin.

Fenneman, N. M.
1938 *Physiography of the Eastern United States.* McGraw-Hill, New York.

Frazier, D. E.
1974 *Depositional Episodes: Their Relationship to the Quaternary Stratigraphic Framework in the Northwestern Portion of the Gulf Basin.* Circular No. 74. Bureau of Economic Geology, The University of Texas at Austin.

Fritz, G. J.
1975 *Matagorda Bay Area, Texas: A Survey of the Archeological and Historical Resources.* Research Report No. 45. Texas Archeological Survey, The University of Texas at Austin.

Hall, G. D.
1995 Interpretations and Hypotheses of Some Prehistoric Cemeteries in Texas. In *Archeological Investigations at the Loma Sandia Site (41LK28): A Prehistoric Cemetery and Campsite in Live Oak County, Texas*, edited by A. J. Taylor and C. L. Highley, pp. 633-647. Studies in Archeology 20. Texas Archeological Research Laboratory, The University of Texas at Austin.

Hall, G. D., M. B. Collins, and E. R. Prewitt
1987 *Cultural Resources Investigations along Drainage Ditch improvements, Hidalgo and Willacy Counties, Texas: 1986 Investigations.* Reports of Investigations No. 59. Prewitt and Associates, Inc., Austin.

Headrick, P.
1993 The *Archeology of 41NU11, the Kirchmeyer Site, Nueces County, Texas: Long-Term Occupation of a Coastal Clay Dune.* Studies in Archeology 15. Texas Archeological Research Laboratory, The University of Texas at Austin.

Hester, T. R.
1969a *Archeological Investigations in Kenedy and Kleberg Counties, Texas, in August 1967.* Report No. 15. Office of the State Archeologist, Texas Historical Commission, Austin.

1969b The Floyd Morris and Ayala Sites: A Discussion of Burial Practices in the Rio Grande Valley and the Lower Texas Coast. *Bulletin of the Texas Archeological Society* 40:157-166.

1975 Late Prehistoric Cultural Patterns along the Lower Rio Grande of Texas. *Bulletin of the Texas Archeological Society* 46:107-125.

1980a A Survey of Paleo-Indian Archaeological Remains along the Texas Coast. In *Papers on the Archaeology of the Texas Coast*, edited by L. Highley and T. R. Hester, pp. 1-12. Special Report No. 11. Center for Archaeological Research, The University of Texas at San Antonio.

1980b *Digging Into South Texas Prehistory: A Guide for Amateur Archaeologists.* Corona Publishing Co., San Antonio.

Hester, T. R., M. B. Collins, and F. A. Weir
1969 Two Prehistoric Cemetery Sites in the Lower Rio Grande Valley of Texas. *Bulletin of the Texas Archeological Society* 40:119-166.

Hester, T. R. and R. Parker
1970 The Berclair Site: A Single Component in Goliad County, Texas. *Bulletin of the Texas Archeological Society* 41:1-24.

Hester, T. R. and H. J. Shafer
1975 An Initial Study of Blade Technology on the Central and Southern Texas Coast. *Plains Anthropologist* 20(69):175-185.

Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343-358.

Huebner, J. A. and A. G. Comuzzie
1989 *The Archaeology and Bioarchaeology of Blue Bayou: A Late Archaic and Late Prehistoric Mortuary Locality in Victoria County, Texas.* Studies in Archeology 9. Texas Archeological Research Laboratory, The University of Texas at Austin.

Jackson, B. E., J. L. Boone, and M. Henneberg
1986 Possible Cases of Endemic Treponematosis in Prehistoric Hunter-Gatherer Populations on the Texas Coast. *Bulletin of the Texas Archeological Society* 57:183-193.

Johnson, L.
1987 A Plague of Phases: Recent Sociocultural Taxomony in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1-26.

1994 *The Life and Times of Toyah-Culture Folk, As Seen from the Buckhollow Encampment, 41KM16, of Kimble County, Texas.* Office of the State Archeologist Report 38. Texas Department of Transportation and Texas Historical Commission, Austin.

Johnston, M. C.
1955 Vegetation of the Eolian Plain and Associated Coastal Features of Southern Texas. Ph.D. dissertation, The University of Texas at Austin.

1963 Past and Present Grasslands of Southern Texas and Northeastern Mexico. *Ecology* 44(3):456-466.

Jones, F. B.
1983 *The Flora of the Texas Coastal Bend.* Welder Wildlife Foundation, Sinton Texas.

Lewis, C. R.
1988 A Possible 18,000 Year Old Hunting and Fishing Camp on the Texas Coastal Plain. *Current Research in the Pleistocene* 5:15-16.

1994 Pleistocene and Holocene Bison with Associated Artifacts from the Petronila Creek Site in South Texas. *La Tierra* 21(4):6-16.

Lorrio, W. L. and W. S. Perret
1980 Biology and Ecology of the Spotted Seatrout (Cynoscion nebulosus Cuvier). In *Proceedings of the Colloquium on Biology and Management of Red Drum and Seatrout, October 19-20, 1978*, pp. 7-13. Gulf States Marine Fisheries Commission, Ocean Springs, Mississippi.

McGowen, J. H., C. V. Procter, Jr., T. J. Evans, W. L. Fisher, and C. G. Groat
1976 *Environmental Geologic Atlas of the Texas Coastal Zone: Port Lavaca Area.* Bureau of Economic Geology, The University of Texas at Austin.

MacNeish, R. S.
1958 Preliminary Investigations in the Sierra de Tamaulipas, Mexico. *Transactions of the American Philosophical Society,* New Series, 48, Part 6.

Mallouf, R. J.
1987 *Las Haciendas, A Cairn-Burial Assemblage from Northeastern Chihuahua, Mexico.* Office of the State Archeologist Report 35. Texas Historical Commission, Austin.

Mallouf, R. J., B. J. Baskin, and K. L. Killen
1977 *A Predictive Assessment of Cultural Resources in Hidalgo and Willacy Counties, Texas.* Office of the State Archeologist Survey Report 23. Texas Historical Commission, Austin.

Mallouf, R. J. and A. N. Zavaleta
1979 *The Unland Site: A Prehistoric Group Burial from Laguna Atascosa National Wildlife Refuge, Cameron County, Texas.* Special Report No. 25. Office of the State Archeologist, Texas Historical Commission, Austin.

Mason, J. A.
1935 The Place of Texas in Pre-Columbian Relationships Between the United States and Mexico. *Bulletin of the Texas Archeological and Paleontological Society* 7:29-46.

Matlock, G. C.
1990 The Life History of Red Drum. In *Red Drum Aquaculture,* compiled by G. W. Chamberlain, R. J. Miget, and M. G. Haby, pp. 1-39. Texas A&M University Sea Grant Program, College Station.

Mock, C. R.
1966 Natural and Altered Estuarine Habitats of Penaeid Shrimp. *Proceedings of the Gulf and Caribbean Fisheries Institute* 19:86-98.

Mokry, E. R., Jr.
1980 Notes on Conch Shell Adze Technology, Texas Coast. In *Papers on the Archaeology of the Texas Coast,* edited by L. Highley and T. R. Hester, pp. 51-60. Special Report 11. Center for Archaeological Research, The University of Texas as San Antonio.

Nelson, H. F. and E. E. Bray
1970 Stratigraphy and History of the Holocene Sediments in the Sabine-High Island Area, Gulf of Mexico. In *Deltaic Sedimentation, Modern and Ancient,* edited by J. P. Morgan and R. H. Shaver, pp. 48-77. Special Publication 15. Society of Economic Paleontologists and Mineralogists.

Newcomb, W. W., Jr.
1961 *The Indians of Texas: From Prehistoric to Modern Times.* University of Texas Press, Austin.
1983 Karankawa. In *Handbook of North American Indians,* Volume 10, edited by A. Ortiz, pp. 359-367. Smithsonian Institution Press, Washington, D. C.

Odum, E. P.
1971 *Fundamentals of Ecology.* W. B. Saunders Co., Philadelphia.

Odum, H. T., B. J. Copeland, and E. A. McMahan (editors)
1974 *Coastal Ecological Systems of the United States II.* The Conservation Foundation, Washington D. C.

Paine, J. G.
1987 The Swan Lake Site and the Holocene Highstand Hypothesis. In *National Register Assessments of the Swan Lake Site, 41AS16, on Copano Bay, Aransas County, Texas,* by E. R. Prewitt, S. V. Lisk, and M. A. Howard, pp. 243-251. Reports of Investigations No. 56. Prewitt and Associates, Inc., Austin.
1991 Late Quaternary Depositional Units, Sea Level, and Vertical Movement Along the Central Texas Coast. Ph.D. dissertation, Department of Geology, The University of Texas at Austin.

Perlman, S.
1980 An Optimum Diet Model, Coastal Variability and Hunter-Gatherer Behavior. *Advances in Archeological Method and Theory,* Volume 3, edited by M. B. Schiffer, pp. 257-310. Academic Press, New York.

Perret, W. S., J. E. Weaver, R. O. Williams, P. L. Johansen, T. D. McIlwain, R. C. Raulerson, and W. M. Tatum
1980 *Fishery Profiles of Red Drum and Spotted Seatrout.* Gulf States Marine Fisheries Commission, Ocean Springs, Mississippi.

Pezeshki, S. R, R. D. De Laune, and W. H. Patrick, Jr.
1987 Response of *Spartina patens* to Increasing Levels of Salinity in Rapidly Subsiding Marshes of the Mississippi River Deltaic Plain. *Estuarine, Coastal and Shelf Science* 24:389-399.

Powell, J. F.
1988 Stress and Survival: Models of Adaptive Success in the Texas Late Prehistoric. *Bulletin of the Texas Archeological Society* 58:249-266.

Powell, J. F. *(Continued)*
1989 An Epidemiological Analysis of Mortality and Morbidity in Five Late Prehistoric Populations from the Upper and Central Texas Coast. M. A. thesis, Department of Anthropology, The University of Texas at Austin.

Prewitt, E. R.
1974 Preliminary Archeological Investigations in the Rio Grande Delta Area of Texas. *Bulletin of the Texas Archeological Society* 45:55-65.

1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201-238.

Prewitt, E. R., S. V. Lisk, and M. A. Howard
1987 *National Register Assessments of the Swan Lake Site, 41AS16, on Copano Bay, Aransas County, Texas.* Reports of Investigations No. 56. Prewitt and Associates, Inc., Austin.

Prewitt, E. R. and J. G. Paine
1988 The Swan Lake Site (41AS16) on Copano Bay, Aransas County, Texas: Settlement, Subsistence and Sea Level. *Bulletin of the Texas Archeological Society* 58:147-174.

Reagan, R. E., Jr.
1985 *Red Drum.* Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates. Fish and Wildlife Service, U. S. Department of the Interior, Washington, D.C.

Ricklis, R. A.
1988 Archeological Investigations at the McKinzie Site (41NU221), Nueces County, Texas: Description and Contextual Interpretations. *Bulletin of the Texas Archeological Society* 58:1-76.

1989 Preliminary Observations on a Late Prehistoric Bison Processing Site (41RF21) on the Central Part of the Texas Coastal Plain. *Texas Archeology* 33(2):12-13.

1990 A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Coast: A Case Study in the Roots of Adaptive Change. Ph.D. dissertation, The University of Texas at Austin.

1992a The Spread of a Late Prehistoric Bison Hunting Complex: Evidence from the South-Central Coastal Prairie of Texas. *Plains Anthropologist* 37(140):261-273

1992b Aboriginal Karankawan Adaptation and Colonial Period Acculturation: Archeological and Ethnohistorical Evidence. *Bulletin of the Texas Archeological Society* 63:211-243.

Ricklis, R. A. *(Continued)*
1993 *A Model of Environmental and Human Adaptive Change on the Central Texas Coast: Geoarchaeological Investigations at White's Point, Nueces Bay, and Surrounding Area.* Coastal Archaeological Studies, Inc., Corpus Christi.

1994a *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island.* Coastal Archaeological Research, Inc., Corpus Christi.

1994b *Limited Testing at the Mustang Lake Site, 41CL3, under Special Use Permit 73683 & ARPA Permit Aransas-94.* Coastal Archaeological Studies, Inc., Corpus Christi.

1995a (Editor)*Environmental and Human Adaptative Change on the Nueces Bay Shoreline: Phase I Archaeological Data Recovery, Koch Refinery Middle Plant, Nueces County, Texas.* Draft MS on file, Coastal Archaeological Research, Inc., Corpus Christi.

1995b Letter report prepared for Koch Refining Company, January, 1995. Coastal Archaeological Research, Inc., Corpus Christi. On file, Texas Archeological Research Laboratory, The University of Texas at Austin.

in press *The Karankawa Indians of the Texas Coast: An Ecological Study of Cultural Tradition and Change.* University of Texas Press, Austin.

Ricklis, R. A. and M. B. Collins
1995 *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas.* Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, R. A. and K. A. Cox
1991 Toward a Chronology of Adaptive Change During the Archaic of the Texas Coastal Bend Area. *La Tierra* 18(2):13-31.

1993 Examining Lithic Technological Organization as a Dynamic Cultural Subsystem: The Advantages of an Explicitly Spatial Approach. *American Antiquity* 58(3):444-461.

Ricklis, R. A. and R. R. Gunter
1986 Archaeological Investigations at the Means Site (41NU184), Nueces County, Texas. *La Tierra* 13:15-32.

Salinas, M.
1990 *Indians of the Rio Grande Delta: Their Role in the History of Southern Texas and Northeastern Mexico.* University of Texas Press, Austin.

Sayles, E. B.
1935 *An Archaeological Survey of Texas.* Medallion Papers No. 17. Gila Pueblo, Globe, Arizona.

Shafer, H. J. and C. Bond

1985 An Archeological Review of the Central Texas Coast. *Bulletin of the Texas Archeological Society* 54:271-285.

Smith, H. A.

1984 Prehistoric Settlement and Subsistence Patterns, Baffin Bay Area of the Lower Texas Coast. Ph.D. dissertation, Southern Methodist University, Dallas.

n.d. The Tucker Site, 41NU46, An Archaic Settlement on the Lower Texas Coast. Unpublished MS on file at the Corpus Christi Museum, Corpus Christi.

Solis, R. F.

1981 *Upper Tertiary and Quaternary Depositional Systems, Central Coastal Plain, Texas: Geology of the Coastal Aquifer and Potential Liquid-Waste Repositories.* Report of Investigations No. 108. Bureau of Economic Geology, The University of Texas at Austin.

Steele, D. G.

1988 Utilization of Marine Mollusks by Inhabitants of the Texas Coast. *Bulletin of the Texas Archeological Society* 58:215-248.

Steele, D. G. and E. R. Mokry, Jr.

1985 Archeological Investigations of Seven Prehistoric Sites Along Oso Creek, Nueces County, Texas. *Bulletin of the Texas Archeological Society* 54:287-308.

Story, D. A.

1968 *Archeological Investigations at Two Central Gulf Coast Sites.* Report No. 13. State Building Commission, Archeological Program, Austin.

1985 Adaptive Strategies of Archaic Cultures of the West Gulf Coastal Plain. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 19-56. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Stuiver, M. and G. W. Pearson

1986 High-Precision Calibration of the Radiocarbon Time Scale, AD 1950-500 BC. *Radiocarbon* 28(2B):805-838.

Stuiver, M. and P. J. Reimer

1993 Radiocarbon Calibration Program, Quaternary Isotope Lab, University of Washington. *Radiocarbon* 35:215-230.

Suhm, D. A. and E. B. Jelks

1962 *Handbook of Texas Archeology: Type Descriptions.* Texas Archeological Society Special Publication No. 1 and Texas Memorial Museum Bulletin No. 4, Austin.

Suhm, D. A., A. D. Krieger, and E. B. Jelks

1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Suhm, R. W.

1980 The La Paloma Mammoth Site, Kenedy County, Texas. In *Papers on the Archaeology of the Texas Coast*, edited by L. Highley and T. R. Hester, pp. 79-103. Special Report No. 11. Center for Archaeological Research, The University of Texas at San Antonio.

Sutter, F. C., R. S. Waller, and T. D. McIlwain

1986 *Black Drum.* Species Profiles: Life Histories and Environmental Requirements of Coastal Fisheries and Invertebrates (Gulf of Mexico). Fish and Wildlife Service, U.S. Department of the Interior, and Coastal Ecology Group, Waterways Experiment Station, U.S. Army Corps of Engineers, Washington, D.C. and Vicksburg.

Tomka, S. A.

1990 Models of Late Holocene Human Adaptation in the Lower Rio Grande Valley. In *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 25-44. Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Tomka, S. A. and C. B. Bousman

1990 Testing the Hunter-Gatherer Mobility and Territorial Models for the Lower Rio Grande Valley. In *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 105-133. Reports of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Turner, E. S. and T. R. Hester

1993 *Stone Artifacts of the Texas Indians.* Second Edition. Gulf Publishing Company, Houston.

Warren, J. E.

1984 *A Cultural Resources Survey at Packery Point Development, Nueces County, Texas.* Report 106. Archeology Consultants, Inc., George West, Texas.

1993 *Archeological Investigations at Koch Refining Company Middle Plant Project, Nueces County, Texas.* Archeology Consultants, Inc., George West, Texas.

Weinstein, R. A.

1992 *Archaeology and Paleogeography of the Lower Guadalupe River/San Antonio Bay Region: Cultural Resource Investigations Along the Channel to Victoria, Calhoun and Victoria Counties, Texas.* Coastal Environments, Inc., Baton Rouge, Louisiana.

Weinstein, R. A. *(Continued)*
1994 *Archaeological Investigations Along the Lower Lavaca River, Jackson County, Texas: The Channel to Red Bluff Project.* Coastal Environments, Inc., Baton Rouge, Louisiana.

Whittaker, R. H.
1975 *Communities and Ecosystems.* 2nd Edition. MacMillan, New York.

Zimmerman, L. S., D. G. Steele, and J. D. Meyer
1988 A Visual Key for the Identification of Otoliths. *Bulletin of the Texas Archeological Society* 58:175-200.

The Archeology of the Post Oak Savannah of East Central Texas

Ross C. Fields

ABSTRACT

This paper presents an overview of the Native American culture history of the Post Oak savannah of East Central Texas, focusing especially on the Late Holocene epoch. This is accomplished chiefly by reviewing the data from Cooper Lake in the upper Sulphur River basin and the Jewett Mine in the upper Navasota River basin and adjacent Trinity River valley. Relevant information from three other project areas in the region—Lake Fork Reservoir, Richland/Chambers Reservoir, and the Gibbons Creek Mine—is discussed in less detail, resulting in data from a north–south transect along the western edge of East Texas.

INTRODUCTION

The primary goal of this paper is to present an overview of the culture history of the Post Oak savannah of East Central Texas. I had planned originally to accomplish this by synthesizing the wealth of data recovered during the last two decades in and near five project areas—Cooper Lake, Lake Fork Reservoir, Richland/Chambers Reservoir, Jewett Mine, and Gibbons Creek Mine—which provide a north–south transect along the western edge of East Texas. However, this paper focuses on data from the two areas with which I am most familiar (Cooper Lake and Jewett Mine), using them as a springboard to point out overall trends in the prehistory of the region. Even within these two areas, I chiefly discuss the archeological data from the sites where the most work has been done and where components can be isolated. What this leaves out are the data from survey and testing projects, as well as the data from excavated sites where the remains of multiple components cannot be separated. Where appropriate and feasible, however, information from the other project areas listed above is discussed herein, but I have not attempted detailed evaluations of the archeological data from these other projects.

The Post Oak savannah occupies that part of the West Gulf Coastal Plain that lies between the pine forests of deep East Texas and the Blackland Prairie to the west (Figure 1). As such, it is at the western edge of the eastern U.S. woodlands. As the name indicates, it is a vegetational region characterized by hardwood forests mixed with prairies. The forests are dominated by a variety of species of nut–producing oaks and hickories, and these apparently played a vital role in prehistoric subsistence. The region also supports a rich fauna, with taxa such as white–tailed deer, turtles, and various small mammals being especially important prehistorically.

The southern part of the area under study here is drained by the southeastward–flowing Trinity and Brazos rivers, while the Sulphur and Sabine rivers flow eastward through the northern part. The climate throughout the region is temperate. Mean annual temperatures range from 63° F in Delta County in the north, to 68° F in Grimes County in the south, with a corresponding increase in the length of the growing season from 233 days to 278 days. Mean annual precipitation varies from 36.6 inches to 45.0 inches; rainfall tends to be more abundant in the northern counties (Delta, Hopkins, Rains, Van Zandt, and Wood) and in Grimes and Madison Counties at the southeastern edge of the region, while rainfall averages less than 40 inches elsewhere (Natural Fibers Information Center 1987).

Just when this modern climate, and flora and fauna approximating those of the historic period prior to disruption by modern land use practices, became established remains debatable, but the data presented by Collins and Bousman (1993:59) suggest that this happened about 3,000 years ago. Offering abundant natural resources, the region was

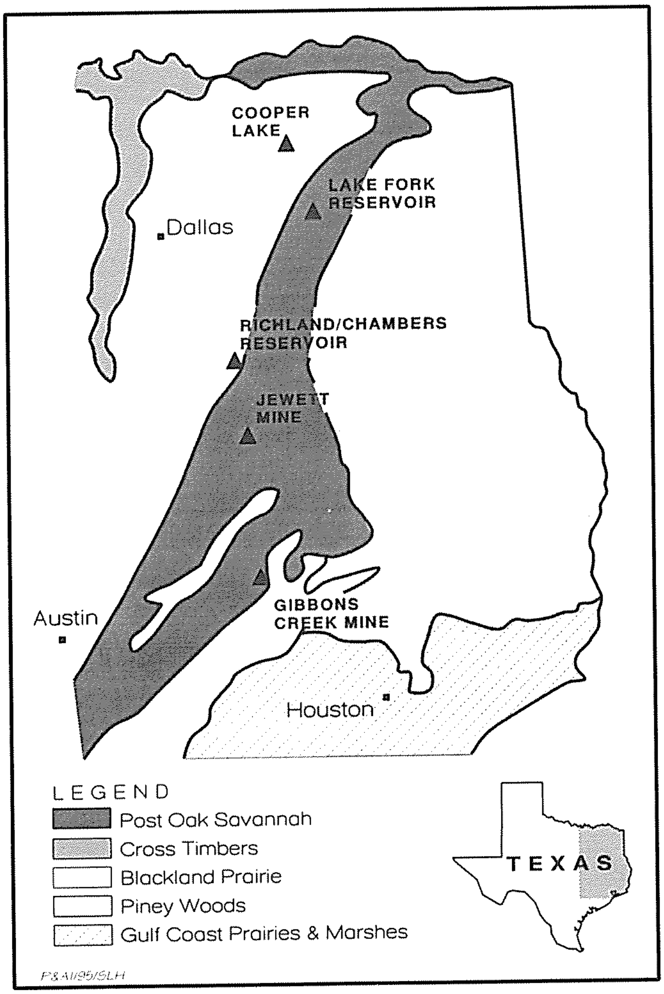

Figure 1. Map showing the Post Oak savannah of East Central Texas and major archeological projects.

occupied intensively by Native Americans at this time and later, and this partly explains the high frequency of archeological sites dating to the Late Holocene (Figure 2). Also contributing to the scarceness of earlier archeological remains, however, are changes in the landscape that removed many pre–Late Holocene sites through erosion, and deeply buried others. Thus, while the record recovered to date is primarily a Late Holocene one, this almost certainly exaggerates a general increase through time in occupational intensity in the Post Oak savannah. Because earlier sites are so few and paleoenvironmental conditions are so poorly understood, this narrative focuses mainly on just the last few thousand years of the archeological record.

The study area for this summary is based only partly on environmental factors. This review is limited to the Post Oak savannah and the adjacent eastern edge of the Blackland Prairie specifically to avoid dealing with Northeast Texas on the east, and North Central and Central Texas on the west. Thus, this study intentionally skirts the Caddo heartland, and it ignores the wealth of data obtained from numerous projects on the central and western Blackland Prairie, the Eastern Cross–timbers, and the eastern Edwards Plateau (e.g., Ray Roberts Reservoir, Lewisville Lake, Lavon Lake, Lake Ray Hubbard, Mountain Creek Lake, Bardwell Lake, Navarro Mills Reservoir, Aquilla Reservoir, Whitney Lake, Waco Lake, Fort Hood, Stillhouse Hollow Lake, North Fork Reservoir, and Granger Lake [see Prikryl 1993 for a summary]). For at least certain parts of the prehistoric period, these areas had culture histories that were distinctly different from those of East Central Texas, and this provides some rationale for viewing them separately. This is not to say, of course, that these areas are irrelevant to the archeology of the Post Oak savannah. In fact, one of the things that makes East Central Texas interesting is its position at the edge of the Caddoan area and only a short distance east of chert–rich Central Texas (e.g., Frederick and Ringstaff 1994).

The study area for this summary, then, encompasses parts of 14 counties, extending some 300 km from Delta County on the north to Grimes County on the south (see Figure 1). The northern edge is defined to include Cooper Lake because, while it is actually in the eastern Blackland Prairie, this part of the Sulphur River valley has yielded important information recently about the prehistory of this edge of the Caddoan area, and Post Oak savannah habitat is present in part of the Cooper Lake basin. The study area is not extended any farther north, however, to avoid the distinctly different (at least during the Late Prehistoric period) Red River valley (Bruseth 1995).

The second anchor for this discussion is the Jewett Mine and adjacent Lake Limestone. These project areas are about 200 km south of Cooper Lake in the upper Navasota River valley, with some of the Jewett Mine sites straddling the divide between the Navasota and Trinity rivers. Important projects between Cooper Lake and the Jewett Mine include Lake Fork Reservoir, which is in the Sabine River drainage, and Richland/Chambers Reservoir,

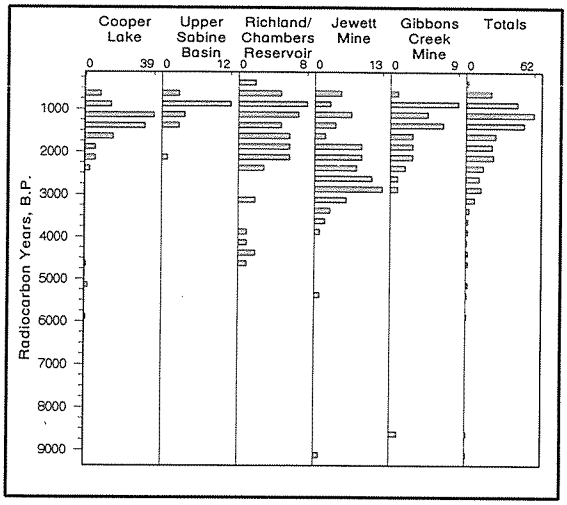

Figure 2. Histograms of uncalibrated, non-modern radiocarbon assays from archeological contexts at selected project areas in the Post Oak savannah; assays are grouped in 250–year increments. Cooper Lake assays are on nutshells/charcoal, most corrected for carbon isotope fractionation; Sabine Basin assays are on nutshells/ charcoal, not corrected for fractionation; Richland/ Chambers Reservoir assays are mostly on charcoal/ nutshells with a few on human bones, not corrected for fractionation; Jewett Mine assays are mostly on charcoal/ nutshells with a few on soil humates or human bones, most corrected for fractionation; Gibbons Creek Mine assays are on charcoal/nutshells, most corrected for fractionation.

which is situated near where the Trinity River enters the Post Oak savannah. One of the notable gaps in archeological coverage for the region occurs downstream from this latter project area (i.e., the stretch of the Trinity River valley that separates Freestone and Leon Counties on the west from Anderson and Houston Counties on the east).

The southern limit of the study area is marked by the Gibbons Creek Mine on the lower Navasota River. While the Post Oak savannah runs southwestward from Grimes County all the way to the other side of the Guadalupe River, the study area discussed here does not extend beyond the Brazos River. There are two main reasons for this. First, the prehistory of the southern part of the Post Oak savannah apparently has more to do with the archeology of Central and Coastal Texas than eastern Texas. And second, while there have been some interesting recent studies of sites in the Brazos River valley (e.g., Bowman 1985, 1991; Roemer and Carlson 1987; Thoms 1993), most of the projects on the Brazos and beyond to the Colorado River have been relatively limited in scope, and this makes it difficult to incorporate the results of these projects into a cultural historical narrative.

The summary below is broken down into three major time periods, the first dealing with archeology that is more than about 4,000 years old (i.e., predating the Late Archaic period), the second encompassing the interval from ca. 2000 B.C. to about A.D. 800 (i.e., the Late Archaic and Woodland or Early Ceramic periods), and the third discussing prehistoric archeology postdating A.D. 800 (i.e., the Late Prehistoric period). Use of this simple scheme accomplishes several things. First, it provides a way to separate out the earliest remains, which are so skimpy that it is hard to do more than catalog their existence. Second, it partly parallels traditional chronologies based on technological changes in weaponry and food preparation (i.e., the introduction of the bow and arrow and pottery vessels), so it should be easy to relate what is said here to chronologies in other areas. And third, it allows for more narrative flow than would be possible if the timeline was segmented into a greater number of temporal units, some of which currently have only limited support in the radiocarbon evidence.

One issue that this summary does not address is use of the region by Native Americans during the historic period. Materials dating to this interval are few and far between in the project areas listed above, with the most conspicuous historic Native American sites in the Post Oak savannah—Gilbert, Pearson, and Vinson (Duffield and Jelks 1961; Jelks 1967; Smith 1993)—representing Wichita groups that moved southward into Texas in the seventeenth and eighteenth centuries. While this certainly is an interesting topic, its proper geographic frame of reference is all of North Central Texas rather than the Post Oak savannah. Further, except for the publication of the report on the 1960s excavations at the Vinson site (Smith 1993), not much new information has appeared recently on these Norteño sites.

PRE–LATE ARCHAIC PERIOD

Cooper Lake

Only one site with an isolable component dating to this interval, the Finley Fan site (41HP159), has been excavated and analyzed (Gadus et al. 1992), although it is likely that materials of this age occur mixed with later deposits at a number of sites, especially along the upland edge adjacent to the valley. The Finley Fan site is situated in the upper deposits of a thick Holocene alluvial fan. Most of the archeological materials are Late Archaic in age, but a Middle Archaic component (Analysis Unit 3/4) dating to 4450–3250 B.C. was found in the lower part of the excavations. The work in this low–density cultural deposit found four cultural features, all of which are burned rock concentrations interpreted as food–processing facilities or general–purpose hearths, and recovered a small collection of 462 lithic artifacts. The artifacts are dominated by unmodified debitage, but small numbers of dart points (1 Yantis and 2 untyped fragments), other shaped tools, modified flakes, cores, and ground/battered stones were found as well (Figure 3). No faunal or macrobotanical remains were recovered because of poor preservation.

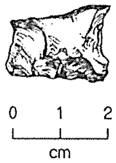

Figure 3. Yantis dart point from the Middle Archaic component at the Finley Fan Site (41HP159), Cooper Lake.

The remains appear to represent small occupational loci adjacent to the hearths. The intensity of use appears to have been quite low, and comparisons with later sites at Cooper Lake suggest that the Middle Archaic occupations of Finley Fan were relatively short lived and infrequent. Nonetheless, the materials recovered are more suggestive of residential occupations than use strictly for procurement/processing tasks.

Jewett Mine and Lake Limestone

Components predating the Late Archaic period also are scarce in the upper Navasota River basin, with only two excavated sites apparently containing substantial materials dating to this temporal interval (Fields 1990). Both sites are in the uplands along a tributary to the Navasota River, and the archeological remains are contained in sandy colluvium. The earlier of these is Analysis Unit 4/5 at the Lambs Creek Knoll site (41LN106), where a single radiocarbon assay of ca. 8000 B.C. and the small collection of classifiable dart points (1 Golondrina, 1 Hoxie, 1 Woden, 1 untyped specimen with a parallel stem, and 4 untyped lanceolate points; Figure 4) suggest that a Late Paleoindian–Early Archaic component is present (although a couple of sandy paste sherds in these deposits attest to the inclusion of later materials as well). These deposits contained a single burned rock hearth and yielded a modest collection of 997 lithic artifacts. The formal tool assemblage contains an unusually high percentage of unifaces, with most of the other tools being dart points and other bifaces. Because of poor preservation, almost no faunal or macrobotanical remains were recovered.

A somewhat later component was identified as Analysis Unit 4/5 at the Charles Cox site (41LN29A). While no radiocarbon dates were obtained from these deposits, a pre–Late Archaic age is suggested for some of the remains by the dated Late Archaic deposits above, and by the relatively high proportion of untyped expanding–stem and parallel–stem dart points (n=9; Figure 5), although four later points (Axtell, Gary, and Neches River types) and a single earlier point (San Patrice) are included as well. No cultural features were found in this unit, but scattered burned rocks suggest the former presence of burned rock hearths. The lithic artifact collection consists of 2,359 specimens, with the formal tools being dominated by dart points and other bifaces. This component yielded no faunal remains at all and very few macrobotanical remains.

Based on comparisons to other sites in the area, both of these pre–Late Archaic components are interpreted as residential bases that were used infrequently. While somewhat higher use intensity is indicated for Charles Cox than the Lambs Creek

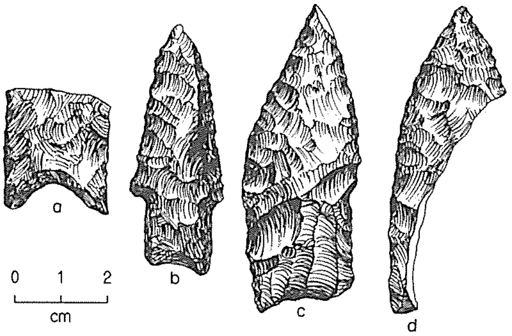

Figure 4. Dart points from the Late Paleoindian–Early Archaic component at Lambs Creek Knoll (41LN106), Jewett Mine: a, Golondrina; b, Hoxie; c–d, untyped lanceolates.

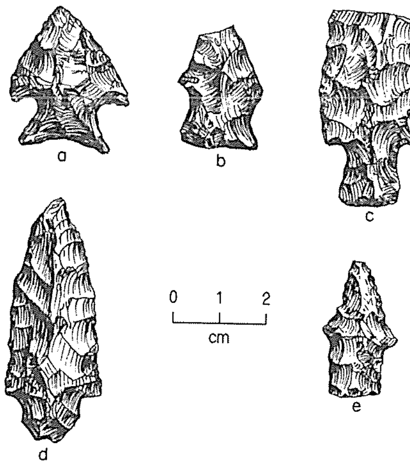

Figure 5. Dart points from the possible Early to Middle Archaic component at the Charles Cox site (41LN29A), Jewett Mine: a–c, untyped expanding stem; d–e, untyped parallel stem.

Knoll site, it is difficult to relate this to differences in occupation length and/or frequency of use, and there is insufficient evidence to suggest that this reflects an increase in population densities through time. The evidence from these two sites is consistent with the idea that the upper Navasota River basin was used by foragers during this time, and that population densities were low.

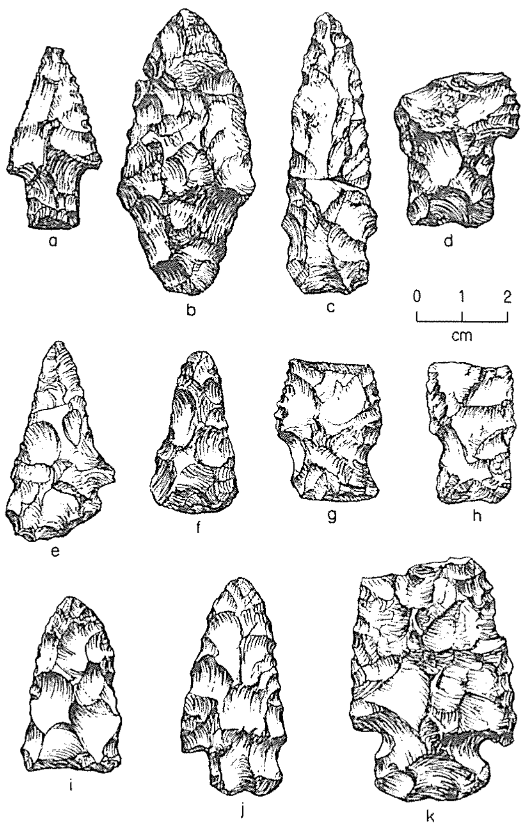

Figure 6. Dart points from the Late Archaic component at the Finley Fan site (41HP159), Cooper Lake: a, Dawson; b, Gary; c, Kent; d, Morrill; e, Trinity; f, Wesley; g–h, Yarbrough; i, untyped stemless; j–k, untyped expanding stem.

LATE ARCHAIC AND WOODLAND PERIOD

Cooper Lake

In the upper Sulphur River basin, components dating to the Late Archaic and Woodland periods are moderately common, with the best excavated examples occurring at six sites: Finley Fan (41HP159), Tick (41DT6), Spike (41DT16), Johns Creek (41DT62), Hurricane Hill (41HP106), and 41HP137 (Fields et al. 1993; Gadus et al. 1992; McGregor 1989; Perttula 1990a). Analysis Unit 1/2 at the Finley Fan site is the sole isolated and excavated Late Archaic component. Although datable materials were scarce, the evidence suggests that this component dates to ca. 1650–150 B.C. The work in this part of the site identified two burned rock hearths and yielded 2,939 lithic artifacts. The formal tools are dominated by bifaces and a variety of kinds of dart points (2 Dawson, 2 Gary, 2 Kent, 2 Morrill, 2 Trinity, 1 Wesley, 1 Yantis, 4 Yarbrough, 4 untyped specimens, and 12 fragments; Figure 6), but gouges, unifaces, cobble tools, and ground/battered stones also were recovered. Faunal and macrobotanical remains were not preserved.

As in the earlier component at this site, the Late Archaic remains appear to represent small, hearth-associated occupational loci. The intensity of use, although somewhat higher than for the earlier component at the Finley Fan site, is low compared to later sites in the area, and it is suggested that the Late Archaic occupations of the Finley Fan site were short lived and infrequent. The artifacts recovered appear to indicate residential, rather than limited purpose extractive tasks, however.

Tick and Spike are similar kinds of sites situated in alluvium on low floodplain knolls adjacent to the South Sulphur River. Both have middens dating to the Woodland and Early Caddoan periods and containing abundant artifacts and faunal remains. The Woodland component at Tick

(Analysis Unit 3/4) appears to date chiefly to ca. A.D. 50–700, while that at Spike (Analysis Unit 3/4) dates primarily to ca. A.D. 0–800. No features were found in the Woodland component at Tick, but the Woodland deposits at Spike contained two possible dumps of hearth debris, one small pit, and one large pit. The artifact collections from these deposits consist of 17,559 lithic items, 82 ceramic vessel sherds, and 75 bone/antler/shell tools or ornaments (mostly awls, but also antler pressure flakers, beamers, a graver/scraper, and beads). The 19 arrow points recovered represent later materials translocated down from the overlying later deposits, and this is probably true for the ceramics as well, since they are so few in number and no different from the pottery in the overlying Late Prehistoric contexts. The formal lithic tools are dominated by bifaces and dart points; perforators, gouges, unifaces, cobble tools, burins, ground stones, hammerstones, and pitted stones are present in much smaller numbers. These deposits contained 172 dart points, with 76 percent of the classifiable specimens being Gary points; most of the remainder are typed as Dawson and Kent (Figure 7). Both components yielded large faunal collections containing a diverse array of taxa, with turtles, deer, rabbits, other small mammals, and mussels being most common; Spike also yielded a few elements identified as bison. The modest collections of macrobotanical remains consist mostly of hickory nutshells, with *Pediomelum* (formerly *Psoralea*) rhizome fragments, acorns, and vetch/peavine seeds occurring in small numbers.

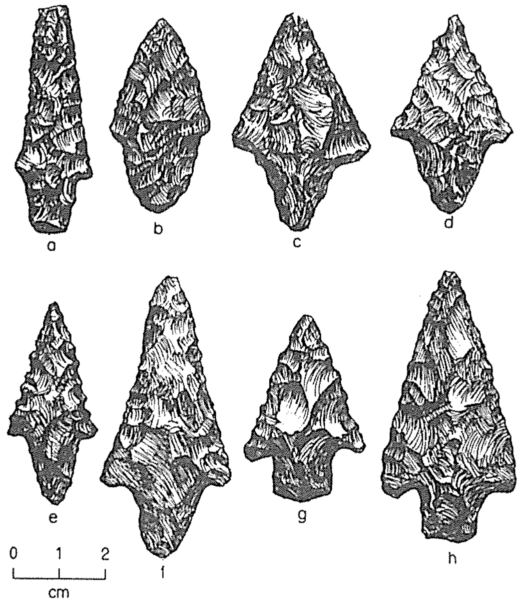

Figure 7. Dart points from Woodland contexts, Cooper Lake: a, Dawson; b–f, Gary; g–h, Kent.

The Johns Creek site sits in probable alluvial deposits on a low knoll adjacent to Johns Creek on the floodplain of the South Sulphur River. The radiocarbon assays provide equivocal evidence about the chronology of the site, but the diagnostic artifacts suggest occupations over much or all of the Woodland period and a light later deposit is present as well. The Woodland component (Analysis Unit 3/4) lacks midden deposits and no cultural features were found, but a sample of 3,348 lithic artifacts was obtained. The collection of formal tools consists mostly of bifaces and dart points, with small numbers of perforators, gouges, unifaces, cobble tools, burins, ground stones, hammerstones, and pitted stones. The three arrow points clearly are intrusive, while the collection of 56 dart points is dominated by specimens classified as Gary or Kent (77 percent of the classifiable specimens). Organic materials were poorly preserved, and the faunal collection is too small to be informative. The meager macrobotanical collection contains hickory and pecan nutshells, acorns, and wild plum seeds.

Hurricane Hill is a large upland site with a complex history of use, although most of the archeological remains appear to represent occupations during the middle part of the Late Prehistoric period and the Woodland period. Woodland materials are best represented in a portion of the site termed the Southwest Rise, where a midden deposit and numerous cultural features were encountered and a modest artifact sample was obtained (Perttula 1990a, 1995). Unfortunately, this part of the site yielded almost no faunal or botanical remains, and it has not been dated. The artifacts assigned to the Woodland period component consist of 19 dart points (79 percent typed as Gary), 51 other chipped stone tools, 8 cores, and 1 hematite axe. Small numbers of arrow points (n=4) and ceramics (n=45) were recovered, but these mostly represent later use by Caddoan peoples. While a few of the features relate to the later component (e.g., an extended burial and an intrusive pit), most of the features are interpreted as being associated with the Woodland component. Included are 12 pits, 9 postholes or possible postholes, 6 possible flexed burials, 4 single cremations, 2 multiple cremations, and 1 hearth. The burials appear to constitute a structured cemetery, perhaps representing a fairly short span of time, and the postholes and pits may mark an adjacent locus of domestic activities. According to Perttula (1990a:276–277), the remains are indicative of multi–seasonal, although not year–round, use for residential purposes. While the delta^{13}C values of –15.0 and -17.6 obtained on the collagen fraction of bones from Burials 15 and 17 imply that C_4 plants, possibly including maize, were an important part of the diet, maize has not been recovered from any Woodland site in the project area, and the lack of dates from the Southwest Rise opens the door for questioning the Woodland age assessment of these burials. While Hurricane Hill is one of the more intriguing sites at Cooper Lake, integrating the data from its Woodland component with the information from other Woodland sites in the area is complicated by the limited controlled excavations there and the fact that it has not been dated.

Site 41HP137, which is located in an upland setting near Hurricane Hill, is a small site that appears to have both Woodland and Late Prehistoric components. Because of uncertainty about the extent to which materials from these components may be mixed, it is difficult to interpret 41HP137 on an assemblage level. Regardless, the site did yield an interesting collection of botanical remains from two pit features that were dated to the Woodland period (140 B.C. and A.D. 490). This collection consists of hickory nutshells, cultivated squash rind fragments, acorn shells, and tuber and rhizome fragments identified tentatively as *Psoralea* (McGregor 1989:8–15), and this hints at a subsistence base containing both wild and cultivated plants.

In sum, it appears that the Woodland period saw a substantial increase in the intensity of site use over the Archaic period, and this probably at least partly reflects increased population densities. Occupations of at least moderately long duration are suggested for most, if not all, of the Woodland components at Cooper Lake, and frequent reuse is indicated for several. This increased redundancy in the use of certain locales suggests decreased residential mobility. The Cooper Lake sites appear to have been used for broad ranges of procurement, processing, and maintenance activities, but there is no evidence of sedentary populations. Subsistence pursuits focused on the hunting of a wide variety of woodland, woodland–edge, and aquatic taxa and on the gathering of wild plant foods. While there is some indication of the use of squash, there is no evidence for substantial reliance on horticulture. Thus, these Woodland components may be interpreted as hunter–gatherer residential bases.

JEWETT MINE AND LAKE LIMESTONE

The upper Navasota River basin was occupied intensively during the Late Archaic and Woodland periods (Fields 1987, 1990; Fields and Klement 1995; Fields et al. 1991; Mallouf 1979). Late Archaic components have been isolated at the following eight sites: Buffalo Branch (41FT311, Analysis Unit 3), Rena Branch (41FT334, Analysis Unit 5/6), Charles Cox (41LN29A, Analysis Unit 3), Alley Road (41LN149B, Analysis Unit 4/5), Moccasin Springs (41LN247C, Analysis Units 3–5), Old Union Bridge (41LT12, Analysis Unit 4), Carl Sadler (41LT17, Analysis Unit 4/5), and 41LT44 (Analysis Unit 1). Components dating predominantly to the Woodland period are present at the Rena Branch (Analysis Unit 4), Charles Cox (Analysis Unit 2), Harris Hole (41LN30, Analysis Unit 1/2), Alley Road (Analysis Unit 3), Old Union Bridge (Analysis Unit 3), and Carl Sadler (Analysis Unit 3) sites. The Bottoms (41FT89, Analysis Unit 3), Buffalo Branch (Analysis Unit 2), Lambs Creek Knoll (41LN106, Analysis Unit 3), and Cottonwood Springs (41LN107, Analysis Unit 2/3) sites have components with mixed Late Archaic and Woodland materials or components dating to the Late Archaic–Woodland transition. In all, 20 components dating to this interval have been isolated, and 62 of the 85 radiocarbon dates from archeological contexts at the mine pertain to this interval (4000–1250 B.P., see Figure 2).

Three of these sites (Old Union Bridge, Carl Sadler, and 41LT44) are situated along the Navasota River, five sites (Charles Cox, Harris Hole, Lambs Creek Knoll, Cottonwood Springs, and Alley Road) are along tributaries to the Navasota River, and four sites (Bottoms, Buffalo Branch, Rena Branch, and Moccasin Springs) are along the upper reaches of tributaries to the Trinity River. Old Union Bridge, Carl Sadler, and Harris Hole are in alluvial settings, while the deposits at the other sites are primarily colluvial. Midden staining was present at Charles Cox (Analysis Units 2 and 3) and maybe Old Union Bridge, and most sites have limited ranges of feature types. The features identified include the following: 51 concentrations of burned rocks interpreted as hearths, shallow baking pits, or discarded hearth debris (and large quantities of scattered burned rocks); 1 possible non-rock hearth; 2 pits of unknown function; 1 concentration of ground stone tools; and 8 definite or possible human burials. Seven of the burials were at a single site (Cottonwood Springs), where they constituted a small cemetery dating to ca. 2800–2000 B.P. Six of the burials in this cemetery contained cremations, and two were accompanied by exotic offerings (galena and a slate gorget).

The artifact collections from these 20 components consist of 59,441 lithic items and just 104 ceramic vessel sherds. Most of the formal lithic tools are dart points and other bifaces, but other tool types—perforators, gouges, unifaces, cobble tools, ground and battered stones, pitted stones, and pigment stones—occur as well. Small numbers of arrow points were recovered from some components (totaling 29 points and fragments), but they appear to be intrusive from later occupations. The dart point collection consists of over 400 specimens. The best represented groups among the classifiable specimens are Dawson (19 percent), Gary (9 percent), Kent (8 percent), Neches River (6 percent), and Godley (5 percent), as well as a variety of untyped expanding–stem (14 percent), parallel–stem (14 percent), and contracting–stem (7 percent) forms (Figure 8). Dawson, Gary, Godley, and Kent points appear to have been used throughout this interval, while Neches River points are most frequent in Woodland components. Minor types that are most common in Late Archaic components are Axtell and Yarbrough.

Most of the ceramics (92 percent) are in Woodland components or mixed Woodland and Late Archaic components, and it is certain that the few sherds in Late Archaic contexts are intrusive. Interestingly, the ceramics are almost evenly split between the sandy paste ware that one would expect for this time period (e.g., Story 1990) and grog– or bone–tempered ceramics, which are found more often in later contexts at the mine and elsewhere in the southern part of East Texas. Given this, it is possible that many of these are intrusive later specimens and that ceramics were an even less prominent part of the material culture than is implied by the small number of sherds found in Woodland contexts at the mine. Another interesting aspect of the ceramic collection is the inclusion of two additional, unusual kinds of pottery: two sherds that are tempered with shell and two sherds that are untempered but have a fine kaolin paste. At least the shell–tempered specimens, and maybe the kaolin–paste sherds as well, may be related to the possibly early shell–tempered ceramics found at Richland/Chambers Reservoir (McGregor and Bruseth 1987:180). The ceramics from Woodland contexts in the mine area are too few and too small to contribute much information about the range of vessel forms, and only a very few display nondistinctive decorations (e.g., random body punctations or incised lines).

Because of the sandy sediments and poor preservation, some of the Late Archaic and Woodland components at the Jewett Mine and Lake Limestone have yielded no faunal remains at all. Where animal bones have been recovered, they tend to be few in number and highly fragmented. The only identifiable specimens are deer and turtle. Macrobotanical remains also are not well preserved, although most of these components have yielded burned nutshells. The nutshells are predominantly hickory (*Carya*), with a few sites also containing walnut (*Juglans*). Based on these limited data, it appears that subsistence pursuits focused on

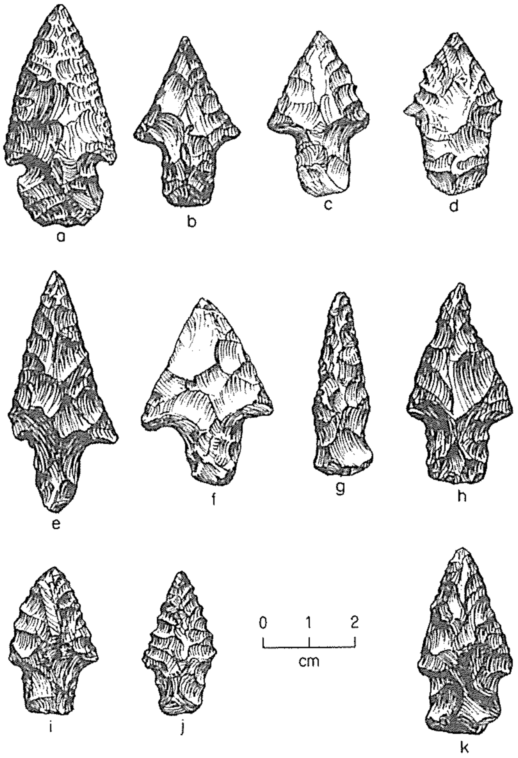

Figure 8. Dart points from Late Archaic and Woodland contexts at the Jewett Mine: a, Axtell; b–d, Dawson; e–f, Gary; g, Godley; h–i, Kent; j, Neches River; k, Yarbrough.

woodland resources, and there is no evidence for horticulture during this time.

Of these 20 Late Archaic and Woodland components, 15 (at 11 sites) are interpreted as residential bases and five (at three sites) as procurement/processing locations. Five of the residential base components (at three sites) are located along the Navasota River, while the others are in the uplands to the east. All five of those in riverine settings are interpreted as general–purpose residential bases (i.e., lacking a special focus on particular activities). In contrast, the upland components consist of two general–purpose residential bases (at two sites) and eight residential bases at which activities focused heavily on plant processing and secondarily on hunting (at seven sites). This distinction suggests that Late Archaic–Woodland settlement systems were scheduled based on the occurrence of plant foods. Eleven of the residential sites appear to have been occupied with low or moderately low frequency, suggesting low population densities overall. A greater intensity of use is indicated for the other four residential bases, and this probably reflects more–frequent reoccupation, the relatively long term nature of the occupations, or both.

The five analysis units interpreted as procurement/processing locations appear to have had a primary focus on plant processing and a secondary focus on hunting–related activities. Four components (at two sites) are in the Trinity River basin in the eastern part of the study area, while the fifth is along a Navasota River tributary to the west. The moderately high to high frequency of use suggested for three of these is surprising in view of the low use frequency indicated for most of the residential sites, and it suggests highly scheduled reuse of particular resource patches.

The data from these 20 components are consistent with the idea that Late Archaic–Woodland groups were chiefly foragers. Procurement/processing locations suggesting logistical use are not frequent, and the few that have been identified suggest intensive exploitation of particular locales. Settlement systems appear to have been highly scheduled, probably on a seasonal basis, with residential sites in riverine settings differing from those in the uplands. Comparisons with earlier components are difficult, but the much greater frequency of Late Archaic–Woodland components and the overall greater intensity of use suggest increased population densities, decreased territories, or both. This also is suggested by the occurrence of the cemetery at the Cottonwood Springs site (41LN107).

LATE PREHISTORIC PERIOD

Cooper Lake

The Cooper Lake area has yielded abundant information on the Late Prehistoric period, especially for the early part (A.D. 800–1300). Components dating to this interval can be isolated at five of the excavated sites—Tick (41DT6, Analysis Unit 2), Spider Knoll (41DT11), Spike (41DT16, Analysis Unit 1/2), Thomas (41DT80), and Doctors Creek (41DT124)—and these are the ones providing most of the summary data below (Cliff 1989; Fields et al. 1993, 1994; Martin 1989). Many other excavated sites (e.g., Manton Miller [41DT1], Ranger, [41DT37], Luna [41DT52], Lawson [41HP78], Arnold [41HP102], Hurricane Hill [41HP106], Cox [41HP105], and 41HP137) have cultural deposits of this age as well, although separation of the early Late Prehistoric remains from earlier or later ones has proven difficult.

Three of the five sites where early Late Prehistoric components can be isolated are on floodplain knolls adjacent to the river and appear to be in alluvial contexts, while the other two (Spider Knoll and Doctors Creek) are on old terraces with limited colluvial deposition. All five sites have middens, and all but Tick have numerous cultural features, including 14 hearths, 3 possible hearth dumps, 1 shell–filled pit, 58 other pits, 13 pits/postholes, 63 postholes, and 10 human burials. At the Spider Knoll site, the spatial arrangement of the features suggests the patterned use of the site over time. One area was used most consistently for domiciliary activities and outside activities associated with small and medium pits and probably structures such as brush arbors and drying racks, another area was used primarily for outside activities associated with large pits, and a third area was used chiefly for trash disposal. This patterned use of space implies residential occupations that were long lived, but the houses built at the site were not the sorts of substantial structures expected for year–round occupations. Instead, they probably were more like brush arbors more suitable for seasonal use. Such patterning was not found at the other sites, but this probably can be ascribed to the more limited excavations there.

The artifacts from the five components assigned most securely to the early part of the Late Prehistoric period consist of 40,763 lithic items, 3,041 ceramic vessel sherds, 6 ceramic pipe sherds, and 777 bone/shell/antler tools or ornaments (mostly awls, but also engraved pins, antler pressure flakers, beamers, gravers/scrapers, pestles, beads, and a fishhook). The formal lithic tools are dominated by bifaces and projectile points, and other tool forms—perforators, gouges, unifaces, cobble tools, burins, ground stones, pitted stones, and hammerstones—occur in smaller numbers. Arrow points are about three times more frequent than dart points (920 vs. 310), but the latter occur in sufficient numbers to show that the atlatl continued to be used after the introduction of the bow and arrow. The most common arrow point groups are Colbert (21 percent of the classifiable specimens) and Steiner (16 percent), with Catahoula (8 percent), Friley (7 percent), Scallorn (6 percent), and Alba (3 percent) points occurring in moderate numbers (Figure 9); most of the untyped specimens have contracting stems (12 percent), expanding stems (7 percent), parallel stems (6 percent), or bulbar stems (4 percent). Gary points are by far most numerous among the classifiable dart points (65 percent), with most of the remainder typed as Gary/Kent (8 percent) or Kent (7 percent).

Most of the ceramics (71 percent) are tempered primarily with grog, while bone, sometimes in combination with grog, is the second most common tempering agent (24 percent). Shell tempering occurs infrequently (2 percent), and these sherds almost certainly are intrusive from later deposits at the sites. Because the sherds tend to be small, it is difficult to determine vessel forms, but it seems that they represent primarily simple bowls, globular bowls, barrel–shaped jars, small globular jars, and large restricted jars. Only 10–20 percent of the pottery is decorated, mostly with punctations and/or incised or engraved lines. Relating the sherds to defined types usually is not easy, but most of the decorated specimens bear similarities to such Caddoan types as Crockett Curvilinear-Incised and Pennington Punctated–Incised (Figure 10). Present in small numbers are sherds with decorative treatments (e.g., overhanging incised lines, incised lips, or punctated raised panels) that are more common on ceramics from the Lower Mississippi Valley (Phillips 1970), and some of these have been classified to Coles Creek types. Also present in consistently small numbers are base–body sherds from flowerpot–shaped vessels that are strongly reminiscent of Williams Plain. Most of the ceramic pipe sherds are not very distinctive, but at least one represents a long–stemmed Red River pipe (Hoffman 1967).

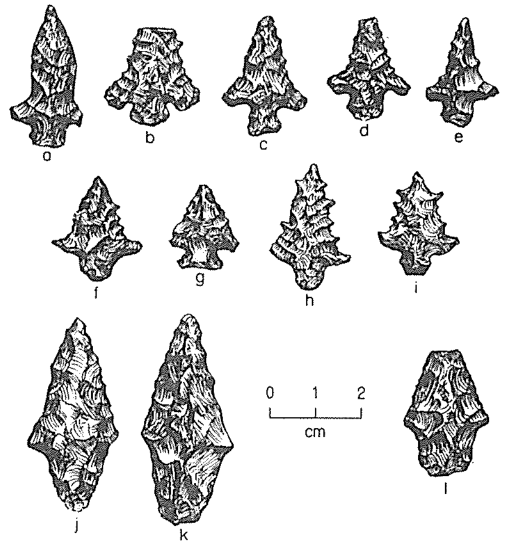

Figure 9. Arrow and dart points from early Late Prehistoric contexts at Cooper Lake: a, Alba; b, Catahoula; c–e, Colbert; f, Friley; g, Scallorn; h–i, Steiner; j–k, Gary; l, Kent.

All five sites yielded large faunal collections. All show that deer, turtles, rabbits, and mussels were important subsistence resources, and all contain a variety of other taxa as well, including fish, amphibians, turkey and other birds, and various small mammals. None of the sites yielded bison remains. Hickory nutshells occur ubiquitously (but not abundantly), and a variety of other kinds of macrobotanical remains have been recovered. Included are acorns, pecans, *Pediomelum* rhizome fragments, squash rind fragments, maize, and seeds of *Rubus*, vetch/peavine, hackberry, maygrass, sunflower, knotweed, Cheno–am, grape, honey locust, sumpweed, bedstraw, sedge, spurge, bindweed, and Graminae.

The archeological data from the early Late Prehistoric components at Cooper Lake indicate an increase in the intensity of site use over the Woodland period, and this probably reflects continued increases in population densities. All five of the components summarized above show evidence of long–duration occupations and frequent reuse. This suggests increased redundancy in site use and further decreases in group mobility. The sites appear to have been used for broad ranges of procurement,

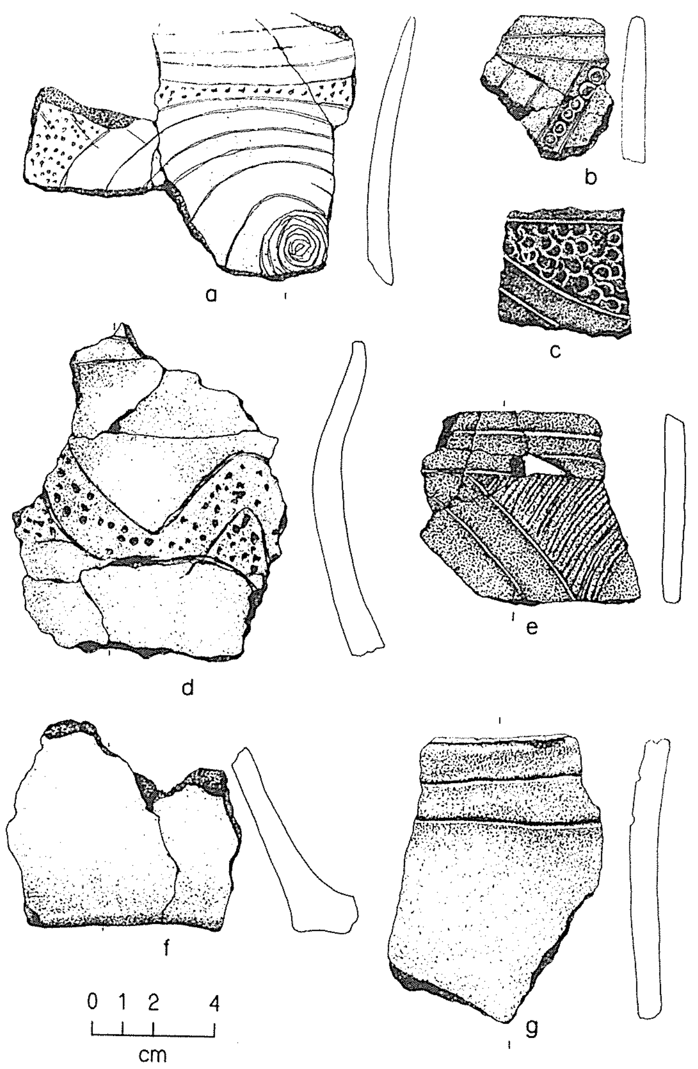

Figure 10. Ceramics from early Late Prehistoric contexts at Cooper Lake: a–e, Crockett Curvilinear-Incised/Pennington Punctated-Incised; f, Williams Plain; g, Coles Creek Incised.

processing, and maintenance activities, and the possibility of ephemeral structures at several sites hints that they may have been used as seasonal campsites. There is no evidence for fully sedentary populations, however, and the absence of constructed mounds or elaborate burials (almost all of the burials at Cooper Lake lack grave goods) points to less-complex social systems than those of early Late Prehistoric Caddoan groups to the north, east, and south. The macrobotanical remains indicate primary reliance on wild plant foods, with tropical cultigens making modest contributions. The high caries rates summarized by Burnett (1990:401-402), and evidence in the skeletal remains analyzed by Derrick and Steele (1993), suggest a diet rich in carbohydrates, such as is provided by maize or, more likely, starchy seeds. Unfortunately, carbon isotope analyses, which could help resolve this question, have not been performed on the Cooper Lake skeletal materials dating to this interval.

The Cooper Lake area appears to have been used less intensively during the latter half of the Late Prehistoric period than before. Only two excavated sites, Hurricane Hill (41HP106) and Peerless Bottoms (41HP175), date to this interval (Fields et al. 1993; Perttula 1990a). Late Prehistoric period materials occur widely across the Hurricane Hill site, being especially common on the North Rise and the South Rise. The primary occupation may date to ca. A.D. 1200–1400 (based on thermoluminescence dates on ceramics), although it probably was used earlier and later in the Late Prehistoric period as well. The extensive excavations on the North Rise and South Rise sampled six middens and identified almost 200 cultural features. The features include 134 stains/postholes, 21 large pits, 15 small pits, 5 hearths, 4 refuse concentrations, 6 extended burials, 2 flexed burials, and 2 cremations. Patterns in the posthole distributions indicate that two houses were present on the North Rise and three on the South Rise, with both areas probably also containing extramural features such as drying racks and brush arbors. Three of the houses were circular to sub-rectangular and two were rectangular, with diameters ranging from 5.0 to 7.6 m.

The artifact collection from these two areas consists of roughly 8,800 sherds, 42 ceramic pipe fragments, 500 dart points, 106 arrow points, ca. 127,000 other stone artifacts, and 60 bone/shell tools and ornaments. Most of the typeable dart points are classed as Gary (79 percent), while the most common arrow point types are Bonham (23 percent), Alba (21 percent), Hayes (20 percent), and Perdiz (16 percent). The abundance of dart points surely reflects mixing with earlier deposits rather than predominant use of the atlatl over the bow and arrow.

As for the earlier pottery characterized above, most of the ceramics (69 percent) are grog-tempered, with bone occurring in 29 percent. Shell temper is especially infrequent (less than 1 percent). The vessel forms represented include bottles, carinated bowls, scalloped–rim bowls, and everted–rim jars as well as simple bowls and jars. Only 8 percent of the sherds are decorated, with the main decorative techniques being incising, punctating, and engraving. Most of the decorated sherds can be related to Caddoan types such as Canton Incised, Sanders Engraved, Crockett Curvilinear-Incised, Pennington Punctated-Incised, and Maxey Noded Redware. The relatively large collection of ceramic pipes includes a number of examples of the long-stemmed Red River style. The bone/shell implements consist mostly of awls, but antler flakers, fishhooks, beads, and a beaver incisor tool are represented as well.

The faunal collection consists of a diverse array of taxa, the best represented of which are deer, turtles, and rabbits (but no bison). The macrobotanical remains indicate utilization of hickory nuts, hazelnuts, and acorns while only traces of maize and squash were found in the features on the South Rise. Subsistence practices appear to have focused on the collection of wild plants as well as the hunting of game that frequented the woodland edge. Cultigens are present, but the small quantity of these plants suggests limited utilization. The data from a small sample of six of the burials at Hurricane Hill seem to be contradictory, with the carbon isotope values (ranging from –15.2 to –17.6) suggesting that maize (or some other C_4 plants) was important, but with the caries rates apparently being low.

The Peerless Bottoms site is buried within alluvial fan deposits along Finley Branch on the south side of the South Sulphur River floodplain. The chronometric and artifactual evidence indicate that it dates primarily to the latter part of the Late Prehistoric period, probably ca. A.D. 1400–1500. The excavations located five potential cultural features—one hearth and four possible posts or stakes—and recovered a large artifact sample consisting of 1,930 ceramic vessel sherds, 7 pipe fragments, 1 ceramic bead, 126 arrow points, 4 dart points, 360 other chipped stone tools (including an unusually large number of small end scrapers), 219 cores, 13,365 pieces of unmodified debitage, 30 ground or battered stones, and 16 bone tools. The majority of the typeable arrow points are classed as Turney (33 percent) or Perdiz (31 percent), with most of the remainder being Cliffton, Fresno, and

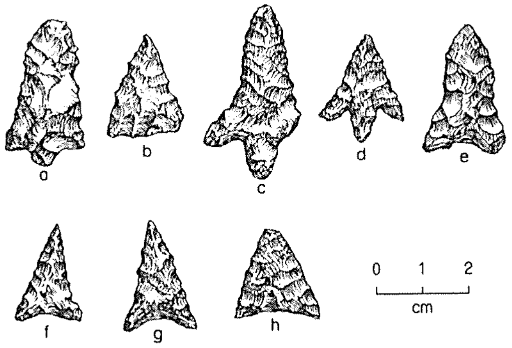

Figure 11. Arrow points from the late Late Prehistoric component at the Peerless Bottoms site (41HP175), Cooper Lake: a, Cliffton; b, Fresno; c–d, Perdiz; e, Talco; f–h, Turney.

Talco (Figure 11). Both of the classifiable dart points are typed as Gary.

The ceramic collection is unusual not only because of the large number of sherds, but also because many of the sherds are relatively large, allowing reconstruction of vessel sections. The sherds are distinctive in that 41 percent contain shell temper (the remainder have grog and/or bone) and 5 percent are red-slipped. A number of vessel forms are represented, including several kinds of carinated bowls, simple bowls, deep bowls, globular jars, large and small cylindrical jars, and bottles, and a couple of the forms that are more typical of Plains vessels than Caddoan ones (Fields et al. 1993). Nonetheless, most of the ceramics can be related comfortably to such Caddoan types as Ripley Engraved, Avery Engraved, Simms Engraved, McKinney Plain, Nash Neck-Banded, and Emory Punctated-Incised (Figure 12). Only two of the pipe fragments are distinctive; one appears to be part of an elbow–shaped pipe, while the other has a short stem that is not typical of either elbow–shaped or Red River pipes. The bone tool collection, although small, is interesting because it contains a grooved bison (?) rib possibly representing a rasp.

Faunal remains were not well preserved, and only a small collection was recovered. The best–represented taxa are deer and turtles, with birds, small mammals, bison, and pronghorn occurring in smaller numbers. The macrobotanical remains consist mostly of hickory nutshells, with *Pediomelum* rhizome fragments, honey locust and water locust

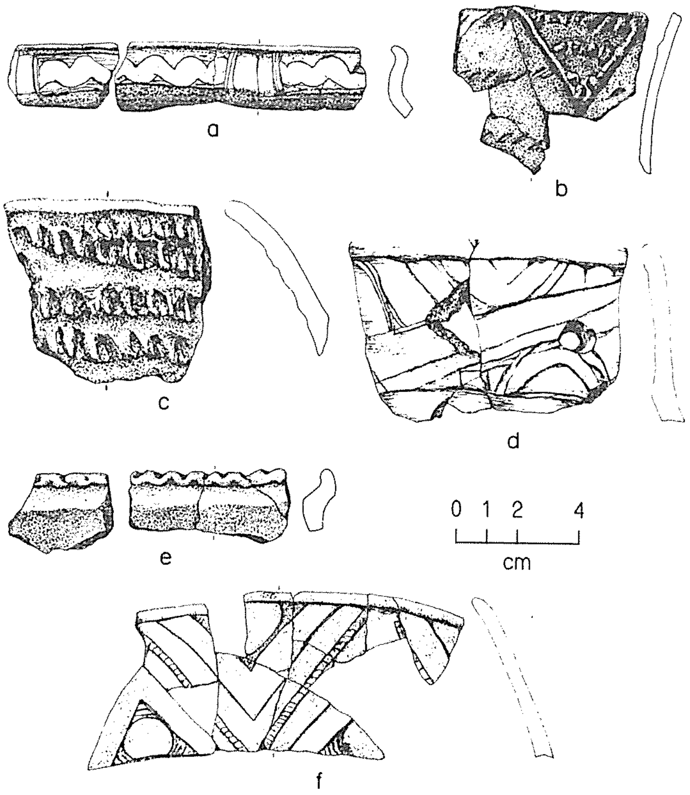

Figure 12. Ceramics from the late Late Prehistoric component at the Peerless Bottoms site (41HP175), Cooper Lake: a, untyped rim with scroll motif; b–c, Emory Punctated-Incised; d, Ripley Engraved; e, untyped red–filmed rim with crenelated lip; f, red–filmed Avery Engraved.

seeds, pecans, acorns, black walnuts, hackberries, squash rind fragments, and maize cupules occurring less commonly. The subsistence data are consistent with the interpretation of a mixed hunter–gatherer and horticultural economy. The distributional evidence suggests that the area sampled represents an outside activity area associated with an undiscovered structure, and comparisons with other sites in the project area suggest that this component represents a single long–lived residential occupation, probably a small farmstead.

In sum, the middle and late parts of the Late Prehistoric period at Cooper Lake are somewhat difficult to interpret because of the limited number of excavated components, but it is clear that there were changes in settlement strategies from the early part of this period. The two analyzed components appear to have seen long–lived occupations involving broad ranges of activities, and at least one, and probably both, were used by sedentary groups. One of the sites may have been reused a number of times during this interval, but the other certainly was not. Thus, limited residential mobility is indicated, and these sites probably were similar functionally, i.e., small farmsteads occupied by groups with mixed hunter–gatherer and horticultural economies. There is no evidence for substantially greater reliance on cultigens than during the early part of the period, and there is no indication of a shift to a bison–oriented hunting strategy, although bison are present at Peerless Bottoms and not at the earlier sites (except the Woodland component at the Spike site).

The small number of isolable components dating to this late interval makes it clear that this stretch of the Sulphur River valley was occupied less densely during this time than before. In fact, small numbers of late artifacts occur at many sites that predominantly predate ca. A.D. 1300, and because of their small numbers these artifacts suggest that most of the late components in the project area represent non-intensive, presumably limited–purpose use. Thus, there is reason to question whether the two excavated and analyzed components discussed above are typical for the area. From this perspective, it appears that settlement systems during the latter half of the Late Prehistoric period may have entailed limited numbers of residential sites but relatively large numbers of limited–function procurement/processing sites. This implies an increase in logistical mobility over the early Late Prehistoric period.

Jewett Mine and Lake Limestone

Eleven components dating predominantly to the Late Prehistoric period have been defined at the Jewett Mine and Lake Limestone: Rena Branch (41FT334, Analysis Unit 2), Charles Cox (41LN29A, Analysis Unit 1), Lambs Creek Knoll (41LN106, Analysis Units 1 and 2), Alley Road (41LN149B, Analysis Units 1 and 2), Moccasin Springs (41LN247D, Analysis Unit 1/2/3), Old Union Bridge (41LT12, Analysis Units 1 and 2), and Carl Sadler (41LT17, Analysis Units 1 and 2) (Fields 1987, 1990; Fields et al. 1991; Mallouf 1979). The Bottoms site (41FT89) also has an important Late Prehistoric component (Analysis Unit 1/2/5), but it is mixed with Woodland materials and is difficult to interpret on an assemblage basis. Just 21 of the 85 radiocarbon dates from archeological contexts at the mine pertain to this interval (1250–250 B.P., see Figure 2), and this apparently reflects decreased intensity of use over the preceding periods.

Two of these sites (Old Union Bridge and Carl Sadler) are on the Navasota River, three (Charles Cox, Lambs Creek Knoll, and Alley Road) are along tributaries to the Navasota River, and three sites (Bottoms, Rena Branch, and Moccasin Springs) are along the upper reaches of tributaries to the Trinity River. The Old Union Bridge and Carl Sadler sites are in alluvial settings, while the deposits at the others are mostly colluvial. Middens were present at the Bottoms, Moccasin Springs, and perhaps Old Union Bridge sites. Eight components lack cultural features entirely, and only four concentrations of burned rocks interpreted as hearths or discarded hearth debris, two postholes, one pit of unknown function, one burial, and one cache of cores were found in the remaining three components. Sixteen additional burned rock concentrations and three pits were recorded at the Bottoms site, but it is hard to be certain that these are associated with the Late Prehistoric component. This is especially the case for the rock concentrations, since rock hearths and scattered non-feature burned rocks are much more common in earlier (i.e., Late Archaic–Woodland) contexts in the region. One additional human burial dating to the Late Prehistoric period was found at the Cottonwood Springs site (Fields and Klement 1995), but the associated occupational debris was so sparse at this predominantly Late Archaic–Woodland site that a late component was not isolated.

The artifacts from the 11 Late Prehistoric components consist of 43,465 lithic specimens, 1,703 ceramic vessel sherds, 4 ceramic pipe fragments, and 6 bone tools (with mixed Analysis Unit 1/2/5 at 41FT89 contributing an additional 15,336 lithics, 556 vessel sherds, and 7 pipe fragments). The formal lithic tools are dominated especially heavily by projectile points, but perforators, gouges, other bifaces, unifaces, cobble tools, ground and battered stones, pitted stones, and pigment stones are present also. The collection from one site (Moccasin Springs) contains an unusually large number of scrapers made on blades. The projectile point collection consists of over 500 specimens, with arrow points being almost twice as frequent as dart points. While the bow and arrow was the predominant method of taking game, it appears that the atlatl continued to be used as well, especially during the early half of the period. Perdiz is by far the best-represented arrow point type (43 percent of the classifiable specimens; Figure 13), although this late style occurs almost exclusively at only a few sites (Bottoms, Moccasin Springs, and Old Union Bridge). Early arrow points that occur more widely but in small numbers include specimens typed as Scallorn (5 percent), Steiner (4 percent), and a variety of untyped forms with expanding or parallel stems (12 and 7 percent, respectively). The most common dart point types, chiefly from components dating to the early part of the period, are Dawson (20 percent of the classifiable specimens), Kent (10 percent), Neches River (7 percent), and Gary (6 percent); 37 percent are untyped points (16 percent with parallel stems, 12 percent with expanding stems, and 9 percent with contracting stems). The collection of bone tools, all of which are from Moccasin Springs, contains two antler pressure flakers, three pointed tools fashioned from long bone splinters (two have parallel grooves along their margins suggesting use as rasps), and one deer metatarsal with parallel grooves across one face which also may be a rasp.

The ceramics are overwhelmingly (96 percent) grog or bone-tempered. Most of the remainder are classified as the sandy paste ware that occurs in

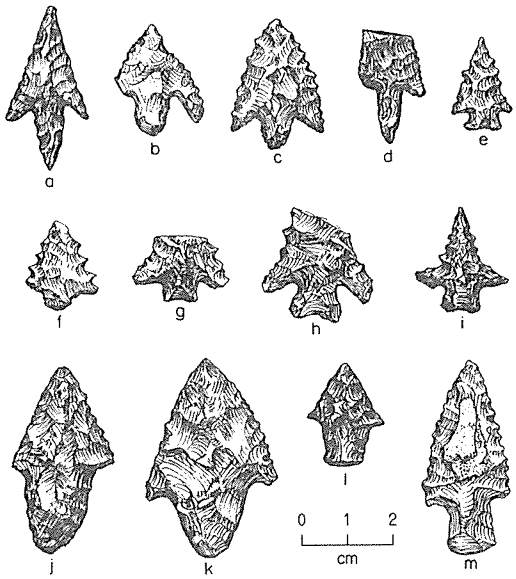

Figure 13. Arrow and dart points from Late Prehistoric contexts at the Jewett Mine: a–d, Perdiz; e, Scallorn; f, Steiner; g, untyped parallel stem; h–i, untyped expanding stem; j, Dawson; k, Gary; l, Kent; m, Neches River.

small numbers in Woodland contexts at the mine and elsewhere across southeastern Texas, and a few sherds belong to the kaolin–paste ware also found earlier in the region. It is unclear if these minor groups represent ceramics actually used during the Late Prehistoric period or if they are intrusive from the earlier deposits. While most of the tempered ceramics are plain, some exhibit decorations (e.g., random body punctations, brushing, diagonal incising, pinching, engraving, neck-banding, and appliquéd strips or nodes) that are characteristic of pottery in Caddoan sites to the east (Figure 14). The motifs on a few sherds are strongly reminiscent of those on defined Caddoan types (e.g., Holly Fine Engraved, Killough Pinched, Maydelle Incised, Patton Engraved, Poyner Engraved, and Weches Fingernail Impressed), although design execution tends to be sloppier on the sherds from the Jewett Mine sites. Hence, it appears that some, and probably all, can be related to the Caddoan ceramic tradition in one way or another, be they pots made by Caddo peoples or copies made by local groups.

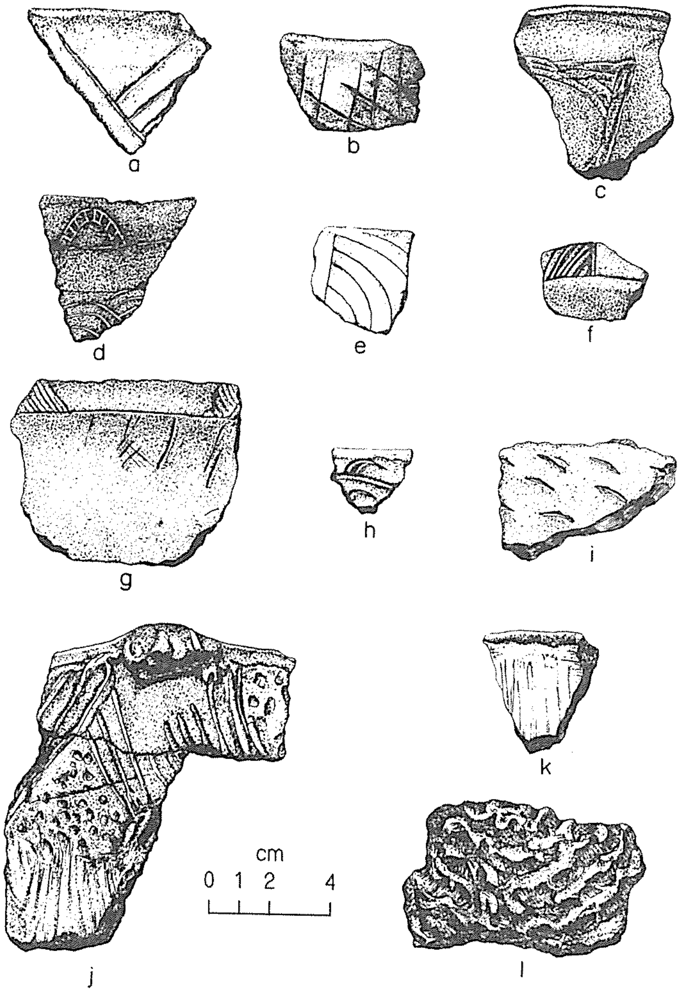

Figure 14. Ceramics from Late Prehistoric contexts at the Jewett Mine: a–b, untyped diagonal incised rims; c–d, untyped engraved rims; e–f, Holly Fine Engraved; g, Poyner Engraved; h, Weches Fingernail Impressed; i, punctated body; j, Maydelle Incised; k, brushed rim; l, Killough Pinched.

While sherds occur ubiquitously in the Late Prehistoric components, they are frequent in only a few. In fact, 95 percent are from just two sites (Moccasin Springs and Old Union Bridge), with the mixed component at the Bottoms site also yielding a sizable sample of 556 sherds. In all three of these cases, most of the sherds probably relate to use during the latter part of the Late Prehistoric period. These late ceramics apparently represent a variety of bowl and jar forms. The later collections also are distinguished by being the only ones to contain ceramic pipes. Although few in number, the recovered specimens appear to represent short–stemmed forms that are unlike either the elbow–shaped form or the long–stemmed Red River form that are found most often across eastern Texas.

As for the earlier components, faunal and macrobotanical remains tend to be poorly preserved. Most of the Late Prehistoric components have yielded small numbers of animal bones, but only Moccasin Springs contained abundant faunal remains that give a good idea of the range of resources used by these people. Deer, turtles, and rabbits are the most common taxa from this site, with other small mammals, bison, fish, birds, lizards, and snakes being represented as well. *Carya* nutshells are by far the most common plant remains; recovered in small quantities were *Quercus* nutmeats and shells, *Corylus* nutmeats, and several kinds of seeds (Cheno–am, *Vitis*, Leguminosae, and *Portulaca*). There is no evidence for horticulture at these components.

Five of the Late Prehistoric components, four along the Navasota River (at Old Union Bridge and Carl Sadler) and one at the far eastern end of the study area (Moccasin Springs), are interpreted as residential bases; another upland site (Bottoms) may have been used in a similar fashion during this time, but the Late Prehistoric component at this site cannot be separated from the earlier Woodland materials. The other six Late Prehistoric components (at Rena Branch, Charles Cox, Lambs Creek Knoll, and Alley Road) are interpreted as procurement/processing locations. These sites suggest that the Late Prehistoric period saw a change in settlement strategies from the Late Archaic and Woodland periods, and that there were changes within the Late Prehistoric period as well.

While many of these components are not well dated, two of the residential components (at Moccasin Springs and Old Union Bridge) and one unit with both Late Prehistoric and Woodland materials (at the Bottoms site) stand out from the others in their high frequencies of vessel ceramics, most of which can be related to Late Caddoan types, and the occurrence of ceramic pipes. These three components are the only ones to contain Perdiz points, and it is likely that these components date primarily to the latter half of the Late Prehistoric period (although small numbers of other kinds of points suggest that earlier occupations are represented also). The other Late Prehistoric components, both those interpreted as residential bases and as procurement/processing locations, contain far smaller collections of typeable arrow points and hence are more difficult to assess temporally, but most of the types represented are suggestive of occupations dating to the early half of the period.

All three of the residential bases dating to the early part of the period are along the Navasota River. Two of these appear to have been focused on plant processing and to a lesser extent on hunting–related activities, while the third exhibits no such emphases. One appears to have been occupied moderately infrequently, but high–intensity use is indicated for the other two components. The greater use intensity could be due to the long–term nature of the occupations, more frequent reoccupation, or both. Vessel ceramics are more common than in the early Late Prehistoric procurement/processing locations or the residential bases dating to the Woodland period, suggesting that ceramic containers were used relatively frequently at these sites.

Five of the early Late Prehistoric procurement/processing locations appear to have been focused on activities related to hunting, and the sixth may have been used for varying purposes during different occupations. All six are located east of the Navasota River, suggesting primarily logistical use of the uplands and a restriction of residential activities to the river valley. This change from earlier periods, and the heavy emphasis on hunting–related activities, supports the idea of organizational differences between early Late Prehistoric settlement systems and those of the Late Archaic and Woodland periods. These components exhibit substantial variability in the frequency of reoccupation, with low–frequency use indicated for one, moderately low frequency use suggested for two, and high–frequency use indicated for three. As noted above, vessel ceramics are relatively infrequent here compared to the residential bases, and this probably reflects the shorter occupations and narrower ranges of activities.

As noted above, only two excavated components date predominantly to the latter part of the Late Prehistoric period. Both are residential bases, with the one along the Navasota River having been focused primarily on plant processing and secondarily on hunting and the one in the uplands supporting a similar range of activities but with relatively little manufacture of plant processing tools. Both were used intensively, probably reflecting the relatively long term nature of the occupations and/or their frequent reoccupation. The especially high frequencies of vessel ceramics suggest relatively great extra-regional mobility and/or interaction, as well as pointing to changes in cooking technologies, supporting the conclusion that the site occupations were relatively long lived.

Based mostly on the abundance of Caddoan ceramics in these components but the lack of evidence for permanent occupations (i.e., structures), Fields et al. (1991) suggested that these sites were used by Caddo Indians as base camps in support of forays by hunting parties or other procurement/processing task groups, or perhaps by groups in transit between the eastern and central parts of the state. It is equally plausible, however, that they were created by local hunter–gatherer groups and that the ceramics are the result of trade or the borrowing of ideas about ceramic manufacture and decoration. The small sample of two human burials found so far in late Late Prehistoric contexts at the mine supports this latter interpretation in that both almost certainly are not those of Caddoan farmers. Both contained flexed skeletons lacking offerings, and the bones yielded delta^{13}C values (-21.1 and -22.3) much lower than would be expected for people who consumed maize regularly.

In sum, the Late Prehistoric period seems to have seen two major changes in settlement strategies. In the early part of the period, residential bases were situated in the Navasota River valley, and the uplands were used primarily for hunting–related activities. This represents a shift to more logistically organized strategies from the forager systems that characterized the Late Archaic and Woodland periods. The late part of the Late Prehistoric period may have seen a return to forager strategies, although it is also possible that the scarcity of procurement/processing locations dating to this period is more apparent than real. Perhaps such sites are present but were not used with sufficient intensity to be distinguishable archeologically (as suggested by the archeological record at the Cottonwood Springs site), or maybe the procurement/processing sites created during this period are outside the Jewett Mine study area.

TEMPORAL AND SPATIAL TRENDS IN THE DATA

Technologies

Several notable patterns regarding when and how technologies changed in the Post Oak savannah can be seen in the archeological data. First, the fact that dart points make up about one–quarter of the projectile points in Late Prehistoric contexts at Cooper Lake and about one–third of those in comparable contexts at the Jewett Mine suggests that the atlatl continued to be used after the bow and arrow was introduced at about A.D. 800. This appears to have been particularly true through the first half of the Late Prehistoric period; later components still contain some dart points, but in much lower frequencies. While some of these points undoubtedly represent mixing with earlier deposits, the numbers are so high and the pattern so consistent that it seems unlikely that this accounts for all of the dart points in the Late Prehistoric sites. Other project areas in the Post Oak savannah contribute limited information on this issue, in part because most sites are multicomponent and poorly stratified (at best). For example, Bruseth et al. (1987:241, 245, 247) posit continued use of the atlatl during the Late Prehistoric period at Richland/Chambers Reservoir, but the small artifact sample from one site in an alluvial setting in this project area (41FT193) suggests that this was not the case at all locations (McGregor and Bruseth 1987:173). At the Gibbons Creek Mine, Late Prehistoric components are present at most of the excavated sites (e.g., 41GM181A, 41GM201, 41GM205, 41GM281, and 41GM282; Rogers 1993, 1995), but because of the difficulty of isolating components and dating them, it is hard to tell if the bow and arrow and atlatl were used contemporaneously.

The second technological change discussed here is the use of ceramic containers. While Woodland contexts at both Cooper Lake and the Jewett Mine do contain small numbers of sherds (the ratios of sherds to shaped chipped stone tools are only 0.1:1 and 0.2:1, respectively), there is reason to suspect that some, or maybe even all, of the ceramics are intrusive from later occupations. Thus, it appears that ceramics were at best a minor part of the material culture during the Woodland period. Pottery is only marginally better represented in early Late Prehistoric contexts at the Jewett Mine (ratio of sherds to shaped chipped stone tools = 0.5:1), and it is clear that activities related to the use of ceramics were not important at the sites used during this temporal interval. In contrast, vessel sherds outnumber shaped chipped stone tools in early Late Prehistoric contexts at Cooper Lake (1.1:1) and especially in contexts dating to the latter part of the Late Prehistoric period in both project areas (5.7:1 at Cooper Lake and 2.8:1 at the Jewett Mine). Thus, both areas exhibit time–related trends in the importance of pottery, and regardless of time period, ceramics played a more prominent role in the material culture at Cooper Lake than at the Jewett Mine.

It is difficult to use the data from other project areas in the Post Oak savannah to elaborate on this pattern because of problems with isolating components and because of varying recovery strategies (e.g., the extensive use of plowing and systematic surface collections at Lake Fork Reservoir). Nonetheless, the mean ratios of sherds to shaped chipped stone tools in sites dating predominantly to the Woodland and Late Prehistoric periods at both Richland/Chambers Reservoir (ratio = 1.1:1, based on Bird Point Island, Adams Ranch, Irvine, Polecat Hill, Little Cedar Creek, and 41FT161B; data taken from Table 18–3 in Bruseth et al. [1987:237] with biface fragments added) and the Gibbons Creek Mine (ratio = 1.0:1, based on 41GM166, 41GM181, 41GM201, 41GM205, 41GM224, 41GM281, and 41GM282; data taken from Rogers [1993, 1994, 1995]) are intermediate between the mean site values for the Jewett Mine (0.8:1) and Cooper Lake

(1.5:1). In contrast, the ratio (51:1) for sites at Lake Fork Reservoir (Bracheen, Gilbreath, Grimes, Hines, Killebrew, Osborn, Spoonbill, and Taddlock; data taken from Tables 5–1 and 6–4 in Bruseth and Perttula [1981]) is vastly higher than any of the others, indicating the much more prominent role played by ceramic vessels in the material culture of the settled villagers who lived in this part of the Sabine River valley.

Additional evidence of changes in cooking technologies can be found in the features. For example, burned rock concentrations interpreted as hearths or shallow baking pits are most frequent in Archaic contexts at both Cooper Lake and the Jewett Mine, although nonfeature burned rocks (disturbed or displaced hearths?) are not so restricted. In fact, based on ratios of shaped chipped stone tools to total burned rocks, it appears that the greatest changes occurred between the early and late parts of the Late Prehistoric period in both areas (Figure 15). This parallels the dramatic increase in the use of ceramic containers for food preparation during this same interval. The ratios for the few pre–Late Archaic components are quite similar, as is the ratio for the single Late Archaic component at Cooper Lake and the mean value for the Late Archaic components at the Jewett Mine. These low ratios suggest similar cooking practices involving extensive use of rocks for heat retention during baking and roasting. The great variability in the values for the Late Archaic components at the Jewett Mine probably reflects intersite variability in the resources processed and perhaps seasons of use (see "Site Functions and Settlement Patterns" below).

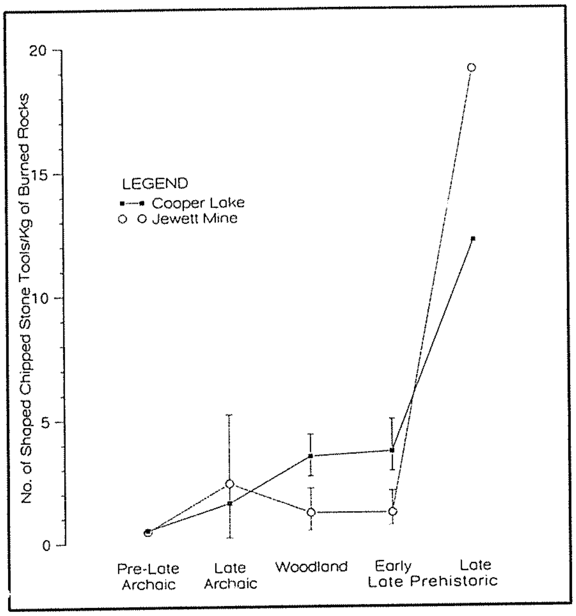

Figure 15. Graph of shaped chipped stone tools/weight of burned rocks by time period for Cooper Lake and the Jewett Mine (includes only components assignable to single periods and excludes the early Late Prehistoric component at Rena Branch [41FT334] because of its anomalously high value; where the ratios are derived from multiple components, the symbols indicate means, while the bars show ranges).

Interestingly, the ratios for the Woodland and early Late Prehistoric components are virtually the same within each project area but different between project areas. The moderate value for the early Late Prehistoric period at Cooper Lake probably can be attributed at least partly to the moderately frequent use of ceramic vessels, and the increased use of boiling at the expense of roasting and baking. The comparable value for the Woodland period suggests that this may not be the sole explanation, however, since there is no evidence for substantial use of pottery during this period. Although not testable with the data currently at hand, this change also could reflect the use of new plant foods that did not require roasting or baking. The fact that the Woodland and early Late Prehistoric values for the Jewett Mine are lower than those for Cooper Lake suggests that groups occupying the southern Post Oak savannah did not follow the same trajectory in terms of changes in cooking practices as did those living in the northern part. This may relate to the lesser importance of ceramic vessels during the early Late Prehistoric period at the Jewett Mine than at Cooper Lake, and it might indicate differences in the kinds of subsistence resources as well.

Subsistence

Almost no direct data pertaining to subsistence have been recovered from the components predating the Late Archaic period. Slightly better information is available for the Late Archaic and Woodland periods at the Jewett Mine, while the Cooper Lake sites have contributed useful information for the latter part of this interval. The overall subsistence pattern prior to the Late Prehistoric period appears to have entailed hunting of a wide variety of animals that frequented woodland, woodland–edge, and aquatic environments, with only minimal use of grassland taxa, and gathering of wild plant foods including hardwood nuts, seeds, and tubers/rhizomes. Very limited amounts of squash at one site at Cooper Lake indicate some use of cultigens, but there is no reason to think that they contributed significantly to the diet. Hence, the Native Americans who lived in the Cooper Lake and Jewett Mine areas during the Late Archaic and Woodland periods appear to have been hunter–gatherers.

Similar hunting patterns prevailed throughout the succeeding Late Prehistoric period in both project areas, with one possible minor exception. Specifically, bones positively identifiable as bison are most common in contexts dating to the latter part of the Late Prehistoric period, although bones identified as possible bison are not so restricted. This may hint at increased use of bison after A.D. 1400, and some support for this can be found in the increased frequencies of formal scrapers at some late sites, but neither the overall tool assemblages nor the faunal collections themselves point to a shift toward bison–oriented economies. Rather, it appears that bison were simply a small part of what was a predominantly woodland–oriented hunting strategy.

While the poor preservation of macrobotanical remains at the Jewett Mine sites makes it difficult to be certain, the plant remains recovered to date and the limited stable carbon isotope evidence indicate that Late Prehistoric groups in the upper Navasota River basin used wild plant foods and were not horticulturalists. This is not the case for the Cooper Lake area, however. Most of the Late Prehistoric sites in the upper Sulphur River basin have yielded small quantities of maize and squash, as well as hardwood nuts, a variety of kinds of seeds, and tuber/rhizome fragments. It is clear that tropical cultigens contributed to the diet of groups who occupied the area during both the early and late parts of the period, but they are not sufficiently abundant to indicate true agricultural economies. Instead, it appears that limited horticulture may have been incorporated into a hunter–gatherer system that had its roots in the preceding Woodland period, or perhaps even earlier. Possibly contradicting this interpretation are the stable carbon isotope values from a sample of the burials at Hurricane Hill, which suggest a possible substantial reliance on C_4 plants such as maize. Given the limited analysis to date of the human remains from this site, however, it is difficult to know how much reliance to put on these isotope values.

The regional data show that the woodland-oriented hunting strategy evidenced at Cooper Lake and the Jewett Mine prevailed throughout the Post Oak savannah. This is the case in contexts dating to the early and late parts of the Late Prehistoric period at Lake Fork Reservoir (Perttula 1990b:Part II, 30–52), Woodland and Late Prehistoric contexts at Richland/Chambers Reservoir (Bruseth et al. 1987:238), and Woodland and Late Prehistoric contexts at the Gibbons Creek Mine (Nash 1993; Rogers 1994:120, 149). Bison bones occur in small numbers in some of these sites, but they are not especially frequent in contexts dating to the late part of the Late Prehistoric period. Hence, the regional data do not support diachronic changes in hunting strategies.

Greater variability is evident in the use of plant foods across the Post Oak savannah. Sites at Lake Fork Reservoir indicate that maize was an important subsistence resource throughout the Late Prehistoric period (Perttula 1990b:Part II, 30–52), and it appears that groups who lived in this stretch of the Sabine River basin relied on farming far more than did groups at Cooper Lake. Moving southward to the Trinity River basin, macrobotanical remains from contexts postdating the Late Archaic period point to use of the same kinds of wild plant foods—hardwood nuts, a variety of seeds, and tubers/rhizomes—that were used at Cooper Lake (Bruseth et al. 1987:243). The only tropical cultigen is maize, and it occurs in very small quantities only in contexts dating to the last half of the Late Prehistoric period. Hence, groups who lived in this area clearly were predominantly hunters and gatherers. Subsistence data from the Gibbons Creek Mine are especially sparse, but hardwood nutshells occur in most sites and liliaceous bulb fragments were recovered from a single site (Dering 1993, 1994; Rogers 1993:74, 174, 214, 1994:120, 149, 1995:56, 153). Consistent with the lack of cultigens at Gibbons Creek is the low stable carbon isotope value on human remains from a Late Prehistoric burial at 41GM205 (Rogers 1993:D–1 through D–3).

Site Functions, Settlement Strategies, and Use Intensity

Judging from their comparably diverse assemblages of stone tools, it appears that all of the excavated sites at Cooper Lake were used in a generally similar manner: predominantly as residential sites of one sort or another. None functioned primarily as processing or procurement locations. It is certain that these kinds of sites exist in the area, however, and the fact that none have been identified probably can be attributed to their low archeological visibility. In fact, there are hints that a number of chiefly early Late Prehistoric sites were used in a much more restricted fashion during the latter part of the Late Prehistoric period, and that this may have been related to a change toward more logistically organized settlement strategies.

The functional differences that can be seen between sites at Cooper Lake appear to have been more a matter of degree than kind and can be best seen in the features. For example, the Archaic components at the Finley Fan site have only a single kind of feature, and these apparently represent relatively short term use as a hunter–gatherer campsite. At the other end of the scale, the Late Prehistoric component at Hurricane Hill clearly represents a settlement of hunter–gatherer–horticulturalists who were sedentary, or nearly so, and the Peerless Bottoms site can be interpreted in this way as well. Occupying the middle ground are the early Late Prehistoric components at Spider Knoll, Spike, Thomas, and Doctors Creek. These sites have middens and numerous features and, judging from the structural evidence at Spider Knoll, appear to have seen repeated occupations of perhaps seasonal length by hunter–gatherer–horticulturalists. Some of the Woodland components probably represent occupations similar in nature to those of the early Late Prehistoric period judging from the presence of middens at Tick and Spike, and the small cemetery and associated features on the Southwest Rise at the Hurricane Hill site, while others may represent less frequent residential use (e.g., the Johns Creek site).

The excavated data from Cooper Lake are too sparse to allow much to be said about settlement strategies during the Archaic period. Nonetheless, low–intensity use by hunter–gatherer groups is likely, and this probably reflects low population densities, high residential mobility, short–duration occupations, and infrequent site reuse. The increased intensity of use during the Woodland period probably represents longer–term site occupations and more frequent reuse of some sites, and this may be traced to decreased residential mobility and perhaps increased populations. There is no evidence for increased logistical mobility among these hunter–gatherer groups, however. This pattern reached its culmination in the early part of the Late Prehistoric period. While horticulture contributed to the resource base, the area was still occupied by groups with at least moderate residential mobility. Individual sites probably were occupied for no longer than a season at a time, although they were reused frequently. Settlement strategies changed significantly in the latter part of the Late Prehistoric period. Fewer sites were used for residential purposes, but they were occupied by groups who were largely sedentary. Many other sites were used much less intensively, probably chiefly for procurement/processing tasks, and this appears to represent increased logistical mobility over the early Late Prehistoric period.

Most of the excavated components at the Jewett Mine, especially those dating to the Late Archaic and Woodland periods, also are interpreted as having been used for residential purposes based on their diverse stone tool assemblages, but it is difficult to compare these sites to those at Cooper Lake because nondurable features such as postholes and pits are poorly preserved in the thick sands that blanket the area. Nonetheless, these kinds of features were not frequent at the few sites where they might have been preserved (e.g., the Bottoms and Moccasin Springs sites), and this suggests that the Jewett Mine residential occupations were of shorter duration than most of those at Cooper Lake (i.e., less than seasonal length). Several kinds of residential sites have been documented at the mine, however. Some were focused primarily on plant processing and secondarily on hunting–related activities as well as a range of maintenance activities, while at others these activities were more balanced. These differences probably can be attributed to the sites having been used at different times of the year when different resources were available.

The Jewett Mine also has a number of components, most dating to the early Late Prehistoric period, that are interpreted as procurement/processing locations based on limited diversity in the stone tool assemblages. Hunting–related activities are especially well represented at many of these, while plant processing may have been more important than hunting at others. Several explanations can be offered for the difference between the Jewett Mine and Cooper Lake in terms of the frequency of these kinds of components at the excavated sites, with the most likely one revolving around the different kinds of depositional settings in the two project areas (i.e., it is easier to isolate components in the often thick sands at Jewett). Perhaps also contributing to the difference, though, is the fact that the Jewett Mine sites represent a broader range of environmental settings (i.e., a major river valley, a major drainage divide, and major and minor tributary valleys) than the Cooper Lake sites, all of which are within or immediately adjacent to a major river valley.

In sum, the Jewett Mine sites point to a similar trajectory in changes in settlement stategies, albeit with differences in timing, as that identified at Cooper Lake. The few pre–Late Archaic components at Jewett suggest non-intensive use by mobile hunter–gatherers, indicating low population densities and infrequent site reuse. More intensive use is indicated for the Late Archaic and Woodland periods. This may mark increased population densities, more frequent reuse of individual sites, or longer–term occupations. The hunter–gatherers who occupied the area still operated primarily as foragers, however, moving their residential bases frequently. Settlement systems may have been scheduled on a seasonal basis, with different activity sets (i.e., related to different subsistence resources?) represented at residential sites in riverine and upland settings. During the early Late Prehistoric period, residential activities were increasingly restricted to lowland sites, while the uplands were used mostly for hunting–related procurement/processing tasks. This indicates that logistical strategies became more important, but, unlike at Cooper Lake, there is no evidence that this was accompanied by increased sedentism within the upper Navasota River basin itself. During the late part of the Late Prehistoric period, the Jewett area apparently saw a return to forager–oriented hunter–gatherer strategies entailing more equable use of upland and lowland settings. The high intensity of use and the infrequency of sites suggest that individual occupations were longer lived and that residential mobility was lower than during the Late Archaic and Woodland periods, however.

These patterns in occupational intensity are illustrated by Figure 16, which plots the numbers of shaped chipped stone tools per square meter of controlled excavations by time period, excluding the pre–Late Archaic components since the data are so scanty (the ratios have been adjusted for different time period lengths). Shaped chipped stone tools are used instead of total lithic artifact counts, as were used by Fields et al. (1991, 1993) for both Cooper Lake and the Jewett Mine, because of differences between the areas in lithic procurement and reduction strategies.

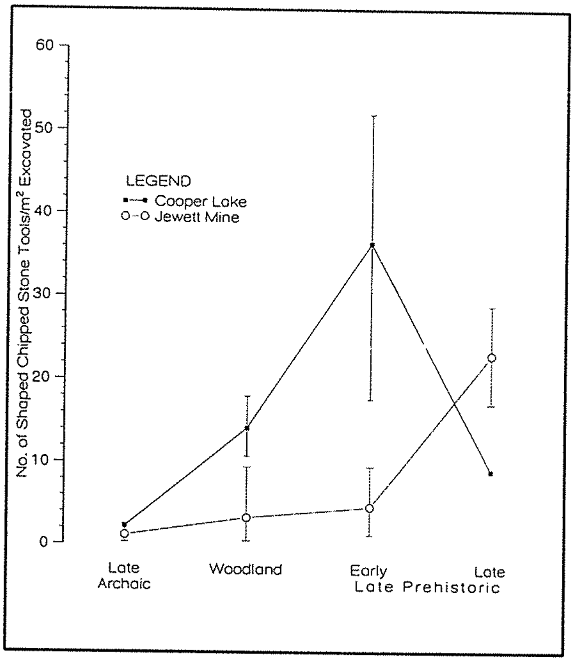

Figure 16. Graph of shaped chipped stone tools/m² excavated by time period (corrected for differences in length) for Cooper Lake and the Jewett Mine (includes only components assignable to single periods and excludes the Late Archaic component at 41LT44 because of its anomalously high value; where the ratios are derived from multiple components, the symbols indicate means while the bars show ranges).

Specifically, the Jewett Mine sites have high ratios of debitage to shaped chipped stone tools (58:1 at Jewett vs. 21:1 at Cooper Lake, using only the sites excavated by Prewitt and Associates, Inc. to eliminate recovery and analysis biases), apparently because of the much more common use of fine–grained materials (67 percent of the debitage at Jewett is of fine–grained chert, as opposed to 3 percent at Cooper Lake [these figures are site means rather than total percentages]) and the staged reduction of bifaces imported from Central Texas at Jewett (as indicated by the relatively numerous biface caches there). This is reflected not only by high debitage frequencies at the Jewett Mine sites, but also by the fact that more of the debitage from Jewett is small and entirely decorticate (84 percent of the debitage at Jewett is smaller than 21 mm and 71 percent is entirely decorticate, while the figures for Cooper Lake are 63 and 49 percent [these figures are site means rather than total percentages]). Hence, including debitage in the density calculations would unfairly inflate the values for the Jewett sites.

Figure 16 shows that both areas start out with a very low intensity of use during the Late Archaic period. The patterns for the two areas diverge after this, however. At Cooper Lake, use intensity increased steeply through the Woodland and early Late Prehistoric periods, followed by a decrease in the latter part of the Late Prehistoric period. This trend points to increasingly frequent site reuse and probably longer individual occupations, followed by less intensive residential use during the late Late Prehistoric period.

The Jewett Mine sites show a much more gradual increase in use intensity through the early part of the Late Prehistoric period, consistent with the idea that site occupations were not as frequent or as long lived as at Cooper Lake and that population densities may have been lower. As noted above, the evidence indicates that, for the latter part of this interval, this may have been related to increased logistical use and less residential use. A much steeper increase in intensity is indicated for the late part of the Late Prehistoric period, perhaps indicating rough comparability (although still lower overall) with the early Late Prehistoric period at Cooper Lake. The fact that the ratios for the two late components at Jewett are higher than that for the single late component at Cooper Lake is intriguing given that the latter appears to represent a single–component occupation by largely sedentary hunter–gatherer–horticulturalists, while the former are more likely to represent repeated, shorter–term residential occupations by hunter–gatherers. Assuming it is not a function of the small number of sites involved, this difference may reflect the more logistical nature of the late Late Prehistoric settlement strategies at Cooper Lake (i.e., more frequent performance of procurement/processing tasks away from residential sites, resulting in decreased tool densities).

Between Cooper Lake and the Jewett Mine, it appears that most of the excavated sites at Lake Fork Reservoir served residential functions, at least during the Late Prehistoric period. This is most clearly the case at the Hines and Spoonbill sites where posthole patterns representing houses were found, but many other sites (e.g., Taddlock, Steck, Gilbreath, Grimes, Killebrew, Osborn, and Sandhill) have middens and clearly were used for more than procurement/processing activities (Bruseth and Perttula 1981). Further, Perttula (1994) lists a number of known or potential mound sites in this stretch of the Sabine River basin, and it is clear that this part of the Post Oak savannah was used intensively by sedentary farmers during most if not all of the Late Prehistoric period.

Moving farther southward, the data suggest that most of the excavated sites at Richland/Chambers Reservoir also were used for residential purposes during the Late Prehistoric period (Bruseth et. al 1987:241, 244, 246), although there are some sites in the area, for example the streamside concentrations of mussel shells and artifacts at 41FT193 and 41NV139, that probably were used in a more limited fashion. The house patterns at the Bird Point Island site point to occupations of some duration by hunter–gatherers during the first half of the period, while other components that are contemporaneous, slightly earlier, or later (e.g., at Bird Point Island, Adams Ranch, Irvine, and Little Cedar Creek) have middens and numerous features suggesting intensive use but no houses. These components may represent occupations that were seasonal in length, comparable to most of the early Late Prehistoric components at Cooper Lake. Shorter–term, but still residential, occupations may be represented by the Late Archaic–Woodland components at sites such as Bird Point Island, Adams Ranch, and 41FT200, judging from the artifact assemblages and the presence of large depressions interpreted as roasting ovens associated with hunter–gatherer band coalescence at the first two of these (Bruseth et. al 1987:225, 237).

At the Gibbons Creek Mine in the southern Navasota River basin, the excavated sites appear generally similar to most of those at the Jewett Mine in that they generally lack middens (except at 41GM281), they have numerous burned rock features but few other features, and they contain generalized (rather than specialized) stone tool assemblages (Rogers 1993, 1994, 1995). Based on these similarities, it is possible that the Gibbons Creek sites, dating mostly to the Woodland and Late Prehistoric periods, represent short–term residential occupations by hunter–gatherers. On the other hand, there are two pieces of evidence suggesting that some of these sites may have functioned more as procurement/processing locations than residential campsites. Specifically, the sites at the Gibbons Creek Mine have much lower frequencies of shaped chipped stone tools (the overall ratio of debitage to shaped chipped stone tools is 106:1) than do the sites at the Jewett Mine or Cooper Lake (58:1 and 21:1, respectively), perhaps implying that the occupations were especially short-lived. And second, the Gibbons Creek sites have greater quantities of burned rocks (the overall ratio of burned rock weight to shaped chipped stone tools is 2.2:1, excluding 41GM166, 41GM281, and 41GM282, for which burned rocks are not quantified in the report) than the Jewett Mine or Cooper Lake sites (1.3:1 and 0.3:1, respectively), suggesting that certain kinds of processing activities were quite important.

Sociocultural Interaction

It is difficult to address the topic of sociocultural interaction with much precision because of the complex relationships between trade, other kinds of interaction between groups, and the various kinds of mobility (i.e., residential vs. logistical, intra-regional vs. extra-regional). Nonetheless, there are some clear patterns.

First, truly exotic items are universally scarce. For example, obsidian flakes (at Cooper Lake and the Jewett Mine), galena (at Cooper Lake, Jewett Mine, and Gibbons Creek Mine), and marine shell beads (at Cooper Lake) have been recovered, but they are so few in number that it is clear that they represent down–the–line exchange rather than any substantial involvement in especially far–flung trade networks. Tools and flakes of chert from the Ozark Mountains apparently occur in fair numbers at Lake Fork Reservoir (Perttula 1984:140), but these materials have not been identified in other project areas (It is likely that these Ozark cherts were from gravel aggregates in Ouachita Mountain sources).

The distributions of the typed projectile points, as presented in Prewitt's paper in this volume, convey some information about interaction, but they must be used with caution since projectile point styles seldom correlate specifically with social groups. Nonetheless, the fact that many of the most common types in the Post Oak savannah (e.g., Gary, Dawson, Kent, Yarbrough, Alba, Catahoula, Friley, and Steiner) occur widely across eastern Texas but not beyond to the west, indicates that there was sufficient interaction among groups who lived in the eastern part of the state to lead to some degree of uniformity in dart and arrow point styles. The only major types that have more westerly distributions are Perdiz and Scallorn. While both of these could represent increased interaction with groups who lived to the west during parts of the Late Prehistoric period, the case is stronger for Perdiz (i.e., the second half of the Late Prehistoric period) than for Scallorn given the heterogeneity evident in this latter type.

Interestingly, there are a few projectile point types, most of them minor, that point to differences between the northern and southern parts of the Post Oak savannah, and suggest relatively localized interaction spheres. For example, the Archaic dart point types Trinity and Yantis occur mostly in the north and suggest ties between the Post Oak savannah and areas to the east, while Archaic types Axtell and Hoxie have restricted distributions to the south and extending westward to Central Texas. Later dart point styles Godley and Neches River oletha also are relatively common south and west of the Trinity River. Among the arrow points, triangular types such as Turney, Talco, and Maud occur in the north but not the south, as do occasional examples of types such as Homan, Keota, Huffaker, and Washita. The former securely link this part of the Post Oak savannah to Northeast Texas proper, while the latter indicate interaction with groups living north of the Red River and west onto the Plains.

The ceramics also point to some clear differences between the northern and southern parts of the Post Oak savannah. The Woodland–age sandy paste ceramic tradition that is characteristic of the southern part of East Texas is not represented at all at Cooper Lake, and the pottery dating to the early part of the Late Prehistoric period in the upper Sulphur River basin shows clear ties to the Caddoan area to the east and north, based on the predominance of Crockett Curvilinear-Incised/ Pennington Punctated-Incised among the decorated wares, the consistent occurrence of Williams Plain pottery, and the occasional occurrence of Spiro Engraved ceramics as well as sherds assignable to Coles Creek types. The pottery from the single excavated late Late Prehistoric site also indicates strong connections both northward to the Red River and eastward to the Cypress Creek basin, judging from the presence of types such as Avery Engraved, Ripley Engraved, Taylor or Wilder Engraved, McKinney Plain, and Emory Punctated-Incised. This late collection also contains sherds representing a few globular jars that are more reminiscent of Plains vessel forms than those found in this part of the Caddoan area, however, and this points to westward or northwestward contacts.

At the Jewett Mine, most of the presumably early pottery is the sandy paste ware typical of the southern part of East Texas, while a few shell–tempered sherds and a few sherds with kaolin pastes hint at local experimentation with ceramic manufacture. The pottery from early Late Prehistoric contexts indicates interaction with Caddoan groups to the east, based on the small numbers of sherds typeable as Holly Fine Engraved and Weches Fingernail Impressed. The later pottery, with its high incidence of brushing and a few sherds typeable as Maydelle Incised, Killough Pinched, Poyner Engraved, and Patton Engraved, also indicates ties to Caddoan groups living east of the Trinity River, specifically to Hasinai Caddo groups in the Neches and Angelina River basins.

Not far south of Cooper Lake, Caddoan pottery is especially abundant at Lake Fork Reservoir, and most of the types identified (e.g., Canton Incised, Sanders Engraved, Ripley Engraved, and McKinney Plain) point north to the Red River or east toward the Cypress Creek basin (Bruseth and Perttula 1981:77–91). Moving farther south to Richland/Chambers Reservoir, sandy paste pottery apparently is present, as are a few arguably early shell–tempered sherds that may relate to similar ceramics at the Jewett Mine. Otherwise, the ceramics clearly relate to Caddoan wares, with most of the identified types (e.g., Maydelle Incised, Poyner Engraved, and Weches Fingernail Impressed) indicating contact with groups in the Neches River drainage east of the Trinity. The ceramics from most of the excavated sites at the Gibbons Creek Mine (Rogers 1993:102, 160–173, 210–212, 1994:116, 1995:108–123, 168–171) are the sandy paste ware that occurs throughout Southeast Texas, first in Woodland contexts and then in some Late Prehistoric contexts (e.g., on the upper coast). Two sites (41GM281 and 41GM282) also have sizable samples of pottery tempered with grog or bone. Some of these probably are related to the Late Prehistoric San Jacinto ware that occurs on the upper coast to the east and southeast, while small numbers of sherds bear designs similar to those seen on Caddoan pottery to the northeast.

The final line of evidence concerning interaction deals with lithic raw material procurement and the use of nonlocal sources. Figure 17 shows that Cooper Lake and the Jewett Mine are dramatically different in this respect, and the evidence indicates that the relationships between the use of nonlocal lithics and interaction (or maybe

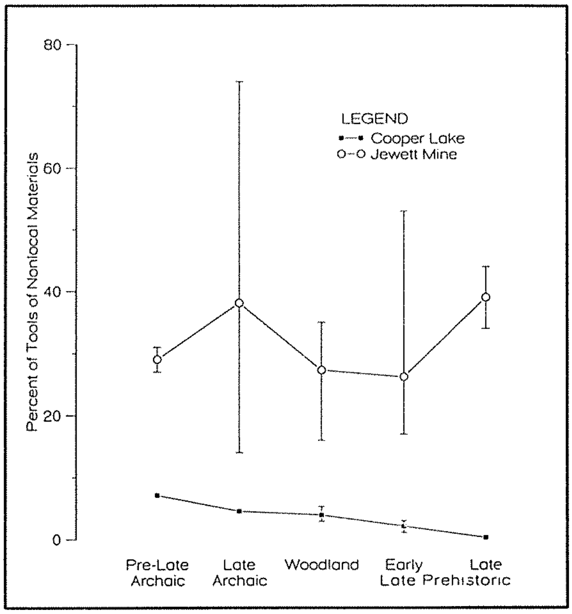

Figure 17. Graph of percentages of shaped chipped stone tools of nonlocal materials by time period for Cooper Lake and the Jewett Mine (includes only components assignable to single periods and excludes the Late Prehistoric component at the Hurricane Hill site because of its anomalously high values [between 3-7 percent]; where the percentages are derived from multiple components, the symbols indicate means while the bars show ranges).

mobility) are not always simple. Cooper Lake shows a simple decrease through time in the use of nonlocal materials, although they were not frequent during any time period. Most of the identified specimens probably represent gravels from the Red River, and the data could suggest an overall decrease in interaction with groups living to the north. This is not supported by the ceramic evidence, however, and it is equally plausible that the graph reflects decreased demand for higher quality materials rather than decreased interaction. In any case, the lithics point to greater use of materials from the Red River than from Central Texas. They do not say much about interaction to the west, east, or south, however, since these areas do not contain lithic materials that are likely to have been imported or that could be distinguished readily from the local Cooper Lake materials. The nonlocal items that were imported were brought in as finished tools, and the very small quantities of debitage of these materials reflect tool refurbishing rather than manufacture.

A very different pattern is evident at the Jewett Mine. Nonlocal lithics, mostly from Central Texas, were used commonly during all time periods, but especially during the Late Archaic period and the late part of the Late Prehistoric period. This certainly indicates substantial interaction with groups who lived west of the Blackland Prairie, and the fact that it did not change much over time is intriguing in view of the other changes that occurred, apparently suggesting that lithic raw material procurement strategies were largely separate from the strategies that conditioned settlement patterns. An explanation for this can be found in the tools and debitage made of these materials and the occasional caches of nonlocal lithics. Specifically, the data indicate that these materials were brought into the Jewett Mine area as large biface and uniface blanks, which were then reduced further. Sometimes they were made into tools that were used in the Jewett area, and sometimes the tools or blanks were exported for use elsewhere. This accounts for the extreme intersite variability in the percentages of nonlocal lithics shown in Figure 17, since some sites saw more reduction of imported lithics while use of tools of these materials was more common at other sites. This pattern indicates that the Jewett area served as a conduit for the transport of Central Texas materials into the eastern part of the state for much of the Holocene, which is not surprising given its location at the western edge of the woodlands and not far east of numerous source areas for abundant high quality lithics.

Elsewhere in the Post Oak savannah, lithics from Central Texas occur in small numbers at the Gibbons Creek Mine, but the vast majority of the tools in the Gibbons Creek sites are made of local materials (Robert Rogers, personal communication 1995). As at Cooper Lake, it is hard to know if this relates to limited sociocultural interaction or little demand for Central Texas lithics. The data from Richland/Chambers Reservoir suggest a decrease in the use of chert over time, reflecting decreased mobility westward across the Blackland Prairie and decreased territory sizes (McGregor 1987, 1993), but it is unknown how this relates to changes in interaction. At Lake Fork Reservoir, nonlocal lithics from a variety of sources (i.e., Central Texas, the Ouachita and Arbuckle Mountains via the Red River, and Ozark Mountains gravels) are present, and there are changes through time in the frequencies of these materials (Perttula 1984). It is difficult to factor out the effects of interaction and mobility, however. In sum, there is much variability across the Post Oak savannah in the use of lithics obtained from nonlocal sources, and it is clear that the frequency of imported lithics is not always a good indicator of sociocultural interaction. On a gross level, however, it is noteworthy that most of the nonlocal materials from Cooper Lake and Lake Fork Reservoir in the northern part of the region are from the Red River, while to the south most of the nonlocal materials were derived from Central Texas.

SUMMARY

Because the archeological record of the Post Oak savannah dates mostly to the Late Holocene, it is difficult to say much about the pre–Late Archaic cultures of the region. In fact, for much of the western edge of East Texas, even Late Archaic components are so infrequent that it is hard to discern coherent patterns in the archeological data. Nonetheless, it is clear that the region was used by hunter–gatherers during this time, and the evidence from Cooper Lake and especially the Jewett Mine indicates that these groups operated largely as foragers, i.e., moving their residential bases frequently to take advantage of temporal and spatial changes in resource availability. Population densities probably were low, and group territories may have been relatively unconstrained. Large territories and widespread interaction may account for the extensive distributions of the most common dart point types, but there are a few types with restricted distributions suggesting distinct localized interaction spheres in the northern and southern parts of the region. This north–south distinction is also evident in the importation of nonlocal lithics, with materials from the north being more common in the Sulphur and Sabine basins and Central Texas materials being more frequent in the Trinity and Navasota basins.

While it sometimes has proven difficult to isolate components dating to the Woodland period, the data from Cooper Lake, Richland/Chambers

Reservoir, the Jewett Mine, and the Gibbons Creek Mine suggest that a forager–oriented hunter–gatherer settlement strategy persisted throughout this period. Squash remains were found at one Woodland site at Cooper Lake, but there is no other evidence that horticulture contributed to the subsistence base. Further, there is no indication of sedentism. It does appear, however, that the Post Oak savannah was used more intensively during this time than before. This likely reflects increases in populations, more frequent reoccupation of favored sites, and occupations of longer duration than during the Archaic period. Ceramic technology was introduced in parts of the region during this interval (e.g., Richland/Chambers Reservoir, Gibbons Creek Mine, and maybe Jewett Mine), but this was not universally the case and there is no evidence that this technological change was accompanied by significant changes in lifeways. Nonetheless, the occurrence of sandy paste pottery only in the southern part of the region and the apparent differences in the timing of this innovation indicate that the north–south distinction noted above for the Archaic period continued into the Woodland period. That this was the case is also indicated by the patterns in the use of nonlocal lithics.

The settlement strategies of the Native Americans who occupied the Post Oak savannah changed during the Late Prehistoric period, and intraregional variability became even more pronounced during this time than before. There is no doubt that these changes were related in part to the development of the Caddo culture in Northeast Texas proper and adjacent parts of Oklahoma, Arkansas, and Louisiana. This was most conspicuously the case in the part of the Post Oak savannah traversed by the Sabine River, as this area was occupied throughout the period by sedentary Caddoan farmers.

Groups with a mixed hunter–gatherer–horticultural economy occupied the Cooper Lake area to the north in an intensive fashion during the Late Prehistoric period, with the first half of the period being marked by seasonal residential mobility and the latter half by increased sedentism and increased logistical use but decreased population densities. The Richland/Chambers Reservoir area saw a similar trajectory involving intensive use during the early half of the period and decreased population densities in the latter half. At Richland/Chambers Reservoir, however, the greatest evidence for sedentism, albeit occasional (i.e., it is not the case at all sites) and not associated with horticulture, was during the early Late Prehistoric period, with more forager–oriented, residentially mobile systems entailing limited horticulture being the case after that. In both of these areas, the decreased intensity of use during the late part of the period may have been related to population aggregations elsewhere in the Post Oak savannah or, perhaps more likely, in the Caddoan area itself.

Evidence for horticulture or any degree of sedentism at all is lacking from the two southernmost project areas considered here: the Jewett Mine and the Gibbons Creek Mine. At the former, the settlement strategies of local hunter–gatherer groups changed during the early Late Prehistoric period such that residential occupations were restricted to the Navasota River valley while the uplands to the east were used mostly for hunting–related activities. This change may have been prompted by pressures from Caddoan groups to the east, but the lack of data from the part of the Trinity River basin east of the Jewett Mine prevents serious evaluation of this hypothesis. The late part of the Late Prehistoric period saw another change in how Native Americans used the area, but there are ambiguities about how this change should be interpreted. It may be that the region was occupied by local forager–oriented hunter–gatherers who interacted regularly with Caddoan groups to the east, or it may be that the area was used mostly by the Caddo on hunting trips or other kinds of forays to the west. It is harder to reconstruct settlement strategies at the Gibbons Creek Mine, although the most recent work there does hint at changes during the late part of the Late Prehistoric period that may parallel those at the Jewett Mine. In any case, it is clear that the lower Navasota River basin was occupied by mobile hunter–gatherers throughout the Late Prehistoric period.

The kinds of ceramics and projectile points and the types of nonlocal lithic materials from Late Prehistoric contexts all point to continued distinctions between the northern and southern parts of the Post Oak savannah, and these probably mark increasingly localized developments. In the north, the strongest ties were with groups living to the east in Northeast Texas proper and to the north along the Red River and beyond. This area was not homogeneous culturally, however. Groups living in the Sabine Basin were fully involved in the Caddo culture, while those farther north in the Sulphur Basin were only marginally so. To the south, especially in the Navasota Basin, Caddoan lifeways never took hold, but it is clear that there was substantial interaction with Caddoan groups to the east. Further, continued contact with Central Texas is reflected in the use of nonlocal lithics, and some of the ceramics from the Gibbons Creek Mine point toward the upper coast.

On one level, the intraregional variability that characterized the Post Oak savannah during the Late Prehistoric period can be ascribed to varying degrees of integration into the Caddoan culture, a situation that is not surprising given the peripheral location of the region relative to the Caddo heartland. This is not a wholly satisfactory explanation, however. It is clear that some of this variability had its roots in distinctions dating to the Archaic period, and it probably can be explained best as the result of overlap between persistent local variations on common adaptive strategies, differences in interaction spheres, variability in the adoption of new technologies and subsistence practices, and differences in the acceptance of new ideologies among groups who had occupied the woodlands of eastern Texas for millenia. Of course, this issue pertains to an area much larger than the Post Oak savannah, emphasizing the critical need for more comparative studies that integrate archeological data between regions rather than simply within them.

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REFERENCES CITED

Bowman, B. F.

1985 Winnie's Mound (41BU17): A Study in the Prehistory of Burleson County, Texas. *Bulletin of the Texas Archeological Society* 56:39–74.

1991 The Foster Site Cremation: A Single Individual, Partition Cremation in Milam County, Texas. *Plains Anthropologist* 36(133):31–42.

Bruseth, J. E.

1995 The Development of Caddoan Polities Along the Middle Red River Valley of Eastern Texas and Oklahoma. In *The Native History of the Caddo: Their Place in Southeastern Archaeology and Ethnohistory*, edited by T. K. Perttula and J. E. Bruseth. MS in review for publication.

Bruseth, J. E., D. E. McGregor, and W. A. Martin

1987 Hunter–Gatherers of the Prairie Margin: Summary of the Prehistoric Archaeological Record. In *Hunter–Gatherer Adaptations Along the Prairie Margin: Site Excavations and Synthesis of Prehistoric Archaeology*, edited by D. E. McGregor and J. E. Bruseth, pp. 229–256. Richland Creek Technical Series, Vol. III. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

Bruseth, J. E. and T. K. Perttula

1981 *Prehistoric Settlement Patterns at Lake Fork Reservoir.* Texas Antiquities Permit Series Report No. 2. Texas Antiquities Committee, Austin, and Southern Methodist University, Dallas.

Burnett, B. A.

1990 The Bioarcheological Synthesis of the Eastern Portions of the Gulf Coastal Plain. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 385–418. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Cliff, M. B.

1989 Archaeological Investigations at the Thomas Site (41DT80). In *Archaeological Investigations at Cooper Lake: 1987 Season*, edited by R. W. Moir, D. E. McGregor, and D. H. Jurney, pp. 6–1 through 6–145. Review Draft. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

Collins, M. B. and C. B. Bousman
1993 Historic Context: Quaternary Environments and Archeology in Northeastern Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 49–67. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Dering, J. P.
1993 Flotation Samples from Sites 41GM181, 41GM201, and 41GM205: The Archaeobotanical Remains. In *Data Recovery of Three Prehistoric Sites at the Gibbons Creek Third Five-Year Mine Permit Area, Grimes County, Texas*, by R. Rogers, pp. C–1 through C–7. Document No. 910529. Espey, Huston & Associates, Inc., Austin.

1994 Plant Remains from 41GM224, Grimes County, Texas. In *Excavations at Site 41GM224 in the Gibbons Creek Lignite Mine Permit 38A Area, Grimes County, Texas*, by R. Rogers, pp. D–1 through D–6. Document No. 930476. Espey, Huston & Associates, Inc., Austin.

Derrick, S. M. and D. G. Steele
1993 Analysis of Human Remains from 41DT6 and 41DT16. In *Excavations at the Tick, Spike, Johns Creek, and Peerless Bottoms Sites, Cooper Lake Project, Delta and Hopkins Counties, Texas*, by R. C. Fields, E. F. Gadus, L. W. Klement, C. B. Bousman, and J. B. McLerran, pp. 271–286. Reports of Investigations No. 91. Prewitt and Associates, Inc., Austin.

Duffield, L. F. and E. B. Jelks
1961 *The Pearson Site: A Historic Indian Site in Iron Bridge Reservoir, Rains County, Texas*. Archaeology Series No. 4. Department of Anthropology, The University of Texas at Austin.

Fields, R. C., E. F. Gadus, L. W. Klement, C. B. Bousman, and J. B. McLerran
1993 *Excavations at the Tick, Spike, Johns Creek, and Peerless Bottoms Sites, Cooper Lake Project, Delta and Hopkins Counties, Texas*. Reports of Investigations No. 91. Prewitt and Associates, Inc., Austin.

Fields, R. C., E. F. Gadus, L. W. Klement, and K. M. Gardner
1994 *Excavations at the Spider Knoll Site, Cooper Lake Project, Delta County, Texas*. Reports of Investigations No. 96. Prewitt and Associates, Inc., Austin.

Fields, R. C. and L. W. Klement
1995 *Excavations at the Cottonwood Springs Site, Jewett Mine Project, Leon County, Texas*. Reports of Investigations No. 102. Prewitt and Associates, Inc., Austin.

Fields, R. C., L. W. Klement, C. B. Bousman, S. A. Tomka, E. F. Gadus, and M. A. Howard
1991 *Excavations at the Bottoms, Rena Branch, and Moccasin Springs Sites, Jewett Mine Project, Freestone and Leon Counties, Texas*. Reports of Investigations No. 82. Prewitt and Associates, Inc., Austin.

Fields, R. C. (editor)
1987 *Excavations at the Alley Road Site (41LN149B) and the Harris Hole Site (41LN30), Jewett Mine Project, Leon County, Texas*. Reports of Investigations No. 61. Prewitt and Associates, Inc., Austin.

1990 *Excavations at the Charles Cox, Lambs Creek Knoll, and Buffalo Branch Sites, Jewett Mine Project, Leon and Freestone Counties, Texas*. 2 Vols. Reports of Investigations No. 70. Prewitt and Associates, Inc., Austin.

Frederick, C. D. and C. Ringstaff
1994 Lithic Resources at Fort Hood: Further Investigations. In *Archeological Investigations on 571 Prehistoric Sites at Fort Hood, Bell and Coryell Counties, Texas*, edited by W. N. Trierweiler, pp. 125-181. Research Report No. 31, United States Army Fort Hood Archeological Resource Management Series. Directorate of Engineering and Housing, Environmental Management Office, Fort Hood.

Gadus, E. F., R. C. Fields, C. B. Bousman, S. A. Tomka, and M. A. Howard
1992 *Excavations at the Finley Fan Site (41HP159), Cooper Lake Project, Hopkins County, Texas*. Reports of Investigations No. 78. Prewitt and Associates, Inc., Austin.

Hoffman, M. P.
1967 Ceramic Pipe Style Chronology Along the Red River Drainage in Southwest Arkansas. *The Arkansas Archeologist* 8(1):1-14.

Jelks, E. B. (editor)
1967 The Gilbert Site: A Norteño Focus Site in Northeastern Texas. *Bulletin of the Texas Archeological Society* 37:1–248.

Mallouf, M. G.
1979 *Archeological Investigations at Lake Limestone, Fall and Winter 1977*. Research Report No. 71. Texas Archeological Survey, The University of Texas at Austin.

Martin, W. A.
1989 Archaeological Investigations at the Doctors Creek Site (41DT124). In *Archaeological Investigations at Cooper Lake 1987 Season*, edited by R. W. Moir, D. E. McGregor, and D. H. Jurney, pp. 7–1 through 7–110. Review Draft. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

McGregor, D. E.
1987 Lithic Raw Material Utilization. In *Hunter–Gatherer Adaptations Along the Prairie Margin: Site Excavations and Synthesis of Prehistoric Archaeology*, edited by D. E. McGregor and J. E. Bruseth, pp. 185–196. Richland Creek Technical Series, Vol. III. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

1989 Excavations at Site 41HP137. In *Archaeological Investigations at Cooper Lake: 1987 Season*, edited by R. W. Moir, D. E. McGregor, and D. H. Jurney, pp. 8–1 through 8–28. Review Draft. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

1993 Pisgah Ridge Chert Distributions: Evidence for Changing Territorial Size in North Central Texas. *Bulletin of the Texas Archeological Society* 64:247–267.

McGregor, D. E. and J. E. Bruseth
1987 Artifact Chronology. In *Hunter–Gatherer Adaptations Along the Prairie Margin: Site Excavations and Synthesis of Prehistoric Archaeology*, edited by D. E. McGregor and J. E. Bruseth, pp. 171–184. Richland Creek Technical Series, Vol. III. Archaeology Research Program, Institute for the Study of Earth and Man, Southern Methodist University, Dallas.

Nash, M.
1993 Faunal Remains from Sites 41GM205 and 41GM181, Area A. In *Data Recovery of Three Prehistoric Sites at the Gibbons Creek Third Five–Year Mine Permit Area, Grimes County, Texas*, by R. Rogers, pp. F–1 through F–10. Document No. 910529. Espey, Huston & Associates, Inc., Austin.

Natural Fibers Information Center
1987 *The Climate of Texas Counties.* Natural Fibers Information Center, The University of Texas at Austin, in cooperation with Office of the State Climatologist, Texas A&M University, College Station.

Perttula, T. K.
1984 Patterns of Prehistoric Lithic Raw Material Utilization in the Caddoan Area: The Western Gulf Coastal Plain. In *Prehistoric Chert Exploitation: Studies from the Midcontinent*, edited by B. M. Butler and E. E. May, pp. 129–148. Occasional Paper No. 2. Center for Archaeological Investigations, Southern Illinois University at Carbondale.

1990a *The Hurricane Hill Site (41HP106): Excavations at Cooper Lake, Hopkins County, Texas.* Second Draft. Contributions in Archaeology No. 9. Institute of Applied Sciences, University of North Texas, Denton.

Perttula, T. K.*(Continued)*
1990b Historic Context: The Evolution of Agricultural Societies in Northeast Texas before A.D. 1600. Historic context funded by the Texas Historical Commission, Austin.

1994 Caddoan Mound Sites in the Sabine River Basin of Northeast Texas. *Caddoan Archeology Newsletter* IV(4):4–19.

1995 Early Ceramic Settlement in Northeast Texas: Archeological Investigations of the Hurricane Hill Site (41HP106), Cooper Lake. In *Advances in Texas Archeology: Contributions from Cultural Resource Management, Volume 1*, edited by J. E. Bruseth and T. K. Perttula, pp. 131-154. Cultural Resource Management Report 5. Department of Antiquities Protection, Texas Historical Commission, Austin.

Phillips, P.
1970 *Archaeological Survey in the Lower Yazoo Basin, Mississippi, 1949-1955.* Papers of the Peabody Museum of Archaeology and Ethnology, Volume 60. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

Prikryl, D. J.
1993 Introduction to the Regional Plan for Archeological Resources, Prairie-Savanna Archeological Region. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 189-203. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Roemer, E., Jr. and S. B. Carlson
1987 *Excavations at 41BU16: State Highway 21 at the Brazos River, Burleson County, Texas.* Contract Reports in Archaeology No. 1. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.

Rogers, R.
1993 *Data Recovery of Three Prehistoric Sites at the Gibbons Creek Third Five–Year Mine Permit Area, Grimes County, Texas.* Document No. 910529. Espey, Huston & Associates, Inc., Austin.

1994 *Excavations at Site 41GM224 in the Gibbons Creek Lignite Mine Permit 38A Area, Grimes County, Texas.* Document No. 930476. Espey, Huston & Associates, Inc., Austin.

1995 *Archeological Excavations at Prehistoric Sites 41GM166, 41GM281, and 41GM282 at the Gibbons Creek Lignite Mine, Grimes County, Texas.* Document No. 940611. Espey, Huston & Associates, Inc., Austin.

Smith, J. E.
1993 The Vinson Site (41LT1): A Norteño Focus Indian Village in Limestone County, Texas. *Bulletin of the Texas Archeological Society* 64:65–162.

Story, D. A.
1990 Cultural History of the Native Americans. In *Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Thoms, A. V. (editor)
1993 *The Brazos Valley Slopes Archeological Project: Cultural Resources Survey and Assessment for the Texas A&M University Animal Science Teaching and Research Complex, Brazos County, Texas.* Reports of Investigations No. 14. Archaeological Research Laboratory, Texas A&M University, College Station.

The Archeology of the Pineywoods and Post Oak Savanna of Northeast Texas

Timothy K. Perttula

ABSTRACT

This paper considers the diverse character of the prehistoric and early historic archeological record in the Pineywoods and Post Oak Savanna of the Northeast Texas Archeological Region, especially that of the Sabine River and Cypress Creek basins. Native Americans settled in the region some 12,000 years ago, and ranged through its forests, grasslands, and broad floodplains and wetlands as mobile hunter-gatherers. About 2000 years ago, these Native Americans (ancestral to Caddo peoples) began to settle down in recognizable territories, to make better use of native seeds and tropical cultigens, and practiced the art of ceramics. From this milieu, developed the vibrant and sophisticated prehistoric Caddo culture ca. A.D. 800. The prehistoric Caddo were prosperous horticulturists and traders, lived in dispersed sedentary hamlets and villages, and were temple and burial mound builders marking the ceremonial and religious places of important priests and chiefs. The Caddo continued to live in this part of Northeast Texas until as late as 1842, cooperatively living and interacting with the European and American colonizers of their land until they were removed to the Brazos River in the 1840s-1850s, and then removed again to Oklahoma in 1859.

INTRODUCTION

The main purpose of this paper is to summarize the current state of knowledge concerning the prehistoric and early historic archeological record of the Pineywoods and Post Oak Savanna of Northeast Texas (Figure 1). I first discuss the natural setting of the area and the history of archeological investigations in Northeast Texas, then turn to a succinct but broad presentation of the native history of the region. Much attention is given to the Late Caddo period (ca. A.D. 1400-1680) archeological record (as defined by Story 1990), particularly what archeologists have come to call the Titus phase, because our knowledge of this span of Caddo prehistory is reasonably well-developed (e.g., Thurmond 1985, 1990a; Turner 1978, 1992; Perttula 1992a), and because our focus on the Titus phase provides the best opportunity to understand what prehistoric Caddo culture was like before, and immediately after, Europeans invaded the area.

NATURAL SETTING

Northeast Texas has three main biotic communities: the Post Oak Savanna or Oak Woodlands, the Blackland Prairie, and the Pineywoods. The area of interest discussed herein lies principally within the modern distribution of the Pineywoods and the Post Oak Savanna, with a small portion of the Blackland Prairie at the western margins of the region (Figure 2).

The Post Oak Savanna is a narrow southwest-northeast trending woodland belt that marks a natural transition zone or ecotone between the more xeric Blackland Prairie to the west and the more mesic Pineywoods to the east (Küchler 1964). Both the Post Oak Savanna and the Pineywoods have medium-tall to tall broadleaf decidous forests, and shortleaf and loblolly pines are common in the Pineywoods on upland fine sandy loam soils with adequate moisture. Small areas of tall grass prairie may be present in both communities throughout the region (e.g., Jordan 1981:Figure 4.1). Bottomland communities along the Sabine and Cypress drainages contained a diverse hardwood and swamp forest.

The climate of the region is humid, with a mean annual precipitation of at least 120 cm; periods of maximum rainfall occur in the spring and fall seasons. Droughts are not uncommon, and dendrochronological analyses of tree rings for the last 500 years suggest there were numerous wet and dry

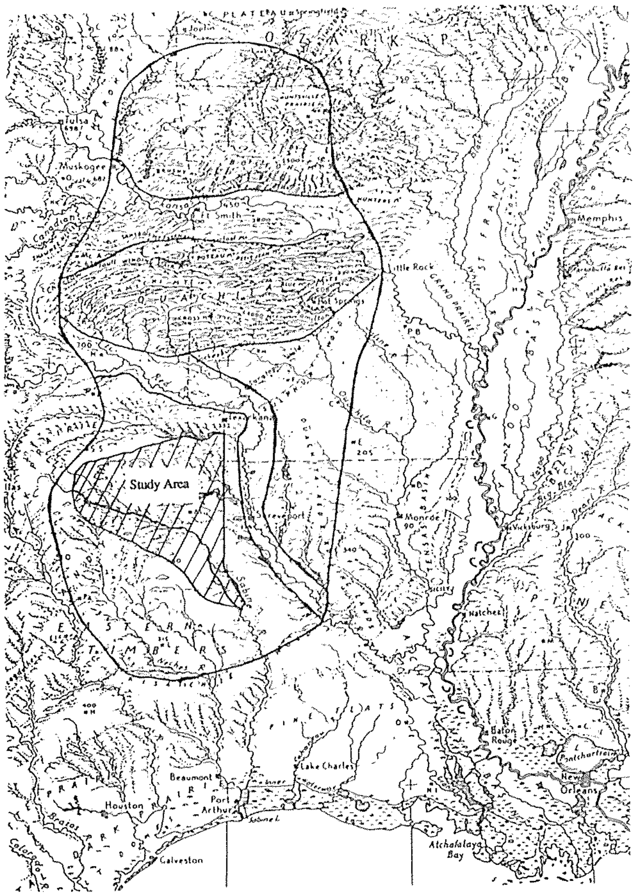

Figure 1. The Caddoan Archaeological Area, Physiographic zones (from Fenneman 1938), and the location of the study area.

spells between ca. A.D. 1500-1700. The worst droughts occurred around A.D. 1555, 1570, 1595, and 1670, and the period between A.D. 1549-1577 has been suggested to have been the worst June drought in the past 450 years (Stahle et al. 1985). These climatic perturbations presumably affected the predictability and success of the maize harvests during the Caddoan occupation of the Pineywoods and Post Oak Savanna, and certainly similar perturbations in the Holocene also affected the range, distribution, and abundance of naturally occurring plants and animals during the long prehistoric Native American settlement of Northeast Texas (see Collins and Bousman 1993:57-59; Ferring 1994). How these droughts affected the flow of the numerous upland springs used by the Caddo in the Pineywoods is unknown.

The Holocene paleoenvironmental record for Northeast Texas is not particularly well known, although paleoenvironmental data from Prairie-Savannah Texas pollen cores and stable carbon isotopes have proved useful to Fields and Tomka (1993) in modelling Paleoindian and Archaic mobility strategies in the Northeast Texas Archeological Region. A 14,000 year stable isotopic record from the Aubrey site in the Trinity River basin documents significant changing climatic conditions, with wetter (and perhaps slightly cooler) or more humid climates from ca. 11,000-7500 years B.P., then again between 4000-2000 years B.P., and after 1000 years ago (Humphrey and Ferring 1994:Figure 8). It was drier than today between 7500-4000 years ago and about 2000-1000 years ago. It is interesting that fossil vertebrate, pollen, and stable isotope data from Central Texas and the Edwards Plateau tell a somewhat different story, highlighting two dry climatic peaks between ca. 7000-3000/2500 years B.P. and after 1000 years ago (e.g., Toomey et al. 1993). While these presumed climatic changes have implications for the relative position of the prairie-forest border, the possible presence or absence of bison, and the natural resource potential of the Pineywoods and Post Oak Savanna, it remains to be determined how these broad environmental changes actually pertain to the archeological record from Northeast Texas.

HISTORY OF INVESTIGATIONS

Archeological research in the central part of the Northeast Texas Archeological Region has a lengthy history that has been thoroughly discussed by Story (1990), Thurmond (1990a), and Guy (1990). Please consult these excellent publications for more specific information on the history of archeological research in Northeast Texas.

Much of our knowledge of the prehistoric use of the region is primarily based on the 1930s excavations of aboriginal sites and cemeteries (Pearce 1932; Jackson 1933, 1934) in the Cypress, Sabine, and Sulphur basins by the University of Texas. Since the 1930s, most of the information about the Paleoindian, Archaic, Early Ceramic, and

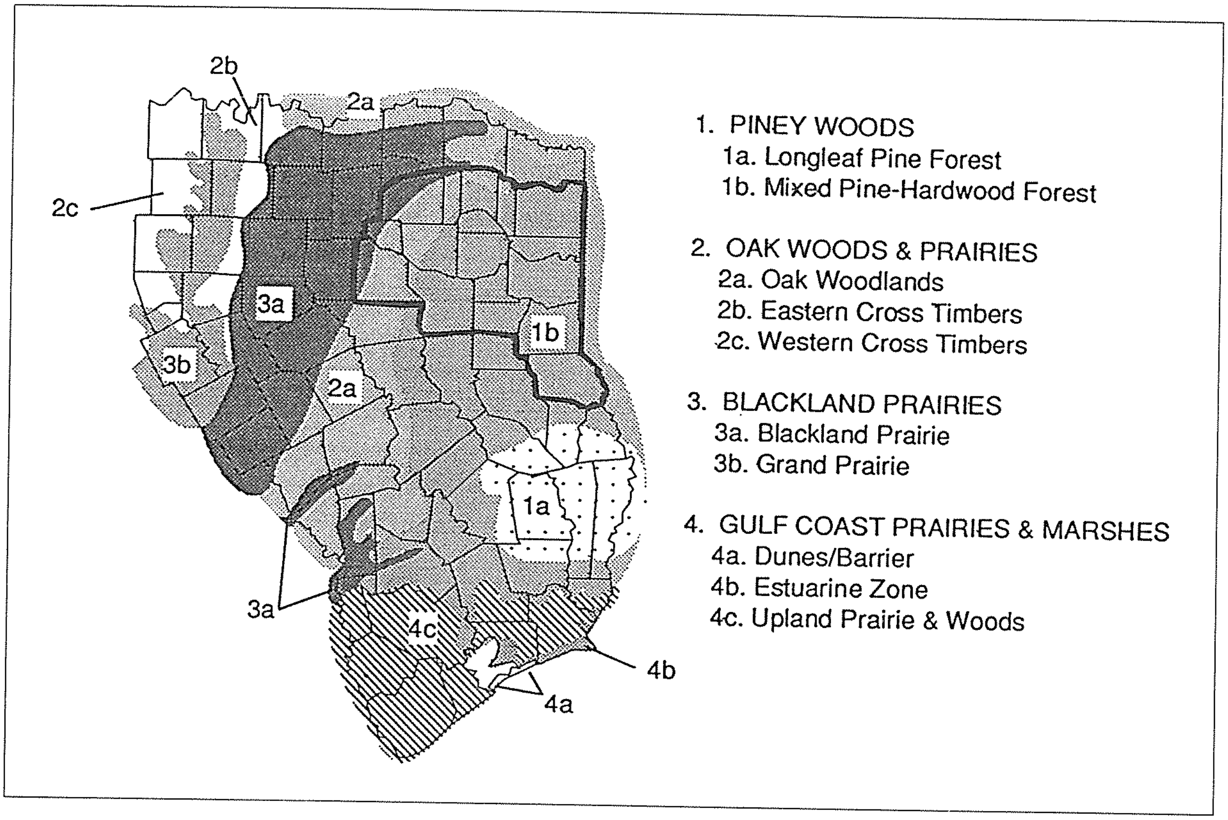

Figure 2. Vegetation zones in the Eastern Planning Region of Texas (after Diamond et al. 1987), and within the central portion of the Northeast Texas Archeological Region.

Caddoan archeological record in the Pineywoods comes from avocational archeological investigations (cf. Nelson et al. 1994; Thurmond 1990a; M. Turner 1993, 1994; R. Turner 1978, 1992, 1995; Webb et al. 1969), along with professional archeological work in a number of state and federally-funded or permitted reservoirs in the Sabine and Cypress basins (Bruseth and Perttula 1981; Horizon Environmental Services, Inc. 1993, 1995; McClurkan et al. 1966; Thurmond 1990a; Woodall 1969) as well as in large surface lignite mines (e.g., Kotter et al. 1991, 1993; Nash et al. 1995; Rogers et al. 1994).

Another source of information, unfortunately, includes the activities of the numerous pothunters and collectors in Northeast Texas. Most of the larger Caddoan cemeteries and habitation sites in the region (including those on Federal lands) have been located and dug by pothunters over the last 15 years (Perttula 1992a, 1992b), although site looting and vandalism has been a persistent problem in the region since the early 1900s (Perttula 1993d:24-25). Very little, if any, reliable archeological data from pothunter digs has been accessible to the professional archeological community. The indiscriminate collecting of lithics and ceramics from sites exposed along the shorelines of federal and state-maintained reservoirs in the region has also unfortunately destroyed many Caddoan archeological sites as well as much useful archeological information.

THE NORTHEAST TEXAS PINEYWOODS AND POST OAK SAVANNA ARCHEOLOGICAL RECORD

The Native American settlement of the Post Oak Savanna and Pineywoods of Northeast Texas is a story that began over 11,000 years ago, and "is long, complex, and endlessly fascinating" (Schambach 1993:1). From the archeological record of this region, one may grasp bits and pieces of the tale: the mobile Paleoindian and Archaic foragers; the long-distance trade and exchange of goods (i.e., lithic raw materials); the development of sedentary communities of foragers and possibly pre-maize cultigen users (e.g., Fritz 1994); the adoption of ceramics and the bow and arrow; the development of complex Caddoan horticultural and agricultural societies; the use of earthen mounds; and the seemingly rapid abandonment of much of the region in the seventeenth and eighteenth centuries due in large measure to the effects of European-introduced diseases as well as the European colonization of traditional Caddoan territory, followed by the permanent expulsion of Caddo groups. Many of the archeological details of these events and developments are well-known (see especially Story 1990; Thurmond 1988, 1990a; Kenmotsu and Perttula 1993:69-187).

For the period prior to about 6000 years ago, the Northeast Texas archeological record primarily consists of surficial, mixed, or isolated finds of diagnostic projectile points (cf. Johnson 1989; Story 1990). Undoubtedly discrete archeological components are present in the region (as shown by the buried Finley Fan site occupied as early as 6400 years B.P. [Gadus et al. 1992] and the spatially discrete Late Paleoindian John Pearce site [Webb et al. 1971]), but they have proven to be quite difficult to define and recognize.

Paleoindian materials have been recovered at a number of archeological sites in the Pineywoods and Post Oak Savanna of Northeast Texas, and the locations of the better known sites are illustrated in Figure 3. At the Forrest Murphey site (41MR62), Clovis, Plainview, Dalton, and other lanceolate projectile point forms and tools were found in several discrete concentrations on a high terrace above Big Cypress Creek; faunal remains from extinct elephants were also recovered in apparent association (Story 1990), which is rather rare (see Meltzer and Bever, this volume).

The distributions of Paleoindian artifacts within the Sabine River and Cypress Creek basins suggest that these early occupations were principally situated within the valleys of major stream basins (Thurmond 1990a:Table 53 and 54). The relatively sparse Paleoindian archeological record, in conjunction with the dispersion of artifacts on many landforms and different settings within the region, seems to indicate that the Paleoindian groups were very mobile hunters and gatherers rather than specialized hunters of extinct megafauna (Fields and Tomka 1993:82). Johnson (1989) also suggests that some of the Paleoindian archeological remains (Plainview and Scottsbluff projectile points, and Cody knives) from the region are a result of Plains Late Paleoindian

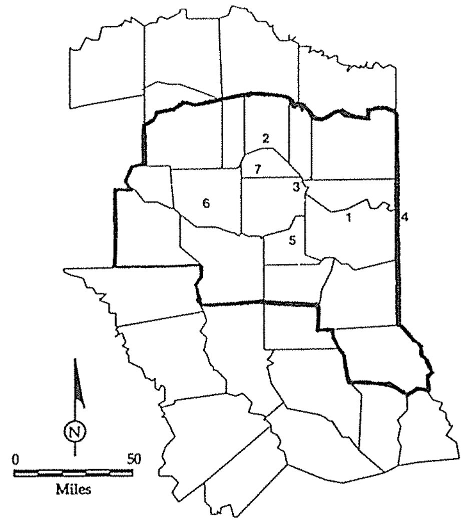

Figure 3. Important Paleoindian archeological sites mentioned in the text from the central part of the Northeast Texas Archeological Region: (1) Murphey (41MR62); (2) Benson's Crossing (41TT110); (3) Jake Martin (41UR12); (4) Swanson's Landing (16CD8); (5) Grace Creek 1 (41GG33); (6) Alum Branch (41WD40); and (7) Lilly Creek (41CP27).

(ca. 10,000-9,000 years ago) groups that moved into parts of Northeast Texas, during periods when grassland habitat spread eastward, to exploit the plains resources (such as bison) found there.

Archeological data from the Yarbrough site (41VN6; see Figure 4) were employed by Johnson (1962) to bring chronological and cultural order to the diverse Archaic (ca. 6000-200 B.C.) archeological record found in Northeast Texas. Of particular import, were Johnson's (1962:208) temporal divisions of the Archaic based on projectile point sequences, and the introduction of plain ceramics at the end of the Archaic. Story (1990:Figure 32) and Thurmond (1990a:Table 8) provide the most current chronological classifications of Archaic-age dart points, with straight and expanding stem forms characteristic of the Early and Middle Archaic periods and the contracting stem darts particularly diagnostic of the Late Archaic (and much of the Early Ceramic period as well [Schambach 1982]).

What have we learned about the Archaic populations who lived in Northeast Texas? While the archeological data are still rather limited, it appears that group mobility remained high for these hunting-gathering foragers during the Early Archaic, and group territories were large and poorly defined,

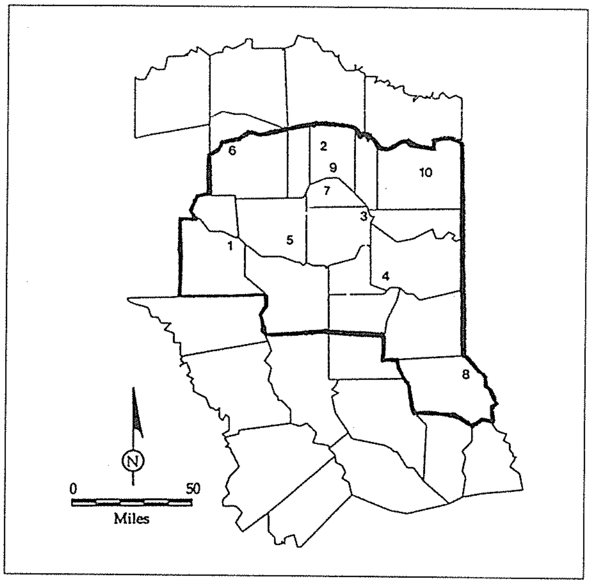

Figure 4. Important Archaic period archeological sites: (1) Yarbrough (41VN6); (2) Tankersley Creek (41TT108); (3) Jake Martin (41UR12); (4) 41HS463; (5) 41WD114, Trammell Crow Pond (41WD185); (6) Finley Fan (41HP159); (7) R. W. Watts #2 (41CP14); (8) 41SY81; (9) Benson's Crossing (41TT110); and (10) Mothershed Springs (41CS119).

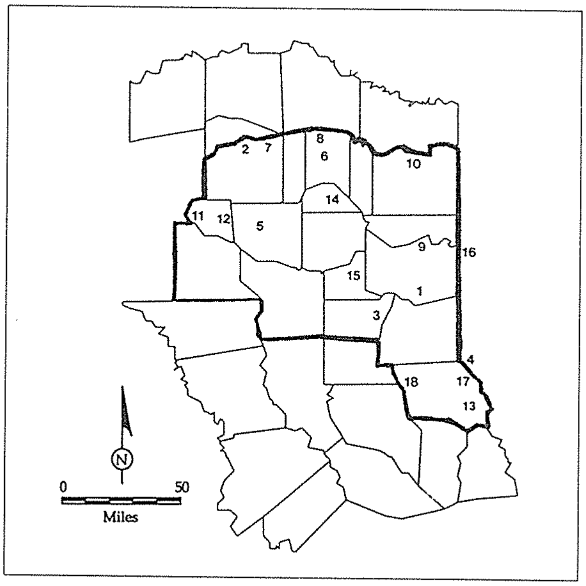

Figure 5. Important Early Ceramic period archeological sites: (1) Resch (41HS16); (2) Hurricane Hill (41HP106), 41HP137, and Lawson (41HP78); (3) Folly (41RK26); (4) James Pace (16DS268); (5) Osborn (41WD74); (6) Tankersley Creek (41TT108); (7) Bert Davis (41HP3); (8) William Farrar (41TT1); (9) Shelton-Downs (41HS27); (10) Snipes (41CS8); (11) Limerick (41RA8); (12) 41RA65; (13) X41SY100; (14) 41CP75; (15) Grace Creek (41GG11); (16) Swanson's Landing (16CD8); (17) 41SY82; and (18) 41SY49.

with most sites conforming to what Thurmond (1990a:41) called "heavy" and "limited-use" areas; that is, repeated and recurrent occupations by small groups. By the Middle Archaic in the Sabine and Cypress drainages, fairly substantial and extensive occupations are recognized within the major basins, with a rather limited use of smaller tributaries and headwater areas (see Thurmond [1990a:Figure 9] where Middle Archaic "heavy use" sites occur along Big and Little Cypress Creek, or on tributaries near their confluence with Big Cypress Creek). Lithic raw material data from a possible Middle Archaic assemblage at Lake Fork Reservoir suggests that the exchange of non-local materials (particularly finished tools) was common place (Perttula 1984), although "patterns in raw material use were not uniform across Northeast Texas" (Fields and Tomka 1993:92).

Late Archaic sites are widely distributed in the Pineywoods and Post Oak Savanna, occurring along the major streams, near springs, on spring-fed branches, upland ridges, and on tributary drainages of all sizes (cf. Thurmond 1990a). Some Late Archaic occupations contain earthen middens (i.e., the Yarbrough site along the Sabine River). These settlement data are compatible with higher population densities, limited group mobility, the possible establishment of definable territorial ranges, and a well-developed foraging economy based on the hunting and gathering of local food resources. No paleobotanical evidence is available that indicates the Late Archaic populations in Northeast Texas cultivated native plant species (i.e., such as sumpweed, sunflower, and chenopod), as was the case by the first millenium B.C. in many parts of Eastern North America (Fritz 1994:25-27). The high use of local lithic raw materials during the Late Archaic in the Sabine and Cypress basins speaks to a more confined interregional interaction at this time (Perttula and Bruseth 1995).

The Early Ceramic period (ca. 200 B.C. to ca. A.D. 800) in this part of Northeast Texas is recognized primarily by plain and relatively thick ceramic bowls and "flowerpot" shaped jars, double-bitted axe heads, the smaller and thinner Gary projectile points, and later in the period by corner-notched arrowpoints (Thurmond 1990a). In several instances, as at the Resch and Folly sites (Figure 5), Lower Mississippi Valley (LMV) related ceramics (such as Tchefuncte Stamped, Churupa Incised, Marksville Incised, Troyville Stamped, and Marksville Stamped) occur with some frequency in Early Ceramic period components in the Sabine River drainage (Story 1990:246). Later LMV Coles Creek period ceramics (and expanding stem arrowpoints similar to the Colbert and Friley types) are present in notable quantities in several sites along the Sabine River, particularly at James Pace in a context dated between ca. 1300-1000 years B.P. (Girard 1994). Similar dated contexts in the Upper Sabine River basin have ceramic assemblages dominated by horizontally incised decorative motifs, and Friley arrowpoints occur in association (Bruseth and Perttula 1981).

While there is much archeologists do not know about the Early Ceramic period peoples of Northeast Texas, what has been learned over the last 40 years or so is that they were still primarily hunter-gatherers who lived in increasingly larger groups and resided for longer periods of time at certain sites. These latter sites have relatively substantial midden deposits, and some evidence for structures (probably daubed pole and thatch structures), but the degree of permanence is still less than that seen in the subsequent long-term Caddo settlement of Northeast Texas (Perttula, Fields, Corbin, and Kenmotsu 1993:99).

No Early Ceramic period burial mounds have been documented in the Pineywoods and Post Oak Savanna of Northeast Texas, although they have been found on the Red River in Northwest Louisiana and Southwest Arkansas (Schambach 1982; Webb 1984), and on the Angelina, Neches, and Sabine rivers in Deep East Texas (Story 1990). The two or three mounds at James Pace did not, however, apparently serve as platforms for burials or structures, or as caps for these features, and their functional significance is equivocal (Girard 1994:15). The appearance of burial mounds in the broader region around Northeast Texas does suggest that more complexly organized local groups did develop during the Early Ceramic period in these localities.

When we turn to a consideration of the Formative (ca. A.D. 800-1000), Early (ca. A.D. 1000-1200), and Middle (ca. A.D. 1200-1400) Caddoan period occupation of the Pineywoods and Post Oak Savanna of Northeast Texas, there is an abundance of archeological information to draw upon. Many an archeologist has been captivated by the beautifully manufactured ceramics and other material goods, the earthen mounds, the well-preserved villages and hamlets, and the existence of an ethnohistorical record (e.g., Swanton 1942; Bolton 1987) that has helped to bring to light behavioral analogs with which to interpret the archeological story. Consequently, our view of the lifeways of these prehistoric Caddo groups is much fuller, and perhaps more behaviorally meaningful, than has been the case for the Paleoindian, Archaic, and Early Ceramic regional archeological record.

First of all, Caddo archeological sites of these ages (Figure 6) are quite common throughout the Pineywoods and Post Oak Savanna (Thurmond 1990a; Story 1990). They are situated primarily on elevated landforms (alluvial terraces and rises, natural levees, and upland edges) adjacent to the major

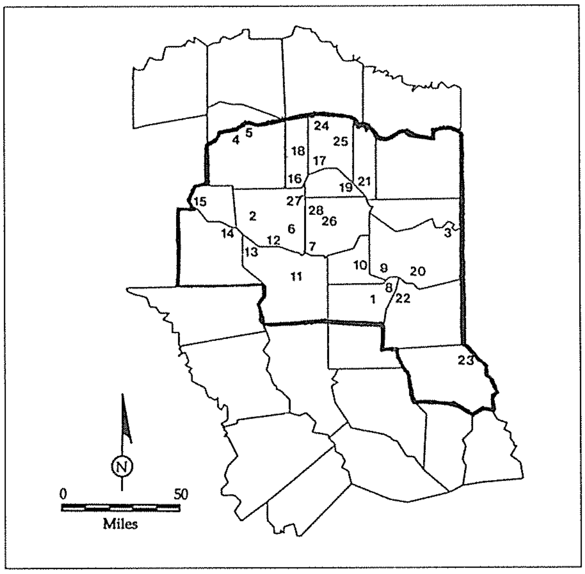

Figure 6. Important Formative, Early, and Middle Caddoan period archeological sites: (1) Oak Hill Village (41RK214); (2) Spoonbill (41WD109), Taddlock (41WD482) and Hines (41WD87); (3) Mound Pond (41HS12 and 41HS29); (4) Arnold (41HS102); (5) Hurricane Hill (41HP106); (6) McKenzie (41WD55); (7) Boxed Springs (41UR30); (8) Hudnall-Pirtle (41RK4); (9) 41HS74; (10) Grace Creek 1 & 2; (11) Bryan Hardy (41SM55); (12) Carlisle (41WD46); (13) Jamestown (41SM54); (14) Yarbrough (41VN6); (15) Limerick (41RA8); (16) Hightower (41FK7); (17) Hale (41TT12); (18) Jaggers (41FK3); (19) Harold Williams (41CP10); (20) C. D. Marsh (41HS269); (21) Richard Watson (41MX6); (22) 41PN14; (23) 41SY81; (24) W. A. Ford (41TT2); (25) 41TT65; (26) Davis-McPeak (41UR4/99); (27) Minnie Garrison (41WD16); and (28) Griffin Mound (41UR142).

streams, as well as along minor tributaries and spring-fed branches. Proximity to arable sandy loam soils were preferred for settlement locations, presumably because of good drainage for habitation, and for cultivation purposes.

The majority of these Caddo sites are:

> permanent settlements that have evidence of the structures, including posts, pits, and features marking their residency, along with the cemeteries and graves where the dead were buried; the middens where the animal and plant food refuse was discarded amidst broken stone tools and pottery vessels; and the material remains of tools and ceramics used in the procurement and processing of the bountiful resources of the region. They represent the settlements of Caddoan communities and sociopolitical entities, and the civic-ceremonial centers that were their focus (Perttula 1993a:125).

The distribution of Caddoan settlements across the landscape suggests that all habitats were used, either by the sedentary communities and farmsteads, or by logistical camps where specific natural resources could be procured by the Caddo in bulk.

The most common types of Caddoan settlements appear to be small hamlets and farmsteads (Perttula et al. 1986; Thurmond 1990a), but larger communities have been recognized that occur in association with mound centers (such as the large settlements at Hale (41TT12) and Hudnall-Pirtle [Bruseth 1991]). One of the more significant Caddoan sites investigated to date in the Northeast Texas Pineywoods, the Oak Hill Village (41RK214), estimated to date between ca. A.D. 1200/1300-1450, has at least 42 circular and rectangular structures (Figure 7). Some of the structures had been rebuilt and some overlapped earlier structures, and they were arranged over the 3.5 acre village in a circular pattern around a central plaza area (Cruse 1994, 1995; Rogers et al. 1994:Figure 11). A small mound (covering a burned structure) is at the north end of the site, and several midden deposits (including a large, possibly communal trash dump near the south end of the site) have been identified that appear to be associated with individual structures.

These Formative-Middle Caddoan groups seem to have been horticulturists, cultivating maize and squash, along with several kinds of native seeds (Perttula and Bruseth 1983), as well as proficient hunters of deer, fish, and many other animal species. The available paleobotanical and bioarcheological evidence from Northeast Texas (and elsewhere in the Caddoan area) does not indicate, however, that Caddoan groups became dependent upon maize and other domesticated crops until about A.D. 1300; by ca. A.D. 1450, maize comprised more than 50 percent of the diet (see Rose et al. 1995; Burnett 1990).

Both temple and burial mounds were built by these Pineywoods and Post Oak Savanna Caddoan groups. The larger sites are important civic-ceremonial centers containing multiple mounds (Figure 8) and associated villages. The multiple mound centers are rather evenly spaced along both the Sabine River and Cypress Bayou, and those that are contemporaneous may represent hierarchical systems of an "integrated...regional network of interaction and redistribution" (Thurmond 1990a:234). Perttula (1994:12) identifies the Jamestown (8 mounds and village), Boxed Springs (4 mounds, village, and large cemetery), and

Figure 7. Structure 2 at the Oak Hill Village, a Middle Caddoan period site; wood stakes mark posthole stains of the structure walls and extended entranceway. Photo courtesy of Mr. Bo Nelson.

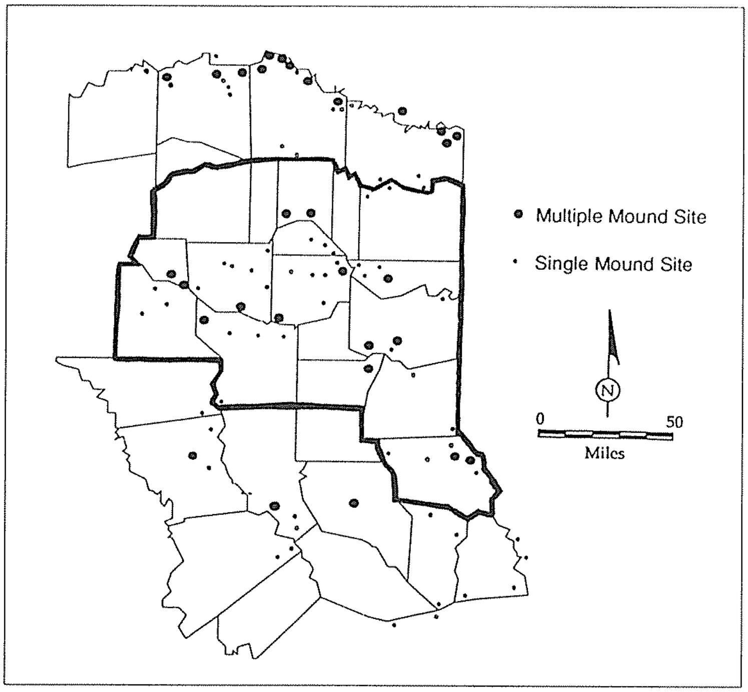

Figure 8. Mound Sites in the Northeast Texas Archeological Region (from Perttula 1993a).

including: carinated bowls, simple bowls, compound bowls, bowls with collared rims and rim tabs, bottles with tall and tapered necks, and substantial jars with short to tall necks or rims and cylindrical to spherical bodies. Many of the utility vessels were decorated, usually with incising, punctation, fingernail impressions, and applique; brushing of vessel bodies is a form of surface treatment that is notable after ca. A.D. 1300 in the Cypress Creek basin, and in Middle Caddoan period sites such as Carlisle and Bryan Hardy (see Figure 6) on the Sabine River (Perttula et al. 1993b). The use of a red hematite slip on interior and/or exterior surfaces of carinated bowls and bottles occurs with some regularity in Early and Middle Caddoan ceramic assemblages, and in the case of Maxey Noded Redware, the squat, long-necked bottles also have appliqued and/or punctated designs below the neck of the bottle (Krieger 1946).

Engraved curvilinear, scroll, and horizontal and/or diagonal motifs were commonly employed on the carinated bowls and bottles. This includes such defined types as Hickory Engraved, Holly Fine Engraved, Spiro Engraved, Sanders Engraved, and Haley Engraved (Suhm and Jelks 1962; Turner 1995).

Hudnall-Pirtle (8 mounds and 60 acre village) multiple mound centers (see Figure 6), as representing the apex of postulated local Early-Middle Caddoan networks in the Sabine River basin. Whether this is actually the case or not, the distribution, number, and spacing of mound centers in this part of Northeast Texas clearly indicates that the Caddoan peoples who built and used these mounds were integrated into societies of considerable socio-political complexity.

The Formative, Early, and Middle Caddoan Pineywoods groups possessed a rich material culture. Well-made, corner-notched, and rectangular-stemmed arrowpoints were common, along with siltstone and greenstone celts, perforators, large Gahagan bifaces, and a variety of more expedient stone tools (flake scraping and cutting implements). Long-stem Red River (Hoffman 1967) and cigar-shaped ceramic pipes were made by the Caddo at this time, as were ceramic earspools and figurines (see Newell and Krieger 1949).

Most distinctive of these Caddo groups were the ceramics they made for cooking, storage, and serving needs (see Perttula et al., this volume). These vessels were made in a variety of forms,

The Late Caddoan Titus phase (ca. A.D. 1400-1680) represents the archeological remains of a number of Caddoan groups who lived between the Sabine and Sulphur rivers in the Northeast Texas Pineywoods (Figure 9). These Caddoan peoples lived in dispersed year-round settlements where they farmed and hunted, buried their dead in planned cemeteries, and manufactured culturally distinctive ceramics of considerable stylistic and functional diversity. The same may be said for the contemporaneous Frankston phase groups in the Upper Neches and Angelina River basins (Kleinschmidt 1982; Story and Creel 1982), and Late Caddoan groups living in the Angelina and Attoyac River basins (Middlebrook 1994).

Socio-politically, these Pineywoods Caddo were somewhat akin to the Kadohadacho Caddo groups on the Red River—who were elite-controlled and hierarchically-ranked societies (cf. Barker and

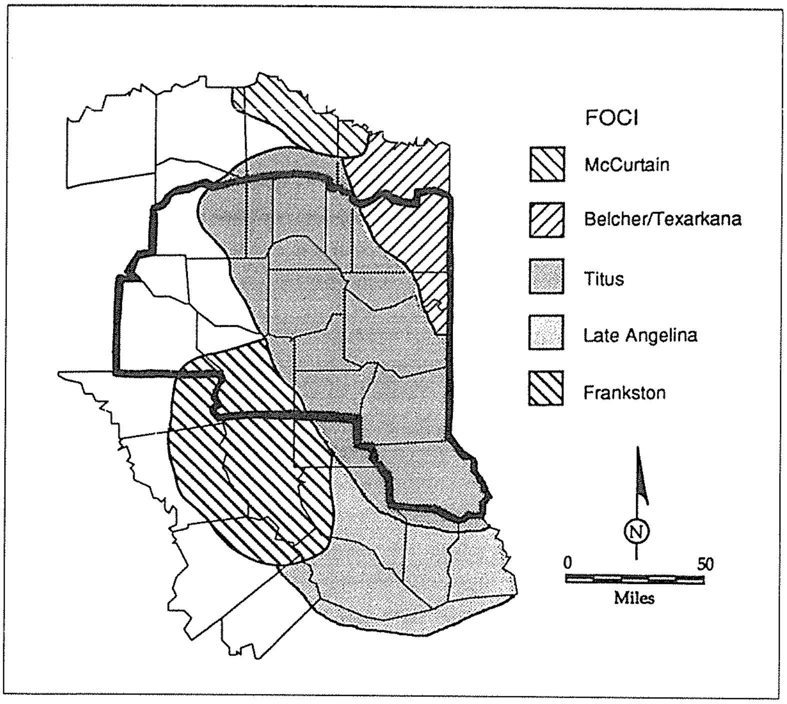

Figure 9. The distribution of Late Caddoan archeological phases in the Northeast Texas Archeological Region (from Perttula 1993c).

Pauketat 1992)—especially as noted in patterns of mound construction and mortuary behavior in the Belcher, McCurtain, and Texarkana phases (Gregory 1980; Webb 1959; Thurmond 1990a; see Bruseth 1995), and in terms of sociopolitical organization (Smith 1994). However, these Pineywoods Caddo groups did not remain in historic times in the Sabine and Cypress basins to be other than cursorily described by Europeans, unlike either the Kadohadacho and Hasinai groups to the north, east, and south (cf. Smith 1995). Scrutiny of the archeological record of these Pineywoods Caddo illustrates their social, economic, and political dynamism during times of significant cultural change in the Caddoan area (e.g., Jeter et al. 1989; Story 1990; Perttula 1992a). The next section of the paper discusses the basic fabric of Late Caddoan period societies between the Sabine and Sulphur rivers as a prelude to exploring the changing nature of these group's socio-political and economic character through time.

Titus Phase Cultural Systems

Boundaries, Time, and People

Several hundred Titus phase components have been identified in the Pineywoods of Northeast Texas (Figure 10).[1] The largest concentration of Titus phase components is found in the Cypress Bayou (or Big Cypress Creek) valley (Thurmond 1990a), with a scattering of sites in the Little Cypress, Sulphur River, White Oak Creek, and Sabine River drainages. For the most part, the general regional limits of the Titus phase are well established, but information on the intra-regional density of sites (including large cemeteries) is still rather biased due to limited professional investigations across the region as a whole (cf. Thurmond 1990a:Figure 5; Perttula et al. 1986:35-59), extensive pothunting on Cypress Bayou, and the lack (until quite recently) of an avocational archeological network in the Pineywoods (Nelson and Perttula 1993). Thus, "apparent site density within the Cypress basin...is largely a function of survey intensity" (Thurmond 1990a:32).

The Late Caddoan period extends from A.D. 1400-1680 (Story 1990:334). In the Northeast Texas Pineywoods, both the Whelan and Titus phases extend into this period. Calibrated radiocarbon dates for the Whelan phase indicate it began around A.D. 1350, with the Titus phase dated from ca. A.D. 1450 to the early 1600s (Thurmond 1990a; Perttula 1992a:102-107). The chronological span of the two phases is poorly developed because of the virtual absence of absolute dates for the Late Caddoan period sequence (Thurmond 1990a:Table 60; Story 1990:Table 81), although this is changing with recent excavations in the Cypress Creek, White Oak Creek, and Sulphur River basins (e.g., Fields et al. 1994; Horizon Environmental Services 1995; Kotter et al. 1991, 1993; Nash et al. 1995) .

[1]Figure 10 is based on Thurmond (1990a) and Perttula (1993a), recent research by Thurmond on the Late Caddoan ceramics at Toledo Bend Reservoir on the Sabine River, and information provided by knowledgeable avocational archeologists in Northeast Texas (Bo Nelson and Mike Turner, 1993-1994 personal communications).

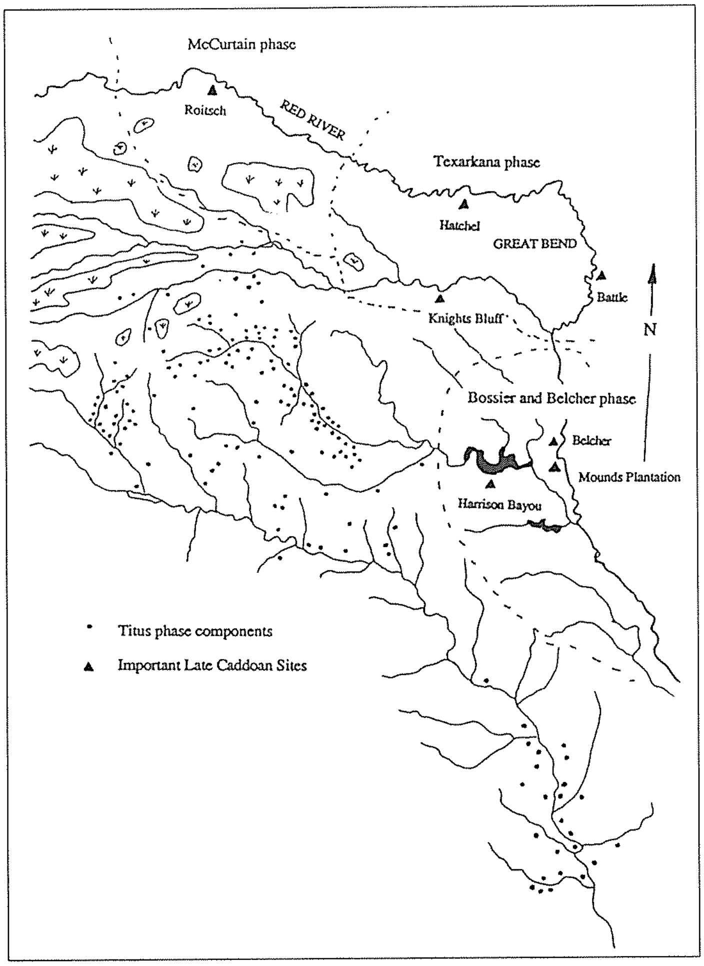

Figure 10. The distribution of Titus phase components in Northeast Texas, and the location of selected Late Caddoan period settlements in the Red, Sulphur, and Cypress basins.

My recent attempt to grapple with the Titus phase and Cypress Cluster chronological sequences (Perttula 1992a:243-249), through an analysis of engraved ceramic types (Figure 11), and motif/arrowpoint associations, led me to propose three temporal periods and a number of subphases (in the sense of Johnson [1987:19]):

- *Period 1, subphases a and b*, estimated to date from ca. A.D. 1350-1450; equivalent to the Whelan phase as described by Thurmond (1985:189).
- *Period 2, subphases a and b*, may date from ca. A.D. 1450 to 1550/1600. Components included in the Titus phase.
- *Period 3, subphases a-c*, estimated to date after ca. A.D. 1550/1600 into the early-middle 1600s. Roughly equivalent to the "classic" Titus phase as described by Thurmond (1985:189-190).

Thurmond (1985, 1990a) has proposed that the Titus phase is composed of four contemporaneous spatial subclusters within the larger Cypress Cluster: the Three Basins, Tankersley Creek, Swauano Creek, and Big Cypress Creek (Figure 12). This is in contrast to the interpretations of Turner (1978), who proposes early and late chronological subdivisions within the Titus phase based on motif variations on Ripley Engraved carinated bowls (see, for example, Figure 11a-b, f-g), and changes in vessel form. Examination of the association of vessel forms, motifs, arrowpoint types, and available radiocarbon dates for the Titus phase suggests a simple alternative: that both spatial and temporal factors contribute to the archeological character of the Titus phase and its subclusters (Perttula 1992a). The subclusters appeared to have maintained a regional or local spatial integrity, "while at the same time there were diachronic changes in their formal composition that . . . permit establishing a detailed temporal sequence" (Perttula 1992a:106).

Each of the subclusters are defined by Thurmond (1985, 1990a) on the basis of different Ripley Engraved bowl motifs or motif combinations (see Figure 11a-g), other shared pottery types of the engraved fine wares (see Figure 11h-p), and different proportions of various arrowpoint styles. Each Titus phase subcluster is characterized by a distinctive constellation of ceramic and lithic styles (Thurmond 1985:193-194). In Period 2 of the Cypress Cluster, dating from ca. A.D. 1450 to 1550-1600 (estimated), Ripley Engraved is most common, along with Maydelle Incised, Bullard Brushed, and Harleton Applique. Period 3 of the Cypress Cluster, the "classic" Titus phase, may have lasted only into the early 1600s, but it certainly seems to have ended by 1700 at the latest (Thurmond 1990a, 1990b). Again, Ripley Engraved is the most common fine ware in the grave lots. There are also a number of Red River Valley trade wares present in the Period 3 burials of the Titus phase (see Figure 11l-p), such as Avery Engraved and Simms Engraved.

Thurmond (1985:191) has argued that the Titus phase spatial groups denote socio-politically integrated separate tribes or subtribes similar to the confederacies known historically among the Hasinai or the Red River Kadohadacho groups. Thus, the larger Cypress Cluster is:

> the archeological manifestation of a series of social groups banded together in a sociopolitical structure analogous to and at least partially contemporaneous with that of the Hasinai to the south and the Kadohadacho to the northeast. Four subclusters . . . are believed to represent the individual component groups comprising this affiliated group (Thurmond 1985:196).

No direct measurements of prehistoric demography are possible for the Titus phase, but changes in settlement count over time in the Cypress Creek and Lake Fork Creek basins do indicate that there was a steady increase in the number and relative frequency of prehistoric sites through the

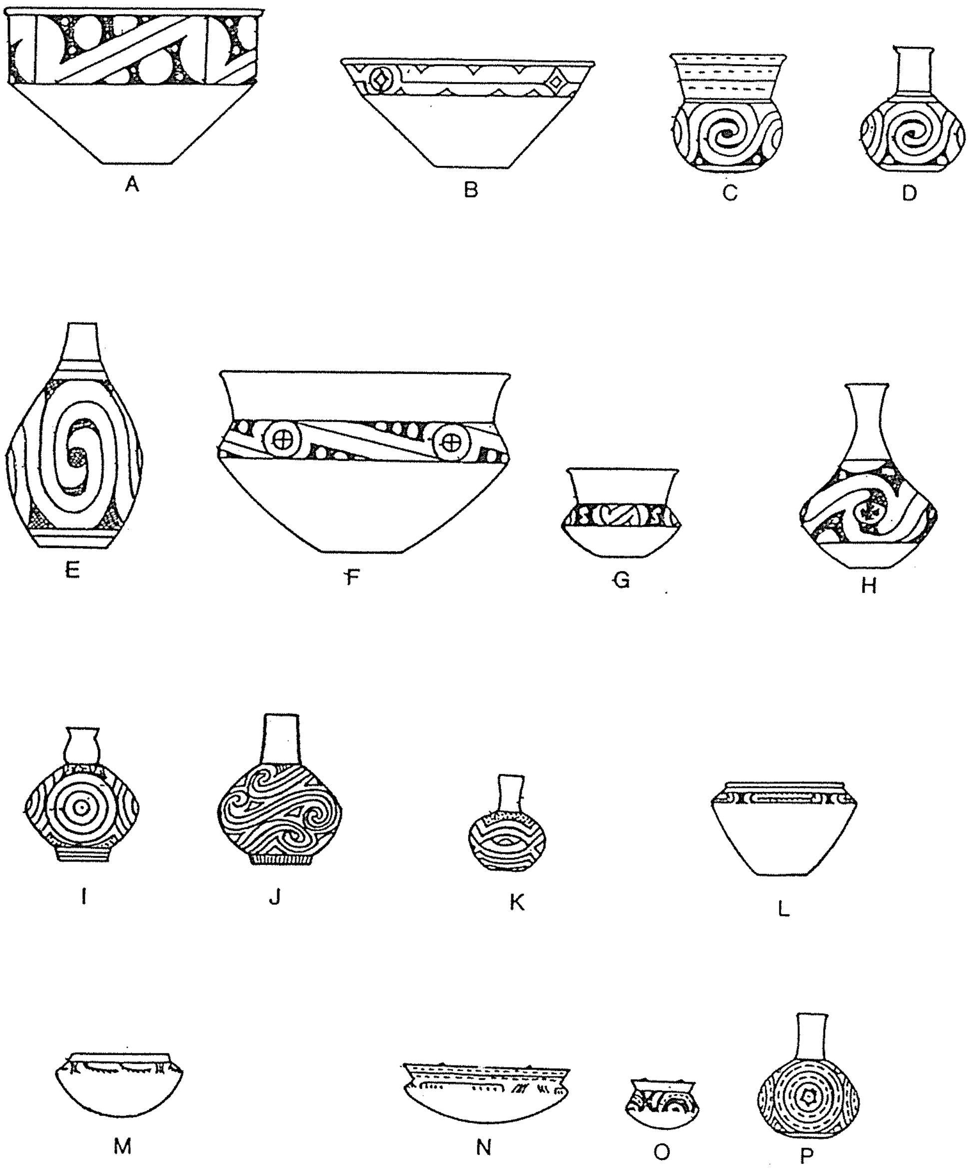

Figure 11. Engraved finewares found in Titus phase cemeteries (after Krieger 1946): a-g, Ripley Engraved; h, Wilder Engraved; i-j, Taylor Engraved; k, Bailey Engraved; l-m, Simms Engraved; n-p, Belcher Engraved.

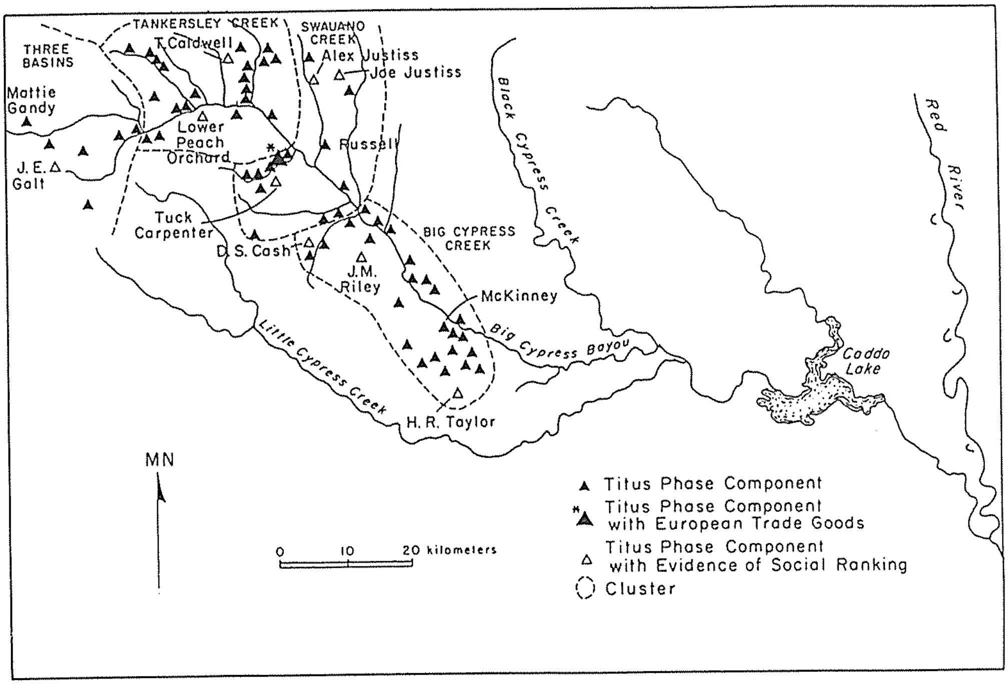

Figure 12. Distribution of Three Basins, Tankersley Creek, Swauano Creek, and Big Cypress subclusters within the Cypress cluster of the Titus phase, Cypress Creek Basin (after Thurmond 1990a).

lengthy Archaic period (6000 B.C. to A.D. 0), followed by a decrease in the Early Ceramic period (A.D. 0-800), and then a substantial increase in the Early and Middle Caddoan periods (Bruseth 1987; Thurmond 1990a). The highest number and density of components occurs during the Late Caddoan period (Table 1).

Studies in the Lake Fork Creek basin (Bruseth and Perttula 1981; Bruseth 1987; Perttula et al. 1993a), and recent investigations in portions of the Big Sandy Creek (Perttula et al. 1986) and Little Cypress Creek basins (Horizon Environmental Services, Inc. 1993, 1995; Glander et al. 1993), as well as at Caddo Lake (Cliff and Peter 1994:141), are similar to Thurmond's overall results for the Cypress Creek Basin in confirming the high frequency of Late Caddoan occupations. Clearly, regional Caddoan populations were extensive throughout much of the Pineywoods after ca. A.D. 1350.

TABLE 1. Relative Frequency of Prehistoric Cultural Components in the Cypress Creek Basin

Period/Phase	Total Components	Components/ 100 Years
Paleoindian	40	1.00
Early Archaic	52	2.60
Middle Archaic	94	4.70
Late Archaic	123	6.83
Early Ceramic	24	4.00
Early Caddoan	40	8.00
Middle Caddoan	14	14.00
Late Caddoan		
Whelan	50	50.00
Titus	77	51.33

From: Thurmond (1990a:Table 63)

Settlement Configuration

Late Caddoan period settlements in the Pineywoods of Northeast Texas have been termed rural Caddoan community systems (Perttula 1992a:96) because they were distributed along secondary streams, were widely dispersed, and because they consisted of functionally equivalent farmsteads and hamlets. Similar kinds of rural communities occur throughout much of the Caddoan area (Story 1982, 1990; Jeter et al. 1989).

Small mound centers were being constructed and used up to ca. A.D. 1500 in Northeast Texas, but they lack evidence of burial mounds or large platforms; rather, they contained mounds that buried burned structures. The larger Caddoan "towns" were distributed along the major stream valleys, such as the Red, Ouachita, and Little rivers. These communities were hierarchically arranged with: civic-ceremonial centers (those with platform and burial mounds), associated "towns" of linear but dispersed farmstead compounds with several structures, bark- or brush-covered shelters and storage platforms (Schambach 1983:7-8), hamlets, farmsteads, and specialized processing and/or procurement locales (such as salt-making sites [Early 1994]) (see also Gregory 1980:356-357).

Thurmond (1990a) recognizes three types of Titus phase settlements: *limited use areas*, *small settlements*, and *large settlements*. The limited use areas were seasonally occupied locations where extractive/processing activities took place, while the settlements were year-round habitations. Small settlements (ranging between 0.2-1.8 ha in size, with midden accumulations, and wattle-daub concentrations) account for 73 percent of the known Titus phase settlements in the Cypress Creek basin, the limited use areas 23 percent, and the large settlements (those larger than 1.8 ha, and with midden accumulations as well as wattle-daub concentrations) only 4 percent of the sample.

The settlements appear to have been composed of one to several family units, with house middens/daub concentrations and trash midden mounds (Figure 13). The range of domestic materials recovered in the midden mounds (e.g., Perttula et al. 1993a), along with limited evidence of structure rebuilding, suggests that most Titus phase settlements were occupied only about a generation, when the settlement was moved to another area where farming was possible. Small family cemeteries typically occurred nearby (Bruseth 1987; Perttula et al. 1993a; Thurmond 1990a).

Analyses of the spatial distribution of cultural materials at the small settlement at the Burks site (41WD52), a Three Basins subcluster component, indicates that the disposal of broken pottery vessels, tools, and animal bones, was quite patterned across the site itself (Perttula et al. n.d.). Midden mounds up to one meter in height were common on Titus phase settlements before they began to be plowed in historic times. Excavations at Late Caddoan Pineywoods settlements also suggest that many activities occurred outside the houses, resulting in trash-filled pits, hearths, and posts in these areas, where ramadas and granaries may also have been present, along with concentrations of artifacts and debris (Bruseth and Perttula 1981; Thurmond 1990a; Woodall 1969).

Because of the intense professional and avocational focus on the cemeteries that occur on Titus phase settlements, few specifics are available on the types of houses and storage structures used by these groups. Based on a few excavated Late Caddoan structures in the Pineywoods (some of which were in mounds and may thus not be at all characteristic of domestic structures), the single pole structures were probably circular in shape, were thatched and wattled, measured between five and six meters in diameter (Figure 14), and may have had, on occasion, extended entranceways (Thurmond 1990a:144, 146, 148, 168, 210-211; Clark and Ivey 1974). Structures had central hearths and centerposts, possible interior benches and racks for sleeping and above-ground storage purposes, as well as storage and trash pits. Structures had some midden accumulation on their floors (i.e., house middens), which were not

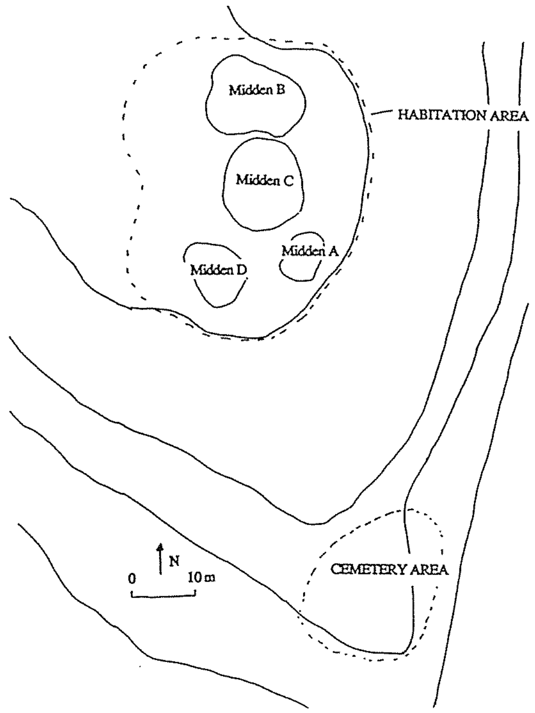

Figure 13. Settlement plan at the Burks site (41WD52), Wood County, Texas.

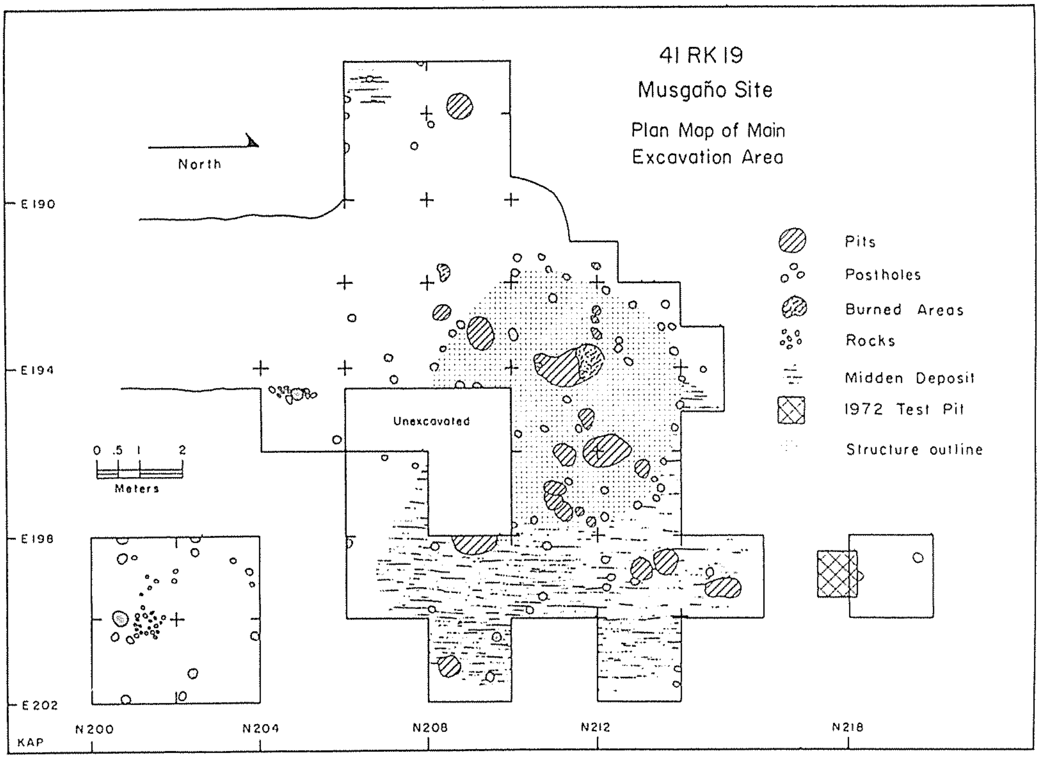

Figure 14. Structure, middens, and other features at the Musgaño site (41RK19) (from Clark and Ivey 1974).

prepared or clay-lined, but the vast majority of the daily trash and refuse was deposited on the nearby trash midden mound.

When Pedro Vial visited the Nadaco Caddo "village" near the Sabine River in 1788 (probably in the vicinity of Longview and Marshall, Texas), he described it as having thirteen to fifteen houses scattered over a distance of three leagues (about 8 miles) (Nasatir and Loomis 1967:344-345). The houses or *ranchos* of the Nadaco were evidently distributed mainly along tributaries of the Sabine River (Jones 1968; Perttula 1992a:177). The distribution of Titus phase settlements indicates an equal dispersion of agricultural farmsteads and hamlets in prehistoric times, usually being found near springs, arable soil, and level ground, but also preferring settings along tributary streams.

Localities and their Character

The best information on the distribution of Titus phase settlements in the Pineywoods comes from Thurmond's (1990a) study of the archeology of the Cypress Creek Basin. Titus phase sites tend to occur on valley terraces, upland projections, and upland slope landforms, with the greatest use of minor (2-10 square kilometers) and upland basins. Fifty-four percent of all Titus phase components (including farmsteads, hamlets, villages, cemeteries, and a small number of extractive/processing sites) occur in the uplands. Given that the majority of archeological survey efforts in the Cypress Creek Basin have concentrated on major streams, and stream valleys in general, "...the frequent occurrence of sites along smaller streams is indicated. One suspects that the occurrence of sites in upland areas may be higher than the present data would indicate" (Thurmond 1990a:220).

The permanent settlements and cemeteries of the Titus phase tend to occur in association with freshwater springs (Thurmond 1990a:Table 58 and Figure 33). Known Late Caddoan mound centers, how-ever, typically do not occur in proximity to a spring, but rather are on the floodplain floor in major and intermediate basins, or they are situated on upland projections. Associated occupations are present on terraces, floodplain rises, or upland projections, but are not found on floodplain floor landforms.

Mounds

Mound-building in the Late Caddoan period in the Pineywoods appears to have ceased between roughly A.D. 1400 and 1500 (Thurmond 1990a; Perttula 1989, 1993a). Only a small number of Late Caddoan period mounds are known in the region (Figure 15), ranging from one to four small mounds per site, and they are unlike the types of mound complexes typically constructed in the major river valleys at this time (Story 1990). Pineywoods mounds were substructural mounds; no pyramidal platform or burial mounds[2] are known for this time period. Substructural mounds are restricted to mounds that cap a burned circular structure (Figure 16) that was constructed on the ground surface or in a small, shallow pit. In at least two instances, the mounds contained sequent structures, but the "structures originated at higher levels in the mound[s] due to occupational accumulations of soil and ash, and not the result of any deliberate capping" (Thurmond 1990a:168).

Thurmond (1990a:234-235) suggests that the locations of Late Caddoan period mounds in the Cypress basin appear to be associated with clusters of contemporaneous settlements, cemeteries, and limited use areas, "and it is therefore possible that these concentrations of components represent the archeological manifestation of . . . Cypress cluster constituent groups during the [preceding] Whelan phase." A similar association has been noted for Late Caddoan mounds and settlements in part of the Middle Sabine river basin (Perttula 1989, 1994:Figure 9).

Cemeteries

There are two types of cemeteries used by the Titus phase groups: the small family cemetery, and

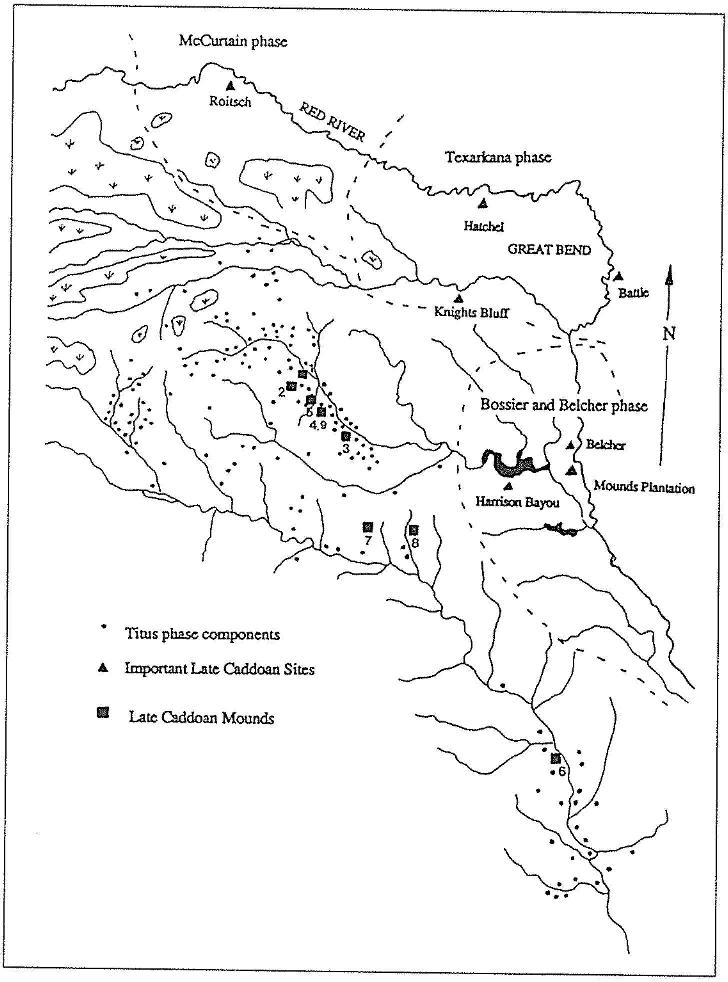

Figure 15. Distribution of Late Caddoan mound centers: 1. P.S. Cash (41CP2); 2. Sam Roberts (41CP8); 3. Whelan Estates (41MR2); 4. Harroun (41UR10); 5. Charles L. Dalton (41UR11); 6. 41SY15; 7. Lane Mitchell farm (41HS4); 8. Jones or Pine Tree (41HS15); 9. Camp Joy (41UR144).

[2]Webb et al. (1969:7-8) describe the Resch Burial Mound on Potters Creek in the Sabine River Basin as having affiliations with the Titus phase in that burial pits in the mound included Ripley Engraved, Hodges Engraved, Glassell Engraved, Cass Appliqued, Pease Brushed-Incised, and Karnack Brushed-Incised ceramics as well as Perdiz and Bassett arrowpoints. Based on the limited information available, the burial pits were placed in the mound between A.D. 1350-1450 (cf. Perttula 1992a:Appendix A-1). The regional significance and sociopolitical relationships of this middle Sabine River Caddoan occupation remain to be clearly elucidated.

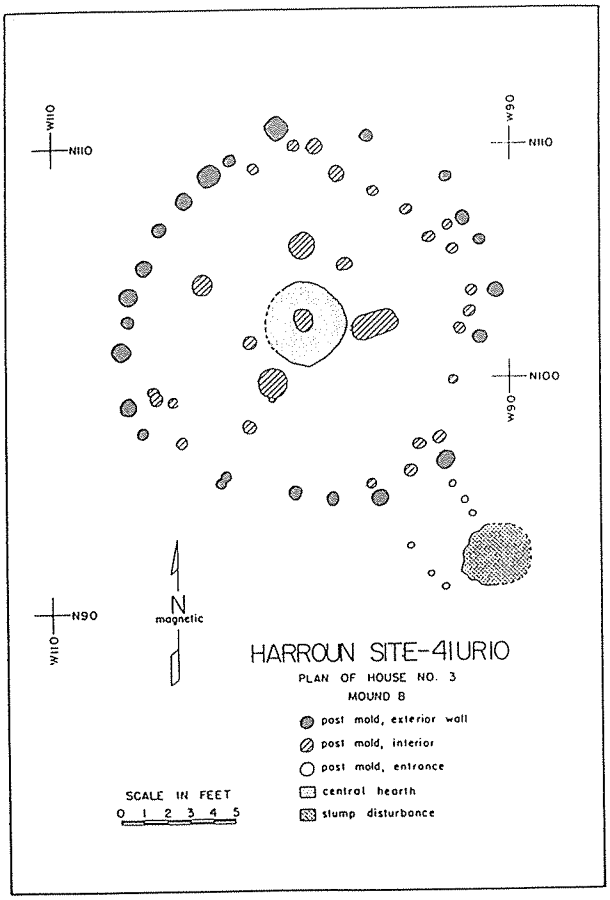

Figure 16. Mound B, House No. 3, Harroun site (41UR10) (from Jelks and Tunnell 1959).

the large supralocal or community cemetery. Demographic profiles from these small cemeteries appear to be representative of a family group in that they contain roughly equal adult male and female representation (e.g., Rose 1984:240). The family cemetery is located in immediate proximity to the farmstead or hamlet (as at the Burks site described above), contains few interments (typically about 10), and evidences no differential status or social rank in grave good associations and burial treatment.

Burials within the family cemeteries include single extended inhumations within a patterned arrangement of burials; burials are oriented roughly east-west. Children were typically buried in subfloor pits within the household structures themselves. According to Thurmond (1990a:235-236), artifact associations in family cemeteries differ only by age and sex:

> adolescents were buried with more offerings than children or infants, and with fewer offerings than adults. The graves of males often contain clusters of arrowpoints in patterns suggesting quivers of arrows, and those of females contain polishing stones or more numerous pottery vessels. Items of exotic material . . . are extremely rare. The occurrence of graves containing very large numbers of artifacts is also quite limited.

The large community cemeteries of the Titus phase (Figure 17) are the product of interments from a number of communities in the vicinity, and thus they are reflective of a wider community-based participation in ceremonial and mortuary activities (Story 1990:338-339). These cemeteries usually contain at least 40 individuals, but some are known that contained at least 150-300 individuals (Turner 1978; Thurmond 1990a; Story 1990; Perttula 1993a).

The community cemeteries contain excellent evidence for the existence of social differentiation within the Titus phase (see below). Since community cemeteries are recognized by the type of burial interment, their relative size, grave good associations, and their relative separation from habitation sites, they are analogous in functional context to the mound centers. Known community cemeteries are not uniformly distributed among the Titus phase groups, but are concentrated on Big Cypress Bayou, the Titus phase "heartland," with a few large cemeteries known on Little Cypress and White Oak creeks (see Figure 17). Presumably, this locality had the most regionally complex sociopolitical organization, and/or the highest population densities during Late Caddoan times (e.g., Story 1990:339-340).

The larger community cemeteries are internally organized by space and structurally divided by rank (Turner 1978:Figure 3; Thurmond 1990a:Figure 20). There is little evidence for graves' overlapping, but instead the cemeteries appeared to have regularly expanded over time (see Perttula 1992a:Figures 18 and 19). Since the cemetery plan was consistently maintained, they may reflect community participation over several generations; the varying position of the higher status burials (as at Tuck Carpenter and H. R. Taylor) evidences this spatial expansion through time.

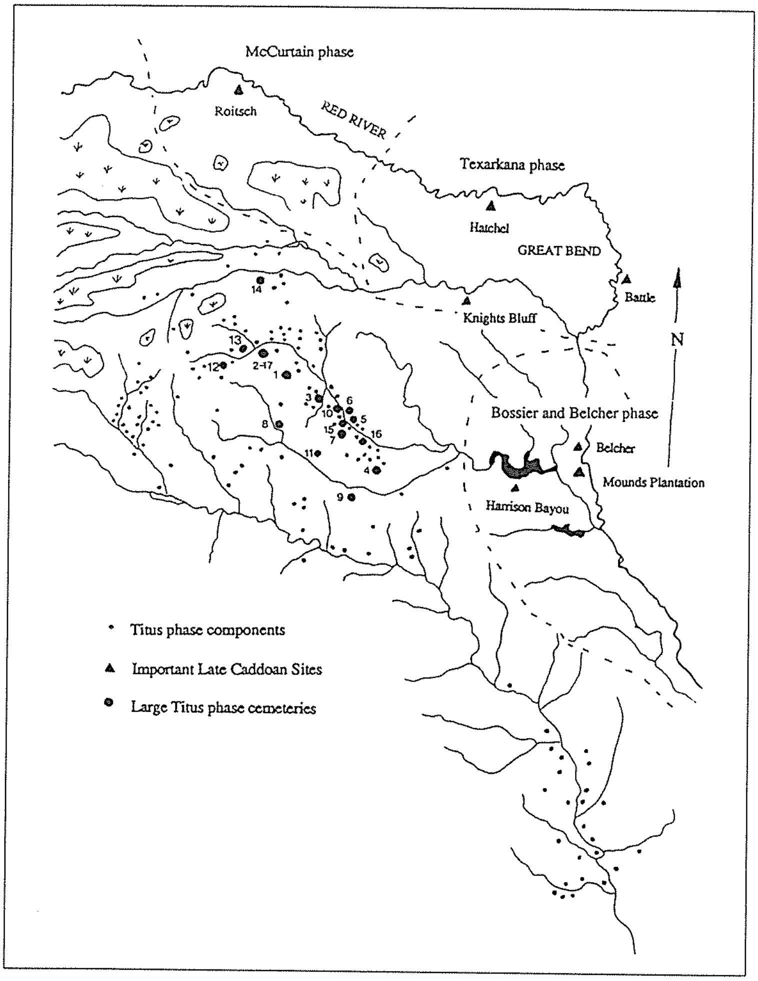

Figure 17. Distribution of large Titus phase cemeteries: 1. Tuck Carpenter (41CP5); 2. Lower Peach Orchard (41CP17); 3. Tracy (41CP71); 4. H.R. Taylor (41HS3); 5. Mims (41MR4); 6. Pleasure Pt. (41MR63); 7. Southall (41UR3); 8. Carson Kennedy (no trinomial); 9. 41HS235; 10. Gold Star (41UR32); 11. Spider Lilly (41UR143); 12. Oil-Topped (no trinomial); 13. Site G (no trinomial); 14. Site B (no trinomial); 15. Meddlin Creek (no trinomial); 16. Arms Creek (no trinomial); 17. Harold Williams (41CP10).

Material remains and Technological character

The most notable aspect of the Late Caddoan Pineywoods archeological record is the diverse and distinctive aboriginal ceramics that occur in domestic and mortuary contexts. The wide variety of vessel shapes and decorations, as well as their frequency in domestic contexts, demonstrates the importance of ceramics in the Titus phase for the cooking and serving of food, as personal possessions, and as social identifiers.

Both fine wares and utility wares were manufactured in the Titus phase. Differences in paste (and decoration) between the two wares presumably relate to technological and functional variability in the way these kinds of vessels were made and designed to be used (e.g., Steponaitis 1984:85-114).

The fine wares were tempered with finely crushed grog and bone, and were well-polished; shell-tempered vessels are quite rare, and are typically trade wares from the Red River Caddo. The fine ware was decorated with engraved lines, with scrolls, scrolls and circles, pendant triangles, and other curvilinear motifs being the most common decorative elements in the Titus phase ceramics (see Figure 11). Another form of decoration was the application of a red hematite slip on both interior and exterior surfaces, and the painting of engraved lines with hematite or kaolin. The diversity of vessel forms is impressive: carinated bowls, compound bowls, bottles, conoidal bowls, ollas, everted rim jars, square bowls, globular peaked jars, and chalice forms.[3] Other fine wares include zoomorphic effigies and rattle bowls.

The utility vessels were tempered with grog and grit, and had a coarser paste along with a thicker body. Small to large jars (over 30 cm in height with orifice diameters greater than 25-30 cm) (Figure 18) and plain conical bowls were typical utility

[3]The chalice-form occurs on only a few Titus phase sites in the Cypress Creek drainage (Turner 1978:98; Bo Nelson, 1993 personal communication). Turner (1978:100) suggests that the ceramic chalices were copies of stemmed wine-glasses, stemmed cups, or stemmed goblets in the possession of individuals in the de Soto entrada. It is interesting to note that the sixteenth century Hispanic bottles, goblets, decanters, and vases illustrated by Deagan (1987) have a similar form to the stemmed vessels recovered in the Titus phase sites. These Titus phase sites are in the area where the province of *Lacane* has been located (Hudson 1990; Thurmond 1990b; Perttula 1992a; Bruseth 1992; Kenmotsu et al. 1993).

vessel shapes. The presence of carbon encrustations, food residues, and sooting on many of the utility vessels indicate that these pots were used for cooking (e.g., Skibo 1992); the large orifice diamaters and vessel volumes also suggests that some utility vessels were used primarily for storage of foodstuffs and liquids.

The types of decorations and/or surface treatment on the utility vessels included neck-banding or corrugation, brushing, applique, incision, punctation, or various combinations thereof (Turner 1995:Table 1). Small handles or lugs were present on some of the utility vessels. Based on sherd samples from domestic contexts, utility vessels probably comprised between 50 to 70 percent of the ceramic assemblages in Titus phase sites, with proportionally fewer utility vessels in mortuary contexts (Thurmond 1990a).

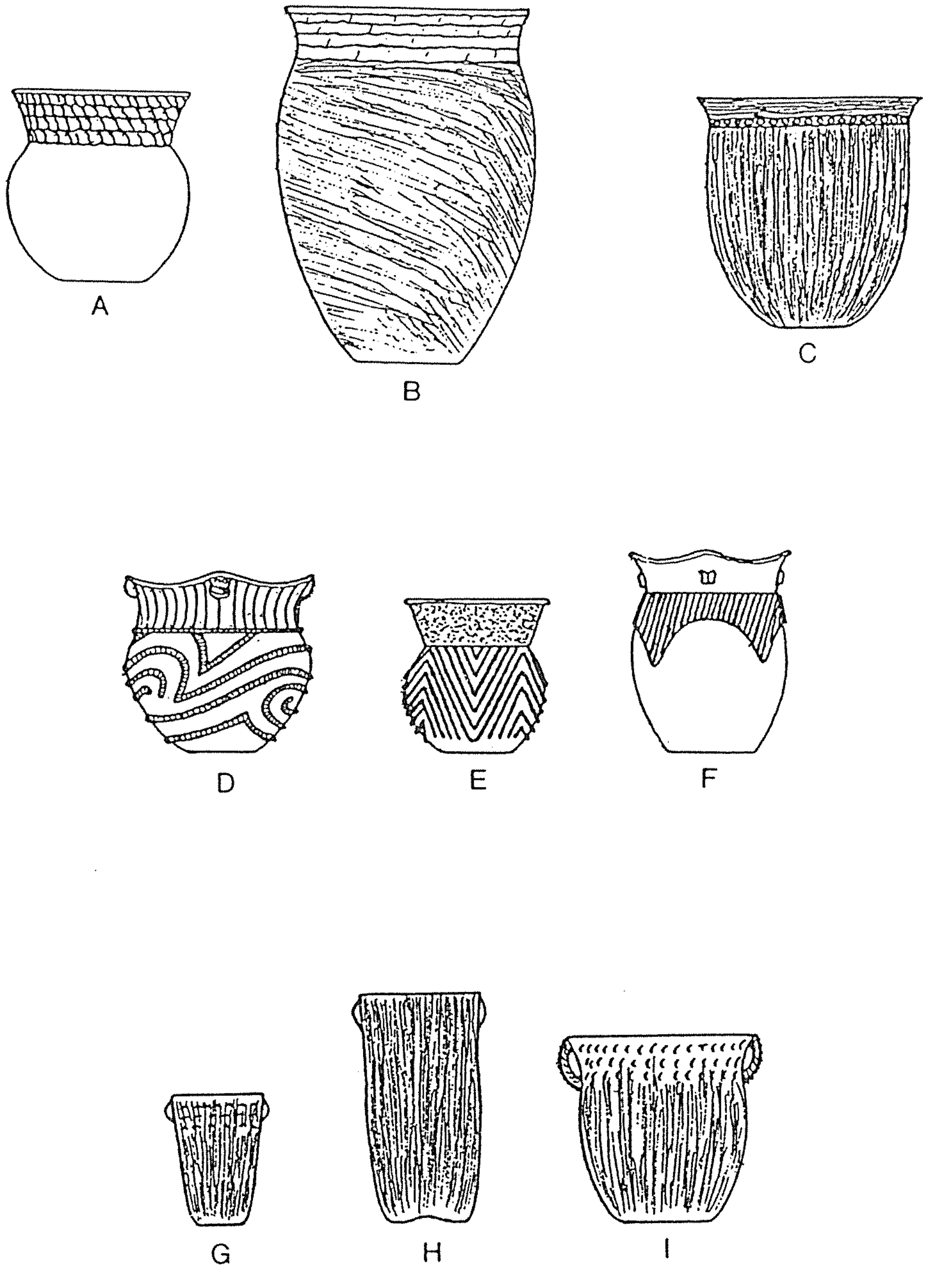

Figure 18. Titus phase utility vessels (after Krieger 1946): a-b, LaRue Neck-banded; c, Karnack Brushed-Incised; d-f, Harleton Appliqued; g-i, Bullard Brushed.

Other ceramic artifacts manufactured by Late Caddoan Pineywoods groups include ceramic earspools, as well as biconical and elbow pipes (see Jackson 1933). Other types of earspools include ones manufactured from siltstone and sandstone, as well as ones of wood (Turner 1992:84). One set of earspools from the Tuck Carpenter site had been covered with copper plate. The elbow pipes are commonly decorated with engraved lines that have been painted with hematite or kaolin clay.

Generally speaking, lithic tools and debris are uncommon on Late Caddoan period sites in the Pineywoods, and presumably this reflects the strong development of wood and bone tool industries, few examples of which are preserved in the archeological record. The tool diversity is low, consisting primarily of triangular and corner-notched arrowpoints, flake tools (drills, scrapers, and retouched pieces), lithic debris and cores, along with an array of groundstone implements. These include petaloid and tabular celts, metates and manos, battered and polished cobbles and pebbles, hematite and limonite pigment stones, and abrading slabs (Turner 1992; Thurmond 1990a).

Although bone is not usually well-preserved on Titus phase sites, bone tools have been recognized at a number of sites. They include deer mandibles, deer beamers, ulna punches, antler tines, and deer and bird bone pins. Turtle carapace rattles have also been noted.

Social status and activity variation

The social status ranking apparent in the Cypress Cluster burials is based on four criteria seen in the archeological record:

(1) high-status burials include large shaft tombs and multiple interments; all other Titus phase burials are single, individual burials. Family cemeteries do not contain shaft tombs or multiple interments;

(2) quantities of grave goods are significantly higher than the mean average for the regional burial population as a whole (approximately 14-15 grave goods per burial [Perttula 1992a:Table 7]). Higher status burials differ from the population primarily in the frequency of arrowpoints and ceramic vessels placed as grave offerings (Perttula 1992a:Table 8);

(3) certain types of artifacts are found in higher status burials. One such example in the Cypress and Upper Sabine basins is the Galt biface (Thurmond 1990a:235); and

(4) they are always adult males.

There are about 10 to 15 Titus phase sites in the Pineywoods that have burials of presumed high-status individuals, such as Galt, Caldwell, Lower Peach Orchard, Tuck Carpenter, H. R. Taylor, and others (see Perttula 1992a:Table 8);[4] all those known are along Cypress Bayou and its tributaries (see Figure 12). Certainly the best-known and studied community cemeteries with high-status burials are the Tuck Carpenter (Turner 1978, 1992) and H. R. Taylor (Thurmond 1990a) sites.

At Tuck Carpenter, high-status burials dating between ca. A.D. 1350-1550 are at the center of the 70-interment cemetery, while the latest high-status burials (estimated to date after ca. A.D. 1550 to the early 1600s) are alongside the outside cemetery boundaries (see Perttula 1992a:Figure 18; Turner 1978). With the exception of the two multiple interments, other single, extended interments were placed in the cemetery in roughly aligned north-south rows. The high-status burials contained on average of 37 grave goods/burial, compared to the 14.8 grave goods/burial for the cemetery as a whole (Turner 1978, 1992).

The same type of burial program noted at the Tuck Carpenter site was in use at the H. R. Taylor site (see Perttula 1992a:Figure 19). Mean values of ceramic vessels (8.3/individual), arrowpoints (5.09/individual), and total number of specimens (14.5/individual) as grave goods at H. R. Taylor are not significantly different from other Titus phase cemeteries, but the high-status burials each contained on the average between 27-55 grave goods (Perttula 1992a:Table 7; Thurmond 1990a).

The segregation of interments by presumed status indicates that high-status individuals account for 8 to 9 percent of the burials at H. R. Taylor and Tuck Carpenter, respectively. Low-status interments, namely those with quantities of grave goods two standard deviations below the mean average for the two sites (between 0 to 9.0 items at Tuck Carpenter and 0 to 6.7 items at H. R. Taylor),

[4] This does not include several community cemetery sites in the Lake O' the Pines area that still remain poorly documented.

account for 19 and 23 percent of the burials at the two sites. Lower-status individuals at these community cemeteries were usually adult females, juveniles, or children. Overall, in the Titus phase mortuary populations, high-status individuals account for less than 2 percent of all known burials (Thurmond 1990a:235).

A perusal of Perttula (1992a:Table 8) indicates that the majority of burials of presumed high-status in the Pineywoods date after ca. A.D. 1550-1600. Those individuals buried prior to A.D. 1550 demonstrate considerable intraregional variability in the manner of burial treatment, as well as in the types of artifactual remains placed in the burials as offerings. For example, in addition to the multiple interments at Tuck Carpenter, shaft tombs[5] are represented in a pre-A.D. 1550 cemetery at the Lower Peach Orchard site (see Figure 12). At the J. E. Galt site, the high-status burial included such offerings as a large number of celt fragments and other native stone implements, rather than caches of arrowpoints (Thurmond 1990a:Table 29). Galt bifaces were also recovered from the cemetery.

The large Titus phase cemeteries with individuals of high-status are distributed within each of the four spatial subclusters identified by Thurmond (1985, 1990a) in the Cypress Creek basin. The earliest appearance of this type of community integration occurs in the Tankersley Creek, Three Basins, and Swauano Creek subclusters, with the latest being present in the Swauano Creek and Big Cypress Creek subclusters (see Figure 12). No post-A.D. 1550-1600 community cemeteries are known in the Three Basins and Tankersley Creek subclusters, with the exception of Tuck Carpenter, which suggests that much of these areas were abandoned by resident Caddoan groups about this time.

In general, these community cemeteries are relatively short-term mortuary phenomena that were used intensively in portions of the Pineywoods after about A.D. 1550 to the early 1600s. It is probably no coincidence that the intensive use of community cemeteries in the region occurs generally contemporaneously with the initial contact between Titus phase Caddoan populations and the Spanish De Soto/Moscoso entrada of 1542-1543. Indeed, Bruseth (1992:91) interprets the short-term use of these cemeteries as reflecting the passage of the army as well as increased mortality from European diseases. The timing in the intensification of this form of community cemetery in the region is also of considerable significance because the Titus phase community cemeteries appear to have replaced the use of mounds for community ceremonial and religious functions by the 1550s. I have argued that this process of replacement is a reflection of changes in social complexity and the scope of community integration, perhaps accompanied by a spatial coalescence and/or decrease in settlement density within the Pineywoods (Perttula 1992a:115).

Subsistence Studies

Titus phase subsistence remains with interpretive significance are rather limited to date to a few sites in the upper Sabine and upper Cypress basins, rather at the western edge of its settlement distribution (Perttula 1993a). However, well-preserved subsistence remains are known from a number of other sites of this age in Northeast Texas that have as yet received little professional attention (Perttula 1993b; Thurmond 1990a). Floral evidence from trash midden deposits suggests that the tropical cultigen maize (*Zea mays L.*) was a dietary staple, and beans (*Phaseolus vulgaris*) were also an important food source. Nuts and seeds were also gathered, but they appear to have been of lesser importance in the Titus phase than they were between ca. A.D. 900-1400 (Crane 1982; Perttula and Bruseth 1983; Perttula et al. 1982). In fact, the subsistence evidence from the Titus phase in the Pineywoods, as well as elsewhere in the Caddoan area, suggests the successful development of an Caddoan maize-based economy at this time (Fritz 1990:421, 425).

Vertebrate species identified in Titus phase trash middens include deer, turkey, cottontail rabbit, jackrabbit, squirrel, and beaver. Turtle and fish were also present, but were relatively uncommon compared to mammals and birds. Deer and turkey appear to have been the dominant exploitable species (Perttula et al. 1982, 1993a).

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[5]Shaft tombs are reported at several other large cemeteries on Cypress Bayou, but their context and grave contents have not been fully assessed. One shaft tomb at the Pleasure Point site was reported to have been about three meters deep and contained two episodes of multiple burial interments (Mike Turner, 1993 personal communication). At the Lower Peach Orchard site, five or six shaft tombs were excavated by collectors from a large community cemetery. The one shaft tomb where information is available contained three individuals and large quantities of grave goods (see Thurmond 1990a).

The examination of bioarcheological remains lends some additional light to the subsistence character of the Titus phase populations, but to date the results have not been substantial. This is because of the relatively small samples of human remains that have been analyzed from Pineywoods Late Caddo sites (Burnett 1990:402-408). Based on admittedly limited bioarcheological evidence, principally the low frequency of dental caries and porotic hyperostosis, Burnett (1990:405, 408) suggests that the Late Caddoan inhabitants of the Cypress/upper Sabine and the middle Sabine consumed little to no maize, and "were not dependent upon a maize-rich diet." The lack of infections, such as osteoarthritis and osteoporosis, in the Late Caddoan samples, while again rather small, may indicate both a different lifestyle and workload than Caddoan residents on the Red River, as well as a high measure of adaptive success (Burnett 1990:404). It is important for current Pineywoods Caddo research to resolve the question of why there is this substantial contradiction between the archeological and bioarcheological evidence regarding the nature of Titus phase subsistence.

REGIONAL RELATIONSHIPS

Although many of the details are sketchy, mortuary goods and other exotic artifacts (such as conch shell, lithic raw materials, etc.) suggest that intraregional contacts and the exchange of resources between rural and town Caddoan communities flourished at the time of initial European contact in the sixteenth century. Interregional exchange and contact was also well developed between Caddoan polities, and horticulturists living in the southwestern United States, the Southern Plains, and the Lower Mississippi Valley (see Baugh 1995; Kidder 1995).

Among Caddoan Groups

Ceramic wares imported from the Red River Caddoan groups are present in the Titus phase. They include such fine wares as Belcher Ridged, Belcher Engraved, Glassell Engraved, and Hodges Engraved from the Belcher phase to the east (Webb 1959:153), and Avery Engraved and Simms Engraved pottery types of the McCurtain and Texarkana phases to the north some 100 km (see Bruseth 1995).

An analysis of the grave good associations in a large sample of Whelan and Titus phase burials indicates that a modicum of interaction occurred between the Pineywoods groups and Caddoan populations to the north between A.D. 1350-1450, and this increased during the Titus phase proper. Glassell Engraved is a significant item of ceramic trade after 1450, with interaction to the north and east seemingly intensifying after about the middle 1500s. In fact, between 3.2-7.6 percent of ceramic vessels in Titus phase burials are Red River trade wares (Perttula 1992a:249).

Significant quantities of non-local lithic raw materials are also present in Titus phase assemblages. Detailed examination of lithic raw materials in Three Basins subcluster components in the Sabine River basin indicates that Red River gravel cherts and chalcedonies comprised about 20 percent of the lithic tools and debris (Perttula 1984). These lithic raw materials were available from Red River Caddoan groups who lived in the vicinity of the McCurtain phase Arnold Roitsch (41RR16) civic-ceremonial center (see Figure 10). Hatton tuff and siliceous shales were obtained from the Ouachita Mountains for the manufacture of celts.

External Relationships

In one study of the lithic raw materials present in Three Basins subcluster sites (Perttula 1984), Edwards chert from Central Texas (Banks 1990) represented about 8 percent of the lithic tools and debris. This material had to have been obtained by Caddoan peoples through trade and exchange with non-Caddoan peoples living more than 150 km to the west and southwest of the Pineywoods Caddo.

Galt bifaces, possible "badges of rank or office" (Thurmond 1990a:35), found with high-status Titus and Belcher phase burials, are made from "non-local high grade cherts." Documentation of several Galt bifaces from the Pleasure Point (41MR63) community cemetery on Big Cypress Bayou indicate that they were also manufactured from a dark-brown Edwards chert (Mike Turner, 1993 personal communication).

The presence of Norteño phase ceramics (Womack Engraved) from Titus phase sites in the Three Basins subcluster suggests that the Norteños (or Wichita-speaking groups who moved into Texas) interacted to some extent with the Pineywoods Caddo. Neither sites with Norteño ceramics contained European trade goods (e.g., Scurlock 1962), though, and the period when there was Norteño and Titus phase contact can only be suggested to have occurred in perhaps the early to late seventeenth century.

Gulf Coast conch shell was obtained by the Pineywoods Late Caddo for the manufacture of conch columella beads and pendants. This exotic material is rarely used in the Titus phase (Turner 1978), however, compared to that seen among the Red River Belcher and McCurtain phase Caddo groups (Webb 1959; Skinner et al. 1969; Trubowitz 1984; Kelley 1994).

DIACHRONIC PERSPECTIVES

The demise of the Titus phase

A reconsideration of Titus phase chronologies, in combination with new assessments of the route of the de Soto-Moscoso 1542-1543 entrada through Northeast Texas (Bruseth 1992; Hudson 1990; Kenmotsu et al. 1993; Schambach 1989; Thurmond 1990b), suggests that: (a) the Spanish entrada encountered the Titus phase peoples— probably the *Lacane* province—and (b) that within 50-60 years of that encounter the area occupied by the Titus phase had been virtually abandoned. While it is likely that some Titus phase peoples moved to either the Red River among the Kadohadacho, or to the Hasinai Caddo south of the Sabine River, current explanations for the demise of the Titus phase hinge on the introduction and initial exposure of Caddoan groups to European epidemic diseases (Thurmond 1990a:233, 1990b; Perttula 1992a), which led to substantial depopulation among the Pineywoods populations.

Subsequent to the discontinuation of community cemeteries in the early to mid-seventeenth century, most of the upper Sabine and Cypress Creek basins were abandoned (Thurmond 1990b; Perttula 1992a). The only post-1700 Caddoan occupations that can be related to earlier use of the Pineywoods are to be found in the lower Sulphur and Sabine rivers (Figure 19a) at known trade portages or along trail crossings of these major streams (Harris et al. 1980; Jones 1968; Perttula 1992a:172-177). None of the Caddoan communities in the Cypress Creek/upper Sabine basins appear to have been ethnographically described, and what is known from ethnographic and archival documents pertains principally to the Nadaco or Anadarko Caddo (Figure 19b). This group's prehistoric antecedents are poorly known, and they appear to have only settled in the Sabine River basin after ca. 1770 (Smith 1995:74).

Late Caddoan period Pineywoods sites such as those of the Titus phase hold great promise to document the nature of sociopolitical, demographic, and economic changes in the region during an eventful time in Caddoan prehistory and protohistory. This is due in large part to their potential for fine-scale chronological control, say on the order of 20-30 years. As other studies of Caddoan archeology make clear, there have been substantial changes in Caddoan societies from ca. A.D. 800 to European contact (cf. Story 1990; Jeter et al. 1989), with one of the more important being the development of more egalitarian sociopolitical systems after ca. A.D. 1400 in many regions of the Caddoan area, including the Pineywoods of Northeast Texas (Perttula 1995).

The intensification of maize-based economies after ca. A.D. 1400 in much of the Caddoan area may be in large part responsible for the demise of many of the civic-ceremonial centers at a time when there was a reorganization of social and political relationships within Caddoan culture on a regional level. The tangible development of predictable maize surpluses at all levels, the "quality of abundance" referred to by Helms (1992:188), would have led to the social homogeneity noted above among Late Caddoan groups in the Pineywoods because household agricultural sufficiency negated the regionally expansive role of the elite-controlled social and political economy. After this time, therefore, social and political integration appears to have been regionally and locally redefined.

CONCLUDING REMARKS

Since the 1950s, a great deal has been learned by a dedicated group of avocational and professional archeologists about the prehistory of this part of Northeast Texas, particularly regarding the last 1000-2000 years when the ancestors of the Caddo Tribe of Oklahoma settled in the area and thrived (Carter 1995; Smith 1995). The knowledge gained about the Native American past in the region, about

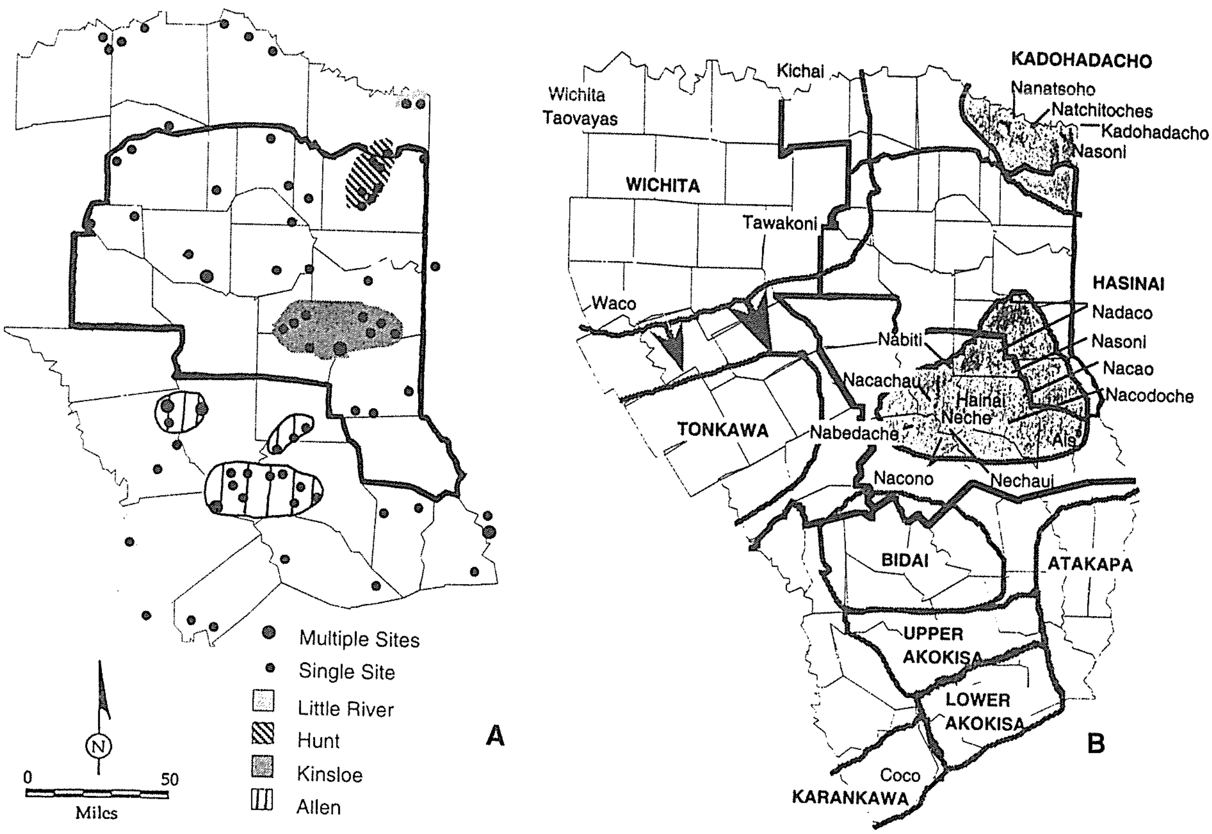

Figure 19. A, Historic Caddoan archeological sites and phases in the Northeast Texas Archeological Region; B, general locations of Native American groups in the Eastern Planning Region of Texas in the early eighteenth century (from Perttula 1993c).

the challenges faced during times of cultural change, and during the wrenching episode (still ongoing) of contact and interaction between the Caddo peoples and European and Anglo-American colonizers and settlers, helps to bring "native history" to the forefront, not a footnote, of the ongoing study of Texas' cultural heritage.

While there is every reason to think that our knowledge of Northeast Texas prehistory will continue to grow by leaps and bounds, there are tremendous research and preservation challenges ahead. On a mundane level, it is important that we continually cast a critical and discerning eye at our research priorities, the value of our methodological approaches, and the worth of our cultural resource management planning documents. From the innovative use of these tools come the new perspectives and conceptions that lead to broader and parsiminious understandings of the past.

Changes in research strategies are critical, but in Northeast Texas they are only, unfortunately, part of the archeological story. Of the utmost concern for the long-term protection and preservation of the region's archeological heritage is dealing straight on with the unabated looting and vandalism of prehistoric Caddo villages and cemeteries—on private as well as state and federal lands. The archeological landscape is pitted and pocked with the looter's holes and backdirt piles. Many of the most important archeological sites in the region have been irretrievably damaged and destroyed, and it is questionable that the looting frenzy can be staunched even if an unmarked burial protection bill was to be made law in Texas. The cultural patrimony of the Caddo peoples is being taken from them, with almost no hand being lifted to help protect these significant cultural treasures. This is our greatest challenge in the years ahead: to find a way, in concert with the Caddo people, to protect and preserve this cultural legacy:

> In 1541 when the Spaniards arrived, every place in the Caddo country had, of course, a Caddo name but almost all of those names are gone now, like the people who bestowed them (Schambach 1993:7).

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REFERENCES CITED

Banks, L. D.

1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest*. Memoir No. 4. Oklahoma Anthropological Society, Norman.

Barker, A. W. and T. R. Pauketat

1992 Introduction: Social Inequality and the Native Elites of Southeastern North America. In *Lords of the Southeast: Social Inequality and the Native Elites of Southeastern North America*, edited by A.W. Barker and T. R. Pauketat, pp. 1-10. Archeological Papers of the American Anthropological Association Number 3. American Anthropological Association, Washington, D.C.

Baugh, T. G.

1995 Regional Polities and Socioeconomic Exchange: Caddoan and Puebloan Interaction. MS on file with the author.

Bolton, H. E.

1987 *The Hasinais: Southern Caddoans as Seen by the Earliest Europeans*. University of Oklahoma Press, Norman.

Bruseth, J. E.

1987 Late Holocene Environmental Change and Human Adaptive Strategies in Northeast Texas. Ph.D. dissertation, Department of Anthropology, Southern Methodist University, Dallas.

1991 Hudnall-Pirtle Site (41RK4): An Early Caddoan Mound Complex in Northeast Texas. *Caddoan Archeology Newsletter* II(3):9-15.

1992 Artifacts of the de Soto Expedition: The Evidence from Texas. *Bulletin of the Texas Archeological Society* 63:67-97.

1995 The Development of Caddoan Polities Along the Middle Red River Valley of Eastern Texas and Oklahoma. MS on file with the author.

Bruseth, J. E. and T. K. Perttula

1981 *Prehistoric Settlement Patterns at Lake Fork Reservoir*. Texas Antiquities Permit Series, Report No. 2. Texas Antiquities Committee, Austin, and Southern Methodist University, Dallas.

Burnett, B. A.

1990 The Bioarchaeological Synthesis of the eastern portion of the Gulf Coastal Plain. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 385-418. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Carter, M. E.

1995 *Caddo History: Where We Come From*. University of Oklahoma Press, Norman.

Clark, J. W. and J. E. Ivey

1974 *Archaeological and historical investigations at Martin Lake, Rusk and Panola Counties, Texas*. Research Report No. 32. Texas Archeological Survey, Austin.

Cliff, M. B. and D. E. Peter (editors)

1994 *Archeological Survey of Selected Portions of the Longhorn Army Ammunition Plant, Harrison County, Texas 1989-1992*. Miscellaneous Report of Investigations No. 38. Geo-Marine, Inc., Plano.

Collins, M. B. and C. B. Bousman
1993 Quaternary Environments and Archeology in Northeast Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 49-67. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Crane, C. J.
1982 Plant Utilization at Spoonbill, an Early Caddo Site in Northeast Texas. *Midcontinental Journal of Archaeology* 7:81-97.

Cruse, J. B.
1994 Archaeological Investigations at a Middle Caddoan Village Site (41RK214) in Rusk County, Texas. Paper presented at the 65th Texas Archeological Society Meeting, Lubbock, Texas.
1995 Archaeology at the Oak Hill Village Site: A Caddoan Settlement in Rusk County. *Heritage* 13(1):10-14. Texas Historical Foundation, Austin.

Deagan, K.
1987 *Artifacts of the Spanish Colonies of Florida and the Caribbean, 1500-1800. Volume I: Ceramics, Glassware, and Beads*. Smithsonian Institution Press, Washington, D.C.

Diamond, D. D., D. H. Riskind, and S. L. Orzell
1987 A Framework for Plant Community Classification and Conservation in Texas. *The Texas Journal of Science* 39:203-221.

Early, A. M. (eeditor)
1994 *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site*. Research Series No. 43. Arkansas Archeological Survey, Fayetteville.

Fenneman, N. M.
1938 *Physiography of Eastern United States*. McGraw-Hill Book Company, Inc., New York.

Ferring, C. R.
1994 McGee Creek in Regional Paleoenvironmental Context. In *Past Environments and Prehistory at McGee Creek Reservoir, Atoka County, Oklahoma*, edited by C. R. Ferring, pp. 29-43. Volume V, Part 4 of the McGee Creek Archaeological Project Reports. Institute of Applied Sciences, University of North Texas, Denton.

Fields, R. C. and S. A. Tomka
1993 Hunter-Gatherer Mobility in Northeast Texas, 10,000-200 B.C. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 69-95. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Fields, R. C., E. F. Gadus, and L. W. Klement
1994 The Peerless Bottoms Site: A Late Caddoan Component at Cooper Lake, Hopkins County, Texas. *Bulletin of the Texas Archeological Society* 65:55-114.

Fritz, G. J.
1990 Multiple Pathways to Farming in Precontact Eastern North America. *Journal of World Prehistory* 4:387-435.
1994 The Value of Archaeological Plant Remains for Paleodietary Reconstruction. In *Paleonutrition: The Diet and Health of Prehistoric Americans*, edited by K. D. Sobolik, pp. 21-33. Occasional Paper No. 22. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Gadus, E. F., R. C. Fields, C. B. Bousman, S. A. Tomka, and M. A. Howard
1992 *Excavations at the Finley Fan Site (41HP159), Cooper Lake Project, Hopkins County, Texas*. Reports of Investigations No. 78. Prewitt and Associates, Inc., Austin.

Girard, J. S.
1994 Investigations at the James Pace Site (16DS268), DeSoto Parish, Louisiana. *Caddoan Archeology Newsletter* V(1):8-16.

Glander, W., G. Sundborg, D. Moore, D. Brown, N. Barker, D. Jurney, K. White, and L. Jones
1993 *Cultural Resources Survey of the Proposed Monticello-Leesburg Coal Surface Mine, Camp County, Texas*. Document No. 861094. Espey, Huston & Associates, Inc., Austin.

Gregory, H. F.
1980 A continuity model for Caddoan adaptation on the Red River in Louisiana. *Louisiana Archaeology* 5:347-360.

Guy, J. A.
1990 Previous Archeological Investigations. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 27-130. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Harris, R. K., I. M. Harris, and M. P. Miroir
1980 The Atlanta State Park Site in Northeastern Texas. *Louisiana Archaeology* 6:223-230.

Helms, M. W.
1992 Political Lords and Political Ideology in Southeastern Chiefdoms:Comments and Observations. In *Lords of the Southeast: Social Inequality and the Native Elites of Southeastern North America*, edited by A. W. Barker and T. R. Pauketat, pp. 185-194. Archeological Papers of the American Anthropological Association Number 3. American Anthropological Association, Washington, D.C.

Hoffman, M. P.
1967 Ceramic Pipe Style Chronology Along the Red River Drainage in Southwestern Arkansas. *The Arkansas Archeologist* 8(1):4-14.

Horizon Environmental Services, Inc.
1993 *Cultural Resources of the Proposed Lake Gilmer Project, Upshur County, Texas*. Horizon Environmental Services, Inc., Austin.
1995 *Test Excavations at Proposed Lake Gilmer, Upshur County, Texas*. Horizon Environmental Services, Inc., Austin.

Hudson, C. M.
1990 A Synopsis of the Hernando De Soto expedition, 1539-1543. In *De Soto Trail: De Soto National Historic Trail Study*, by the National Park Service, Southeastern Regional Office, pp. 75-126. National Park Service, Washington, D.C.

Humphrey, J. D. and C. R. Ferring
1994 Stable Isotopic Evidence for Latest Pleistocene and Holocene Climatic Change in North-Central Texas. *Quaternary Research* 41:200-213.

Jackson, A.T.
1933 Some Pipes of East Texas. *Bulletin of the Texas Archeological and Paleontological Society* 5:69-86.
1934 Types of East Texas Pottery. *Bulletin of the Texas Archeological and Paleontological Society* 6:38-57.

Jelks, E. B. and C. D. Tunnell
1959 *The Harroun Site: A Fulton Aspect Component of the Caddoan Area, Upshur County, Texas*. Archaeology Series, No. 2. Department of Anthropology, The University of Texas, Austin.

Jeter, M. D., J. C. Rose, G. I. Williams, Jr., and A. M. Harmon
1989 *Archeology and Bioarcheology of the Lower Mississippi Valley and Trans-Mississippi South in Arkansas and Louisiana*. Research Series No. 37. Arkansas Archeological Survey, Fayetteville.

Johnson, L., Jr.
1962 The Yarbrough and Miller Sites of Northeastern Texas, with a Preliminary Definition of the LaHarpe Aspect. *Bulletin of the Texas Archeological Society* 32:141-284.

Johnson, L., Jr. *(Continued)*
1987 A Plague of Phases: Recent Sociocultural Taxonomy in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1-26.
1989 *Great Plains Interlopers in the Eastern Woodlands in Late Paleoindian Times: The Evidence from Oklahoma, Texas, and Areas Close By*. Report Series 36. Office of the State Archeologist, Texas Historical Commission, Austin.

Jones, B. C.
1968 The Kinsloe Focus: A Study of Seven Historic Caddo Sites in Northeast Texas. Master's thesis, University of Oklahoma, Norman.

Jordan, T. G.
1981 *Trails to Texas: Southern Roots of Western Cattle Ranching*. University of Nebraska Press, Lincoln.

Kelley, D. B.
1994 *The McLelland and Joe Clark Sites: Protohistoric-Historic Caddoan Farmsteads in Southern Bossier Parish, Louisiana*. Coastal Environments, Inc., Baton Rouge.

Kenmotsu, N. A., J. E. Bruseth, and J. E. Corbin
1993 Moscoso and the Route in Texas: A Reconstruction. In *The Expedition of Hernando De Soto West of the Mississippi, 1541-1543: Proceedings of the De Soto Symposia 1988 and 1990*, edited by G. A. Young and M. P. Hoffman, pp. 106-131. University of Arkansas Press, Fayetteville.

Kidder, T. R.
1995 Rethinking Caddoan-Lower Mississippi Valley Interaction. MS on file with the author.

Kleinschmidt, U. K. W.
1982 Review and Analysis of the A. C. Saunders Site, 41AN19, Anderson County, Texas. Master's thesis, The University of Texas at Austin.

Kotter, S. M., L. Jones, C. Frederick, and W. Glander
1991 *An Archaeological Investigation of 41TT182 in the Monticello-Winfield South Surface Mine, Titus County, Texas*. Document No. 910264. Espey, Huston & Associates, Inc., Austin.

Kotter, S. M., R. Rogers, R. Taylor, K. Reese-Taylor, and W. P. Glander
1993 *Archaeological Investigation within the Monticello B-2 First Five-Year Disturbance Area, Titus County, Texas*. Document No. 920013. Espey, Huston & Associates, Inc., Austin.

Krieger, A. D.
1946 *Culture Complexes and Chronology in Northern Texas with Extension of Puebloan Datings to the Mississippi Valley*. Publication No. 4640. University of Texas, Austin.

Küchler, A.W.
1964 *Potential Natural Vegetation of the Conterminous United States*. American Geographical Society Special Publication 36. New York.

McClurkan, B. B., W. T. Field, and J. N. Woodall
1966 *Excavations in Toledo Bend Reservoir, 1964-65*. Papers of the Texas Archeological Salvage Project, No. 8. Texas Archeological Salvage Project, The University of Texas at Austin.

Middlebrook, T.
1994 An Update of Archaeological Investigations at the Tyson Site (41SY92). *Journal of Northeast Texas Archaeology* No. 3:1-36.

Nasatir, A. P. and N. M. Loomis
1967 *Pedro Vial and the Roads to Santa Fe*. University of Oklahoma Press, Norman.

Nash, M. A., S. M. Kotter, and K. V. Reese-Taylor
1995 *National Register Testing of Ten Sites in the Monticello B-2 Surface Mine, Titus County, Texas*. Document No. 930529. Espey, Huston & Associates, Inc., Austin.

Nelson, B. and T. K. Perttula
1993 Site 41UR136, a Titus Phase Site in the Little Cypress Creek Basin, Texas. *Caddoan Archeology Newsletter* III (No. 4):11-16.

Nelson, B., T. Perttula, and M. Turner
1994 Caddoan Archaeology in the Little Cypress Creek Valley: Recent Investigations at the Griffin Mound Site (41UR142), Upshur County, Texas. *Caddoan Archeology Newsletter* 5(3):6-17.

Newell, H. P. and A. D. Krieger
1949 *The George C. Davis Site, Cherokee County, Texas*. Memoirs No. 5. Published jointly by the Society for American Archaeology and the University of Texas, Menasha, Wisconsin.

Pearce, J. E.
1932 The Archaeology of East Texas. *American Anthropologist* 34:670-687.

Perttula, T. K.
1984 Patterns of Prehistoric Lithic Raw Material Utilization in the Caddoan Area: The Western Gulf Coastal Plain. In *Prehistoric Chert Exploitation-Studies from the Midcontinent*, edited by B. M. Butler and E. E. May, pp. 129-148. Occasional Paper 2. Center for Archaeological Investigations, Southern Illinois University-Carbondale.

1989 *A study of mound sites in the Sabine River Basin, Northeast Texas and Northwest Louisiana*. Final report submitted to the Texas Historical Commission by the University of North Texas, Institute of Applied Sciences, Denton.

Perttula, T. K. *(Continued)*
1992a *"The Caddo Nation": Archaeological and Ethnohistoric Perspectives*. University of Texas Press, Austin.

1992b The Looting and Vandalism of Archaeological Sites in East Texas. *American Society for Conservation Archaeology Report* 18 (No. 2):3-13.

1993a The Development of Agriculture in Northeast Texas before A.D. 1600. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 121-146. Cultural Resource Management Document 3. Texas Historical Commission, Department of Antiquities Protection, Austin.

1993b Sites with Excellent Faunal and Floral Preservation in the Northeast Texas Archeological Study Region. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 259-261. Cultural Resource Management Document 3. Texas Historical Commission, Department of Antiquities Protection, Austin.

1993c Effects of European Contact on Native and Immigrant Indians in Northeast Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 147-187. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

1993d Threats to Archeological Resources in the Eastern Planning Region. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 15-25. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

1994 Caddoan Mound Sites in the Sabine River Basin of Northeast Texas. *Caddoan Archeology Newsletter* IV(4):4-19.

1995 Agricultural Economies and the Character of Caddoan Societies in the Trans-Mississippi South. In *Politics and Economies in the Mississippian Southeast*, edited by C. Cobb and J. Muller. MS under review, University of Alabama Press.

Perttula, T. K. and J. E. Bruseth
1983 Early Caddoan Subsistence Strategies, Sabine River Basin, East Texas. *Plains Anthropologist* 28:9-21.

1995 Trade and Exchange in Eastern Texas, 1100 B.C.-A.D. 800. In "Exchange in the Lower Mississippi Valley and Contiguous Areas in 1100 B.C.," edited by J. L. Gibson. *Louisiana Archaeology* 17:93-121.

Perttula, T. K., C. J. Crane, and J. E. Bruseth
1982 A Consideration of Caddoan Subsistence. *Southeastern Archaeology* 1:89-102.

Perttula, T. K., B. D. Skiles, and B. C. Yates
1993a The Goldsmith Site (41WD208): Investigations of the Titus phase in the Upper Sabine River Basin, Northeast Texas. *Bulletin of the Texas Archeological Society* 61:139-191.

1993b The Carlisle Site (41WD46), a Middle Caddoan Occupation on the Sabine River, Wood County, Texas. *Notes on Northeast Texas Archaeology*, No. 1:34-62.

n.d. The Burks Site (41WD52), A Late Caddoan Titus Phase Village in Wood County, Texas. MS in preparation.

Perttula, T. K., R. C. Fields, J. E. Corbin, and N. A. Kenmotsu
1993 The Emergence of Sedentism in the Northeast Texas Archeological Region, ca. 500 B.C. to A.D. 1000. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 97-120. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Perttula, T. K., B. D. Skiles, M. B. Collins, M. C. Trachte, and F. Valdez, Jr.
1986 *"This Everlasting Sand Bed": Cultural Resources Investigations at the Texas Big Sandy Project, Wood and Upshur Counties, Texas*. Reports of Investigations No. 52. Prewitt and Associates, Inc., Austin.

Rogers, R., E. Foster, and K. Reese-Taylor
1994 *National Register Testing at Eight Archaeological Sites within the Oak Hill 2,280-Acre Study Area, Rusk County, Texas*. Document No. 930169. Espey, Huston & Associates, Inc., Austin.

Rose, J. C.
1984 Bioarchaeology of the Cedar Grove Site. In *Cedar Grove: An Interdisciplinary Investigation of a Late Caddo Farmstead in the Red River Valley*, edited by N. L. Trubowitz, pp. 227-256. Research Series No. 23. Arkansas Archeological Survey, Fayetteville.

Rose, J. C., M. P. Hoffman, B. A. Burnett, A. M. Harmon, and J. C. Barnes
1995 Skeletal Biology of the Prehistoric Caddo. MS on file with the author.

Schambach, F. F.
1982 An Outline of Fourche Maline Culture in Southwest Arkansas. In *Arkansas Archeology in Review*, edited by N. L. Trubowitz and M. D. Jeter, pp. 132-197. Research Series No. 15. Arkansas Archeological Survey, Fayetteville.

1983 The Archeology of the Great Bend Region in Arkansas. In *Contributions to the Archeology of the Great Bend Region*, edited by F. F. Schambach and F. Rackerby, pp. 1-11. Research Series No. 22. Arkansas Archeological Survey, Fayetteville.

Schambach, F. F. *(Continued)*
1989 The end of the trail: The route of Hernando de Soto's army through Southwest Arkansas and East Texas. *The Arkansas Archeologist* 27/28:9-33.

1993 A Summary of the History of the Caddo People. *Notes on Northeast Texas Archaeology*, No. 2:1-7.

Scurlock, J. D.
1962 The Culpepper Site, A Late Fulton Aspect Site in Northeast Texas. *Bulletin of the Texas Archeological Society* 32:285-316.

Skibo, J. M.
1992 *Pottery Function: A Use-Alteration Perspective*. Plenum Press, New York and London.

Skinner, S. A., R. K. Harris, and K. M. Anderson (editors)
1969 *Archaeological Investigations at the Sam Kaufman Site, Red River County, Texas*. Contributions in Anthropology No. 5. Department of Anthropology, Southern Methodist University, Dallas.

Smith, F. T.
1994 The Red River Caddos: A Historical Overview to 1835. *Bulletin of the Texas Archeological Society* 65:115-127.

1995 *The Caddo Indians: Tribes at the Convergence of Empires, 1542-1854*. Texas A&M University Press, College Station.

Stahle, D. W., M. K. Cleaveland, and J. G. Hehr
1985 A 450-Year Drought Reconstruction for Arkansas, United States. *Nature* 316:530-532.

Steponaitis, V. P.
1984 Technological Studies of Prehistoric Pottery from Alabama: Physical Properties and Vessel Function. In *The Many Dimensions of Pottery: Ceramics in Archaeology and Anthropology*, edited by S. E. Van Der Leeuw and A. C. Pritchard, pp. 79-127. Universiteit van Amsterdam, Amsterdam.

Story, D. A.
1990 Cultural History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Story, D. A. and D. G. Creel
1982 The Cultural Setting. In *The Deshazo Site, Nacogdoches County, Texas*, Volume 1, edited by D. A. Story, pp. 20-34. Report No. 7, Texas Antiquities Permit Series. Texas Antiquities Committee, Austin.

Story, D. A. (editor)
1982 *The Deshazo Site, Nacogdoches County, Texas.* Volume 1. Texas Antiquities Permit Series, Report No. 7. Texas Antiquities Committee, Austin.

Swanton, J. R.
1942 *Source Material on the History and Ethnology of the Caddo Indians.* Bulletin 132. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Thurmond, J. P.
1981 Archeology of the Cypress Creek Drainage Basin, Northeastern Texas and Northwestern Louisiana. M.A. thesis, University of Texas at Austin.
1985 Late Caddoan social group identifications and sociopolitical organization in the upper Cypress Basin and its vicinity, Northeastern Texas. *Bulletin of the Texas Archeological Society* 54:185-200.
1988 Caddoan Archeology—Its Present Status and Future Directions: A Perspective from Northeast Texas. Paper presented at the 30th Caddo Conference, Dallas.
1990a *Archeology of the Cypress Creek drainage basin, Northeastern Texas and Northwestern Louisiana.* Studies in Archeology, No. 5. Texas Archeological Research Laboratory, The University of Texas at Austin, Austin.
1990b Was the Cypress Cluster one of the (many) victims of the 1539-1543 De Soto expedition? *Caddoan Archeology Newsletter Volume* I(3):5-11.

Toomey, R. S. III, M. D. Blum, and S. Valastro Jr.
1993 Late Quaternary Climates and Environments of the Edwards Plateau, Texas. *Global and Planetary Change* 7:299-320.

Trubowitz, N. L. (editor)
1984 *Cedar Grove: An Interdisciplinary Investigation of a Late Caddo Farmstead in the Red River Valley.* Research Series No. 23. Arkansas Archeological Survey, Fayetteville.

Turner, M.
1993 A Two-Phase Caddo Mound at the Camp Joy Site (41UR144). *Notes on Northeast Texas Archaeology*, No. 2:66-75.

Turner, M. *(Continued)*
1994 From Soccer Socials to Caddo Archeology. *The Cache: Collected Papers on Texas Archeology*, Volume 2, edited by C. A. Hoyt, pp. 69-72. Office of the State Archeologist, Texas Historical Commission.

Turner, R. L.
1978 The Tuck Carpenter site and its relation to other sites within the Titus focus. *Bulletin of the Texas Archeological Society* 49:1-110.
1992 *Prehistoric Mortuary Remains at the Tuck Carpenter Site, Camp County, Texas.* Studies in Archeology, No. 10. Texas Archeological Research Laboratory, The University of Texas at Austin, Austin.
1995 Native American Ceramics of Northeast Texas. *Texas Archeological Stewardship Network Newsletter* 10(1):19-21.

Webb, C. H.
1959 *The Belcher Mound, A Stratified Caddoan Site in Caddo Parish, Louisiana.* Memoirs, No. 16. Society for American Archaeology, Salt Lake City, Utah.
1984 The Bellevue Focus: A Marksville-Troyville Manifestation in Northwestern Louisiana. *Louisiana Archaeology* 9:251-274.

Webb, C. H., J. L. Shiner, and E. W. Roberts
1971 The John Pearce Site (16CD56): A San Patrice Site in Caddo Parish, Louisiana. *Bulletin of the Texas Archeological Society* 42:1-49.

Webb, C. H., F. E. Murphey, W. G. Ellis, and H. R. Green
1969 The Resch Site, 41HS16, Harrison County, Texas. *Bulletin of the Texas Archeological Society* 40:3-106.

Woodall, J. N.
1969 *Archaeological Excavations in the Toledo Bend Reservoir, 1966.* Contributions in Anthropology No. 3. Department of Anthropology, Southern Methodist University, Dallas.

Forty Years of Archeology in Central Texas

Michael B. Collins

ABSTRACT

Substantive, theoretical, and methodological accomplishments in the archeology of Central Texas since the 1954 publication of *An Introductory Handbook of Texas Archeology* are notable and diverse, but scientific maturity has not been achieved.

INTRODUCTION

This contribution to the 66th *Bulletin of the Texas Archeological Society* reviews what has been learned about the prehistory of the Central Texas archeological region, a task undertaken twice before in this venue (Suhm, Krieger, and Jelks 1954; Suhm 1960). In the earlier of these, a formal structure of archeological inquiry was established for the entire state, and the diverse data gathered over the first half of the century were organized and synthesized.

Although successive metamorphoses have rendered the particulars of the 1954 *Handbook* virtually unrecognizable in current practice, each revision was built on what had gone before, so that much of what we know today rests on sturdy foundations laid 40 years ago. Typologies of ceramics and projectile points published in the *Handbook* have remained more intact than the other cultural constructs. In his introduction to the *Handbook*, Krieger (Suhm et al. 1954:2-10) also established a number of the tenets of typology that continue to underlie some artifact classifications in the state.

The review published in 1960 is the first metamorphosis, beginning by offering a smaller and less rigidly bounded delineation of "Central Texas" (Suhm 1960:Figure 1). Among the lasting contributions of the review are good visual (Suhm 1960:Figures 2 and 3) and descriptive (Suhm 1960:89-103) images of the nature of the Central Texas archeological data base, particularly its key sites. Historic Indian groups in Central Texas received greater treatment, and Suhm's review also reflects the beginnings of the preoccupation with prehistoric chronology-building that overwhelmed the research effort over the next 25 years and dominated subsequent reviews and syntheses. At the time Suhm wrote her review (1958), only one radiocarbon date was available for a Central Texas site (Suhm 1960:88), and analyses of stratified site excavations were too few to use as a basis for establishing a chronology.

Since 1960, several topically, temporally, or theoretically focused reviews of Central Texas archeology have been written (e.g., Weir 1976), or published (e.g., Johnson 1967; McKinney 1981; Prewitt 1981, 1985; Black 1989; Creel 1991; Howard 1991; Johnson and Goode 1994; Lintz 1993; Ellis 1994). Some of these have been more influential than others, but, as the present review will show, none has adequately considered the nature of the region's archeological record.

The vast data base that now exists for Central Texas cannot be adequately synthesized and presented in the space available. This essay attempts instead to:

- critique the practice of archeology in Central Texas,
- offer a brief summation of what we presently know, and
- opine some ways by which we might know significantly more, and have greater confidence in that knowledge, by the time a next review is written.

It is necessary to critique the manner of our work because archeology rarely answers questions that have not been asked, and because the questions asked and the ways they are addressed in any archeological paradigm largely dictate the nature of the substantive findings. Over most of the last 40 years, archeological efforts in Central Texas have excessively emphasized questions of chronology, have failed to identify and sustain a focus on but a few other issues of substance, and have not adequately understood the nature of the archeological record.

Inexplicably, the preoccupation with chronology prevailed without development of a very effective methodology for its pursuit. Specifically, although the *sondage* technique was adopted, the greatest effort has been expended on precisely the kinds of sites with the least potential for yielding good chronological information, while sites with that potential languished with comparatively little attention. There have been many data generated, but not much synthesis of those data.

Belatedly, four trends have emerged in the last 100 months that encourage me to believe that the prospect is good for significantly improved research in the archeology of the region (cf. Ellis 1994). First, we have begun to better recognize the nature of the archeological record, and how it was formed, as well as the greater need for data *quality* over data *quantity*. Second, preoccupation with issues chronological has begun to give way to sustained concern with several questions of human adaptation. Third, research now reflects an awareness of great data potential that had long been overlooked, and the relevance of data to the questions asked is being scrutinized. Finally, cracks may be appearing in the wall of provincialism that surrounds us. Great openings should follow and, in the words of Johnson (1991:21-22):

> The future of archaeological research in the Edwards Plateau and adjacent areas will be considerably less gloomy if the region can get the attention it deserves, and if its synthesis is addressed to a national or international audience that will be critical of any local misadventures.

Lest the wrong impression be implied by the foregoing, archeology *is* a historical science; therefore, constantly improving chronological control of the past must remain a primary objective, *but only as the framework for ordering more substantive inquiries and findings*. In this vein, much has been said about the validity and meaning of various temporal frameworks offered for Central Texas prehistory. In spite of the use of terms such as *phase*, and the discussion of phases in ways suggesting they have ethnic meaning, the foremost purpose of such constructs has been temporal ordering of archeological material culture. These are based largely on morphological (supposedly stylistic) trends in artifact forms, and, as such, are *archeological style periods*, not unlike style periods (e.g., Victorian, Greek Revival, or Tudor) used by architects. Johnson (1987, 1991) has suggested that some of our archeological style periods be called *patterns*, and I (Collins et al. 1990) have proposed the label, *intervals*. Either of these is better suited than *phase*, to which we both object, but I continue to prefer *interval*, first because it emphasizes the main thrust—time—and, second, because *pattern* implies that we know more about the material cultural composition of some of the time slices than I believe we do. Whatever we call the segments of our temporal framework, their function is to order cultural change, which is the essential basis for understanding cultural processes.

CENTRAL TEXAS AS AN ARCHEOLOGICAL AREA

Culture areas (Kroeber 1939) and their archeological counterparts (e.g., as used by Willey 1966) have long served to focus attention on regions of shared cultural traits. At any single moment in time, culture area boundaries often can be drawn relatively easily. Some boundaries persist for centuries or millennia, but others shift and blur over time. The longer the time period under consideration, the more arbitrary boundaries become. Much of North America might be considered a single culture area during Clovis times, but by A.D. 1000, scores of areas would be needed to each embrace the same degree of material-culture sameness as seen in all of Clovisdom.

Any delineation of the Central Texas archeological area is highly arbitrary. Conversely, to draw boundaries based on careful considerations of material-cultural sameness would result in a sequence of perhaps a dozen Central Texas areas of quite different sizes and shapes, an unmanageable array for the purposes of this essay. So, for the present discussion, Prewitt's (1981:71 and Figure 2) delineation of the Central Texas Archeological Area (Figure 1) has been used as a descriptive framework, but its boundaries have not been adhered to rigidly as regards certain archeological and geological data that inform on key issues in the local record. Also, this delineation is selected with the proviso that, like any

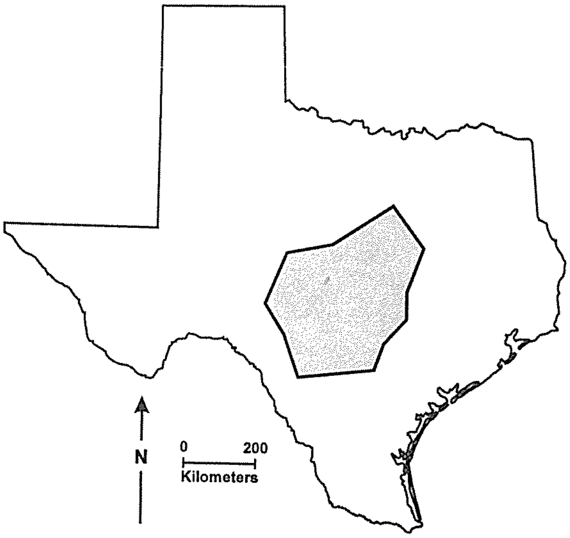


Figure 1. The Central Texas archeological area (after Prewitt 1981).

such arbitrary construct, it is more satisfactory for some parts of the prehistoric record than for others.

More importantly, as Gamble (1986), Hodder (1978), Clarke (1977), Ebert (1992) and others have noted in general, and Ellis (1994:54-56) has discussed specifically for the Central Texas culture area (see also Ellis et al., this volume), our spatial concepts can seriously impair our efforts to interpret past human adaptations. In the past 11,000 years, there probably has never been any cultural group whose key resources, geographic range, or political sphere conformed even approximately to what archeologists designate as "Central Texas."

This is an area of roughly 84,300 square kilometers, or 12 percent of the area of the state. As of January 1995, recorded archeological sites numbered 11,355 for Central Texas, which could be as low as 10-20 percent of the actual number, judging from site densities in a few thoroughly surveyed areas. Documented sites are located in open areas on various topographic features, along blufflines, in rockshelters, and in caves; site characteristics differ greatly, but afford clues as to the function or functions of any given site, or of a component within a site (Table 1).

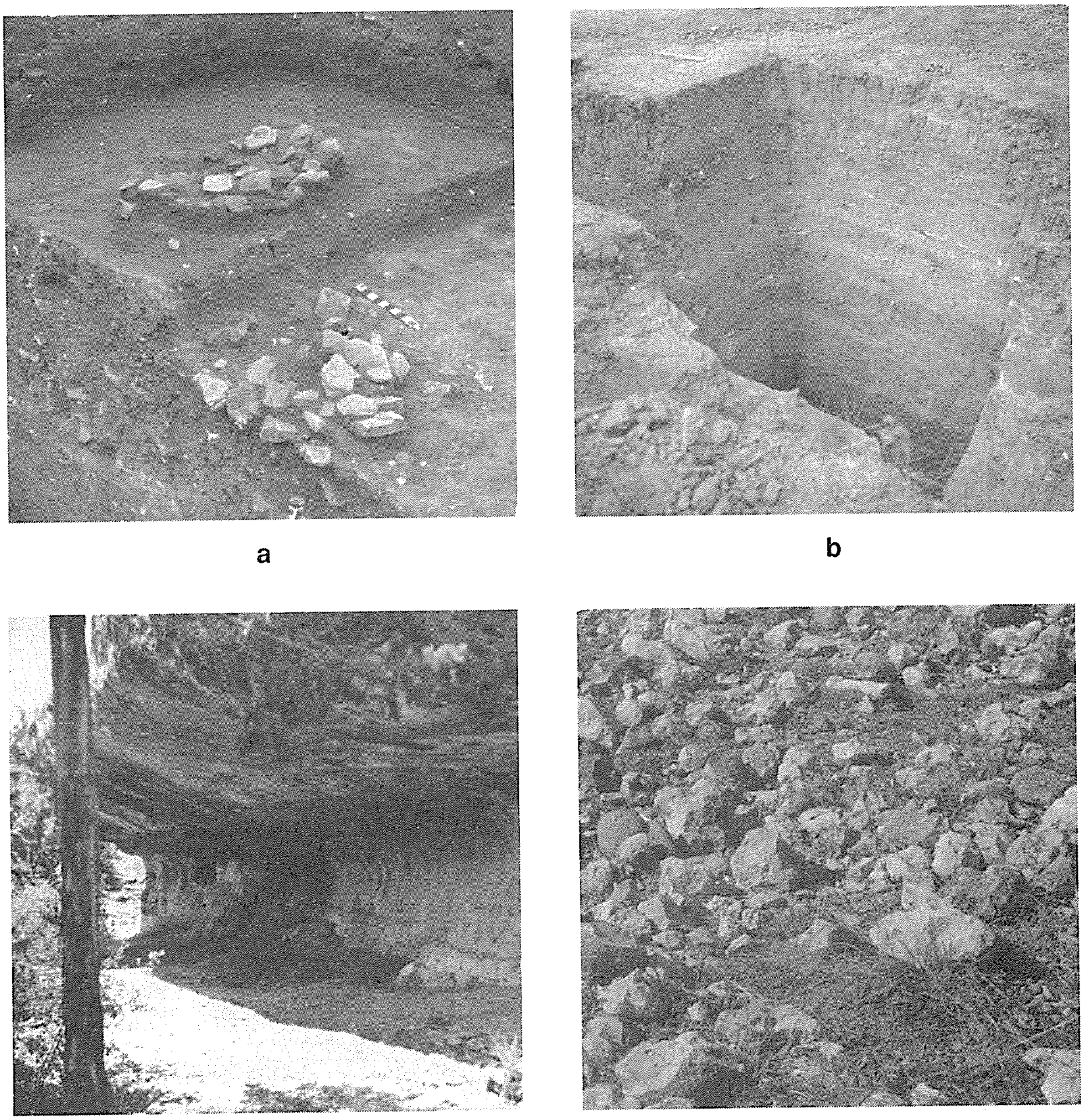
In Central Texas, the most common kind of site recognized is an accumulation of debris (burned rock, stone chipping residue, pottery sherds) and diverse utilitarian objects (grinding stones, hammerstones, unifaces, bifaces), sometimes in great quantities. Although various more-specific interpretations ("base camps," "extractive sites," etc.) have been offered, it is probably safest to say that the vast majority of these represent the residue from one or more periods of habitation; in simplified terms, these are camp sites where people stayed for a time, regardless of their more specific purposes for being at that location. Camps are found in all settings (see Table 1; Figure 2): in the open, along bluffs, in rockshelters, and even a few in caves such as Scorpion[1] and Halls. Features found at camps include just about all kinds: hearths (Figure 2a), knapping areas, graves, caches, pits, houses, and many others. One of the more conspicuous and, therefore, most commonly noted features in Central Texas, are massive, mounded accumulations of burned rocks or "burned rock middens" (Figure 3a-c). Because they have played such a large role in the archeology of Central Texas (cf. Ellis 1994), burned rock middens are discussed separately, below.

The elements (artifacts and features) that make up or accompany camp sites sometimes occur apart

Table 1. Simplified characterization of site types and settings in Central Texas

SITE TYPES	SITE SETTINGS			
	Open	Bluffline	Rock-shelter	Cave
camp	x	x	x	x
caches	x	x	x	
isolated artifacts	x	x	x	
interments	x	x	x	
cemeteries	x		x	x
kill/butchery	x		x	
quarry/workshop	x	x		
lithic scatters	x			
rock art		x	x	

[1]Bibliographic references for sites and geologic studies mentioned in the text and Table 2 are in the Appendix.



a b c d

Figure 2. Examples of common kinds of archeological sites in Central Texas: a, open campsite; b, stratified open campsite; c, rockshelter; d, lithic quarry and workshop.

from camps. These include caches, isolated artifacts, burials, bedrock mortars, and rock art (Figure 3d), all of which are known to occur in various settings (see Table 1). Cemeteries, in and away from camps, are known in the prehistoric record of Central Texas, and have been found in rockshelters (Watt 1936), open localities (Loeve Fox, Frisch Auf!), and in vertical shaft caves (Hitzfelder, Mason Burial Cave).

Few animal kill sites have been documented in Central Texas. The Late Prehistoric bison skeleton (Feature 66) at Loeve Fox is one possible example (Prewitt 1982:73-79). Another is inferred from fossilized bison bones and Folsom points dislodged by treasure-hunters from the floor of Kincaid Rockshelter, where it seems a bison died after it was wounded but not retrieved by Folsom hunters (Collins 1990b).

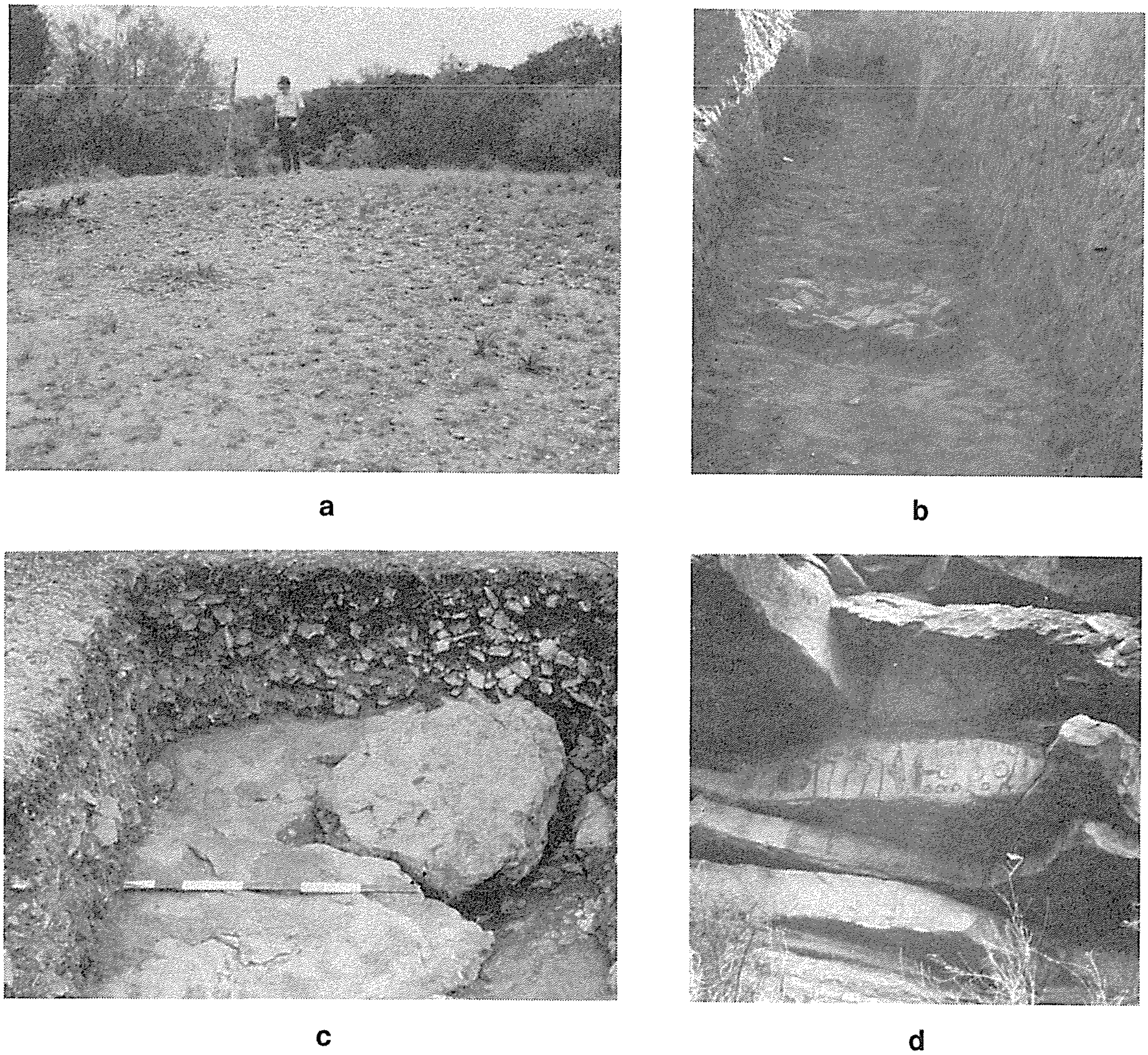


Figure 3. Examples of the very common burned rock middens (a-c) and the uncommon rock art panels (d) of Central Texas: a, a pristine burned rock midden in Blanco County; b, burned rock midden and hearth in the stratified Wiley Williams site, Travis County; c, typical structure of a burned rock midden (Sutton County); d, pictographs at Paint Rock in Concho County.

Chert has been the most important kind of toolstone throughout the prehistory of Central Texas, and the area is rich in the quantity and quality of this raw material (Banks 1990). This is reflected in numerous sites where chert was acquired (quarries), acquired and knapped (quarry/workshops [see Figure 2d]), or just knapped (lithic scatters).

Each of these kinds of sites has its own characteristic parameters. The diverse kinds of sites are not equally visible to the archeologist, their interpretive potential varies greatly, they were never equally numerous, and they have survived the vagaries of nature at different rates. Efforts to interpret and compare patterns of land use over time, or to estimate such things as relative population sizes, are heavily burdened with these sampling issues.

As a natural area, Central Texas is diverse. Its single most significant feature is a prominent fault scarp, the Balcones Escarpment, which arcs from northeast to southwest around the center of Central Texas, and breaks the area into two contrasting subareas (Figure 4a). The larger subarea is north and west of the scarp, on its upside. Most of this is

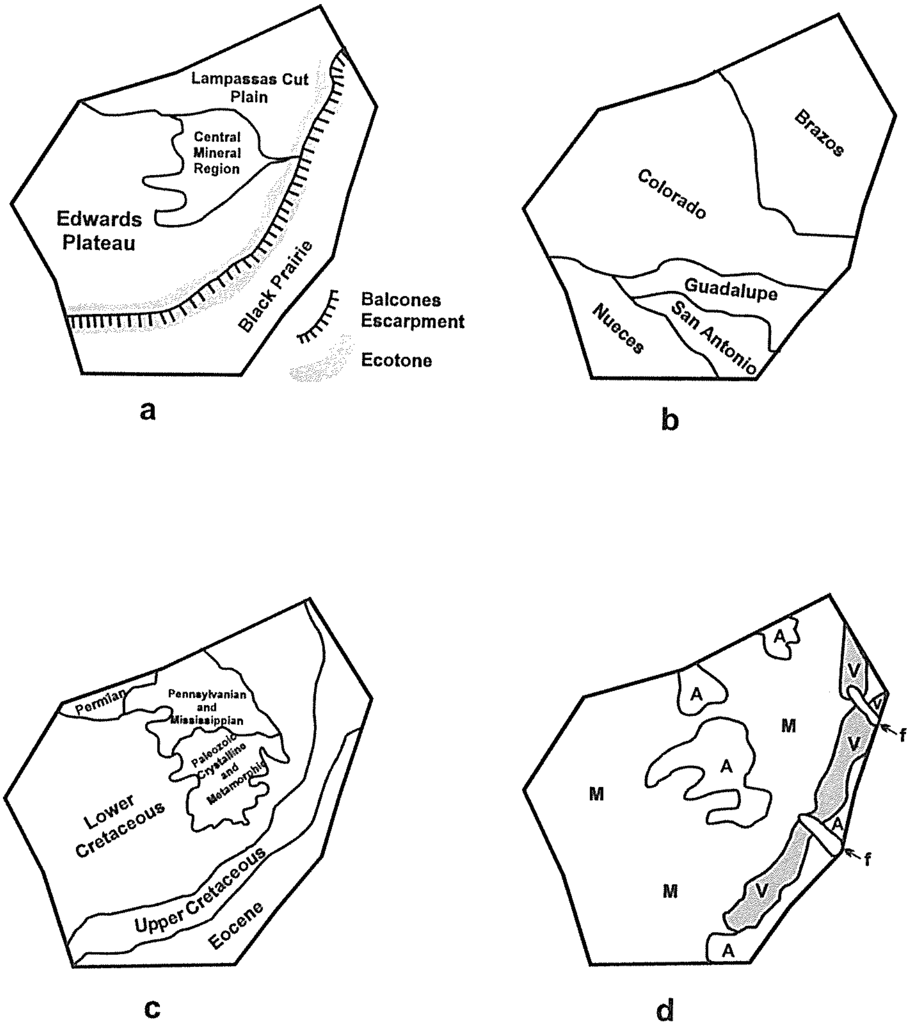


Figure 4. Geographic aspects of Central Texas: a, physiography; b, major river basins; c, geology; d, soils (A=alfisols; M=mollisols; V=vertisols; f=fluvial valley fills, various soils).

dissected plateau land of resistant limestone and thin upland soils, but deeply eroded crystalline rocks—the Central Texas Mineral Region—are present as well. The prevailing vegetation is oak and juniper savanna. Of roughly half the size is the smaller subarea, south and east of the scarp, on its downside. This is part of the coastal plain, a region of relatively soft bedrocks and deep soils. Most of this subarea is prairie with deep clayey soils, but a narrow strip along its eastern margin is post oak forest standing on deep sandy soils.

Along the escarpment lies a great ecotone (see Figure 4a) where natural conditions are transitional between the plateau to the west and north and the prairies to the east and south. More importantly, it is beneficial for humans to occupy an ecotone whence they can readily access contrasting resources in the adjacent biomes and capitalize on the resource diversity of the transitional zone.

Annual precipitation decreases from east to west across Central Texas from near 100 cm to 55 cm. The primary water resources for preindustrial peoples are streams and springs. Two river systems, the Brazos and the Colorado, drain approximately 75 percent of the Central Texas area (Figure 4b); the remaining 25 percent is roughly equally divided into the catchments of the Nueces, San Antonio, and Guadalupe rivers (see Figure 4b). Generally, drainage is toward the southeast. Of the 281 springs documented for Texas, 139 (49 percent) are in the area, including both of the state's *very large* springs (>100 cubic ft/sec), and 12 of the state's 17 *large* (10-100 cubic ft/sec) springs (Brune 1975).

Change, as it is everywhere, is and always has been unrelenting across the land of Central Texas. Wind, water, and gravity move earth material from place to place; lakes, streams, and springs flourish and fail; caves and rockshelters form, enlarge, degrade, and collapse. The delicate balances between soils, climates, plants, and animals are ceaselessly being adjusted. *Terra firma is but an illusion.*

LANDSCAPE EVOLUTION FROM EARTHQUAKES TO EARTHWORMS

Foremost among deficiencies in the methodology by which most of the Central Texas archeological record has been built is inadequate recognition of the dynamic nature of the physical environment, and the profound implications landscape evolution has for archeological inquiry. Issues of long-term changes in climate (Bryant and Shafer 1977; Bryant and Holloway 1985) and biotic communities (e.g., Dillehay 1974) have received considerable attention from archeologists, but these are like words wtihout music when portrayed across a static terrain. A few examples will illustrate the importance of integrating archeological inquiry with an understanding of landscape change—whether studying a region or a single site.

Most archeological surveys, until recent years, were conducted without the explicit objective of discovering buried sites (e.g., Shafer et al. 1964). Even though awareness of the need for subsurface reconnaissance has increased (e.g., Saunders et al. 1992), much of our archeological data base was generated without this awareness and is significantly biased as a result. Corollary to discovering buried sites is the recognition that in some areas landscape change has been sufficient to obliterate sites. The important point here is that geologic and pedogenic processes have *nonrandomly* altered, buried, and destroyed sites (e.g., Abbott 1994). Examples from different areas of Central Texas are instructive.

Fluvial Systems

Simplified depictions of site distributions from archeological surveys in three reservoirs along the Colorado River clearly illustrate one aspect of this bias. In two of the three project areas (Figures 5 and 6), virtually no sites were recorded on the inside of

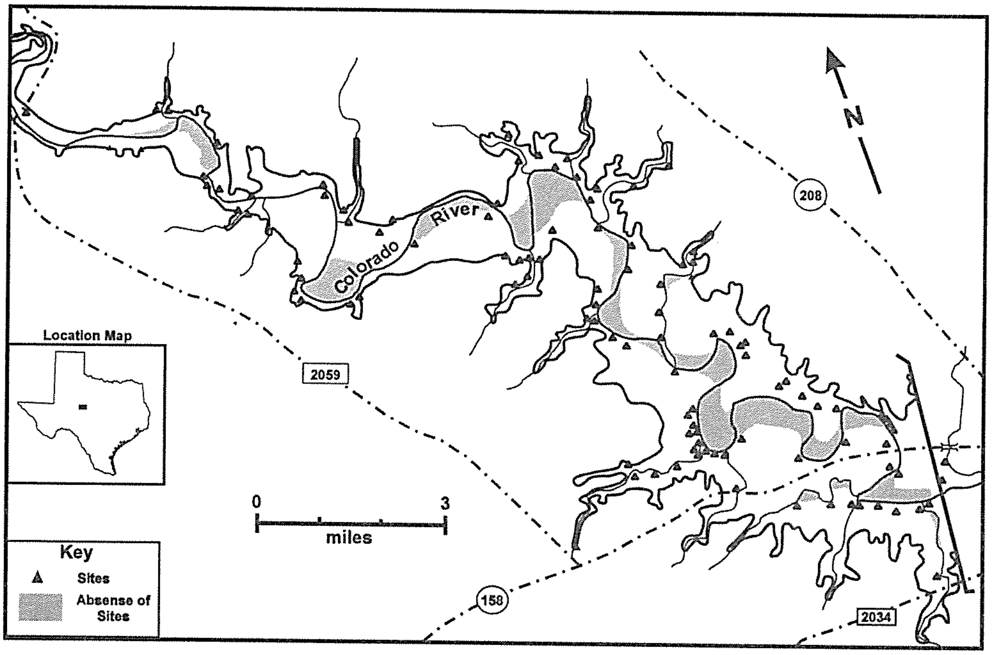


Figure 5. Site distributions in the basin of Robert Lee Reservoir; note paucity of sites on the inside of river bends (from Shafer 1967).

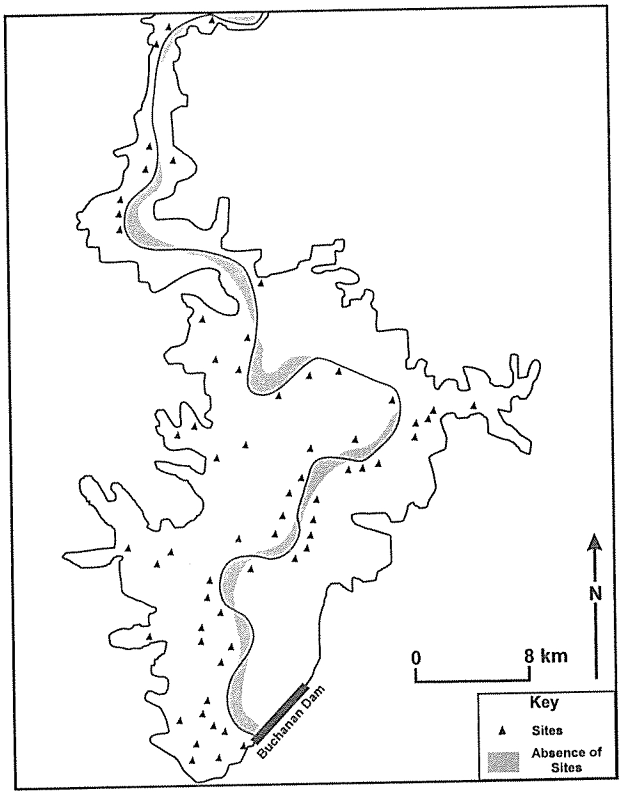


Figure 6. Site distributions in Buchanan Lake Basin; note paucity of sites on the inside of river bends (from Jackson and Woolsey 1938).

bends in the river (Shafer 1967; Jackson and Woolsey 1938). In the third (Figure 7), only a few sites, "ephemeral and not worthy of excavation," were noted on the inside of bends (TARL files). Are we to infer that people chose almost never to live on the inside of river bends? No, I suggest we are to infer instead that the surveys failed to discover sites buried on the interior of the river bends. Since streams almost invariably cut on the outside of their bends and deposit on the inside, a sequence of prograding deposits forms on the interior of bends. These are referred to as "pointbars," and are often the ideal depositional environment for the formation of stratified sites. Such sites, however, are commonly invisible or decidedly meager in appearance at the surface, exactly the pattern seen in the three surveys.

Another aspect of site distributional data in the valleys of major streams is that even along a single stream, different histories of deposition often occurred in different areas. Almost no Early Holocene fill is exposed in the larger stream valleys in the central Edwards Plateau, and almost no Late Holocene fill occurs in the upper reaches of small streams (Blum and Valastro 1989; Collins et al. 1990). Skinner (1974) found larger sites typically occurring along the main trunk of the Guadalupe River, with small sites more characteristic of the tributaries. He interpreted this to reflect an Archaic settlement pattern with base camps on the large river linked to extractive sites in the smaller valleys. However, this conclusion cannot be valid because the archeological record formed differently along the main trunk and its tributaries. Exposed Early Archaic sites are extremely infrequent in the main Guadalupe valley, probably because most of them are deeply buried in Late Holocene alluvium, whereas in the upper reaches of tributaries, where little deposition has occurred since the Early Holocene, components dating throughout the Archaic are present, often mixed

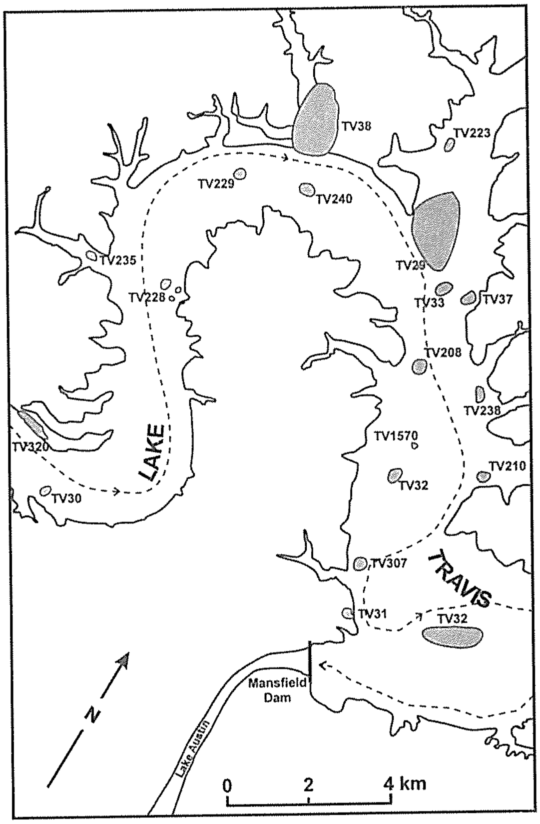


Figure 7. Site distributions in the lower reaches of Marshall Ford (Lake Travis) basin; note that relatively few sites were mapped on the inside of river bends; sites 41TV207, 208, 220, 229, and 240 tabulated in survey report as "ephemeral and not worthy of excavation" (from records on file, TARL).

together in multi-component sites on long-stable surfaces (Collins et al. 1990:13-15).

Finally, recent mapping and dating of allostratigraphic[2] units in the valley of the Colorado River downstream from the Balcones Escarpment (Blum 1992) has shown that major changes have taken place in a much shorter time than previously inferred (e.g., Baker and Penteado-Orellana 1978). During the culturally-relevant past (ca. 12,000 B.P. to the present), four periods of Colorado River valley geomorphic history can be recognized, based on Blum's (1992) findings, as relevant to the formation of the archeological record in the eastern part of Central Texas.

At ca. 12,000 years ago, the river had downcut in its older valley fill and was cutting into bedrock. High surfaces of the older fill (the Eagle Lake Alloformation that had built up during the period between 18,000 and 15,000 B.P.) were exposed as terraces along the river as possible localities for any very early sites to form. Significant portions of this landform were subsequently cut away, but scores of square kilometers are still present in the Central Texas stretch of the lower Colorado River valley. From then until ca. 3500 years ago, the valley floor aggraded, forming a unit mapped as Member 1 of the Columbus Bend Alloformation. This unit dates from ca. 11,000 to 3300 years ago, and often exceeds 10 meters in thickness. Deeply stratified sites containing Paleoindian to Late Archaic components, such as the Vara Daniel site in Austin's Zilker Park (Ricklis et al. 1991), formed in this unit. This unit was then partly cut by the river. Member 2 of the same alloformation then aggraded against, and partly over, Member 1 between about 1600 and 1000 years ago. Member 2 often exceeds 12 meters in thickness and contains Late Archaic to early Late Prehistoric sites; these, too, were present at the Vara Daniel site (Takac et al. 1992). There are a few hundred square kilometers of members 1 and 2 of the Columbus Bend Alloformation in Central Texas, concealing an untold number of buried archeological components.

The river downcut again, ca. 1000 years ago, before depositing its most recent unit, Member 3 of the Columbus Bend Alloformation, which is inset against the older members 2 and 1. Blum (1992:193) noted modern artifacts (e.g., barbed wire) in this member, but radiocarbon ages back to ca. 500 B.P. (Blum 1992:Table 6.4) indicate that some buried Late Prehistoric components could be present. Accelerated deposition in the last 100 years (Blum 1992:193), is probably attributable to disruption of the natural vegetation by grazing and farming, and this may have buried most late sites.

For the archeologist, the horizontal extent of fluvial deposits may be as important as their temporal coverage. Deposits of any particular age might occur only in extremely limited areas favorable for deposition, might be massive and extensive, or might be moderately widespread. Knowledge of these conditions is essential to discovering sites, and to interpreting their frequencies relative to other sites and by time periods.

"Eocene" Sand Sheet and the Big Brushy Formation

Along the eastern margin of the Central Texas Archeological Area is a narrow strip of deep sandy land (see Figure 4c), generally mapped as Eocene on geologic maps (Barnes 1981). As in much of eastern Texas, prehistoric sites found in this setting commonly are either buried or exposed by some kind of land disturbance (cf. Brown 1986; Taylor 1987). Just outside the Central Texas area, but in the same sand belt, recent geoarcheological work has defined a Holocene unit (the Big Brushy formation), a widespread sand mantle of variable thickness which in places contains buried archeological remains (Bianchi 1984; Perttula et al. 1986). This work sheds light on the kinds of formation processes that might be expected in the Central Texas part of the sand belt. Basically, in the words of Bousman and Fields (1988:195) regarding the Big Brushy formation:

> sand thickness is viewed as having a direct bearing on the preservation and interpretability of the archeological record, with thick sands having the potential to contain intact, stratified cultural deposits and thin sands having a greater likelihood of containing eroded, displaced cultural materials.

Furthermore, since the Big Brushy formation is thought to have aeolian and colluvial facies, it has

[2]A sedimentary unit defined and mappable on the basis of its bounding discontinuities; such a unit itself does not have to be continuous (North American Commission on Stratigraphic Nomenclature 1983: 865-867).

the potential of reflecting changes in environmental conditions over time.

Blackland Prairie

That band of the coastal plain just east of the Balcones Escarpment known as the Black Prairie or Blackland Prairie is an area of deep soils ultra-rich in clay, called "ultraclay soils." Sites formed in these soils are subject to extreme disruption through soil processes (pedoturbation). Soil textbooks (e.g., Boul et al. 1989) even use Houston Black Clay, the prevalent soil series in the Blackland Prairie, as representative of the adverse properties of ultraclay soils (see Figure 4d). Extreme plasticity when wet, deep vertical cracking when dry (Duffield 1970), and a propensity to roll like a slowly boiling thick liquid (producing soil features called *gilgai*), are the factors that threaten site integrity. *Gilgai* movement in soil is like that in dough as it is kneaded. In deep Houston Black Clay, the rolling motion typically extends downward about 1.5 to 2 meters and produces distinctive shear features, called slickensides, between masses of soil that move past each other. I have seen pieces of modern metal and glass dragged to the bottom of *gilgai* (a downward distance of more than 1.5 meter) by this process, showing that the rolling time of *gilgai* is on the order of decades. If excavations encounter large slickensides (often observable in irregular planes 25 to 50 cm or more across) in a site, that site, in all likelihood, is badly disturbed.

Bluffs and colluvial slopes

Much of Central Texas is dissected limestone plateau land, and there are also areas where hills of granite, sandstone, and other rock types occur. Hillsides and valley walls in all of these are subject to degradation in the form of slope movement, or colluviation. At least one site (41ML64 in McLennan County) has been documented as partially disrupted by a landslide (Collins and Holliday 1985). Where overhangs occur ("rockshelters"), these, too, degrade and collapse over time (Collins 1991b). Sites on, or at the toe of, slopes are subject to movement or burial by colluviation. As rockshelters degrade and collapse, sites within them are buried in detritus. All of these factors profoundly shape the archeological record.

Ubiquitous Processes

Minor surface deformation events, as well as earthquakes with magnitudes up to 5 on the Richter scale, occur in the area (Osmond 1963; Davis et al. 1989). The consequences of seismicity and tectonic activity during the Late Quaternary (cf. E. Collins 1982; E. Collins et al. 1980) may have influenced human history or the archeological record of that history in Central Texas. Expectable consequences of earthquakes include: degradation of rockshelters and blufflines (Collins 1991b), soil liquefaction or ejection events, and the alteration of stream courses (Rapp 1986; Schumm 1977; Talwani and Cox 1985).

Pedoturbation occurs to some extent in all soils. Common forms include the action of roots of trees, brush, and herbaceous vegetation; the burrowing of animals; and the constant action of earth worms. Dens of the social insects, particularly ants, can also cause extensive damage to sites.

As the landscape aggrades, soil formation and the disruptive forces that accompany soils are lessened proportionally to the rate of aggradation. Conversely, cessation of aggradation intensifies disturbance in the soil zone. It also invites the mixing of archeological evidence from multiple periods of occupation, called *palimpsests* (cf. Ferring 1986). It is important to recognize that any surface upon which archeological materials rest was stable, at least briefly. If that surface is buried, aggradation resumed after a time of stability. Not all buried surfaces are equal, since the time of stability can vary from days to millennia before deposition resumes.

Archeologists do not always discriminate the differences among buried archeological surfaces, placing too much emphasis on the fact of burial and not enough on the nature of the interval of stability (lacuna or hiatus) that preceded burial. Palimpsest sites can become buried and be just as mixed as their counterparts at the present surface.

A particular pitfall is that of *pene-contemporaneity*, or burial at the same time. At any moment, the land surface will be composed of surfaces that have been exposed for different lengths of time. If widespread deposition abruptly covers part of that land surface, the preceding interval of stability will have been of greater duration in some areas than in others, but the overlying sediments will all be of the same age. Any attempt by archeologists to use the age of a depositional unit to estimate anything other than the minimum age of underlying archeological materials is at risk.

CHRONOLOGY AND OTHER ACCOMPLISHMENTS

It has become fashionable to criticize efforts to build an archeological chronology for Central Texas. McKinney (1981), Peter et al. (1982), Johnson (1987, 1991; Johnson and Goode 1994), Black (1989), Collins (1994a; Collins et al. 1991), Ellis (1994), among others, have all found fault with the leading chronological schemes proposed by Weir (1976), and by Prewitt (1981, 1985). There are significant flaws in both, but these are also two remarkable and significant contributions to the archeology of the region, not so much as chronologies but as attempts to integrate and synthesize large amounts of archeological data. It is also important to remember that Weir and Prewitt did not lack for prototypes (notably those of Johnson et al. [1962] and of Sorrow et al. [1967]).

Johnson, Suhm, and Tunnell (1962) and Sorrow, Shafer, and Ross (1967) proposed local archeological chronologies, each on the basis of a few sites. The data from the Footbridge, Oblate, and Wunderlich sites were not robust chronologically, but an effort was made to bring Central Texas chronological thought into closer agreement with that being used in the Eastern United States (Johnson et al. 1962; Johnson and Goode 1994). The Evoe Terrace and Landslide sites (Sorrow et al. 1967) afforded better chronological evidence, especially with the benefit of earlier findings at the nearby Youngsport site (Shafer 1963). Sequencing of diagnostic chipped stone tools, especially projectile points, was emphasized in these efforts.

Weir (1976) and Prewitt (1981, 1985) proceeded beyond chronologizing projectile point types, sought to find temporal patterning in site types, features within sites, and assemblages of artifacts, and offered suggestions to explain some of the patterns they discerned. Ellis (1994) presents an insightful critique of Weir's and Prewitt's efforts.

It is a credit to Weir's and Prewitt's skills in the *art* of archeological analysis that such comprehensive schema could be developed, when many of the data they used were from sites with: (a) mixed components, (b) poor stratification, (c) unclear associations among artifacts and between artifacts and features, and (d) weak associations between samples dated by radiocarbon and the target archeological manifestations. Weir (1976) relied on only 46 radiocarbon dates, the vast majority of which were from sites outside of Central Texas; Prewitt (1985) had 147.

Considerable use has been made of Weir's and especially of Prewitt's chronological schemes and revisions have been proposed (e.g. Johnson and Goode 1994; Collins et al. 1991; Ricklis and Collins 1994). The work of verifying and improving the regional archeological chronology will always remain unfinished. Recent efforts, especially the more rigorous use of absolute dating (cf. Johnson and Goode 1994), show promise for substantial improvements. Importantly, the *caveat emptor* posted by Johnson (1987) regarding Prewitt's chronology must continue to be heeded.

Many sites in Central Texas are deficient or totally lacking in suitable organic materials for conventional radiocarbon dating. Use of AMS (accelerator mass spectrometry) in radiocarbon dating has enhanced the capability of the technique and brings more sites within the scope of radiocarbon dating.

Alternatives to radiocarbon dating and application of radiocarbon techniques to a wider array of materials are also important developments. Archeomagnetic (Eighmy 1993), optically-stimulated luminescent (Stokes 1992), thermoluminescent (Collins 1994c:499-501), and in rare cases even obsidian hydration (Stevenson 1992), procedures may hold promise for dating certain recalcitrant sites in the area. Dating of organic constituents of bone, soil, sediments, snail shells, travertines and other carbonate rocks using radiocarbon techniques are becoming more useful as the chemistry of each becomes better known, and the problems associated with assaying these materials become less serious.

Burned rock middens, because they are numerous and conspicuous in Central Texas, have long received a large share of the archeologists' attention. After decades of limited success in understanding what these sites represent in human behavioral terms, recent efforts employing more thoughtful research strategies and improved techniques for gathering and analyzing data have begun to extract information that promises to answer some questions and more-clearly frame others. Perhaps the single most fundamental conceptual advance in burned rock midden research is recognition that burned rock middens likely formed in several different ways. Recovery of detailed data on the structure, composition, content, and context of middens in search of data on explicitly defined material expressions of different aspects of human behavior is the approach that has long been lacking in burned rock midden research (Collins 1991a, 1994b; Creel 1991; Goode 1991; Howard 1991; Prewitt 1991; Hester 1991; Potter et al. 1995; Potter and Black 1995).

Archeology in Central Texas has also seen development of sophisticated research into the technology of stone tool manufacture and use. A trend that began in the late 1960s (e.g., Sorrow 1969) and has become almost routine (e.g., Ensor and Mueller-Wille 1988), is to include technological findings in lithic artifact descriptions. This has included efforts at sourcing cherts (e.g., Quigg and Peck 1995) and obsidians (e.g., Hester et al. 1985), along with sustained considerations of how people acquired stone, worked it, as well as used, maintained, and recycled the resultant objects. What has not occurred is any regional synthesis of the diverse descriptive data that have been amassed. Debitage analysis, properly done on assemblages of high contextual quality, contributes otherwise unknowable information about prehistoric knapping behavior (cf. Ensor and Mueller-Wille 1988; Quigg and Peck 1995; Collins 1994a; Ricklis 1994b).

Although ceramics are far less common than lithic artifacts in Central Texas, concern with ceramic technology and the cultural implications of pottery-making behavior has recently emerged (e.g., Johnson 1994; Reese-Taylor et al. 1994). This is an important development that, if sustained, will produce valuable results concerning the prehistoric Central Texas archeological record.

Archeologists in Central Texas have increasingly considered the processes of site formation and incorporated the findings into their interpretations (e.g., Potter and Black 1995). This is not a research goal in its own right, but it is an essential element in sound archeological inquiry, and it should become a routine part of any site investigation. An outstanding early example of the site-formation-process perspective is that of Kelley and Campbell (1942), which considered the relationship between rates of alluviation and the formation of burned rock middens. Unfortunately, this perspective did not prevail in the region, and only recently has it become very common.

Butzer (1982) notes that the archeological record can be viewed on three contrasting scales—micro, meso, and macro. Research at each scale has its own set of strengths and weaknesses. Archeological inquiry in Central Texas has heavily emphasized the meso-scale, which usually encompasses a single site and its immediate setting. Unfortunately, archeological patterns are more vulnerable to disruption at the meso-scale than at either the micro-scale or the macro-scale (Collins et al. 1991a). A few studies at the macro-scale, where archeological data patterns covering wide areas are sought, have been concluded which incorporate data from Central Texas (Meltzer 1987, 1989, see also Meltzer and Bever, this volume; Creel 1991; Howard 1991; Largent and Waters 1990), but considerable gain could be expected from more such studies.

Historically, archeological excavations in Central Texas have emphasized the vertical dimension, a direct outgrowth of the emphasis placed on the building of an archeological chronology. Growing interest in recovering evidence of human behavior has led to increasing use of wide-area excavations on "living surfaces" (e.g., at the Slab, Loeve Fox, Higgins, Camp Pearl Wheat, Mustang Branch, Turkey Bend Ranch, Sleeper, and Rush sites, to name a few). These shifts in emphasis constitute one of the most positive developments in the regional paradigm, but much is yet to be done to bring this approach to full fruition. Principally, the first requirement is that any archeological array thought to be a "living surface" be assessed for length of exposure. The primary aim in excavations of this sort is to find horizontal patterning within a single component of short duration. Ideally, that is a surface lived upon by only one cultural group, who left material clues of the spatial organization of their activities where those patterns have not been sullied by subsequent occupations of the same surface (cf. Ferring 1986; Johnson 1987). Rapid burial of such surfaces is the surest process by which such conditions are produced, and comprehensive geologic evidence is the best indicator that burial was swift and sure. Good examples of these conditions having been met are for Late Prehistoric components at the Rush (Quigg and Peck 1995) and Mustang Branch (Ricklis 1994a, 1994b) sites. Obviously, "living surfaces" can be reused, as at the Slab site, where multiple components are clearly indicated at the same level in the site (Patterson

1987). Difficulty arises when it is unclear how long a surface remained exposed, and how many episodes of use may be represented by the archeological materials on that surface (Collins 1994a).

A great advantage of horizontal exposures in archeological sites is the opportunity to fully investigate entire features in their horizontal contexts. Thoughtful inquiry into the form, function, and content of burned rock features, and the behaviors responsible for their creation (cf. Thoms 1989), is burgeoning in Central Texas (Johnson 1991; Collins et al. 1990; Collins 1991a; Potter et al. 1995). Explicit criteria for recognizing ovens, open hearths, rock disposal heaps, and other behaviorally-significant kinds of burned-rock features are emerging, although consensus on these interpretations does not yet exist. The use of geomagnetic evidence to determine whether or not any given burned rock has been moved since it was last heated and cooled is one technique that holds promise in this area of inquiry (Gose 1994). The greater use of comparative ethnology and ethnographic analogy (Thoms 1989) has also been a major benefit to this line of inquiry. It is too early to know what the ultimate potential of investigations in this vein might be.

Wide area excavations have also brought about more interest in the nature of prehistoric structures in Central Texas. For example, at the Slab, Turkey Bend Ranch, Mustang Branch, Currie, Rocky Branch, and Zatopec sites, possible evidence of structures has emerged. These suggest the presence of domiciles or other architecture from Early Archaic to Late Prehistoric times. The nature and functions of domestic structures has been one of the more neglected topics in Central Texas archeology, but these recent developments should bring about increased awareness and interest in the subject. New findings will then follow in due course.

Faunal remains and, less often, floral remains have long been identified and reported when recovered from archeological sites in Central Texas (Jelks 1962; McDonald 1974; Weir 1979; Sorrow et al. 1967). In the last few years, investigators have emphasized closer scrutiny of faunal taphonomy, and have made more concerted efforts to recover and interpret economically important floral remains, including pollen and phytoliths as well as macrofloral specimens (Jelks 1962; Hester 1973; Black and McGraw 1985; Holloway 1988; Howard 1991). Bone breakage is no longer lamented as interfering with taxonomic classification, but is seen as an eloquent expression of the cultural and natural forces that have operated on the assemblage (Masson and Holderby 1994). These are essential views to understanding the human behaviors and adaptations behind the regional archeological record, and thus integrate closely with the investigation of living surfaces and burned rock features.

Archeologists in Central Texas have been mindful of the need to understand the relationship between cultural history and past climatic conditions (Bryant and Shafer 1977; Bryant and Holloway 1985; Gunn and Mahula 1977). Integration of the two lines of evidence (cf. Bryant and Shafer 1977) has not been particularly successful, however, in part because the better environmental records have not been found in archeological sites (Blum 1992), and because neither record has been consistent and precise.

An almost complete hiatus exists between the prehistoric and ethnographic records of native peoples in Central Texas. In the last decade, considerable progress has been made in clarifying this gap, and in focusing attention on issues which are perhaps subject to meaningful investigation. No longer are the Jumanos (Kelley 1947), nor the Tonkawas (Suhm 1960), considered to be possible descendants of the authors of Toyah prehistoric manifestations; no serious scholar still considers Cabeza de Vaca's trek to have crossed Central Texas (Campbell and Campbell 1981). The present territory of Central Texas was not the long ancestral homeland of any indigenous group for whom an ethnographic account exists. The ethnographically known Comanche, Apache, Wichita, Kiowa, and even the Tonkawa arrived in Central Texas just before or during the early European contact period (Newcomb 1961, 1993; Campbell 1988). Historic records document the presence of numerous other groups during the first decades of European contact but provide rather little information about them. Concerted ethnohistoric work (Campbell: multiple listings under Indian group names in Branda 1976; Campbell 1988; Campbell and Campbell 1985; Newcomb 1993) has gleaned valuable but incomplete information on these peoples who mostly vanish from historical view by the early 18th century. Thus we have an early part of the Historic period, essentially a protohistoric, consisting of historic glimpses of indigenous peoples, and a later Historic subperiod during which relocated, acculturated remnants of earlier groups as well as very recently arrived groups are known from more complete historic records and, in some cases, later ethnographic studies. These facts greatly reduce, but do not eliminate, the usefulness of any direct historical approach to the prehistory of Central Texas (Newcomb 1993; Collins and Ricklis 1994).

THE FRENCH HAVE A WORD FOR IT

Six features and 35 artifacts recovered in excavation of the Camp Pearl Wheat site in Kerr County (Collins et al. 1990) tell more about Archaic lifeways than the large burned rock midden and its 1,282 artifacts documented at the John Ischy site in Williamson County (Sorrow 1969). *The difference is in data quality.* At John Ischy, multiple components were hopelessly mixed as they accumulated in a midden on a long-stable land surface; at Camp Pearl Wheat, the land surface was stable for only a brief time during which people occupied the site on one or a very few occasions, and their leavings were buried before later cultural materials could be added. Sorrow could detect patterns in the distributions of certain artifact classes across the John Ischy site—for example manos were more abundant just outside of the midden than within or farther away from it (Sorrow 1969:50-51 and Figure 27)—but there was no way to know if this reflects behavior that continued throughout the 3,200 or so years (my estimate) of the site's use, or to only some portion of that time.

In contrast, all or part of a single, integrated, functional artifact assemblage is probably represented at the Camp Pearl Wheat site in an isolable component. These contribute to an emerging regional pattern of site types and distributions that reflect subsistence behavior during the Early Archaic (see discussion, below).

Localities where low-energy natural deposition is active during or between episodes of human occupation afford the optimum conditions for the isolation of discrete assemblages of material culture remains. Such localities become stratified archeological sites with one or more isolable archeological components sealed between strata of natural deposits. When archeological methods of investigating such sites are integrated with those from the earth sciences, the results are superior to any which derive from archeology alone. Prehistorians in the Old World, especially in France, have long recognized and practiced this integrated approach to site-specific and regional studies (a good discussion as regards rockshelters appears in Laville et al. 1980).

A site with stratified archeological and geological layers is referred to in French as a *gisement* (plural, *gisements* [both pronounced "geeze·mohn," the "gee" as in "gee whiz"]). Increasingly over the last 40 years in Old World prehistory, the methodology for excavating and interpreting *gisements* has emphasized the interdisciplinary approach, covering geology, soil science, paleontology, palynology, archeology, and whatever other fields are appropriate. Had archeologists in Central Texas over the last 40 years concentrated on the discovery and comprehensive analysis of *gisements*, even a small fraction as much as have their counterparts in the Old World, the record at hand today would be more complete; chronology would have been much more easily controlled; better constrained assemblages would exist for each time interval; and the regional archeological sequence would be integrated with a paleoenvironmental sequence. Data of this improved quality would have long ago fostered the kinds of substantive research just now beginning to emerge in the Central Texas region.

Gisements can form in caves, rockshelters, dunes, or any area of natural, low-energy deposition. As a practical matter in Central Texas, however, most have formed in the alluvium of stream valleys.

GISEMENTS AND CENTRAL TEXAS ARCHEOLOGY

Contrary to an appearance that *gisements* might be scarce in Central Texas or that none was known until recently, the problem has been that most archeologists have simply not appreciated the value of the ones that have been found and have not rigorously sought others. Also, it is common for *gisements* in Central Texas to have denser cultural deposits in the upper layers and sparser ones at depth (e.g., Landslide, Wilson-Leonard). I have no doubt that countless times the excavators of such sites stopped digging either when artifact counts dropped off or when a sterile deposit was encountered (cf. account of the previous testing of the Camp Pearl Wheat Site

[Collins et al. 1990]). In those cases, any deeper components went undetected.

Deep stratified sites, with one, several, or many isolable cultural components, have been documented for at least 60 years (for examples the Merrell site, excavated in 1934 and 1935 [Campbell 1948], and Rob Roy, dug in 1938 and 1939 [Jackson 1939]). A few have been important in the development of the local archeological record (notably Youngsport, Landslide, Kyle, Smith, Loeve Fox, and Jetta Court). None the less, in spite of archeological work begun at least by 1918 (Pearce 1932:48), only about 31 *gisements* with one or more securely isolated archeological components have been reported in Central Texas (Table 2 and Figure 8).

I have characterized the components at these sites as having either very high or moderately high integrity on arbitrary and somewhat subjective criteria. Components with high integrity (depicted in solid shading in Table 2) show evidence of rapid burial, lack evidence for extensive post-depositional disturbance, and consist of a relatively homogeneous archeological assemblage (especially of diagnostic artifact forms). Components of moderately high integrity (stippled in Table 2) are either slightly deficient in one or more of these criteria, the sample is too small for a high-confidence assessment, or sufficient information is lacking to fully assess integrity.

Several aspects of the information in Table 2 require comment. Three main periods, Paleoindian, Archaic, and Late Prehistoric are used approximately in the conventional sense to depict what have long been inferred to be significant shifts in adaptations. While these inferences may not be entirely sound, the periods are, none the less, useful in organizing the archeological record. Subdivi-sions of these periods into subperiods are also based on adaptive shifts thought to reflect changes in subsistence strategies. In this presentation, the subdivisions of the Archaic follow the recent revisions proposed by Johnson and Goode (1994). Early and late subperiods of the Paleoindian and Late Prehistoric periods are used in this presentation to reflect distinctive archeo-logical patterns.

The finer subdivisions, style intervals, are dependent primarily on diagnostic projectile point

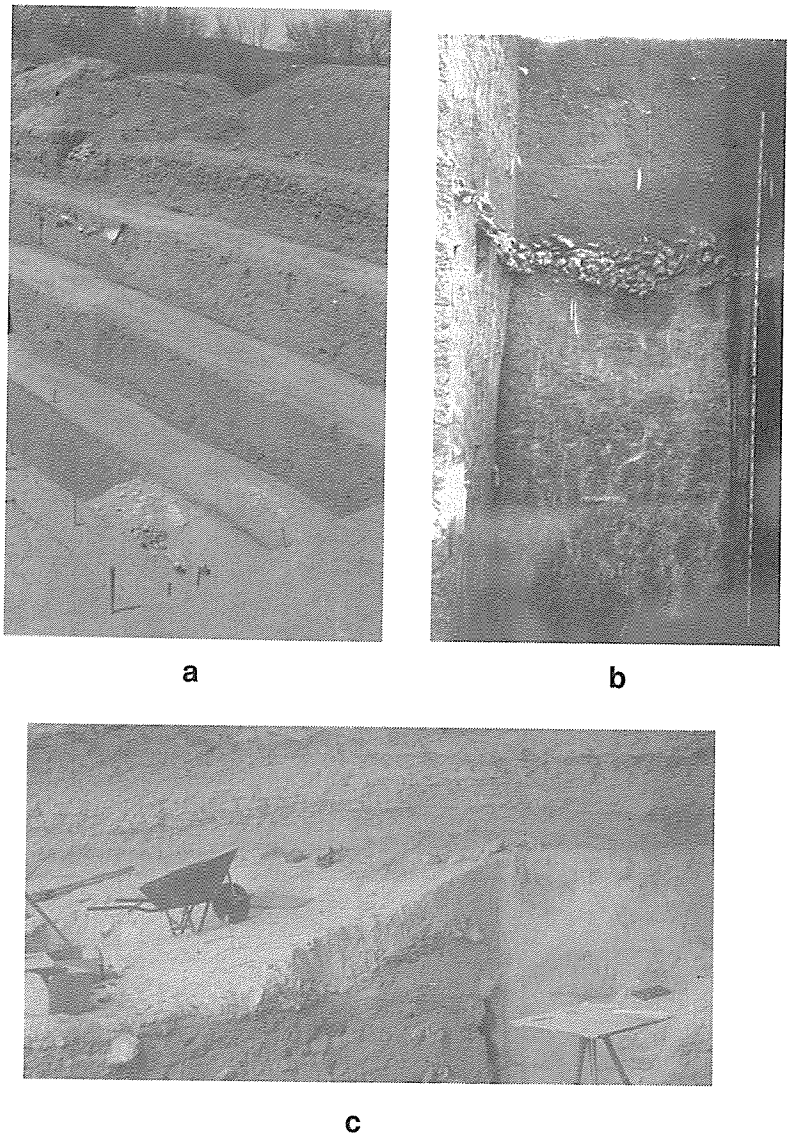


Figure 8. Representative *gisements* (deeply stratified layers of cultural and natural deposits) in Central Texas: a-b, open *gisements* in fluvial valley fill (Wiley Williams and Wilson-Leonard); c, rockshelter *gisement* in limestone detrital fill (Kyle site).

Table 2. Central Texas Archeological Chronology key *Gisements*, and Paleoenvironmental Records
(See Appendix for references)

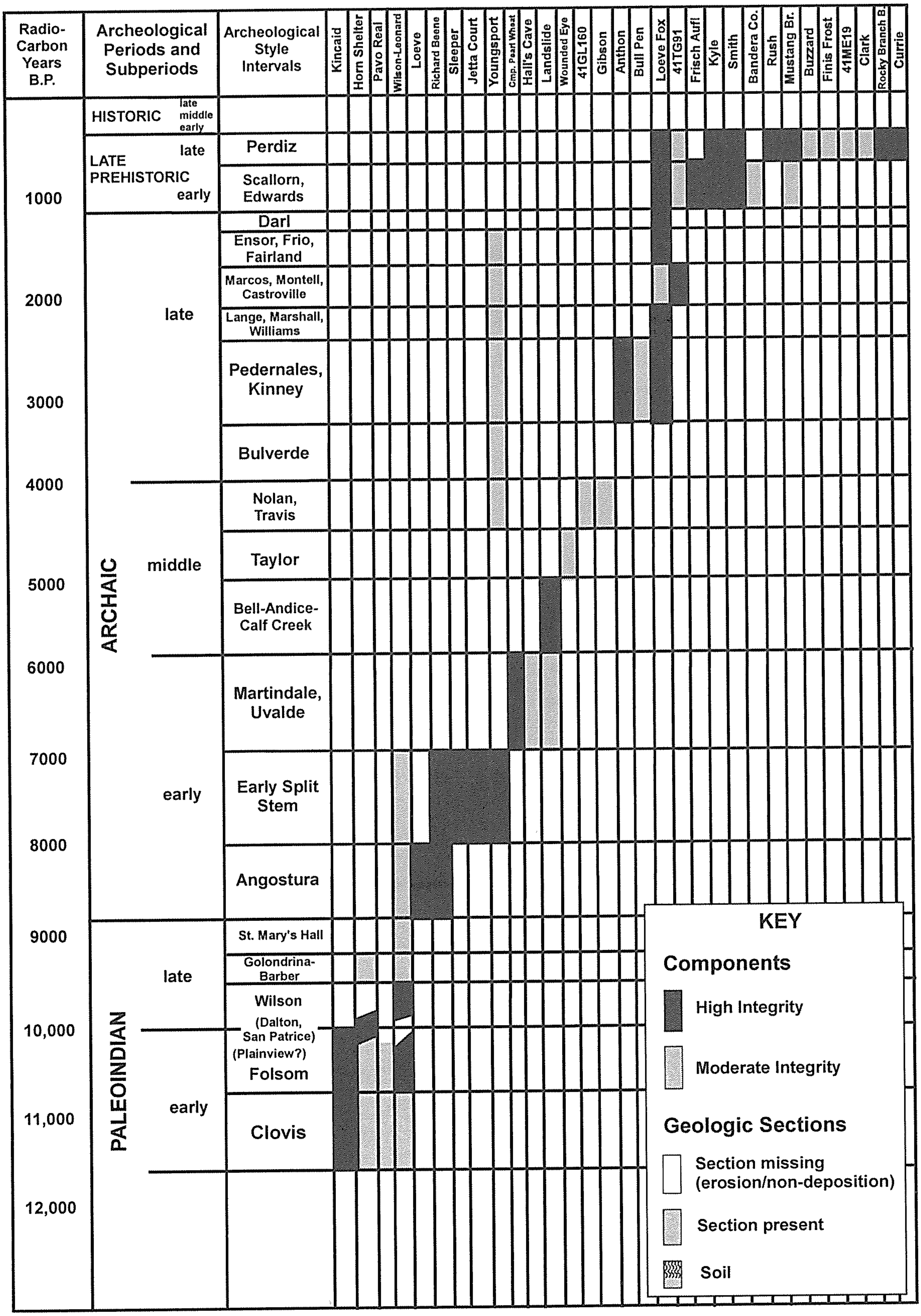
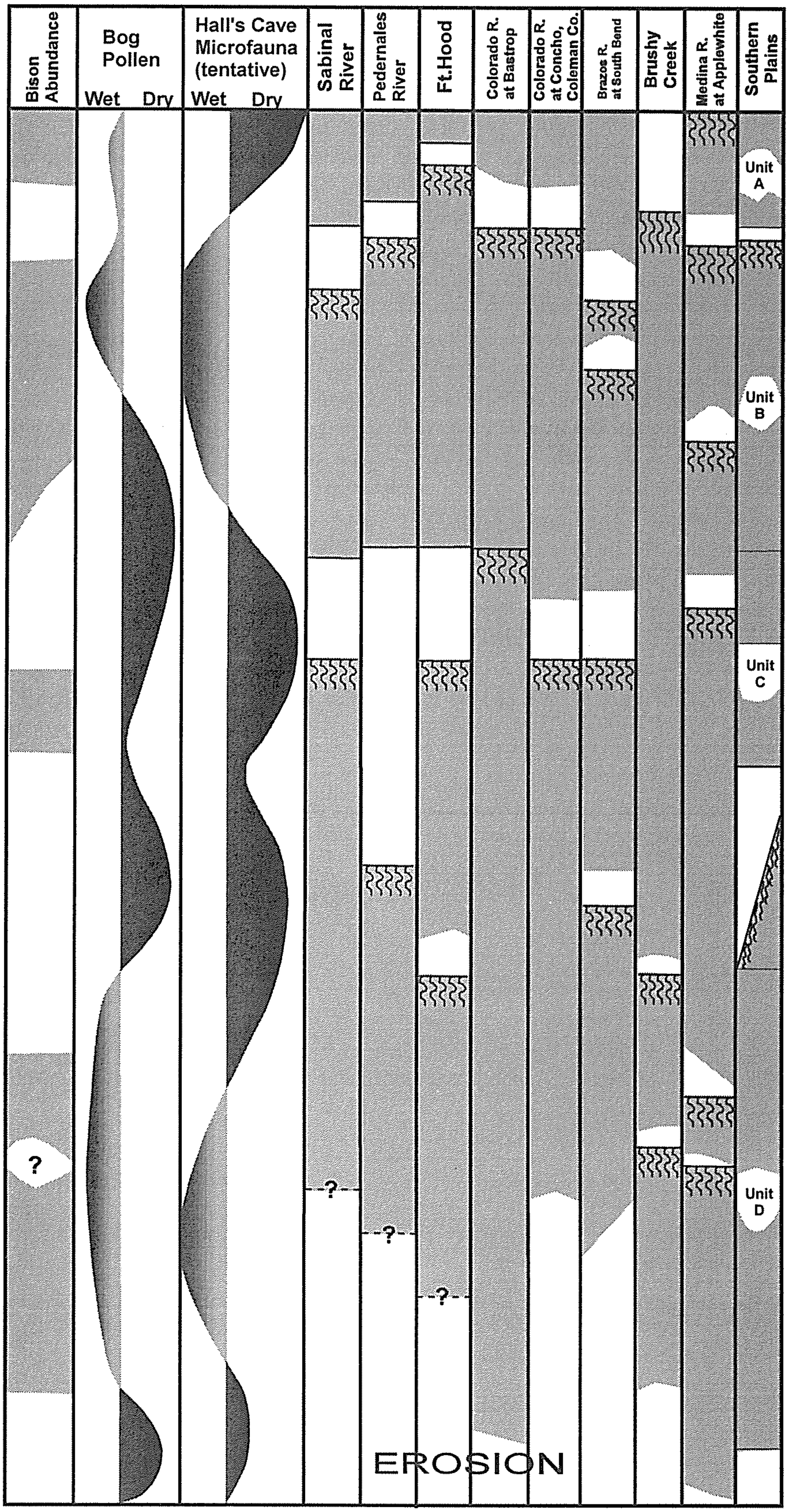


Table 2. (Continued)



styles ("types") which change for reasons not really understood at our present level of knowledge. These, too, follow approximately the scheme offered by Johnson and Goode (1994), and derive from the syntheses of Weir (1976) and Prewitt (1981, 1985). As already observed, some style intervals are better constrained than others—that called Toyah being probably the best; and that called Taylor, perhaps the poorest.

Absolute dating is portrayed in radiocarbon years before the present on Table 2, the convention generally followed by geoarcheologists. This convention facilitates use of uncalibrated dates from the literature of the geological sciences and from that of earlier archeological projects. It also allows any calibration to be applied. As a better, stratigraphically-constrained archeological sequence emerges, higher-precision radiocarbon procedures along the lines advocated by Johnson and Goode (1994) will have greater efficacy.

Sixty-one components of moderately high to high stratigraphic integrity are reported for the 31 Central Texas *gisements* presented in Table 2. Additional components of lesser integrity occur at a number of these sites, but these are not included. As seen in a cumulative percentage graph of these components by subperiod (Figure 9), the record is weighted toward the recent end with 19 (31 percent) of the 61 components assigned to the Late Prehistoric Period (the last 1000 years, or 8.7 percent, of the local prehistory). The Late Paleoindian and Middle Archaic subperiods are represented by the fewest components (4 and 5, respectively; that means that 6.5 percent of the components are in the Late Paleoindian subperiod, which is 10 percent of the sequence, and that 8.2 percent are in the Middle Archaic subperiod—16.5 percent of the sequence).

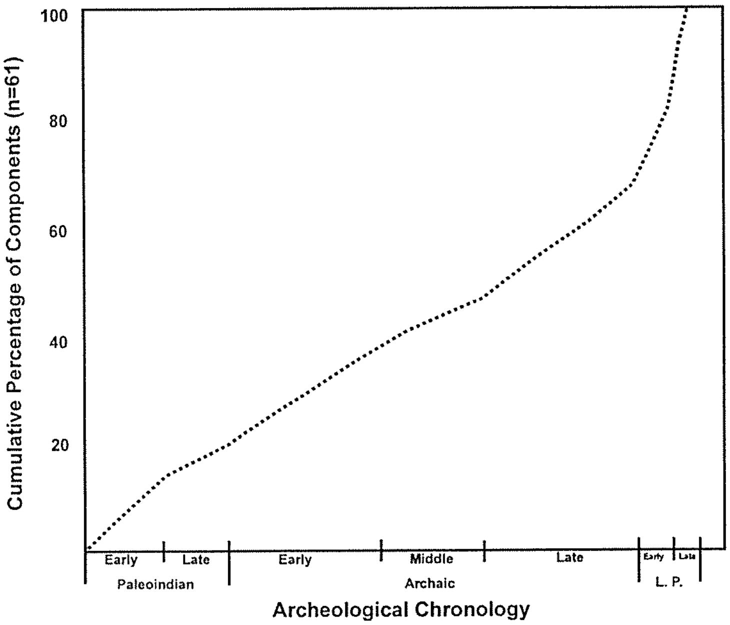


Figure 9. Cumulative percentage graph of documented *gisements* by archeological time periods in Central Texas.

Twelve geological, palynological, or paleontological records (see Table 2) in and near the Central Texas archeological area reflect a consistent but generalized environmental sequence (sources listed in the Appendix). Alternating intervals of comparatively mesic or xeric conditions have been inferred by Bousman from the pollen sequences from bogs in East Central Texas (Collins et al. 1993), and by Toomey from the vertebrate faunal record of Hall's Cave (Toomey 1993; Toomey et al. 1993). The bog-pollen sequence is not well controlled chronologically; however, the available dates indicate relatively constant rates of sedimentation from which Bousman interpolated the depicted sequence. Bousman's interpretation of the reported pollen data from Weakly and Boriack bogs considered the relative frequency of grass to arboreal pollens. In doing this, a climatically-sensitive aspect of the pollen record emerges from the complete spectrum, which otherwise contains numerous taxa whose abundances are more likely to be reflective of localized conditions around the bogs.

A deeply-stratified, abundant, high-resolution sequence of small animal remains was found in Hall's Cave. Toomey excavated 3.7 m into the fill of Hall's Cave and recovered thousands of faunal specimens (over 12,000 had been cataloged in 1993, with many more remaining to be cataloged). Only the upper 2 m of the Hall's Cave sequence is considered here, and the climatic history depicted is based only on the relative proportions of the least shrew (*Cryptotis* [which requires a relatively moist habitat]) to the desert shrew (*Notiosorex* [found in more arid habitats]) following Toomey (1993) and Toomey et al. (1993). The Hall's Cave sequence I have used here is controlled by 41 radiocarbon dates on bone provided by Stafford (personal communication, 1995) and by three charcoal dates (Toomey 1993). Because of the large number of dates, the fact that the dates are almost perfectly stratigraphically consistent, and there is generally high internal agreement between radiocarbon ages determined on different chemical fractions of the same bone, this sequence can be considered one of the best-dated and most environmentally sensitive records in North America. Concern expressed by Johnson and Goode (1994:22) in regard to dates on the earthen fill of Hall's Cave are clearly dispelled by the bone-organic chronology. When it is fully reported, the Hall's Cave biostratigraphy will be a landmark contribution to Quaternary studies.

These pollen and faunal records both indicate an early xeric interval ending near 12,000 B.P. (closely correlative with the "Clovis Drought" noted by Haynes [1991]), followed by a significant time of relatively mesic conditions. Each record then indicates a long Middle Holocene interval of relatively xeric conditions, that was slightly ameliorated at roughly its midpoint. That the two records are not synchronous probably results largely, if not entirely, from inaccuracy in the ages interpolated for the bog-pollen sequence. In general terms, the Middle Holocene xeric interval lasted approx-imately 5,000 years—close to half of the local prehistory. The effects of Middle Holocene aridity are seen widely in Central Texas, often in the form of stream incision, but precise dating is often difficult (cf. Abbott 1994).

Late Holocene conditions returned to being more mesic. The pollen and faunal evidence is inconsistent only in the latest Holocene where a final swing toward xeric conditions appears in the Hall's Cave fauna. Other than relatively small samples of the species (and, therefore, possible sampling error) on which Toomey based the depicted interpretations, the inconsistency is not readily understood. It is possible, of course, that contrasting conditions could exist because the pollen record is from the eastern-most, while the faunal record is from more nearly the western-most, edges of the area.

The relative abundance of bison in and near Central Texas has been inferred from occurrences in archeological sites (Dillehay 1974; Prewitt 1981, 1985; Collins et al. 1990). There is a general correlation between bison occurrences and comparatively mesic portions of the bog-pollen and Hall's Cave faunal records.

The geologic records are based on fluvial sequences where episodes of valley filling alternate with periods of erosion and/or stability and soil formation. Geologic sequences portrayed in Table 2 are based on data of varying completeness and precision (particularly as regards dating). Geologists working with Quaternary-age sequences vary widely in their application of the concept of soils (some emphasizing soil-formation and reporting every minor soil, others emphasizing sedimentary process and reporting only major soils). Local conditions in each fluvial system differ, and circumstances determining the amount of radio-carbon dating that can be applied are unequal. Furthermore, investigators allocate their radiocarbon resources differently, some targeting soils, others preferring to date sediments. For these reasons, the depictions in Table 2 must be viewed only as indicating general trends, and are not to be taken to represent detailed, precisely-dated alluvial sequences.

Consistently, the valleys of Central Texas (and much of North America [Haynes 1991, 1992, 1993]) were downcut and scoured of sediment in the Late Pleistocene, ca. 15,000 to 12,000 years ago. Valley filling followed during the ensuing mesic interval, and it is in these sediments that a number of the important Early Paleoindian sites have been found.

Erosion and stability with soil formation are more characteristic of the Middle Holocene, during the long xeric interval. This interval was first recognized in North America on the basis of extensive evidence for erosion and arroyo-cutting in the Southwest, and has been called the Altithermal (Antevs 1955). Whether or not the interval was significantly warmer, it does seem to have been drier, and the paleoenvironmental record of Central Texas was clearly influenced by those conditions. It is yet to be determined exactly what the consequences of this xeric interval were in terms of human ecology. It is abundantly clear that the archeological record has been significantly and adversely affected by the Middle Holocene xeric conditions. Erosion undoubtedly destroyed many sites and many others formed on stable surfaces, resulting in palimpsests of long duration. The approximately 5,000 years of the Middle Holocene xeric interval—43 percent of the record—are represented by only about 17 (22 percent) of the 61 components in Table 2.

Downcutting of valleys occurred widely in the Middle Holocene, leaving former valley floors above the reach of most flooding and bringing deposition on these surfaces to a virtual halt. Major soils that formed on these long stable surfaces are documented over wide areas in the valleys of Central Texas during the Middle Holocene, and many sites, especially burned rock middens, reside on those surfaces. It is from these numerous, highly-visible, artifact-rich sites that much of the archeological record for the Middle Holocene has been derived.

Returning for a moment to the poorly-defined Taylor style interval, the question to be answered by future research is whether its archeological scarcity reflects a cultural reality, or results from gaps in the archeological record brought about by erosion and reduced deposition during the Middle Holocene. This poorly-represented "interval" is left on Table 2 to underscore this aspect of the record, and to provide a tempting target for sound archeological dismissal or verification.

Fortunately, all Central Texas streams did not respond in exactly identical fashion to the Middle Holocene xeric interval, and neither erosion nor non-deposition are absolute in any fluvial system—there is always deposition somewhere. Deposits of Middle Holocene age are present but less abundant and less conspicuous than those of Early and Late Holocene ages. Corollary to this, there are sites of Middle Holocene age in good geologic context to be found. The search will need to be made using geomorphological sampling designs (cf. Blum and Lintz 1993:313; Mandel 1992:79-83; Nordt 1992:68-80).

In the Late Holocene, valley filling prevailed, but one widespread episode of downcutting occurred ca. 1000 B.P. (Hall 1990). In part because the evidence is better preserved, the Late Holocene record includes several less significant interruptions to deposition (see Table 2).

Some ten years ago, Hall (1986) reviewed an entirely different set of geologic data and recognized essentially the same aspects of the Quaternary record as revealed by the data summarized here in Table 2. He presented an insightful synthesis of those data in an effort to inform archeologists of the nature of the data base with which they were working. That paper (Hall 1986) has not been published, but the essence of the synoptic graph from that presentation (Hall, personal communication, 1995) is reproduced here as the far right column of Table 2. It is noteworthy that Hall perceived these patterns in valleys primarily north and northeast of Central Texas, indicating the geographic extent of this general sequence.

A BRIEF SYNTHESIS OF THE PREHISTORY OF CENTRAL TEXAS

Several lines of evidence are now brought together to offer a generalized cultural history of Central Texas. Ideally the empirical basis for this effort would come solely from the 61 isolable components arrayed in Table 2, but two limitations stand in the way of that approach. First, there are comparatively few paleoenvironmental data from those components, and those that are available are not consistent or systematic. Second, archeological assemblages recovered from short-term components tend to be small, and sampling error is probably responsible for gaps in the data. We need many more such components to produce a less rarefied record.

Pre-Clovis

One site in Central Texas—Levi Rockshelter (Alexander 1983)—has been explicitly interpreted as containing a component that predates the Clovis horizon. There is no question that humans made the purported pre-Clovis artifacts at Levi, but poor stratigraphy, lack of a coherent assemblage with several consistent radiocarbon dates, and no unambiguous cultural associations with fauna known to have become extinct before 11,500 B.P., render Alexander's argument for a pre-Clovis age invalid. A human presence of great antiquity has been discussed to account for selected fractured stones from Friesenhahn Cave (Krieger 1964), the absence of caudal vertebrae among mammoth remains at the Waco Mammoth site (J. Fox et al. 1992), and for a "presapiens" human form at Hitzfelder Cave (Givens 1968a, 1968b). None of these suggestions has been sustained with sufficient evidence for general acceptance. This is not to say that some future find might not prevail as a pre-Clovis site.

In addition to meeting the widely recognized criteria of stratigraphic integrity, unambiguous human evidence, and secure dating, two factors must be overcome in any search for sites earlier than Clovis. The first is geomorphological. Most valleys in much of North America were scoured to bedrock during the time immediately before Clovis, meaning that there is little chance of finding components stratigraphically beneath Clovis in fluvial contexts. Outside of alluvial valley settings, sites would either be on upland landforms or in rockshelters. Upland localities rarely produce good stratigraphic contexts and rockshelters of pre-Clovis age may be highly degraded (Collins 1991b). The second is cultural. It is not known what might constitute the pre-Clovis material culture assemblages, and, lacking these criteria for its recognition, the evidence will almost certainly have to come from the unlikely context of stratigraphically underlying a Clovis archeological component.

Paleoindian

Paleoindian sites and isolated artifacts are fairly common in Central Texas. Concepts of Paleoindian lifeways in North America generally, and in Central Texas particularly, are changing rapidly. The simple cultural sequence of big-game hunting "cultures"—Clovis, Folsom, Plainview, and Cody (Krieger 1947; Sellards and Evans 1960; Wormington 1957; Suhm et al. 1954)—is no longer adequate to accommodate the diverse material culture assemblages, projectile point styles, and indicated subsistence behaviors now documented during what has been traditionally recognized as the Paleoindian period; that is, the period earlier than ca. 8800 B.P. It is necessary to draw upon some data from outside of Central Texas to adequately portray these developments, but this is warranted because (1) there is an almost frenetic tempo of Paleoindian research in the Americas at the moment, (2) there is no cultural manifestation during Paleoindian times constrained to just Central Texas, and (3) although sites in Central Texas are contributing evidence to the broader developments, there are important ideas emerging elsewhere with implications for understanding the local Paleoindian evidence.

In this discussion, because the fundamental defining criteria of "Paleoindians" (best stated in Wormington's [1957] Paleoeastern Tradition) as nomadic big-game hunters are being challenged, the Paleoindian period is defined as a temporal span from ca. 11,500 to 8,800 B.P. This allows the issue of Paleoindian lifeways to be considered more objectively. As already noted, an Early and a Late subperiod of the Paleoindian period are proposed for Central Texas (see Table 2).

The Paleoindian period began as the Pleistocene waned, when now-extinct forms of large animals were among the prey taken by Early Paleoindian hunters. Projectile points in use during the Early Paleoindian subperiod were primarily, if not exclusively, of lanceolate form and typically were fluted, Clovis and Folsom being the defined types.

Clovis is the earliest well-defined cultural horizon in Central Texas, assumed on the basis of dating at sites elsewhere in North America to have existed here between approximately 11,200 and 10,900 B.P. (Haynes 1992). Kincaid Rockshelter, Wilson-Leonard, Gault, Horn Shelter #2, Pavo Real, and Crockett Gardens are where the principal Clovis components have been documented in the area, and surface finds of distinctive Clovis points are reported from a number of other localities (Meltzer 1987; see also Meltzer and Bever, this volume). Generally, in North America Clovis manifestations are the most diverse in the Paleoindian period with types of sites including: kill, quarry/stone-working, caches, camps, ritual, and burial. The artifact inventory includes chipped stone artifacts produced using bifacial, flake, and prismatic-blade techniques, always on high quality and often on exotic stones (Collins 1990). Engraved stones (Collins et al. 1991; Collins et al. 1992), bone and ivory points, a bone shaft straightener, stone bolas, and ochre are reported from Clovis contexts (Collins n.d.b)

Subsistence in Clovis times was based on diverse fauna, including large herbivores such as mammoth, bison, and horse as well as smaller animals such as water turtles, land tortoises, alligator, mice, badger, and raccoon. An array of plants presumably also constituted part of Clovis subsistence (Collins et al. 1989).

A paved floor at Kincaid Rockshelter reflects a greater investment of labor than nomadic hunters could afford on a fleeting habitation (enough stones, totalling more than 2 metric tons, were brought in from the nearby river bed to cover ten square meters of the muddy shelter floor [Collins et al. 1989; Collins 1990]). Caches of Clovis artifacts (in Texas and elsewhere in North America [Collins n.d.a]) are suggestive of hunting and gathering rounds that returned groups to the same places more reliably than is the case with nomadic hunters of big game.

Overall, the data indicate the Clovis lifeway to have been that of well-adapted, generalized hunter-gatherers with the technology to hunt big game but not the need to rely exclusively on it. Either their travels or their contacts with other groups enabled them to acquire exotic stone from great distances. Ironically, more is known of these earliest Paleoindians than of those who came later.

In contrast to Clovis lifeways, subsistence in Folsom times seems to have been more reliant upon specialized hunting of big game, namely bison. Sites with Folsom-age components in Central Texas include Horn Shelter 2, Pavo Real, Wilson-Leonard, and Kincaid, the latter two of which evidence bison-hunting. Camps, stone-working, and kill sites are all that have been documented, mostly in or near grassland habitats. These, along with a tool kit of Folsom points, end scrapers, and large ultra-thin bifaces, are the trappings of hunters. Diagnostic artifacts in Folsom times are the large thin bifaces, fluted Folsom points, and thin unfluted ("Midland") points.

An urgent problem in and beyond Central Texas regards what constitutes "Plainview," and where that manifestation fits chronologically. Much that has been called Plainview—a plethora of unfluted, lanceolate dart point forms—fails to match the type-site points in thinness and flaking technology. A serious revisiting of existing typological and contextual evidence bearing on this problem is needed as well as new and better archeological data. I am beginning to suspect that true Plainviews (as at the Plainview site and some of the artifacts from Bone Bed 2 at Bonfire Shelter) are equally as old as Folsom (i.e., greater than 10,200 B.P. [cf. Haynes 1993]), and are absent from, or extremely rare in, Central Texas. "Plainview" points at Horn Shelter 2 are thicker and have more deeply-concave bases than those at the Plainview site and come from zones dated ca. 8400 B.P. (Redder 1985). At Wilson-Leonard, the unfluted lanceolate points previously identified as Plainview (Weir 1985) are morphologically distinct from points at the Plainview type site and date to the interval 9500-8000 B.P. These points from Wilson-Leonard are placed in the Late Paleoindian subperiod and are referred to as Golondrina, Barber, and St. Mary's Hall (Masson and Collins 1995).

Also murky in Central Texas and elsewhere are the temporal position and cultural significance of the few Dalton and not-so-few San Patrice-like points (variously called San Patrice, Brazos Fishtail, and Rodgers Side-Hollowed). The latter occur at Wilson-Leonard and at Kincaid, and both occur at Horn Shelter 2 in Central Texas. Daltons are dated in the Middle Mississippi valley as ca. 9500 to 10,500 B.P. (Morse and Morse 1983) and are close to that age at Horn Shelter 2 (ca. 9500-9980 B.P. [Redder 1985]). San Patrice-like Rex Rodgers points are associated with a Clovis point and an unfluted lanceolate point in what appears to be a single-event bison kill site in the Texas Panhandle (Willey et al. 1978). They occur in a deposit dated between 9500 and 9980 B.P. at Horn Shelter 2 (Redder 1985) but remain undated at Kincaid (Collins 1990b). Everything about the fauna, associated artifacts, and features (including a double burial) found with San Patrice ("Brazos Fishtail") and Dalton points at Horn Shelter 2 suggests an Archaic-like, hunter-gatherer cultural manifestation (Redder 1985). Tentatively, I have placed this material as transitional between Early and Late Paleoindian on Table 2; hopefully future work or new finds will clarify the picture.

Three style intervals, Wilson, Golondrina-Barber, and St. Mary's Hall, are here proposed for the late subperiod of the Paleoindian period (see Table 2). These are moderately well defined at the Wilson-Leonard site (Masson and Collins 1995). The Wilson component is the better represented, and is characterized as having corner-notched, Archaic-like Wilson dart points (Weir 1985; Masson and Collins 1995) in association with features, a burial, artifacts, and faunal remains more Archaic than Paleoindian in appearance. Dates for this component are ca. 10,000 to 9650 B. P. (Masson and Collins 1995).

The Archaic-like character continues for the Golondrina-Barber and St. Mary's Hall components, dated between 9500 and 8800 B.P. All three of these components (Wilson, Golondrina-Barber, and St. Mary's Hall) have burned rock features, but the size of the features and the amounts of rock present is decidedly less than that in Archaic features of younger ages. The subperiod here called Late Paleoindian is in many ways archeologically intermediate (or "transitional") between Early Paleoindian and the Archaic; the question to be answered is how accurately this material culture-based impression reflects their respective human adaptations.

Two burials between 9500 and 10,000 years old, one at Wilson-Leonard and one at Horn Shelter 2, have produced three of the better-preserved early human skeletons in North America (Steele and Powell 1994). Both of these contained objects of a utilitarian as well as an ornamental nature.

Archaic

Two-thirds of the prehistory of Central Texas is "Archaic" in character. Archeologists have viewed the Archaic as a time when hunting and gathering of local resources was intensified over that in Late Paleoindian times. Material culture shows greater diversity—especially in the application of ground stone technology. A hallmark of the Archaic in Central Texas is extensive use of heated rocks found archeologically as various forms of hearths, ovens, middens, scatters, and other features. Multiple tons of heat-altered rocks occur at many Archaic sites in the region. The full gamut of uses of these rocks can only be guessed at from available evidence, but thoughtful inquiry into this problem is increasingly common.

For more than 7500 years the basic Archaic mode of life prevailed in Central Texas. There are distinctive changes to be seen within the Archaic archeological record, but it is not clear how significant these really were at the times they occurred. It is clear, however, that, in the broadest sense, this long span represents a basic adaptation that was successful. A priority in the investigation of the Archaic record is to better understand the fundamentals of that adaptation, and to determine the significance of the variations seen over time and across space. In briefly reviewing the Archaic of Central Texas, the cultural-chronological framework recently proposed by Johnson and Goode (1994) is adopted with minor adjustments.

The early part of the Archaic, from ca. 8800 to 6000 B.P., is here subdivided into the three projectile point style intervals, Angostura, Early Split Stem, and Martindale-Uvalde (see Table 2). Open campsites (including Loeve, Wilson-Leonard, Richard Beene, Sleeper, Jetta Court, Youngsport, Camp Pearl Wheat, and Landslide) as well as a cave (Hall's Cave), occupied at the far reach of daylight, contain noteworthy components of the Early Archaic. Numerous dart points and Guadalupe tools attributable to the Early Archaic also are present in Kincaid Rockshelter, but in mixed context.

It is unclear if the distributional data are representative, but a number of authors have noted a concentration of Early Archaic components near the eastern and southern margins of the Edwards Plateau (Johnson 1991; Johnson and Goode 1994; Ellis 1994; Black 1989; McKinney 1981). Large and varied burned-rock features (Sleeper, Camp Pearl Wheat, Wilson-Leonard, Richard Beene), domestic structures (Turkey Bend Ranch), and caches (Lindner) are known from the Early Archaic. Grinding and hammering stones, Clear Fork and Guadalupe bifaces (both inferred to be specialized tools, probably for wood-working), along with a variety of unifacial and bifacial chipped stone implements, are reported from Early Archaic components. Subsistence data are sparse for the subperiod, but hunting of deer, exploitation of various small animals including fish, and the cooking of bulbs in earth ovens are indicated.

If the presently-known site distributional data reflect land use in the Early Archaic, this was a time when people were living in the better watered parts of the live-oak savanna habitats on the Edwards Plateau. Acorns, deer, and turkey are conspicuous among live-oak savanna resources, but geophytes (e.g., onions, prairie turnip), other nuts (e.g., pecan, walnut), berries (e.g., agarita, hawthorn), fruits (e.g., grapes, plums, persimmons), and grass seeds, along with a host of small terrestrial, amphibious, and aquatic animals round out a diverse and reliable subsistence base.

Pollen and fluvial geologic evidence portrays an oscillation from mesic through extremely xeric and back to mildly xeric conditions during the Early Archaic (see Table 2). Bison (and antelope?) were evidently scarce or absent. What mix of other foods constituted the staple diet(s) during the Early Archaic is unknown at this time.

The appearance during the Early Split Stem interval (as at Wilson-Leonard) of specialized cooking appliances which use quantities of stone as heating elements reflect a sophisticated technology for exploiting the oak-savanna resource base. These features almost certainly represent the technological antecedents of the larger burned rock middens that become a diacritic of later intervals in the Archaic of Central Texas.

The middle subperiod of the Archaic, from ca. 6000 to 4000 B.P., too, is further subdivided into three style intervals (Bell-Andice-Calf Creek, Taylor, and Nolan-Travis; see Table 2). The earlier two of these intervals reflect a shift in lithic technology from that which had prevailed earlier. Bell-Andice-Calf Creek and Taylor are thin, basically triangular bifaces with long thinning flakes emanating bifacially from the base; Taylor bifaces remain unnotched whereas Bell, Andice, and Calf Creek bifaces are characterized by deep, narrow basal notches. All of these thin-bladed forms would serve equally well as knives or as tips of lances, spears, or darts. Impact fractures common on the Bell-Andice-Calf Creek forms attest to their use as weapon tips.

Climate during the earliest interval (Bell-Andice-Calf Creek) was somewhat mesic. It was a time when bison were hunted, leading Johnson and Goode (1994) to surmise, correctly I think (Collins 1994a:94), that these thin bifaces were part of a specialized bison-hunting weaponry, probably brought to the region by peoples moving southwesterly from the prairie, prairie margins, and woodlands west of the Ozarks (see Wyckoff 1995). A tantalizing hint of functionally-different sites is seen in this interval, with a greater diversity of tool forms occurring at the Landslide, than at the Barton, Bell-Andice components. Notable at Landslide are more wood- and bone-working kinds of tools and, especially, milling equipment that is absent from the Barton site. It seems apparent that more diverse tasks were undertaken at Landslide than at Barton. Large burned rock features—hearths as well as rock ovens—are inferred for the interval, particularly at the Barton site. In a very subjective sense, components of this interval seem to me to show less intense use than that indicated at earlier-interval components, particularly those of the Early Split Stem interval. Perhaps greater mobility associated with bison hunting is indicated.

By the later Middle Archaic intervals (Taylor and Nolan-Travis), bison have disappeared from the record and a more xeric climate has returned—in fact, culminating toward the end of the Nolan-Travis interval in what appears from the record to have been the onset of the most xeric conditions ever experienced by humans in Central Texas. Interestingly, Taylor and Nolan-Travis components again have the appearance of either long-term or intensive use, or both. Burned rock middens debut (best seen at the Wounded Eye site in Kerr County where Taylor bifaces dominate the assemblage recovered from a small burned rock midden). Another technological shift is seen in the production and morphology of Nolan and Travis projectile points, which are comparatively thick and often have narrow blades (especially on Travis points) with stems and shoulders; distinctive beveling of the stems is characteristic of Nolan points.

Johnson and Goode (1994:26) suggest, as Prewitt (n.d.) had done earlier, that burned rock middens at this time were more frequently being used to cook xerophytes such as sotol that may have thrived in Central Texas as conditions became drier. This does not necessarily signal an end to extraction of the more typical oak-savanna floral and faunal resources, but perhaps a shift in emphasis with concomitant adjustments in subsistence technology, strategic planning, and scheduling (cf. Bousman 1993).

The Late Archaic, ca. 4000 to 1200 or 1300 B.P., began as effective moisture was at its lowest in Central Texas, but gradually the climate became substantially more mesic (see Table 2). Six style intervals have been postulated for the Late Archaic (see Table 2). The Late Archaic is well represented by investigated sites, including a number with components in good stratified contexts, although well-stratified components are almost completely unreported for the earliest style interval (Bulverde). Middle Archaic subsistence technology, and the burned rock middens resulting from a portion of it, continue well into the Late Archaic. In fact, during the second style interval (best known for its Pedernales points), the growth of burned rock middens was at its greatest, especially in the easterly parts of the area. It appears, however, that xeric vegetation and whatever reliance people placed upon it, gradually disappeared from the easterly parts of Central Texas between 3500 and 2500 B.P. and burned rock midden growth slowed, but did not cease. The xeric vegetation remained, and continues to remain, in the western reaches of the area, where its exploitation continued to include use of communal earth ovens into Late Prehistoric times (Goode 1991).

Johnson and Goode (1994) have offered a succinct account of the main cultural aspects of the Late Archaic on the eastern Edwards Plateau. In so doing, they distinguished between early ("Late Archaic I") and late ("Late Archaic II") subperiods. Their provocative ideas need not be repeated here other than to mention some highlights. Diverse and comparatively complex archeological manifestations toward the end of the Late Archaic attest to the emergence of kinds of human conduct without precedent in the area. Among factors that have been cited as contributing to these developments are increasing population size (Weir 1976; Prewitt 1981) and stimuli from religious practices in the eastern part of the continent (Johnson and Goode 1994). Much remains to be learned about the hunter-gatherers of Central Texas in Late Archaic times, and the questions prompted by the interpretations of Johnson and Goode (1994) will require thorough and comprehensive archeological investigations using data of the highest possible integrity.

Late Prehistoric

Considerable discomfort is evident among archeologists faced with assessing the magnitude of material culture change that occurred ca. 1200 B.P. in Central Texas. This is the somewhat arbitrary break commonly made between the long Archaic period and its successor, the "Late Prehistoric." Previously this was referred to as the "Neo-American Stage" (Suhm et al. 1954:20) in the expectation that all three defining traits (pottery, bow and arrow, and agriculture) would eventually be recognized in the region. It now appears that generally for Central Texas, only the bow and arrow appeared initially, pottery was added later, and agriculture came last and was of quite minor importance. Because basic hunting and gathering subsistence continued, what is here called the Late Prehistoric has also been labeled the "Neo-Archaic" (Prewitt 1981) or the "Post-Archaic" (Johnson and Goode 1994). Two subperiods, early and late (see Table 2) are here recognized in the Late Prehistoric (Jelks 1962); these correspond to the Austin and Toyah "phases" (I will continue to use "interval") of long-standing in the systematics of the local prehistory (Prewitt 1981). More than projectile-point style change distinguishes Austin from Toyah manifestations, and the subperiod level of designation is intended to reflect the importance of these differences. I agree with Johnson and Goode (1994:39-40) when they note that an equally satisfactory solution would be to place the break between the Archaic and the Late Prehistoric at ca. 800 B.P., when Toyah replaces Austin as the prevailing archeological configuration.

The most apparent change seen at the beginning of the early Late Prehistoric (or Austin interval) is from a prevalence of dart points to that of arrowpoints and, inferentially, from use of the atlatl and dart to that of the bow and arrow. Evidence is seen of widespread hostilities in the form of what are thought to be numerous incidents of arrow-wound fatalities (Prewitt 1974). Otherwise, comparatively little change is noted from terminal Late Archaic patterns, particularly in subsistence behavior. Goode (1991) even finds evidence that in western Central Texas burned rock middens continued to be produced in what he believes to be the cooking of sotol.

The late subperiod of the Late Prehistoric is expressed as a single style-interval, designated on Table 2 by the Perdiz arrow point. However, it has long been recognized that in Central Texas the Toyah archeological manifestation consists of a constellation of traits—notably pottery (both local and imported from the Caddoan area; see also Perttula et al., this volume), large thin bifaces, Perdiz arrowpoints, end scrapers, and prismatic blades—all associated with the hunting of bison as well as deer and antelope. The occurrence of these distinctive traits on about the same time line across a wide area of the state distinguish the Toyah as an archeological "horizon." A question that arises is whether such a horizon is the spread of a people across the landscape, or the spread of ideas and their adoption by different peoples. Johnson (1994) and Ricklis (1994b) have recently brought forth differing views on Toyah lifeways. In keeping with traditional interpretations, Johnson sees Toyah as the material leavings of a single ethnic group ("folk"). Ricklis, in contrast, observes that the cultural materials which define Toyah represent tools and technologies that can be spread among different groups rather easily—a techno-complex. The issue hinges on how similar do lithic and ceramic objects, and their technologies of production, have to be to represent the work of a single ethnic group? In the absence of linguistic evidence (which is precluded by a pre-contact truncation of Toyah culture) or more robust archeological data, the issue will not be resolved since the answer to the question just posed is too subjective. No time in the prehistory of Central Texas is represented by more *gisements*, and thus the prospects for discovering more and better Toyah components are good. The debate framed by Ricklis and Johnson is the kind of anthropological issue so rare in the history of Central Texas archeology. Because it is both intriguing and substantive, such a debate can be expected to continue, grow, and be refined—maybe even resolved to a degree with robust new data in the future.

Historic

Historic archeology differs from prehistoric archeology in that past people, places, and events can be investigated from the two vantages of written accounts as well as tangible archeological records. In the case of Central Texas, the collision of multiple indigenous and European cultures produced complex and rapidly changing events that are chronicled spottily in the early documents, and seen sparingly in the archeological record. With time, both the written and archeological records become fuller, but by the middle of the 19th century, little but the European-derived cultures remained.

This review considers three subperiods in the Historic period of Central Texas—early, middle, and late. In the first two, vestiges of both indigenous and European peoples and cultures are represented; in the third, the indigenous peoples have virtually disappeared.

The early Historic subperiod in Central Texas begins in the late 17th century with the first documented arrival of Europeans (Bolton 1915; Newcomb 1961; Berlandier 1969). Although there are documentary glimpses of the indigenous groups in and near Central Texas, political consequences of the arrival of Europeans were already in motion, most notably the southern advance of mounted Apaches. For the indigenous peoples, little more than group names, locations, and limited descriptions exist. Concerted ethnohistorical research (Campbell: multiple listings under Indian group names in Branda 1976; Campbell 1988; Hester 1989a, 1989b; Newcomb 1961, 1993) has been used to piece together important, yet incomplete, accounts which reveal several distinctive features of native cultures in Central Texas between the late 17th (ca. 1690) and early 18th (ca. 1720) centuries.

In these earliest historical accounts, numerous displaced groups are found in and near Central Texas, some having gone northeastward to escape Spanish oppression, others having fled southeastward ahead of the Apache incursion. Their lifeways had been affected substantially by the political accommodations to this new propinquity, and possibly by social disruption brought about by the mortality of European-introduced diseases. French and Spanish vying for the territory that is now Texas often manipulated the indigenous groups for their own political purposes. Also, native patterns of mobility had been altered by acquisition of horses. It is obvious that these accounts do not provide direct analogs to prehistoric patterns. Instead, they represent a time of drastic cultural change and political conflict to be investigated in its own right.

There may be some indigenous cultural patterns that prevail through this time and afford insights into prehistoric lifeways of Central Texas (Collins and Ricklis 1994). Small band-sized residential camps are indicated, but so are large, diffuse encampments composed of peoples with mixed ethnic affiliations. It is not clear whether the large, diffuse camps or political amalgamations occurred prehistorically, but to judge from the apparent ease and frequency of these occurrences historically, it is possible that large camps shared by different ethnic groups had precedents in prehistory.

Hunting, particularly of bison but also of deer and of antelope, is repeatedly noted in Spanish and in French documents, as is the extensive use and exchange of bison products. Much of the mobility and hunting behavior of peoples was in response to movements and densities of bison populations. Although the historically-observed behavior was affected by use of horses, the same was probably true to some extent of pedestrian peoples whenever bison were present in the area.

Of particular interest to our understanding of Late Prehistoric archeology are the many historic accounts of Hasinai Caddo traveling into Central Texas to hunt bison, and at times camping with indigenous groups (see Foster 1995). The fairly common presence of Caddoan ceramics, and of local pottery with Caddoan style decoration, in Toyah interval sites of Central Texas suggests that this was a long-standing pattern.

At a very general level, the early Historic subperiod informs prehistoric archeological inquiry on two topics. First, indigenous peoples clearly were more cosmopolitan than most archeologists seem to think. Second, large and dispersed encampments, exceeding the usual parameters of "a site," may have been fairly common.

The middle Historic subperiod, when much of the record on aboriginal peoples is in reference to remnants of native groups living in the Spanish missions, began about 1730 and ended about 1800 as the mission system was failing (Hester 1989a).

Central Texas lies mostly outside of the Spanish colonial sphere, and the mission Indian subperiod is manifest primarily at the missions in Bexar County (Campbell and Campbell 1985). Interesting continuities from prehistoric times, and new behaviors resulting from acculturation, are reflected in the material culture of the mission Indians (D. Fox 1979).

Shoshonian-speaking Comanches, who had become consummate equestrians by 1800, began to spread into northwestern Texas from the high plains toward the end of the middle Historic subperiod (Wallace and Hoebel 1952). Their presence in Central Texas is documented mostly from the hostile view of Euroamerican settlers.

The late Historic subperiod, extending into the 20th century, encompasses minor numbers of mission Indians, far flung nomadic native groups (primarily the Comanches) until the late 19th Century, and a rich archeological record of the European-derived cultural presence (D. Fox 1983). As the Comanche presence in Central Texas waned in the mid-to late 19th century, the more than 11 millennia of Native American presence in the area came to an end.

CONCLUSIONS AND COMMENTS ON FUTURE RESEARCH

Central Texas was occupied by Native American hunter-gatherers more or less continuously for longer than 11,000 years. During that time the net change in population was from zero to a precontact figure that may have been as high as 150,000 (based on a very approximate hemisphere-wide estimate of 2.1 persons per km^2 [Dobyns 1966]), but was probably much lower (Ubelaker 1988). Whatever the actual ending figure, and however nonlinear the rate of increase, it is an absolute certainty that over time more and more people lived in and around Central Texas. Without doubt, population growth increasingly constrained subsistence and mobility options and may have fostered political conflict, but it also led to a cosmopolitan condition where more knowledge, commodities, words, and mates could be exchanged.

Exchange in each of these domains of culture is likely to have comparatively low archeological visibility except when non-perishable commodities are exchanged, or knowledge is transmitted that is reflected in durable items of material culture. The more exchange occurs, no matter its form, the more likely it is to have archeological visibility.

In the course of Central Texas prehistory, archeological evidence for the exchange of ideas and exotic commodities becomes more visible in the latter part of the Late Archaic and reaches its greatest expression in the Toyah interval (assuming that exotic lithics in Paleoindian times more often represent high mobility). When Late Archaic sites in Central Texas contain exotic obsidian and marine shells, and there are interments influenced by Hopewellian burial ceremonialism, the indigenous population is not living in isolation. Unseen behind these tangibles are undoubtedly culture brokers, travelers, multilingual interpreters, and diplomats—prehistoric counterparts of the likes of Juan Sabeata, Sacagewea, and the Turk.

To have reached sufficient levels for archeological expression in the Late Archaic, when did distant connections first develop? I doubt the natives of Central Texas were ever isolated—a key element in my views of the local prehistory which follow.

Horticulture or agriculture had come to be practiced in all directions (Mesoamerica, the Southwest, Southeast, and Plains) during what in Central Texas was still the Late Archaic. Early European settlers found Central Texas optimal for farming (Fehrenbach 1968), and much of it is farmland today. A shift to horticulture or agriculture by natives of the region was not precluded by natural conditions of soil or climate. Nor was it precluded out of ignorance on the part of its inhabitants. These conclusions argue for the alternative interpretation that efficient technologies for hunting and gathering prevailed, and that the plant and animal resource base was both rich and diverse. Central Texas was one of those places in the world where the labors and limitations of food production could be looked upon with disdain.

What then are the ingredients of that technology and the characteristics of that resource base? The axiom that specialization is the path to extinction seems to be born out by it corollary—11,000 years of successful, generalized exploitations of a diverse resource base in Central Texas. The adaptability of hunter-gatherer subsistence in Central Texas is underscored by the swings in climate (see Table 2): from relatively mesic (ca. 11,500 to 8800 or 8500 B.P.) to xeric (ca. 8800 or

8500 to 2800 or 3000 B.P.), with a brief amelerioration (ca. 6800 to 5500 B.P.), and back to mesic again (ca. 2800 to 1000 B.P.), then followed by a brief drying interval near 1000 B.P. Since ca. 1000 B.P., the climate seems to have been rather moderate compared with the more mesic and more xeric periods of earlier times.

From the earliest arrival of peoples into the area, which present evidence places near the middle of the 12th millennium B.P., until ca. 8800 B.P., conditions were relatively mesic; the archeological record reflects hunter-gatherers of moderately high mobility. Campsites of these Paleoindians usually have simple fireplaces with little or no use of rock. During Folsom times, there may have been a substantial reliance on bison-hunting, but otherwise Paleoindian subsistence seems to have been rather generalized. A small human population and reasonably abundant plant and animal resources would seem to best account for the archeological evidence.

Beginning around 8800 years ago, large fireplaces with quantities of burned rocks appear and signal important changes in adaptations, ushering in what we refer to as the Archaic. It is in the Archaic that we see the development and perseverance of archeological patterns distinctive to Central Texas; a conspicuous element in that distinctiveness is extensive use of rock in a variety of fireplaces. It is apparent that these rocks were used primarily for their heat-storage capacity in most cases, and that this is basic to the long history of Archaic adaptations.

There is a clear correlation in Central Texas between mesic climatic indicators and the archeological occurrence of bison remains. There is a less clear, but suggestive appearance that burned rock features (middens and complexes of earth ovens) grew at faster rates in the more xeric intervals. In general, large hot-rock cooking appliances are needed for plant foods requiring long cooking times, whether baking or steaming. The labor and fuel required for efforts of this kind are efficient only if a large volume of food is cooked. It follows that the existence of the large hot-rock cooking appliances is *prima facie* evidence of bulk processing of starchy plants, be they sotol bulbs, prairie turnip roots, cattail roots, acorns, or wild onion bulbs. But it is important to consider that once the effort is made to construct and fuel a hot-rock cooking appliance, it can be used to cook almost any kind of food, plant or animal—wherein lies the adaptability of these facilities.

As the abundance of various plant foods change seasonally or in response to longer-term climatic shifts, rock ovens can be used to bake or steam, as appropriate, the most available bulk staple, augmented with anything from river mussels or turtle meat to hawthorn or persimmon fruits. It would appear, in this vein, that at those (mesic) times when bison were more abundant, somewhat less reliance was placed on the bulk processing of plant foods, and there was relatively less use of hot-rock appliances. One of those times was when Calf Creek, Bell, and Andice bifaces were in vogue, another (although far less evident) when Marcos, Montell, and Castroville points prevailed. Johnson and Goode (1994) offer the suggestion that makers of Calf Creek and related forms migrated into the region as bison ranges spread.

Central Texas environments are, and have been, far from uniform, and the foregoing generalizations will not apply equally over the region (see Ellis et al., this volume), and not at all in places. Certainly such potentially important resources as desert succulents, bison, acorns, and riverine plants and animals have varied greatly over time, and archeological understanding of their importance will emerge locally, not regionally.

During the late (Toyah) interval of the Late Prehistoric, when bison-hunting and mobility were evidently at their highest levels since Folsom times, the ancient practice of using large hot-rock appliances came to an end. Once again, as in the Bell-Andice-Calf Creek interval, there is good evidence that the Toyah interval is the archeological expression of bison hunters that migrated into the area. These hunters neither depended very much on other local resources nor adopted the technology for their exploitation.

Such are a few general interpretations of the prehistory of Central Texas. Should any of these be found worthy, they could guide future archeological investigations in a general sense, but as framed they are too general to be tested directly. Instead, archeological effort in the area needs to be directed toward more basic tasks, including accumulating specific evidence relevant to these generalizations.

First, a very small percentage of the archeological data base of Central Texas derives from well-stratified contexts. To correct this deficiency, *gisements* need to be targeted as widely in space and as fully along the temporal vector as possible. Artifact assemblages and paleoenvironmental data of high resolution derived from such contexts can provide the evidence needed to address most of our presently-recognized archeological issues.

As assemblages with greater integrity—higher data quality—are investigated, more comprehensive data-recovery and analytical techniques must be applied. First, the basics of archeological evidence must be better met, and second, the perspective of comparative ethnology should be used to structure inquiry.

The basics of archeological inquiry are relatively simple—obtaining well-documented, representative samples of archeological assemblages, and controlling for the relative and absolute dating of those assemblages. A start at this task has been made in Central Texas.

I suggest that a comparative ethnological perspective is needed because in Central Texas we have learned relatively little about the human lifeways that came and went here for nearly 12,000 years. We need to have an organizational framework for our investigations that defines objectives and directs effort toward those objectives in the greatest need of attention. An obvious framework is comparative ethnology. The elements of culture that ethnologists compare cannot all be known from extinct cultural systems, but a subset of those that realistically can be at least partially reconstructed out of archeological evidence is useful. A matrix table with cultural traits across the top and our archeological intervals arrayed up the left side would constantly remind us of our major data gaps. Within each cell of the matrix is a research objective that must be carefully considered in terms of what archeological evidence is needed, and how that evidence would best be obtained. Traits from the general (e.g., subsistence, settlement pattern, transhumance) to the specific (e.g., burial practices, ornaments, wood-working tools) need to be included. Obviously, the evidence required to satisfy any specific objective will not be found just because it is listed in the matrix. What is important is that research will proceed with that objective in mind, the essential evidence needed to satisfy the objective will have been thought out, and in the long run our efforts will be more productive by being allocated more appropriately.

A significant element in our lack of progress to date is redundancy. We keep digging up the same kinds of evidence using the same techniques. Targeting other aspects of the archeological record and using a greater array of procedures are priorities.

Another impediment is how we conceive evidence. We see deer bones and dart points and infer that game was taken with a weaponry that employed darts. We rarely consider alternative or complementary paraphernalia or strategies—use of nets, snares, or dogs. We seldom ask, much less try to answer, questions like: "what was made using those tools we infer to be adzes or gouges; were people making canoes, shelter, wooden mortars; if so, what were they doing with them?"

Explicitly defined research objectives on the macro-, meso-, and micro-scales of investigation are starting points. Fuller use needs to be made of the more sophisticated techniques of dating and archeometry—techniques that mostly are not warranted unless applied to data from superior contexts. These are suggestions that carry a price. The costs of doing archeology, even mediocre archeology, continue to rise, and unless substantive new information is gained on nearly every attempt, those costs are not justified. Only by eliminating redundant efforts, and targeting quality data with explicit research objectives and well-conceived plans for data recovery and analysis, can we expect to make those substantive contributions. Because archeologists working in Central Texas have begun to evaluate site data for their integrity, to move beyond single-minded pursuit of chronology-building, to give thought to data and analytical requirements for selected other research objectives, and to have recognized important kinds of evidence previously ignored, conditions are right for making real progress in understanding the local prehistory.

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APPENDIX

ALPHABETICAL LISTING OF SELECTED CENTRAL TEXAS SITES AND ENVIRONMENTAL DATA SETS WITH BIBLIOGRAPHIC REFERENCES

Sites

ANTHON	Goode n.d.
BARTON	Ricklis and Collins 1994
BULL PEN	Ensor 1988
BUZZARD	Stephenson 1970
CAMP PEARL WHEAT	Collins et al. 1991
CLARK	Watt 1965
CROCKETT GARDENS	McCormick 1982
CURRIE	Treece et al. 1993
EVOE TERRACE	Sorrow et al. 1967
FINIS FROST	Green and Hester 1973
FOOTBRIDGE	Johnson et al. 1962
FRIESENHAHN CAVE	Krieger 1964
FRISCH AUF!	Hester and Collins 1969
GAULT	Collins et al. 1991; Collins et al. 1992
GIBSON	Ray 1940
HALL'S CAVE	Toomey 1993; Toomey et al. 1993
HIGGINS	Black et al. 1993
HITZFELDER CAVE	Givens 1968a, 1968b
HORN SHELTER 2	Redder 1985
JETTA COURT	Wesolowsky et al. 1976
JOHN ISCHY	Sorrow 1969
KINCAID	Collins 1990b; Collins et al. 1989
KYLE	Jelks 1962
LANDSLIDE	Sorrow et al. 1967
LEVI ROCKSHELTER	Alexander 1963, 1983
LINDNER	Brown 1985
LOEVE	Prewitt 1982
LOEVE FOX	Prewitt 1974
MASON BURIAL CAVE	Benfer and Benfer 1981
MERRELL	Campbell 1948
MUSTANG BRANCH	Ricklis and Collins 1994
OBLATE	Johnson et al. 1962
PAVO REAL	Henderson and Goode 1991
RICHARD BEENE	Thoms and Mandel 1992
ROB ROY	Jackson 1939
ROCKY BRANCH	Treece et al. 1993
RUSH	Quigg and Peck 1995
SCORPION	Highley et al. 1978
SLAB	Patterson 1987
SLEEPER	Johnson 1991
SMITH	Suhm 1957
TURKEY BEND RANCH	Treece et al. 1993
VARA DANIEL	Collins et al. 1990; Ricklis et al. 1991; Takac et al. 1992
WACO MAMMOTH	J. Fox et al. 1992
WILEY WILLIAMS	TARL Files

APPENDIX *(Continued)*

WILSON-LEONARD	Collins et al. 1993; Mear n.d.b; Masson and Collins 1995
WOUNDED EYE	Luke 1980
WUNDERLICH	Johnson et al. 1962
YOUNGSPORT	Shafer 1963
ZATOPEC	Garber 1987
UNNAMED SITE IN BANDERA COUNTY	Beasley 1978
41BC50	TARL Files
41CC1	TARL Files
41GL160	Kelly 1987
41ME19	Hester and Kelly 1976
41ML64	Collins and Holliday 1985
41SU43	TARL Files
41TG91	Creel 1990
41TV29	TARL Files

Environmental Data Sets

BISON ABUNDANCE	Dillehay 1974
BOG POLLEN	Collins et al. 1993
SABINAL RIVER	Mear n.d.a
PEDERNALES RIVER	Blum and Valastro 1989
FT. HOOD	Nordt 1992
COLORADO RIVER AT BASTROP	Blum 1992
COLORADO RIVER IN CONCHO AND COLEMAN COUNTIES	Blum and Valastro 1992
BRAZOS RIVER AT SOUTH BEND	Mandel 1992
BRUSHY CREEK	Mear n.d.b; Collins et al. 1993; Masson and Collins 1995
MEDINA RIVER AT APPLEWHITE	Thoms and Mandel 1992
SOUTHERN PLAINS	Hall 1986

REFERENCES CITED

Abbott, J. T.
1994 Geomorphic Context of the Barton Site (41HY202) and the Mustang Branch Site (41HY209). In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 353-379. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Alexander, H. L. Jr.
1963 The Levi Site: A Paleo-Indian campsite in central Texas. *American Antiquity* 28:510-528.
1983 The Pre-Clovis and Clovis Occupations at the Levi Site. In *Peopling of the New World*, edited by J. E. Ericson, R. E. Taylor, and R. Berger, pp. 133-145. Ballena Press, Los Altos.

Antevs, E.
1955 Geologic-Climatic Dating in the West. *American Antiquity* 20:317-335.

Baker, V. R. and M. M. Penteado-Orellano
1978 Fluvial Sedimentation Conditioned by Quaternary Climatic Change in Central Texas. *Journal of Sedimentary Petrology* 48:433-451.

Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest.* Memoir 4. Oklahoma Anthropological Society, Norman.

Barnes, V. E.
1981 *Austin Sheet.* Geologic Atlas of Texas. Bureau of Economic Geology, The University of Texas at Austin.

Beasley, T. S.
1978 A Site with Edwards Points in Bandera County, Texas. *La Tierra* 5(4):23-31.

Benfer, R. and A. Benfer
1981 The Mason Ranch Burial Cave, Uvalde County, Texas. *La Tierra* 8(3):16-26.

Berlandier, J. L.
1969 *The Indians of Texas in 1830.* Edited by J. C. Ewers. Smithsonian Institution Press, Washington, D.C.

Bianchi, T. H.
1984 The Surficial Stratigraphy of State Highway 16 within the Amite River Valley. In *CRMP Level II Cultural Resource Investigations along Route LA 16 between Watson and Amite*, edited by A. F. Servello, pp. 416-419. Louisiana Department of Transportation and Development, Baton Rouge.

Black, S. L.
1989 Central Texas Plateau Prairie. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 17-38. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

Black, S. L. and A. J. McGraw
1985 *The Panther Springs Creek Site: Cultural Change and Continuity Within the Upper Salado Creek Watershed, South-Central Texas.* Archaeological Survey Report 100. Center for Archaeological Research, The University of Texas at San Antonio.

Black, S. L., K. Jolly, and D. R. Potter
1993 *The Higgins Experiment.* Wurzbach Project Working Papers. Texas Archeological Research Laboratory, The University of Texas at Austin.

Blum, M. D.
1992 Modern Depositional Environments and Recent Alluvial History of the Lower Colorado River, Gulf Coastal Plain of Texas. Unpublished Ph.D. Dissertation, Department of Geology, The University of Texas at Austin.

Blum, M. D. and C. Lintz
1993 Late Quaternary Geology in the Reservoir Basin. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume I: Project Introduction, Setting and Methods*, by C. Lintz, W. N. Trierweiler, A. C. Earls, F. M. Oglesby, M. Blum, P. L. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock, pp. 280-314. Technical Report No. 346-I. Mariah Associates, Inc., Austin.

Blum, M. D. and S. Valastro, Jr.
1989 Response of the Pedernales River of Central Texas to Late Holocene Climatic Change. *Annals of the Association of American Geographers* 79(3):435-456.

1992 Quaternary Stratigraphy and Geoarchaeology of the Colorado and Concho Rivers, West Texas. *Geoarchaeology* 7:419-448.

Bolton, H. E.
1915 *Texas in the Middle Eighteenth Century: Studies in Spanish Colonial History and Administration.* University of California Press, Berkeley.

Boul, S. W., F. D. Hole, and R. J. McCracken
1989 *Soil Genesis and Classification.* Iowa State University Press, Ames.

Bousman, C. B.
1993 Hunter-Gatherer Adaptations, Economic Risk and Tool Design. *Lithic Technology* 18 (Nos. 1 & 2):59-86.

Bousman, C. B. and R. C. Fields
1988 Results of the Geoarcheological Investigations. In *Archeological Survey of the 1989-1993 Permit Area, Jewett Mine Project, Freestone and Leon Counties, Texas*, edited by R. C. Fields, pp. 195-237. Reports of Investigations 63. Prewitt and Associates, Inc. Austin.

Branda, E. S. (editor)
1976 *The Handbook of Texas, Vol. III.* The Texas State Historical Association, Austin

Brown, K. M.
1985 Three Caches of Guadalupe Tools from South Texas. *Bulletin of the Texas Archeological Society* 56:75-126.

1986 *Archaeological Studies of the CPS Butler Lignite Prospect, Bastrop and Lee Counties, Texas, 1983.* Archaeological Survey Report 140. Center for Archaeological Research, The University of Texas at San Antonio.

Brune, G.
1975 *Major and Historical Springs of Texas.* Report 189. Texas Water Development Board, Austin.

Bryant, V. M. Jr.
1977 A 16,000 Year Pollen Record of Vegetational Change in Central Texas. *Palynology* 1:143-156.

Bryant, V. M., Jr. and R. G. Holloway
1985 A Late-Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence. In *Pollen Records of Late-Quaternary North American Sediments*, edited by V. M. Bryant, Jr. and R. G. Holloway, pp. 39-70. American Association of Stratigraphic Palynologists, Dallas.

Bryant, V. M., Jr. and H. J. Shafer
1977 The Late Quaternary Paleoenvironment of Texas: A Model for the Archeologist. *Bulletin of the Texas Archeological Society* 48:1-25.

Butzer K. W.
1982 *Archaeology as Human Ecology.* Cambridge University Press, Cambridge.

Campbell, T. N.
1948 The Merrell Site: Archeological Remains Associated with Alluvial Terrace Deposits in Central Texas. *Bulletin of the Texas Archeological and Paleontological Society* 19:7-35.

Campbell, T. N. *(Continued)*
1988 *The Indians of Southern Texas and Northeastern Mexico*. Texas Archeological Research Laboratory, Department of Anthropology, College of Liberal Arts, and Institute of Latin American Studies, The University of Texas at Austin.

Campbell, T. N. and T. J. Campbell
1981 *Historic Indian Groups of the Choke Canyon Reservoir and Surrounding Area, Southern Texas*. Choke Canyon Series, Volume 1. Center for Archaeological Research, The University of Texas at San Antonio.
1985 *Indian Groups Associated with Spanish Missions of the San Antonio Missions National Park*. Special Report 16. Center for Archaeological Research, The University of Texas at San Antonio.

Clarke, D. L.
1977 Spatial Information in Archaeology. In *Spatial Archaeology*, edited by D. L. Clarke, pp. 1-32. Academic Press, London.

Collins, E. W.
1982 *Surface evidence of tectonic activity and erosion rates, Palestine, Keechi, and Oakwood salt domes, East Texas*. Geological Circular 82-3. Bureau of Economic Geology, The University of Texas at Austin.

Collins, E. W., D. K. Hobday, and C. W. Kreitler
1980 *Quaternary faulting in East Texas*. Geological Circular 80-1. Bureau of Economic Geology, The University of Texas at Austin.

Collins, M. B.
1990a Observations on Clovis Lithic Technology. *Current Research in the Pleistocene* 7:73-74.
1990b The Archaeological Sequence at Kincaid Rockshelter, Uvalde County, Texas. *Transactions of the 25th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 25-33. Midland Archeological Society, Midland, Texas.
1991a Thoughts on future investigations of burned rock middens. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. 1-24. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.
1991b Rockshelters and the Early Archaeological Record in the Americas. In *The First Americans: Search and Research*, edited by T. D. Dillehay and D. J. Meltzer, pp. 157-182. CRC Press, Boca Raton.

Collins, M. B. *(Continued)*
1994a Evidence of Early Archaic Occupation. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 67-100. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
1994b Late Archaic Evidence in the Project Area. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 101-189. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
1994c Chronometric Investigations. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 499-505. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
n.d.a The Keven Davis Cache (41NV659) and Clovis Blade Technology in the South Central United States. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin.
n.d.b Taking Stock of Paleoindian Archeology in Texas, 1994. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Collins, M. B. M. D. Blum, R. A. Ricklis, and S. Valastro
1990 Quaternary Geology and Prehistory of the Vera Daniel Site, Travis County, Texas. *Current Research in the Pleistocene* 7:8-10.

Collins, M. B., C. B. Bousman, P. Goldberg, P. R. Takac, J. C. Guy, J. L. Lanata, T. W. Stafford, and V. T. Holliday
1993 The Paleoindian Sequence at the Wilson-Leonard Site, Texas. *Current Research in the Pleistocene* 10:10-12.

Collins, M. B., C. B. Bousman, and T. K. Perttula
1993 Historic Context: Quaternary Environments and Archeology in Northeastern Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 49-67. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Collins, M. B., B. Ellis and C. Dodt-Ellis
1990 *Excavations at the Camp Pearl Wheat Site (41KR243): An Early Archaic Campsite on Town Creek, Kerr County, Texas*. Studies in Archeology 6. Texas Archeological Research Laboratory, The University of Texas at Austin.

Collins, M. B., G. L. Evans, T. N. Campbell, M. C. Winans, and C. E. Mear
1989 Clovis Occupation at Kincaid Shelter, Texas. *Current Research in the Pleistocene* 6:3-4.

Collins, M. B., T. R. Hester, and P. J. Headrick
1992 Engraved Cobbles from the Gault Site, Central Texas. *Current Research in the Pleistocene* 9:3-4.

Collins, M. B., T. R. Hester, D. Olmstead, and P. J. Headrick
1991 Engraved Cobbles from Early Archaeological Contexts in Central Texas. *Current Research in the Pleistocene* 8:13-15.

Collins, M. B. and V. T. Holliday
1985 Geoarcheology in the Lower Bosque Basin, McLennan County, Texas. Report submitted to U.S. Army Corps of Engineers, Fort Worth District, Fort Worth, Texas.

Collins, M. B. and R. A. Ricklis
1994 Cultural Background. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 11-26. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Creel, D. G.
1990 *Excavations at 41TG91, Tom Green County, Texas, 1978*. Publications in Archaeology, Report No. 38. Texas Department of Transportation, Austin.

1991 Assessing the relationship between burned rock midden distribution and archaic subsistence in west central Texas. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. 33-43. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.

Davis, S. D., W. D. Pennington, and S. M. Carlson
1989 *A Compendium of Earthquake Activity in Texas*. Geological Circular 89-3. Bureau of Economic Geeology, The University of Texas at Austin.

Dillehay, T. D.
1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19(65):180-196.

Dobyns, H. F.
1966 Estimating Aboriginal American Population, an Appraisal of Techniques with a New Hemispheric Estimate. *Current Anthropology* 7:395-416

Duffield, L. F.
1970 Vertisols and Their Implications for Archeological Research. *American Anthropologist* 72:1055-1062.

Ebert, J. I.
1992 *Distributional Archaeology*. University of New Mexico Press, Albuquerque.

Eighmy, J.
1993 Archaeomagnetic Results. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho Coleman, and Runnels Counties, Texas, Volume IV: Data Recovery Results from Ceramic Sites*, by A. C. Treece, C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller, pp. K-1 through K-22. Technical Report 346-IV. Mariah Associates, Inc., Austin.

Ellis, G. L.
1994 Archeological Overview and Theoretical Perspectives. In *Significance Standards for Prehistoric Cultural Resources: A Case Study from Fort Hood, Texas*, by G. L. Ellis, C. Lintz, W. N. Trierweiler, and J. M. Jackson, pp. 41-99. Technical Report CRC-94/04. U. S. Army Corps of Engineers, Construction Engineering Research Laboratories, Champaign, Illinois.

Ensor, H. B. and C. S. Mueller-Wille
1988 *Excavations at the Bull Pen Site 41BP280, Colorado River Drainage, Bastrop County, Texas*. Contract Reports in Archaeology, Report Number 3. Texas State Department of Highways and Public Transportation, Austin

Fehrenbach, T. R.
1968 *Lone Star, a History of Texas and the Texans*. Collier, New York

Ferring, C. R.
1986 Rates of Fluvial Sedimentation: Implications for Archaeological Variability. *Geoarchaeology* 1:259-274.

Foster, W. C.
1995 *Spanish Expeditions into Texas, 1689-1768*. University of Texas Press, Austin.

Fox, D.
1979 *The Lithic Artifacts of Indians at the Spanish Colonial Missions, San Antonio, Texas*. Special Report 3. Center for Archaeological Research, The University of Texas at San Antonio.

1983 *Traces of Texas History: Archeological Evidence of the Past 450 Years*. Corona, San Antonio.

Fox, J. W., C. B. Smith, and D. O. Lintz
1992 Herd Bunching at the Waco Mammoth Site: Preliminary Investigations, 1978-1987. In *Proboscidean and Paleoindian Interactions*, edited by J. W. Fox, C. B. Smith, and K. T. Wilkins, pp. 51-73. Baylor University Press, Waco.

Gamble, C.
1986 *The Paleolithic Settlement of Europe.* Cambridge University Press, Cambridge.

Garber, J. F.
1987 Transitional Archaic Structure and Activity Areas at the Zatopec Site, San Marcos, Texas. *La Tierra* 14(2):19-30.

Givens, R. D.
1968a On the Peopling of America. *Current Anthropology* 9:219.
1968b A Preliminary Report on Excavations at Hitzfelder Cave. *Bulletin of the Texas Archeological Society* 38:47-50.

Goode, G. T.
1991 Late Prehistoric burned rock middens in Central Texas. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. 71-93. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.
n.d. Report on excavations at the Anthon site, Uvalde County, Texas. Manuscript on file, Texas Department of Transportation, Austin.

Gose, W.
1994 Archeomagnetism. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 507-537. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Green, L. M., and T. R. Hester
1973 The Finis Frost Site: A Toyah phase occupation in San Saba County, Texas. *Bulletin of the Texas Archeological Society* 44:319-333.

Gunn, J. and R. A. Mahula
1977 *Hop Hill: Culture and Climatic Change in Central Texas.* Special Report 5. Center for Archaeological Research, The University of Texas at San Antonio.

Hall, S.
1986 Late Quaternary Alluvial Chronology of the Southern Plains. *Geological Society of America, Abstracts with Programs* 18:625.
1990 Channel trenching and climatic change in the Southern U.S. Great Plains. *Geology* 18:342-345.

Haynes, C. V., Jr.
1991 Geoarchaeological and paleohydrological evidence for a Clovis-age drought in North America and its bearing on extinction. *Quaternary Research* 35:438-450.

Haynes, C. V., Jr. *(Continued)*
1992 Contributions of radiocarbon dating to the geochronology of the peopling of the New World. In *Radiocarbon after Four Decades*, edited by R. E. Taylor, A. Long, and R. S. Kra, pp. 355-374. Springer-Verlag, New York.
1993 Clovis-Folsom Geochronology and Climatic Change. In *From Kostenki to Clovis*, edited by O. Soffer and N. D. Praslov, pp. 219-236. Plenum Press, New York.

Henderson J. and G. T. Goode
1991 Pavo Real: An Early Paleoindian Site in South-Central Texas. *Current Research in the Pleistocene* 8:26-28.

Hester, T. R.
1973 The Formation of a Burned Rock Midden: A California Example. *The Record* 30(1):4. Dallas Archeological Society, Dallas.
1989a Texas and Northeastern Mexico: An Overview. In *Columbian Consequences, Volume 1: Archaeological and Historical Perspectives on the Spanish Borderlands West*, edited by D. H. Thomas, pp. 191-211. Smithsonian Institution Press, Washington.
1989b Perspectives on the Material Culture of the Mission Indians of the Texas-Northeastern Mexico Borderlands. In *Columbian Consequences, Volume 1: Archaeological and Historical Perspectives on the Spanish Borderlands West*, edited by D. H. Thomas, pp. 213-229. Smithsonian Institution Press, Washington.
1990 Plainview Artifacts at the St. Mary's Hall Site, South Central Texas. *Current Research in the Pleistocene* 7:14-17.
1991 Preface. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. v-vii. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.

Hester, T. R., G. L. Evans, F. Asaro, F. Stross, T. N. Campbell, and H. Michel
1985 Trace Element Analysis of an Obsidian Paleo-Indian Projectile Point From Kincaid Rockshelter, Texas. *Bulletin of the Texas Archeological Society* 56:143-153.

Hester, T. R. and T. C. Kelly
1976 *Archaeological investigations at sites near Natalia, Medina County, Texas.* Archaeological Survey Report 20. Center for Archaeological Research, The University of Texas at San Antonio.

Highley, L., C. Graves, C. Land, and G. Judson
1978 Archeological investigations at Scorpion Cave (41ME7), Medina County, Texas. *Bulletin of the Texas Archeological Society* 49:139-194.

Hodder, I.
1978 The Spatial Structure of 'Cultures:' A Review of Some of the Evidence. In *The Spatial Organization of Culture*, edited by I. Hodder, pp. 93-111. University of Pittsburgh Press, Pittsburgh.

Holloway, R. G.
1988 *Pollen Analysis of 41MI8, Mills County, Texas*. Contribution 4. Laboratory of Quaternary Studies, Department of Anthropology, Eastern New Mexico State University, Portales.

Howard, M. A.
1991 Burned rock midden excavations, hearths and botanical remains. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. 45-69. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.

Jackson, A. T.
1939 A Deep Archeological Site in Travis County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 11:203-225.

Jackson, A. T. and A. M. Woolsey
1938 *The Fall Creek Sites and Additional Buchanan Lake Sites*. Publications 3802. The University of Texas, Austin

Jelks, E. B.
1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas*. Archaeology Series 5. Department of Anthropology, The University of Texas, Austin.

Johnson, L. Jr.
1967 *Toward a Statistical Overview of the Archaic Cultures of Central and Southwestern Texas*. Bulletin 12. Texas Memorial Museum, Austin.

1987 A Plague of Phases:Recent Sociocultural Taxonomy in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1-26.

1991 *Early Archaic Life at the Sleeper Archaeological Site, 41BC65, of the Texas Hill Country, Blanco County, Texas*. Publications in Archaeology, Report 39. Texas Department of Transportation. Austin.

1994 *The Life and Times of Toyah-Culture Folk as Seen From the Buckhollow Encampment, Site 41KM16 of Kimble County, Texas*. Office of the State Archeologist Report 38. Texas Department of Transportation and the Texas Historical Commission, Austin

Johnson, L. Jr. and G. T. Goode
1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archeological Society* 65:1-51.

Johnson, L. Jr., D. A. Suhm, and C. D. Tunnell
1962 *Salvage Archeology of Canyon Reservoir: The Wunderlich, Footbridge, and Oblate Sites*. Bulletin 5. Texas Memorial Museum, Austin.

Kelley, J. C.
1947 The Lehmann Rock Shelter: A Stratified Site of the Toyah, Uvalde, and Round Rock Foci. *Bulletin of the Texas Archeological and Paleontological Society* 18:115-128.

Kelley, J. C. and T. N. Campbell
1942 What are the Burnt Rock Mounds of Texas? *American Antiquity* 7:319-322.

Kelly, T. C.
1987 Archaeology of the Gamenthaler Valley, Gillespie County, Central Texas: A Preliminary Report. *La Tierra* 14(1):5-27.

Krieger, A.D.
1947 Certain Projectile Points of the Early American Hunters. *Bulletin of the Texas Archeological and Paleontological Society* 18:7-27.

1964 Early Man in the New World. In *Prehistoric Man in the New World*, edited by J. D. Jennings and E. Norbeck, pp. 23-81. University of Chicago Press, Chicago.

Kroeber, A. L.
1939 *Cultural and Natural Areas of Native North America*. Publications in American Archaeology and Ethnology 38. University of California, Berkeley.

Largent, F. B. and M. R. Waters
1990 The Distribution of Folsom Points in Texas. *Current Research in the Pleistocene* 7:27-28.

Laville, H., J-P. Rigaud, and J. Sackett
1980 *Rock Shelters of the Perigord*. Academic Press, New York.

Lintz, C.
1993 Paleoenvironmental Reconstruction. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume I: Project Introduction, Setting and Method*, by C. Lintz, W. N. Trierweiler, A. C. Earls, F. M. Oglesby, M. Blum, P. L. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock, pp. 261-280. Technical Report No. 346-I. Mariah Associates, Inc., Austin.

Luke, C. J.
1980 *Continuing Archaeology on State Highway 16: The Shep Site (41KR109) and the Wounded Eye Site (41KR107)*. Publications in Archaeology 19. State Department of Highways and Public Transportation, Austin.

Mandel, R. D.
1992 Geomorphology. In *An Archeological Survey of The Proposed South Bend Reservoir Area: Young, Stephens, and Throckmorton Counties, Texas*, edited by J. W. Saunders, C. S. Mueller-Wille, and D. L. Carlson, pp. 53-83. Archeological Surveys No. 6. Archeological Research Laboratory, Texas A&M University, College Station.

Masson, M. A. and M. B. Collins
1995 The Wilson-Leonard Site (41WM235). *Cultural Resource Management News and Views* 7(1):6-10. Texas Historical Commission, Austin.

Masson, M. A. and M. W. Holderby
1994 Subsistence Patterns at 41HY209 and 41HY202: An Analysis of Vertebrate Faunal Remains. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 353-379. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

McCormick, O.
1982 41WM419 (Crockett Gardens Site). In *Archaeological Investigations at the San Gabriel Reservoir Districts, Central Texas*, compiled and edited by T. R. Hays, pp. 12.135-12.166. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.

McDonald, J.
1974 Non-human Bones from the Loeve-Fox Site: A Preliminary Analysis. In *Archeological Investigations at the Loeve-Fox Site, Williamson County, Texas*, by E. R. Prewitt, pp. 132-134. Research Report 49. Texas Archeological Survey, The University of Texas at Austin.

McKinney, W. W.
1981 Early Holocene Adaptations in Central and Southwestern Texas: The Problem of the Paleoindian-Archaic Transition. *Bulletin of the Texas Archeological Society* 52:91-120.

Mear, C. E.
n.d.a Quaternary Geology of the Upper Sabinal River Valley, Uvalde and Bandera Counties, Texas. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

n.d.b Geomorphology and Quaternary Geology of the Wilson-Leonard site area. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Meltzer, D. J.
1987 The Clovis Paleoindian Occupation of Texas: Results of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archeological Society* 57:27-68.

Meltzer, D. J. *(Continued)*
1989 An Update on the Texas Fluted Point Survey. *Current Research in the Pleistocene* 6:31-34.

Morse, D. F. and P. A. Morse
1983 *Archaeology of the Central Mississippi Valley*. Academic Press, San Diego

Newcomb, W. W., Jr.
1961 *The Indians of Texas: From Prehistoric to Modern Times*. University of Texas Press, Austin.

1993 Historic Indians of Central Texas. *Bulletin of the Texas Archeological Society* 64:1-63.

Nordt, L. C.
1992 *Archaeological Geology of the Fort Hood Military Reservation, Ft. Hood, Texas*. Archaeological Resource Management Series, Research Report 25. United States Army, Fort Hood, Texas.

North American Commission on Stratigraphic Nomenclature
1983 North American Stratigraphic Code. *The American Association of Petroleum Geologists Bulletin* 67:841-875.

Osmond, J. C., Jr.
1963 *Recent Small-Scale Deformations of Limestone Strata*. Guide Book, Publication 61-46. West Texas Geological Society, Midland.

Patterson, P. E.
1987 *Archaeological Excavations at 41LL78, the Slab Site, Llano County, Texas*. Publications in Archaeology 34. State Department of Highways and Public Transportation, Austin.

Pearce, J. E.
1932 The Present Status of Texas Archeology. *Bulletin of the Texas Archeological and Paleontological Society* 4:44-54.

Peter, D. E., D. Prikryl, O. McCormick, and M. A. Demuynck
1982 Site Excavation Reports: Primary Contract. In *Archaeological Investigations at the San Gabriel Reservoir Districts, Central Texas, Volume 1*, edited by T. R. Hays, pp. 8-1 through 8-156. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.

Perttula, T. K., B. D. Skiles, M. B. Collins, M. C. Trachte, and F. Valdez, Jr.
1986 *"This Everlasting Sand Bed": Cultural Resources Investigations at the Texas Big Sandy Project, Wood and Upshur Counties, Texas*. Reports of Investigations 52. Prewitt and Associates, Inc., Austin

Potter D. R. and S. L. Black

1995 *Archeology Along the Wurzbach Parkway, Module 2: Initial Testing and Evaluation of Five Prehistoric Sites in the Upper Salado Watershed, Bexar County, Texas*. Studies in Archeology 18. Texas Archeological Research Laboratory, The University of Texas at Austin.

Potter, D. R., S. L. Black, and K. Jolly

1995 *Archeology along the Wurzbach Parkway, Module 1: Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas*. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.

Prewitt, E. R.

1974 *Archeological Investigations at the Loeve-Fox Site, Williamson County, Texas*. Research Report 49. Texas Archeological Survey, The University of Texas at Austin.

1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

1982 Archaeological Investigations at the Loeve-Fox, Loeve, and Tombstone Bluff Sites in the Granger Lake District of Central Texas. In *Archaeological Investigations in the San Gabriel Reservoir Districts, Central Texas, Volume 4*, edited and compiled by T. R. Hays. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.

1985 From Circleville to Toyah: comments on Central Texas chronology. *Bulletin of the Texas Archeological Society* 54:201-238.

1991 Burned rock middens: A summary of previous investigations and interpretations. In *The Burned Rock Middens of Texas: An Archeological Symposium*, edited by T. R. Hester, pp. 25-32. Studies in Archeology 13. Texas Archeological Research Laboratory, The University of Texas at Austin.

n.d. The Rogers Springs Site: 1974 Investigations. Research Report 54. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin. Austin

Quigg, J. M. and J. Peck

1995 *The Rush Site (41TG346) A Stratified Late Prehistoric Locale in Tom Green County, Texas*. Technical Report 816C. Mariah Associates, Inc., Austin.

Rapp, G., Jr.

1986 Assessing Archaeologial Evidence for Seismic Catastrophies. *Geoarchaeology* 1:365-379.

Ray, C. N.

1940 The Deeply Buried Gibson Site. *Bulletin of the Texas Archeological and Paleontological Society* 12:223-237.

Redder, A. J.

1985 Horn Shelter Number 2: the south end, a preliminary report. *Central Texas Archeologist* 10:37-65.

Reese-Taylor, K., J. Hageman, and R. A. Ricklis

1994 Preliminary Paste Analyses of Ceramic Samples from the Mustang Branch Site (41HY209) and Barton Site (41HY202). In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 549-568. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, R. A.

1994a Occupation in the Project Area during the Austin Interval, or Early Part of the Late Prehistoric Period. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 191-205. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

1994b Toyah Components: Evidence for Occupation in the Project Area During the Latter Part of the Late Prehistoric Period. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 207-316. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, R. A. and M. B. Collins

1994 *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, R. A., M. D. Blum, and M. B. Collins

1991 *Archeological Testing at the Vera Daniel Site (41TV1364), Zilker Park, Austin, Texas*. Studies in Archeology 12. Texas Archeological Research Laboratory, The University of Texas at Austin.

Saunders, J. W., C. S. Mueller-Wille, and D. L. Carlson (editors)

1992 *An Archeological Survey of the Proposed South Bend Reservoir Area: Young, Stephens, and Throckmorton Counties, Texas*. Archeological Surveys 6. Archeological Research Laboratory, Texas A&M University, College Station.

Schumm, S. A.

1977 *The Fluvial System*. John Wiley and Sons, New York.

Sellards, E. H. and G. L. Evans
1960 The Paleo-Indian Culture Succession in the Central High Plains of Texas and New Mexico. In *Men and Cultures: Selected Papers of the 5th International Congress of Anthropological and Ethnographical Sciences, 1956.*

Shafer, H. J.
1963 Test Excavations at the Youngsport Site: A Stratified Terrace Site in Bell County, Texas. *Bulletin of the Texas Archeological Society* 34:57-81.
1967 *An Archeological Survey of Robert Lee Reservoir, Coke County, Texas.* Survey Report 4. Texas Archeological Salvage Project, The University of Texas at Austin.

Shafer, H. J., D. A. Suhm, and J. D. Scurlock
1964 *An Investigation and Appraisal of the Archeological Resources of Belton Reservoir, Bell and Coryell Counties, Texas: 1962.* Miscellaneous Papers 1. Texas Archeological Salvage Project, The University of Texas, Austin.

Skinner, S. A.
1974 Prehistoric Settlement of a "Natural Area." Unpublished Ph.D. dissertation, Department of Anthropology, Southern Methodist University, Dallas.

Sorrow, W. M.
1969 *Archeological Investigations at the John Ischy Site: A Burnt Rock Midden in Williamson County, Texas.* Papers of the Texas Archeological Salvage Project No. 18. Texas Archeological Salvage Project, The University of Texas at Austin.

Sorrow, W. M., H. J. Shafer, and R. E. Ross
1967 *Excavations at Stillhouse Reservoir.* Papers of the Texas Archeological Salvage Project No. 11. Texas Archeological Salvage Project, The University of Texas at Austin.

Steele, D. G. and J. F. Powell
1994 Paleobiological Evidence of the Peopling of the Americas: A Morphometric View. In *Method and Theory for Investigating the Peopling of the Americas*, edited by R. Bonnichsen and D. G. Steele, pp. 141-163. Center for the Study of the First American, Oregon State University, Corvallis.

Stephenson, R. L.
1970 Archeological Investigations in the Whitney Reservoir Area, Central Texas. *Bulletin of the Texas Archeological Society* 41:37-286.

Stevenson, C. M.
1992 Obsidian Hydration Summary. In *An Archeological Survey of the Proposed South Bend Reservoir Area: Young, Stephens, and Throckmorton Counties, Texas*, edited by J. W. Saunders, C. S. Mueller-Wille, and D. L. Carlson, pp. 539-541. Archeological Surveys 6. Archeological Research Laboratory, Texas A&M University, College Station.

Stokes, S.
1992 Optical Dating of Independently Dated Late Quaternary Eolian Deposits from the Southern High Plains. *Current Research in the Pleistocene* 9:125-129.

Suhm, D. A.
1957 Excavations at the Smith Rockshelter, Travis County, Texas. *The Texas Journal of Science* 9:26-58.
1960 A Review of Central Texas Archeology. *Bulletin of the Texas Archeological Society* 29:63-107.

Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Takac, P. R., M. B. Collins, P. Goldberg, and S. Valastro, Jr.
1992 *Archeological and Geomorphological Testing Along The Proposed South Austin Outfall Relief Main, Phase II Tunnel Alignment: The Vara Daniel Site (41TV1364), Zilker Park, Austin, Texas.* Technical Series 28. Texas Archeological Research Laboratory, The University of Texas at Austin.

Talwani, P. and J. Cox
1985 Paleoseismic evidence for recurrence of earthquakes near Charleston, South Carolina. *Science* 229:379-381.

Taylor, A. J.
1987 *Archaeological Survey of the CPS Butler Lignite Prospect, Bastrop and Lee Counties, Texas, 1984.* Archaeological Survey Report 151. Center for Archaeological Research, The University of Texas at San Antonio.

Thomas, G. B.
1978 A survey and assessment of the archeological resources of Fort Hood, Texas. *Bulletin of the Texas Archeological Society* 49:195-240.

Thoms, A. V.
1989 The Northern Roots of Hunter-Gatherer Intensification: Camas and the Pacific Northwest. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Thoms, A. V., and R. D. Mandel
1992 The Richard Beene Site: A Deeply Stratified Paleoindian to Late Prehistoric Occupation in South-Central Texas. *Current Research in the Pleistocene* 9:42-44.

Toomey, R. S. III
1993 Late Pleistocene and Holocene Faunal Changes at Hall's Cave, Kerr County, Texas. Unpublished Ph.D. dissertation, The University of Texas at Austin.

Toomey, R. S. III., M. D. Blum, and S. Valastro, Jr.
1993 Late Quaternary Climates and Environments of the Edwards Plateau, Texas. *Global and Planetary Change* 7:299-320.

Treece, A. C., J. M. Quigg, C. Lintz, and K. Miller
1993 Rocky Branch Site (41RN169). In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume IV: Data Recovery from Ceramic Sites*, by A. C. Treece, C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller, pp. 31-118. Technical Report 346-IV. Mariah Associates, Inc., Austin.

Treece, A. C., J. M. Quigg, K. Miller, and C. Lintz
1993 Turkey Bend Ranch Site (41CC112). In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume III: Data Recovery Results from Non-Ceramic Sites*, by A. C. Treece, C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller, pp. 67-242. Technical Report 346-III. Mariah Associates, Inc., Austin.

Treece, A. C., J. M. Quigg, K. Miller, and P. L. O'Neill
1993 Currie Site (41CC131). In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume IV: Data Recovery from Ceramic Sites*, by A. C. Treece, C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller, pp. 119-306. Technical Report 346-IV. Mariah Associates, Inc. Austin.

Ubelaker, D.
1988 North American Indian Population Size, A.D. 1500 to 1985. *American Journal of Physical Anthropology* 77: 289-294.

Wallace, E. and E. A. Hoebel
1952 *The Comanches, Lords of the South Plains*. University of Oklahoma Press, Norman.

Watt, F. H.
1936 A Prehistoric Rock-Shelter Burial in Bell County, Texas. *Bulletin of the Central Texas Archeological Society* 2:5-27.

1965 Notes on the Clark Site, McLennan County, Texas. *Bulletin of the Texas Archeological Society* 36:99-110.

Weir, F. A.
1976 The Central Texas Archaic. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

1979 Greenhaw: An Archaic Site in Central Texas. *Bulletin of the Texas Archeological Society* 50:5-67.

1985 An Early Holocene Burial at the Wilson-Leonard Site in Central Texas. *Mammoth Trumpet* 2(1):1, 3.

Wesolowsky, A. B., T. R. Hester, and D. R. Brown
1976 Archeological Investigations at the Jetta Court Site (41TV151) Travis County, Texas. *Bulletin of the Texas Archeological Society* 47:25-87.

Willey, G. R.
1966 *An Introduction to American Archaeology, Volume 1: North America*. Prentice-Hall, Englewood Cliffs, New Jersey.

Willey, P. S., B. R. Harrison, and J. T. Hughes
1978 The Rex Rodgers Site. In *Archaeology at MacKenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 51-114. Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Wormington, H. M.
1957 *Ancient Man in North America*. Fourth Edition. The Denver Museum of Natural History, Denver.

Wyckoff, D. G.
1995 A Summary of the Calf Creek Horizon in Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 42:179-210.

Implications of Environmental Diversity in the Central Texas Archeological Region

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ABSTRACT

The Central Texas environment is usually described in terms of Blair's (1950) biotic provinces. However, Blair's provinces obscure wide environmental diversity, even within the relatively small area subsumed under Elton Prewitt's (1981, 1985) version of the Central Texas archeological region. As a result, hunter-gatherers distributed across Prewitt's Central Texas would have faced substantially–even radically–different subsistence challenges, and any synchronic regional description or comprehensive explanation of prehistory in the region as a whole would necessarily gloss over a wide range of diversity. Furthermore, under conditions of uniform precipitation change, environments in different parts of Central Texas will not change uniformly. Even if a single climate history applies all across the region, different cultural or processual histories will occur in different places because substantially different adaptive challenges will be imposed on people who already had substantially different subsistence regimes. Thus, any regional culture or processual history would have to gloss over a wide range of adaptive responses that lie at the heart of any prehistory of Central Texas. Consequently, to achieve any accuracy about the cultures and/or processes that characterize Central Texas prehistory as a whole, it is necessary to simplify our descriptions of cultures and/or processes to a series of quintessential constructs that do not refer to the people or activities we are interested in understanding as prehistorians.

Rounding off lies at the heart of working with symbols and speech. Rounding off compresses information. It simplifies matters and reduces the many to the few, reduces the complex to the manageable. . . . We have to simplify to get things going, at least at first. No harm in that. But actions have costs.

—Kosko (1993:90)

When you speak, you simplify. And when you simplify, you lie.

—Kosko (1993:86)

INTRODUCTION

Central Texas traditionally has been treated as a relevant match-up between prehistory and geography. However, despite the fact that archeologists have begun to question their basic approaches to, and assumptions about, Central Texas prehistory (e. g., Potter and Black 1995; Ellis 1994; Black et al. 1993; Collins 1991), the validity and utility of the term "Central Texas" has yet to be evaluated to determine the extent to which the term is relevant to either culture history or processual approaches to archeology. In our view, the term "Central Texas" obscures too much environmental variability to be useful as a spatial concept around which to build our knowledge of prehistory: despite the fact that typologically similar artifacts occur widely in and around Central Texas, the environment subsumed within this area is simply too variable to support talk about "Central Texas archeology" except in overgeneralized terms.

Our argument is as follows. Although the Central Texas environment traditionally has been described in terms of Blair's (1950) biotic provinces, more recent environmental studies show that there is wide environmental diversity within Blair's provinces, even within the relatively small area subsumed under Prewitt's (1981) version of the Central

Texas archeological region. By looking at an array of hypothetical hunter-gatherer territories distributed across Prewitt's Central Texas, it is obvious that groups exploiting different parts of the region would face substantially–even radically–different subsistence challenges at any given time. Thus, any synchronic regional description or explanation of prehistory in the region would gloss over a wide range of diversity.

Furthermore, recent paleoclimate research has produced a series of conflicting models of Central Texas climate history: if Central Texas can be subsumed under a single climate model, then at least one of the extant climate models must be false. In any event, examining hypothetical change in precipitation shows that under conditions of uniform precipitation change, environments in different parts of Central Texas will not change uniformly. Even if a single climate history applies to all of the region, different culture or processual histories will occur in different parts of the region because substantially different adaptive challenges must be met by peoples who already had substantially different subsistence practices. Simply put, any regional culture or processual history would have to gloss over or ignore a wide range of adaptive responses that lie at the heart of any prehistory of Central Texas. As a result, to achieve any accuracy about the cultures and/or processes that characterize Central Texas prehistory *as a whole,* it is necessary to simplify our descriptions of cultures and/or processes to a series of quintessential, lowest-common-denominator constructs. However, the price of such simplification is high because to attempt to identify accurate region-wide quintessential constructs creates fictive entities that do not refer to the people or activities we are interested in learning about as prehistorians.

WHERE IS CENTRAL TEXAS, ANYWAY?

Central Texas has traditionally encompassed most or all of the Edwards Plateau and varying adjacent areas. However, the "Central Texas" geographic region has no well-fixed boundaries: they shift with each new problem. Studies that focus on geologic problems generally depict Central Texas differently from studies that focus on natural vegetation, fauna, or archeology. For example, Spearing's (1991:112) geologic study of Texas defines Central Texas as encompassing all of the Edwards Plateau, the Hill Country, and the Llano Uplift, with the Balcones Escarpment representing its eastern margin. However, in Gehlbach's (1991:Figure 1) analysis of terrestrial vertebrates, Central Texas begins at the eastern margins of the Edwards Plateau and extends past the escarpment to the Trinity River on the northeast and Grimes and Washington counties on the southeast. Thus, it appears that "Central Texas" is not so much a discrete geographic area, as it is more a study area that is defined by the nature of a particular problem and by the state of current understanding about the phenomena relevant to that problem.

If Central Texas is more a study area than a discrete geographic area, then how do we draw geographic boundaries for the Central Texas archeological region? If the boundaries are drawn on the basis of specific problems, then by what criteria do we affix geographic boundaries to cultural boundaries? For purposes of the present discussion, we focus on the relationship between the geographic boundaries that presently define the Central Texas archeological region and the environmental domains they encompass.

Over the past 40 years, the geographic boundaries of the Central Texas archeological region have shifted (Figure 1). As archeological research progressed and new data came to light, the geographic boundaries shifted to reflect the results of new investigations. However, as Suhm (1960:63) pointed out, there are no precise boundaries for the region and "one can anticipate that they will always remain somewhat fuzzy."

In 1954, Suhm et al. (1954:102-112) used trait complexes to define the boundary of the Edwards Plateau Aspect or Archaic Stage in Central Texas prehistory. It covered a large area from the Brazos River basin on the northeast and southeast, and extended westward to about Sterling County on the northwest and the headwaters of the Devil's and Nueces rivers on the southwest. It reached approximately as far north as Jones County and then as far south as Victoria County (Suhm et al. 1954:Figure 4). A second somewhat more restricted area was defined for the later chronological stage known as the Central Texas Aspect of the Neo-American Stage. The Central Texas Aspect was seen as extending from the Brazos River drainage on the east and north, to about Tom Green and Edwards counties on the west, and to the central Gulf Coastal Plain on the south (Suhm et al. 1954:112 and Figure 5).

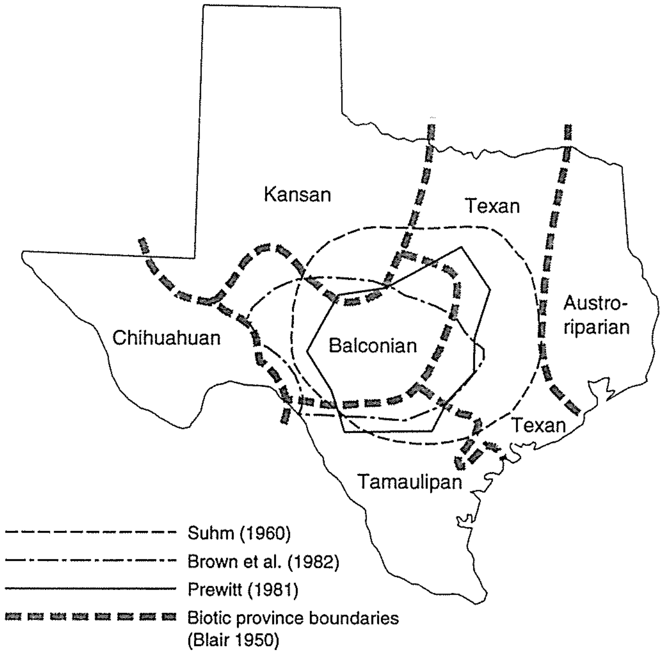

Figure 1. Selected versions of the Central Texas Archeological Region and their relationship to Blair's (1950) biotic provinces.

By 1960, the geographic boundaries of prehistoric Central Texas more closely resembled the 1954 boundaries ascribed to the Central Texas Aspect, except that the eastern boundary had shifted to include portions of the Trinity River basin. Suhm (1960:63 and Figure 1) defined the Central Texas archeological region as:

> embracing the middle stretches of the Colorado and Brazos rivers and their tributaries. More specifically, it customarily extended westward to include Tom Green and Edwards counties, northward to a line reaching from Jones to Kaufman counties, eastward to the middle Trinity River, and southward to approximately the central section of the Gulf Coastal Plain.

Weir's (1976) definition of prehistoric Central Texas appears to include an area similar to that defined by Suhm (1960). For Weir (1976:1), Central Texas included "the headwaters of the Nueces and Guadalupe rivers, and the middle stretches of the Colorado and Brazos rivers including their tributaries." His northern and northeastern boundaries were less explicit, being defined only as "from the Plateau onto the Blackland Prairies, and northward onto the Grand and Rolling prairies" (Weir 1976:2). No southern boundary was noted, and no map was given.

A similar geographic area was included within the Central Texas archeological region defined by Brown et al. (1982) during the Texas Historical Commission's Resource Protection Planning Project. Using an interdisciplinary approach, geographic boundaries were defined based on specific sociocultural systems. These boundaries were seen as "transitional demarcations" that may or may not have changed through time, and were designed after Suhm (1960) and Weir (1976). For Central Texas, these boundaries remained relatively unchanged from Archaic times through the Late Prehistoric (Brown et al. 1982:Figures 4 and 5). The Brown et al. (1982) study defined the Central Texas Archaic/Late Prehistoric geographic extent as extending to just below the escarpment on its southern edge. At its eastern margins it was seen as extending northeastward along a line running from southern Bexar County to eastern Lee County. Its northern boundary extended just to the north of the middle stretches of the Colorado River and included the southern portions of Runnels and Coke counties. Its western boundary included eastern Val Verde County, most of Crockett County, and western Reagan County.

Currently, the most commonly used geographic boundaries for the Central Texas archeological region are those defined by Prewitt (1981). In his attempt to devise a cultural chronology for the area, Prewitt (1981:72 and Figure 2) narrowed the defined boundaries to include fewer counties on its northern, western, and eastern margins. Prewitt (1981:71) did note that although geographic boundaries may shift through time, the greater Central Texas archeological region was seen as including:

> the eastern half of the Edwards Plateau, the Llano Uplift, most of the Lampasas Cut Plains, the Comanche Plateau, the southern end of the Grand Prairie, and the Blackland Prairies bordering the Balcones Escarpment from near Waco to near Uvalde.

It should be noted, however, that Prewitt's Central Texas, although smaller than previously defined regions, still includes all or part of 47 Texas counties.

Regardless of which definition one accepts, the Central Texas archeological region has vague geographic boundaries, and encompasses an environmentally diverse area that is characterized by dramatic changes in landscapes, climatic variations, and vegetative zones. Note that the wider the definition one accepts for "Central Texas" (whether geographic or archeological), the greater the environmental diversity it contains. In what follows, we will arbitrarily accept Prewitt's definition of "Central Texas." Because Prewitt's Central Texas is relatively small, if it subsumes too much environmental diversity to be a plausible match-up between geography and culture, the other schemes will, too.

ENVIRONMENTAL DIVERSITY IN PREWITT'S CENTRAL TEXAS

To understand why the term "Central Texas" may not be especially informative for archeological purposes, it is useful to begin with a discussion of current conditions of environmental diversity. Until recently, Blair's (1950) discussion of biotic provinces has been the virtually universal reference of choice in archeological discussions of flora and fauna.

One feature of this historical practice is that Blair's model subsumes a very large portion of all archeological versions of "Central Texas" under a single biotic rubric–the Balconian province. In Prewitt's Central Texas, the counties not contained in the Balconian province are contained in the Texan, Kansan, and Tamaulipan provinces. The historical association between Prewitt's (and others') Central Texas and Blair's Balconian province has helped reinforce the notion that the former is a relevant match-up between prehistory and geography. The distributions of geology, large-scale landforms, biota, and typologically distinct artifacts seem to provide a basis for judging that the spatial conjunction of artifactual and environmental evidence is too close to be a coincidence.

However, Blair's biotic provinces are fairly blunt descriptive instruments. The Central Texas archeological region encompasses all or part of six natural vegetative regions: Oak Woods and Prairies, Blackland Prairies, Edwards Plateau, Llano Uplift, Rolling Plains, and South Texas Plains. The major regions represent broad and general distributions of plant communities that can be distinguished on the basis of physiographic and biological differences. These major regions can be divided further into subregions representing varying, distinctive vegetative patterns that occur within the larger, associated plant communities (Lyndon B. Johnson School of Public Affairs [LBJ] 1978:20-24 and Figure 2; McMahan et al. 1984; Van Auken 1988). Table 1 and Figure 2 show the natural regions and subregions included in Prewitt's Central Texas.

Two of the Edwards Plateau subregions, the Live Oak-Mesquite Savanna and the Balcones Canyonlands, lie entirely within the Balconian province. The undissected uplands of the central and western Edwards Plateau are known as the Live

Table 1. Natural Regions and Subregions in and Around Prewitt's Central Texas

Regions	Subregions
Oak Woods and Prairies	Post Oak Savanna* Eastern Cross Timbers Western Cross Timbers
Blackland Prairies	Blackland Prairie Grand Prairie
Rolling Plains	Mesquite Plains Escarpment Breaks** Canadian Breaks**
Llano Uplift	Mesquite Savanna Oak & Oak-Hickory Woodlands
Edwards Plateau	Live Oak-Mesquite Savanna Balcones Canyonlands Lampasas Cut Plains
South Texas Plains	South Texas Brush Country Bordas Escarpment** Subtropical Zone*

* Prewitt's Central Texas does not contain these subregions, but Suhm's does.

** Neither Prewitt's nor Suhm's Central Texas includes these subregions.

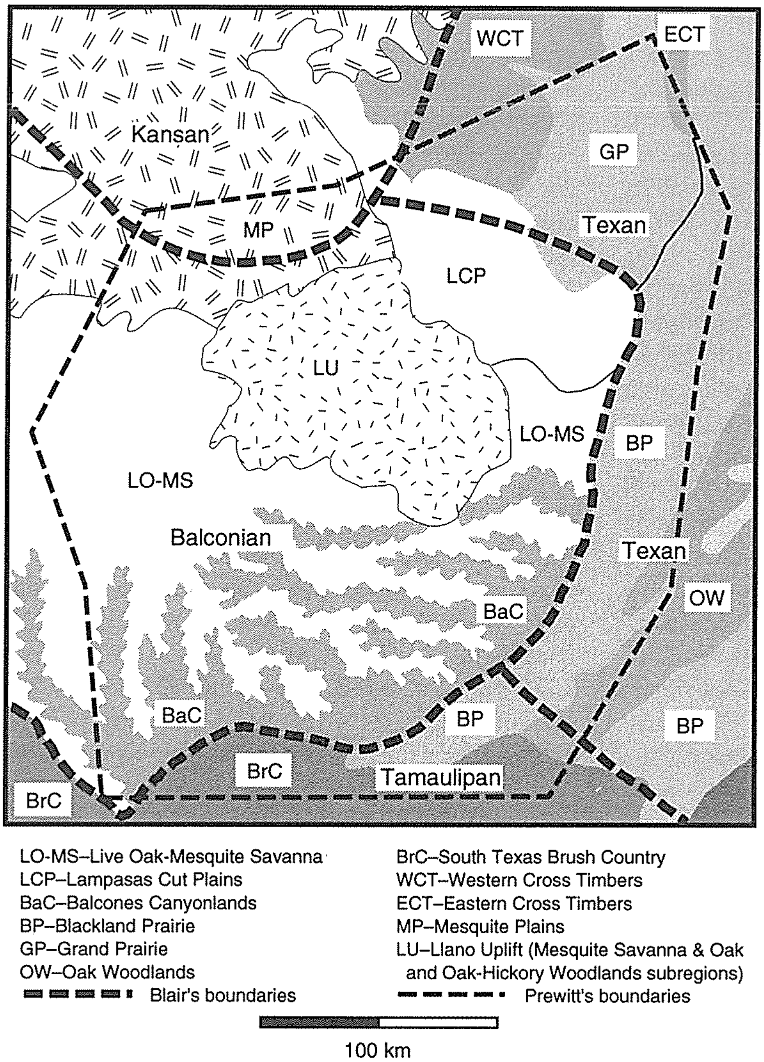

Figure 2. Natural subregions of Central Texas (LBJ School of Public Affairs 1978) and Blair's (1950) biotic provinces. Subregions of the Llano Uplift cannot be resolved clearly at this scale. Note the gross environmental diversity within the biotic provinces and Prewitt's Central Texas.

Oak-Mesquite Savanna. This portion of the Edwards Plateau is more xeric and is characterized by a grassland-woodland-shrubland mosaic. Here, woody plants and scrubs grow in clusters surrounded by continuous grasslands such as Texas wintergrass and little bluestem. The patchy landscape of the central portion of the region supports more woodland mixtures of mesquite, Texas oak, Shin oak, cedar elm, and hackberry. At its western edge, mesquite-juniper shrublands mixed with yucca, sotol, and Texas prickly pear predominate (LBJ 1978:Figure 2; Diamond et al. 1987:204, 208-211; McMahan et al. 1984:10, 17). Of the more than 400 species of terrestrial vertebrate found on the Edwards Plateau, only a few are actually endemic to the area (Dixon 1987, cited in Toomey et al. 1993).

In the more mesic Balcones Canyonlands subregion, plant communities are dominated by evergreen woodlands and deciduous forests. The steep slopes are covered by short-stature woodlands ranging from evergreen juniper and juniper-oak to deciduous mixed-oak-hardwood woodlands. Along high gradient perennial streamsides, bald cypress and sycamore predominate, while intermittent drainages support sycamore woodlands or cedar elm. Floodplains along major, perennial waterways have gallery forests whose composition varies considerably from east to west. For example, in the eastern, more mesic bottoms, pecans and chinkapin oaks predominate, while in the western, more xeric bottoms, live oak and cedar elm predominate. Grasslands are primarily restricted to drainage divides and include both mid- and short-grass varieties (LBJ 1978:Figure 2; Riskind and Diamond 1986:24-25; Van Auken 1988:52-55). Although there are several species of terrestrial reptiles, nesting songbirds, and mammals endemic to the Balcones Canyonlands (Blair 1950:112; Kutac and Caran 1994:10), the area also reflects an intermixture of fauna (Gehlbach 1991:420).

The Lampasas Cut Plain overlaps two biotic provinces, the Balconian and the Kansan. Biologically, it represents a transitional area between the Edwards Plateau and the Oak Woods and Prairies region (Kutac and Caran 1994:11), and studies often disagree as to which vegetative region this area is most closely affiliated. Some studies suggest that it is most closely affiliated with the plant communities of the Edwards Plateau vegetative region (see LBJ 1978; Riskind and Diamond 1986), while others think the area is more closely related to the prairie vegetative region (see Diamond and Smeins 1985; McMahan et al. 1984). In general, the more mesic climate of the Lampasas Cut Plain results in taller trees than those found in the upland Live Oak-Mesquite Savanna of the Edwards Plateau. There are, however, fewer drainages and more open grassland prairies than in the Balcones Canyonlands, and there are fewer southern elements, such as Mexican pinyon and Lacey oaks. The shallow soils of the area support a more open woodland of post oak, blackjack oak, Ashe juniper, hickory, and mesquite, intermixed with tall-, mid-, and short-grass prairies (Riskind and Diamond 1986:29). Many of the fauna in this subregion are at their edge of range (Gehlbach 1991:422).

The Llano Uplift is part of the Balconian biotic province. Its sandier soils and rolling topography are dominated by Oak-Hickory Woodlands interspersed with Mesquite-Whitebrush Savannas. These two subregions are patchily distributed in the region and cannot be distinguished as subregions in Figure 2. Weathering of the granite has produced coarse textured, gravelly to stony sandy loams supporting a mesquite-whitebrush savanna. Pockets of deep, well-watered sandy soils occur in the stream bottoms and support an Oak and Oak-Hickory Woodlands. While live oak, post oak, and blackjack oak abound, there is a conspicuous absence of the Texas oak and Ashe juniper that are so common throughout the Edwards Plateau. In general, the uplift area has a greater affinity with plant communities to the north/northeast rather than with plant communities to the west and south (Arbingast et al. 1973:10; Diamond et al. 1987:204, 208-211; LBJ 1978:22; Riskind and Diamond 1986:29).

The Mesquite Plains, a subregion of the Rolling Plains, lie within the Kansan biotic province. Although it represents the southernmost extension of the Great Plains, the Mesquite Plains receive more precipitation. The moderately rolling topography is dissected by narrow intermittent stream valleys that also make the Mesquite Plains better drained than the Great Plains. The soils, ranging from coarse sands to red-bed clays, support a predominately mesquite-grasslands mosaic (Blair 1950:109-112; Gould 1962:12-13). Grasslands include a number of mid- and tall-grass species; however, mesquite appears to have increased significantly during historic times. Oaks are also present, and cedar mixes with the deciduous trees in the western portions of the Mesquite Plains (Diamond et al. 1987:207-212; LBJ 1978:22-23). Only a few faunal species are endemic to the area; rather, most are intermixtures of species that prefer either eastern evergreen woodland or western grassland habitats. For example, of the more than 30 species of snakes found in the area only one species, *Tatrix harteri*, is restricted to the Mesquite Plains (Blair 1950:110-112).

The Blackland Prairie and the Grand Prairie lie within the Texan biotic province. They form the southernmost extension of the True Prairie communities to the north (Diamond and Smeins 1985:307). The dark, calcareous clay soils of the Blackland Prairie support predominately tall-grass prairies that have, in recent years, been invaded by mesquite, blackjack oak, and post oak. Isolated bands of Blackland Prairies occur within the Oak Woods and Prairies region to the east (LBJ 1978:19-20), while the Balcones Escarpment serves as its western boundary. This area forms a range barrier to the east-west dispersal of a number of faunal species (Gehlbach 1991:423).

The slight topographic and lithologic differences between the Grand Prairie and the Blackland Prairie create somewhat different vegetative zones. The Grand Prairie, with its gently sloping, almost level, surfaces and shallower Mollisols, supports a mid-grass rather than tall-grass prairie. Annual forbs, such as *Gaillardia* (members of the sunflower family) and *Draba* (members of the mustard family), are also abundant. However, due to increased grazing activities, perennial forbs (and grasses) have increased significantly. Woody plants, such as mesquite, blackjack oak, and hackberry, are confined to the valleys and stream margins (Dyksterhuis 1946; LBJ 1978).

The Western and Eastern Cross Timbers, subregions of the Oak Woods and Prairies, lie within the Texan biotic province. These continuous belts of woodland/forest extend southward from the Red River, crosscutting, rather than paralleling, the major river valleys and flanking the Grand Prairie. Due to the difference in rainfall amounts, the Western Cross Timbers are less well-developed than the Eastern Cross Timbers.

In the Western Cross Timbers region, the vegetative patterns reflect the character of the underlying geological formations and the rainfall patterns. The original savanna-like landscape has been severely modified by grazing. Today, the overstory vegetation consists primarily of woodlands of blackjack oak, post oak, and black hickory. Mesquite is a recent invader. Originally, the understory vegetation was essentially prairie-like, in that tall-and mid-grass species predominated. However, since the 1850s, short-grass species and perennial grasses, such as buffalograss, have almost wholly displaced the tall- and mid-grass species (Dyksterhuis 1946; LBJ 1978:20-21). Fauna in the Western Cross Timbers subregion is a mix of both eastern Austroriparian species and western grassland species (Gehlbach 1991). (For a more detailed discussion of the environment of the Western Cross Timbers subregion, see Gardner [1992].)

The Eastern Cross Timbers subregion consists of a narrow strip of woodland/forest that separates the Grand Prairie from the Blackland Prairie. This subregion has woody vegetation that is common to both the Western Cross Timbers and the Post Oak Savanna.[1] Blackjack oak, post oak, and black hickory are also common in the Eastern Cross Timbers. However, due to the more abundant rainfall in this subregion, forests are denser and taller here than they are in the Western Cross Timbers. In places where the oak overstory is thinner, prairies of mid-grass species, such as little bluestem, are also found. During historic times, this subregion has also been severely impacted by cultivation and grazing. As a result, the Eastern Cross Timbers subregion has been heavily overrun by mesquite, juniper, and other woody brush types (Diamond et al. 1987:206-209; LBJ 1978:20; Texas Almanac 1994:95).

The South Texas Brush Country, a subregion of the South Texas Plains, is an area of thorny brush and grassland. Originally a more open grassland or savanna, historical land use patterns, such as grazing, have significantly altered the landscape. Thorny short brush, such as cactus and bullnettle, and tall brush, such as mesquite and spiny hackberry, are now the principal vegetation in the area. Mid- and short-grass species predominate (Diamond et al. 1987:207, 210-211; LBJ 1978:21; Texas Almanac 1994:95).

Thus, when moving from north to south or from east to west across Prewitt's Central Texas, locally specific physiographic, climatic, and biotic elements interact to produce a wide range of distinctive environments. Within each major natural region, there are distinctive subregions whose plant communities are distributed along soil and moisture gradients with local modifying factors such as exposure, relief, and soil depth (see Van Auken 1988:55). The importance of the close relationship between geology, soils, topography, climatic, and biotic elements should not be underestimated because each has important influences on the structure and content of the environment. Moreover, it is important to recognize that despite the fact that the defining features of each subregion produce a much more differentiated description of major environmental features than do Blair's (1950) biotic provinces, these subregions nonetheless do obscure a great deal of local environmental variation.

The pattern of environmental diversity in Central Texas becomes much more complex when the regional variability of mean annual precipitation is added to the picture (Figure 3). In general, precipitation declines from east to west, with isohyets bulging markedly westward at the southeast edge of the Edwards Plateau. Mean annual precipitation ranges from about 36 inches in the southeastern corner to less than 22 inches at the west-central edge. Since biological productivity within any natural subregion depends largely on precipitation (cf. Owen and Schmidly 1986), one can readily divide each of the subregions on the basis of precipitation, forming "subsubregions" that comprise specific moisture regimes within the larger patterns of climate, geology, soils, topography. and vegetation that make up the natural subregions. Net primary above-ground productivity of vegetation decreases by about 145 $g/m^2/yr$ for each 2 inch decrease in mean annual precipitation from east to west (Table 2). Thus, for example, the area of the Live Oak-Mesquite Savanna at the 22 inch isohyet (763 $g/m^2/yr$) is about half as productive as the area at the 32 inch isohyet (1490 $g/m^2/yr$). These precipitation-based subsubregions therefore represent distinct subdivisions of biological productivity within their respective subregions and regions.

As areas with a particular range of mean annual precipitation values, the subsubregions also are places that have distinct probability distributions for the occurrence of more or less than average yearly precipitation. As a result, in each

[1]The Post Oak Savanna is east of the area depicted in Figure 2.

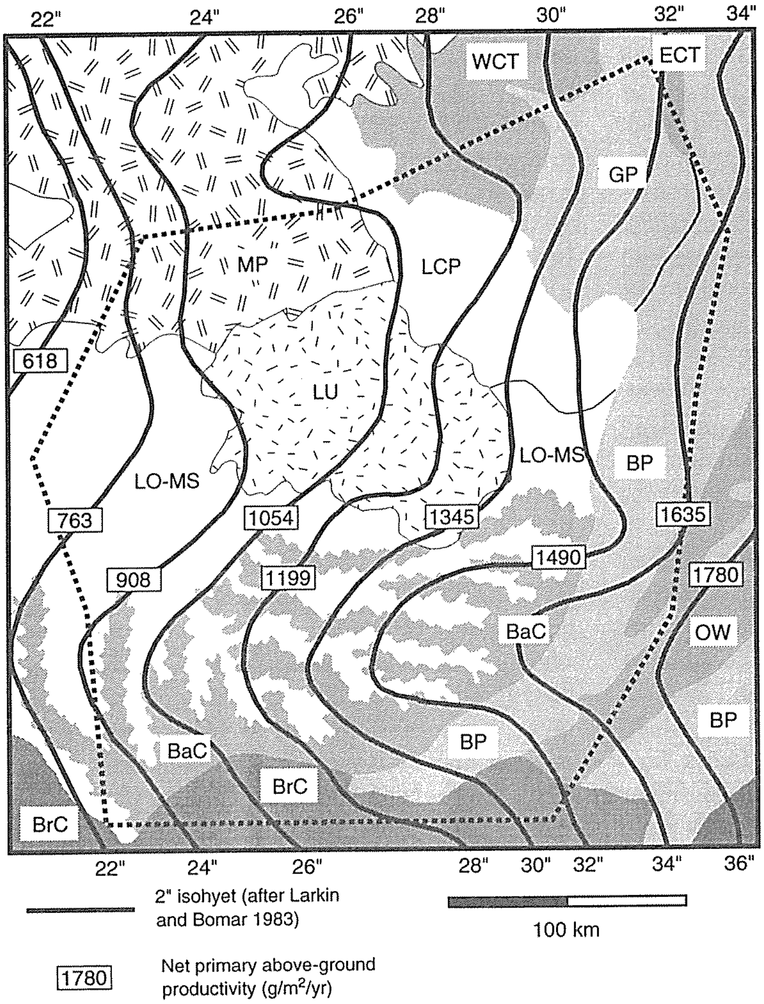

Figure 3. Precipitation and natural environments. Isohyets divide natural subregions into "subsubregions" with different productivity characteristics, increasing the resolution of environmental diversity in Prewitt's Central Texas.

subsubregion, the annual total productivity of any given plant resource would vary from year to year—sometimes drastically—as a function of normal oscillations above and below the mean (including normal seasonal oscillations). Consequently, each subsubregion is characterized by a different probability distribution with respect to the frequency at which a given plant resource would fail as a result of precipitation that was too much, too little, too early, or too late.

Since the different subsubregions occupy different places on the overall precipitation gradient, a normal oscillation that produces a resource failure in one subsubregion might not produce a resource failure in another. For example, a relatively dry year with a 2 inch deviation from mean annual precipitation in the Live Oak-Mesquite Savanna subsubregion at the 22 inch and 32 inch isohyets would reduce annual productivity by about 145 g/m^2 in both places. However, the area at the 22 inch isohyet would have a 19 percent productivity loss, whereas the area at the 32 inch isohyet would have a 10 percent loss. Thus, the amount of precipitation in the west might fall below the failure threshold for a particular resource without doing so in the east. Hence, in a year that was relatively dry all over the region, resource failure might occur in a western subsubregion without occurring in an eastern one.

It is within these smaller-scale patterns of local environmental variation that culture and processual histories have been played out during the course of prehistory. At any given time, Central Texans had at their disposal a cultural geography (consisting, among other things, of their knowledge of how resources are distributed in space and time in their territories) and a range of learned, more or less patterned procedures for accomodating their subsistence activities to known patterns of resource availability. Some subsistence activities, such as the Mariames' well known "tuna trek" (cf. Potter and Black 1995), are patterned at the strategic level, and reflect tried and true formulas for being in the right general area at the right general time to accomplish certain subsistence goals. Other subsistence activities are patterned at the tactical level, and reflect tried and true gambits for achieving strategic goals in a specific place at a specific time under specific conditions. For example, Eskimos and Ngatatjaras frequently leave areas with abundantly available resources to obtain information about resource availability elsewehere, or to exploit less secure resource bases, knowing that if they fail, they have a safety net (Binford 1983:204-205).

For lack of a better term, we will refer to patterned strategic and tactical subsistence

Table 2. Relationship between net primary above-ground productivity and mean annual precipitation

Mean Annual Precipitation	Net Primary Above-Ground Productivity (g/m²/yr)	Comparative Productivity Differentials (g/m²/yr)								
		20”	22”	24”	26”	28”	30”	32”	34”	36"
20”	618	0	145	290	435	580	725	870	1015	1160
22”	763		0	145	290	435	580	725	870	1015
24”	908			0	145	290	435	580	725	870
26”	1054				0	145	290	435	580	725
28”	1199					0	145	290	435	580
30”	1345						0	145	290	435
32”	1490							0	145	290
34”	1635								0	145
36"	1780									0

Note: Calculated from data in Owen and Schmidly (1986:Table 2) by linear regression of productivity against mean annual precipitation. Comparative productivity differentials are rounded.

procedures as “practices” in which fulfilling subsistence goals depends on successful integration of strategies and tactical activities on a day-to-day, season-to-season basis. Indeed, some of the most important tactical gambits are the ones that enable a group to respond successfully to an unforeseen resource failure by adjusting their strategic mobility plans and/or implementing back-up tactics that ordinarily would not have been the chosen course of action (cf. Binford 1983:207-208). At any given time, then, a successful adaptation is one in which a population has (and passes on to its children) subsistence practices enabling them to deal with resource failures that follow normal oscillations around precipitation means, including wet and dry extremes. In other words, a successful subsistence practice is one in which the members of any given group had back-up procedures (including scheduling, mobility, social, and other mechanisms) that would allow them to cope successfully with resource failures of particular kinds and magnitudes. However, a strategy or tactical gambit that serves as a back-up response to worse-than-average conditions in one subsubregion would probably work as a prime response to average conditions in another. Thus, successful subsistence practices in any given subsubregion would consist of an array of strategic and tactical decision-making responses that are implemented at varying frequencies that largely correspond to the frequencies at which variations in precipitation lead to resource abundance or failure. Given the broad range of natural subregions in Prewitt’s Central Texas, it should be very surprising indeed if prehistory in the region could be accurately and precisely described in terms of a single culture or processual history because subsistence practices and cultural geographies are culture traits which must be as highly variable as the region or subregion they were developed in.

A THOUGHT EXPERIMENT: HUNTER-GATHERERS ON A DIVERSE LANDSCAPE

In order to see the effects of environmental diversity on the possibility of a unified culture or processual history in Central Texas, it would be useful to impose some hunter-gatherer territories onto the landscape. However, no nonspeculative estimates of territory size are available for the region since little attention has yet been paid to exactly what the term “highly mobile” means when it is applied in the region. Since the Alaskan Nunamiut are undoubtedly familiar to many readers, they provide a good worst-case example since the Nunamiut occupy an area that is much less climatically favorable than Central Texas. The residential core of a Nunamiut annual range may be up to 5,400 km², and the area exploited during a year may be up to 25,000 km² (Binford 1983:110).

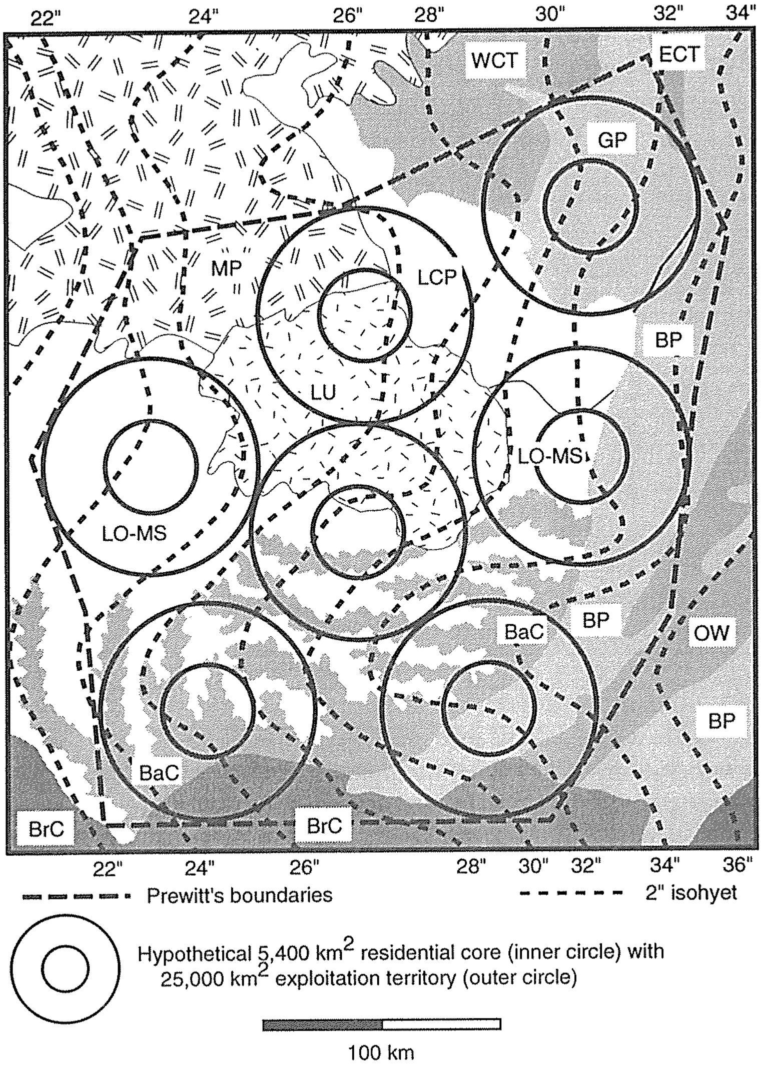

Figure 4. Hypothetical Nunamiut-size territories superimposed over Central Texas. Even these overly large territories contain comparatively different ranges of environmental characteristics and biological productivity.

If a series of idealized, Nunamiut-size residential cores and exploited territories are distributed around Prewitt's Central Texas (Figure 4), we can see that despite the very large size of these territories, the people occupying them face quite different adaptive challenges.

For example, superimposing these territories at the southern corners of the region yields two territories with large areas of interfingered Canyonlands and Live Oak-Mesquite Savanna. However, the western territory is composed almost entirely of this mix with a relatively small amount of Brush Country, whereas the eastern territory includes a large expanse of Blackland Prairie and small expanses of Brush Country and Oak Woodlands. Moreover, the western territory is substantially drier, and hence less productive than the eastern one: plant productivity ranges from 908-1343 g/m^2/yr in the western territory and from 1272-1573 g/m^2 in the east. The most productive area of the western territory is only marginally more productive than the least productive eastern area.

In contrast to these territories, another fits almost entirely within the Live Oak-Mesquite Savanna. Unlike other territories containing the Savanna, this one occupies the driest Savanna subsubregions in Prewitt's Central Texas. However, even this territory is not overly homogeneous because it contains a precipitation gradient that ranges from a high of just under 26 inches to a low of about 21 inches, a difference that differentially affects biological productivity in the territory. An examination of all of the territories shows that regardless of which subregions they occupy, they all subsume a precipitation gradient of at least 4 inches and a productivity gradient of at least 290 g/m^2/yr. They also occupy generally different positions on the scale between minimum and maximum precipitation in Prewitt's Central Texas. Even if hunter-gatherer groups occupied and exploited huge territories, the territories would subsume a wide variety of natural/moisture subsubregions, many of which would not closely resemble the mix or range of subsubregions in other territories.

Of course, it is unlikely that Central Texans required or used Nunamiut-size territories to support themselves. If we envision a distribution of 5,400 km^2 territories (the smaller circles), we see that groups occupying smaller territories would be exploiting less geographically diverse environments that were restricted to narrower portions of the precipitation and productivity gradients. As a result, we see groups faced with subsisting within smaller arrays of distinct subsubregions. Thus, as territory size decreases to more realistic parameters, the array of distinct environments exploited by different Central Texas groups would multiply dramatically so that there is no quintessential Central Texas environment or cultural geography, even if there are at least some quintessentially Central Texan culture traits.

However, subsistence practices (i.e., combinations of strategic and tactical activities) would not be on the list of quintessential traits because the different environments of the region would require Central Texans to make widely divergent economic choices from season to season and year to year. In other words, to the extent that environment-specific subsistence practices are part of the cultures to be described in an accurate Willey and Phillips-like culture history of Central Texas, this very important aspect of culture would not be shared throughout the region. There is virtually no chance that subsistence strategies would be similar enough all across the region to be subsumed under a single description of adaptive process that accurately captures the variability of strategic and tactical decision-making that *must* accompany the region's environmental variability. Even in periods when typologically similar artifacts occur all across the region, the economic aspects of culture would be so variable that no single description could accurately circumscribe them withouit simplifying them so much that the description does not refer meaningfully to an economy that actually existed.

CLIMATE CHANGE IN CENTRAL TEXAS

Diachronic environmental variability compounds the improbability of a culture or processual history that could characterize the region as a whole. The reason for this is that the diverse environmental baseline would lead to differential environmental responses (and opportunities) for people in different parts of the region. To illustrate this, it would be useful to examine the effects of climate change on hunter-gatherer populations. Unfortunately, paleoclimate research has not advanced to the point where one can examine the history of climatically induced environmental change in a rigorous way. Hence, we will resort to another hypothetical exercise. Before doing so, however, let us examine the state of paleoclimate research since many readers will be put off by the foregoing claim about the utility of existing paleoclimate models.

Over the last several decades, paleoclimate models have become an increasingly common element of archeology in Central Texas. A broad array of kinds of evidence has been used to build these models, and a broad array of models has been forthcoming. Among the kinds of evidence that has been used are fossil vertebrates (e.g., Lundelius 1967; Toomey 1993; Toomey et al. 1993), pollen (e.g., Bryant and Shafer 1977; Bryant and Holloway 1985), geomorphic changes (e.g., Blum and Valastro 1989; Holliday 1985, 1989; Hall 1990; Nordt 1992; Johnson and Goode 1994; Johnson 1995), stable isotope ratios (e,g., Humphrey and Ferring 1994; Nordt et al. 1994), and fossil invertebrates (Elias 1994; Johnson and Goode 1994; Johnson 1995). Although some of the models are based on a variety of kinds of evidence (e.g., Toomey et al. 1993; Johnson and Goode 1994; Johnson 1995), others are based on a single line of evidence (Nordt et al. 1994) or a very narrow range of evidence (Humphrey and Ferring 1994). Moreover, the source locales for climatic data in most of the models typically come from a highly limited geographic area (e.g., Nordt et al. 1994), and many of the source locales are peripheral to the Central Texas region (e.g., Humphrey and Ferring 1994) in all but the broadest definition of the term "Central Texas." Note that although some of the models were not constructed explicitly for use in Central Texas (e.g., Holliday 1985, 1989; Humphrey and Ferring 1994; Hall 1990), they nevertheless get used as a basis for discussing paleoclimate in Central Texas.

Figure 5 illustrates a range of paleoclimate models that have been constructed for major high-temperature and/or dry periods (i.e., the Altithermal or similar events) in and around Central Texas. In general, the figure shows that different lines of evidence from different places in and around the region have yielded largely different temporal reconstructions of paleoclimate.

It would do little good to elaborate on the differences between the models (see Potter 1995:14-17 for a discussion) because the basic point has already been made implicitly in Figure 5: the current models are mutually exclusive on major and/or minor issues. Part of the mutual exclusivity of the

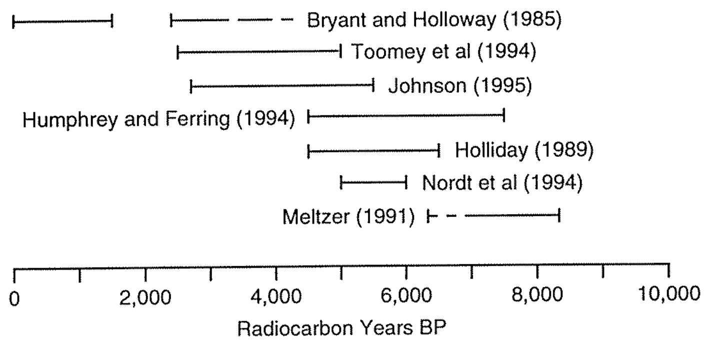

Figure 5. Major hot and/or dry periods postulated by selected models for areas in and around Central Texas. Shorter hot/dry periods have been omitted.

models follows from the fact that different researchers have used different proxy variables as a basis for constructing climate history, which introduces two dimensions of uncertainty about the accuracy of their results.

First, as Caran (1994) notes, none of the proxies that have been used to date in models that are applied in Central Texas are "first-order" proxies from which one can make "first-order" inferences from proxy measurements directly to one or more climatic variables. For example, Nordt et al. (1994) use stable carbon isotope measurements from humic materials as a basis for reconstructing vegetation history, from which they then infer temperature and moisture history. Although the inference from proxy measurements to vegetation can be considered a first-order inference, all subsequent climatic inferences are second- or higher-order inferences, the soundness of which depends on both the soundness of the first-order inference and the soundness of the middle-range theories (sensu Kosso 1991) that support additional inferences from hypothetical vegetation structure to climate conditions. Thus, inaccuracy and/or imprecision may enter into model construction as a function of how accurately and precisely changes in first-order proxy measurements directly reflect the climate values inferred from them. Since each additional order of inference has its own precision constraints (e.g., quantified standard errors of estimates or unquantified levels of uncertainty), the accuracy of second- and higher-order inferences can be maintained only by accepting increasing levels of imprecision, or conversely, decreasing levels of confidence.

Second, each different proxy operates within different process-response (i.e., causal) networks. For example, cut-and-fill cycles are geomorphic responses to the amount and speed of surface runoff (as well as intrinsic thresholds); soil formation episodes are responses to periods of surface stability; differential tree-ring growth is a response to changes in the moisture intake of the plant; and pollen assemblages respond to changes in vegetation structure. Obviously, significant long-term changes in rainfall would affect all four proxies. However, each proxy has a different sensitivity and threshold response to climatic variations (Butzer 1982:27-28). For example, noncomplacent tree species will begin to record a pattern of diminished precipitation immediately, whereas a change in rainfall could take an archeologically significant amount of time to register a detectable change in either geomorphology, soil, or pollen records. Research in central Europe indicates that cycles of downcutting were clearly visible in the European geomorphic record after several centuries. However, striking changes in the pollen record were only visible after several millennia. This implies that "slope-soil-stream subsystems had lower critical thresholds than did the vegetative subsystems" (Butzer 1982:29). Thus, it is difficult to compare the significance of data from one proxy with that of another, which is another way of saying that it may be too optimistic to believe that different proxies *should be expected* to yield directly comparable results.

Moreover, some proxies are subject to equifinality constraints (e.g., Butzer 1982; Blum 1987:103-108; Caran 1994) such that the same outcome can be caused by different things. Nordt (1992), for example, links stream entrenchment at Fort Hood to periods of aridity. However, Hereford (1984) links aggradation in Arizona to increased aridity, while Macklin et al. (1992) link stream entrenchment in Great Britain to periods of increased humidity. Hence, individual fluvial systems may exhibit a wide range of adjustments under changing climatic conditions, and many of these adjustments may have more to do with internal systemic constraints than with climatic change (Blum 1987:103-108). Thus, the accuracy of a climate model is only as high as the researcher's ability to constrain interpretation according to a well developed body of middle-range theory that reduces ambiguity about the relationships between proxies and climatic processes. As a result, part of the models' mutual exclusivity probably follows from the fact that different proxies may record the same climate event in different ways, at different magnitudes, and/or at different times relative to the time of the event's onset. This is another way of saying that two or more different climatic models could be accurate accounts of climate history, but might appear to be mutually exclusive because the proxies record the same climatic events at different levels of temporal precision.

Other elements of mutual exclusivity may result from problems of assigning dates to climatic events. For climate to be an explanatory variable, the timing of climatic change must be correlated in a determinate way with the timing of change in cultural or processual history. Any lag between the time of a change in a crucial climatic variable and the time that the change becomes measurable in one or more proxy variables introduces spurious chronological correlations between climatic and cultural/processual events. In particular, the models are affected by chronological precision constraints. It is especially telling that the chronological boundaries of various events typically fall at even increments of 1000 or 500 radiocarbon years B.P. The fact that climatic events are chronologically bounded in this manner *should* suggest that the chronological precision usually obtained from paleoclimate studies does not come very close to the chronological precision that often can be obtained in a stratigraphic sequence of occupations that reflect different culture-history units or subsistence practices. This issue is important because any given 500 radiocarbon-year interval is long enough to contain two of Prewitt's (1981, 1985) phases, or to subsume part of three of his phases, including two phase-to-phase shifts. Thus, the boundaries between climatic events are not dated precisely enough to tell whether a particular climatic event occurs several hundred years before or after a particular cultural/processual change. As a result, the match-up between climate history and culture/processual history must be regarded as loose. The key problem to be resolved in using paleoclimate as an explanatory dimension is thus to correlate the timing of crucial climatic *thresholds* and crucial changes in the record of cultural or processual history.

Climate is a set of average values accompanied by more or less patterned annual or seasonal oscillations. As such, a climate is characterized by a range of low-, high-, and extreme-magnitude oscillations around average conditions. The range of these oscillations places limits on the extent that many floral and faunal species can flourish or survive in a given area. From a particular species' perspective, a climatic threshold is a set of boundary conditions within which the range of oscillations around average conditions limits its ability to survive and successfully reproduce. With climatic change, a species in a given territory may be progressively decimated by increases in the frequency of years with unfavorable weather conditions. At some point, the range of weather oscillations includes too few favorable years, and climate crosses a crucial threshold beyond which a species cannot survive. Since one species' Purgatory can be another's Eden, a climatic change that progressively decimates or extirpates one species may cross a crucial threshold that eliminates climatic obstacles to colonization or expansion of populations.

For instance, the ability of agaves and cacti to withstand low winter temperatures depends on their ability to "harden" by internally redistributing water and organic molecules (Nobel 1994:102-103). The degree of hardening, however, depends on the speed at which temperature declines from fall to winter values. Furthermore, at any degree of hardening, the length of time that subfreezing temperatures are sustained determines whether cellular dehydration and tissue damage are severe enough to kill the plant. For agaves and cacti to colonize a new territory, therefore, average climatic conditions must cross a threshold where years with rapid fall-to-winter cooling and sustained very low temperatures are rare enough to support reproductively successful populations. Moreover, years with rapid spring-to-summer heating and sustained very high temperatures must remain rare enough to avoid killing off seedlings and pups (Nobel 1994:103-106). Climatic thresholds vary from organism to organism, but all species of flora and fauna have them.

It is important to identify climatic thresholds because in cases where climate best explains culture change, crossing a climatic threshold is the causal factor that leads to culture change (e.g., Meltzer 1991). Consider Johnson's recent and forthcoming (Johnson and Goode 1994; Johnson 1995) model of climate and culture change for the eastern half of Central Texas. Johnson (Johnson and Goode 1994:26) correlates the development of burned rock middens in the Middle Archaic with a gradual drying trend that led to the expansion of succulents, and their exploitation by people who baked them in rock ovens. Johnson's model relies on an unstated claim that climate crossed a threshold that allowed xerophytes to expand their range in Middle Archaic times. Although Johnson's climate/culture model is plausible and well-argued (especially in Johnson 1995), that his model does not address climatic thresholds leaves several issues implicit and unaddressed. First, when did climate conditions cross the threshold that allowed xerophytes to occur in sufficient densities to become enough of a staple to lead to formation of burned rock middens all across the eastern Edwards Plateau? Second, did the warming trend start from thresholds above the tolerance level for xerophytes, or did the warming occur in a climate that already widely supported them across the region? If these thresholds were crossed early, and xerophytes were both widespread and sparsely exploited before the Middle Archaic,[2] then climate changes (at least with respect to climate/xerophyte relationships) would not explain culture change. If these thresholds were crossed later, then climate change might explain the adoption of xerophytes as a staple without explaining why burned rock middens began to form. Third, and of most importance, is the crucial culture-changing threshold one that led to the expansion of xerophytes, or another that led to the extirpation of a different resource? In other words, Johnson could be absolutely correct about a correlation between an unquantified warming trend and the emergence of certain culture traits without being correct about whether climate change has an explanatory role, and without having identified the correct climate/resource relationship(s) that led to culture change.

Thus, the point is not whether Johnson's or anyone else's model is accurate (although at least several of them must be false for Central Texas); rather, the point is that even if they are accurate, they are not sufficiently precise to permit a critical evaluation of the results of using them in descriptions and explanations of culture change. The varying degrees of remoteness between proxies and climatic variables, the absence or imprecision of evidence about the magnitude of climatic events, and the chronological imprecision of climate history, combine to indicate that the models can be used only in impressionistic ways. Of course, many may not be persuaded by this argument, if for no other reason than that our current explanatory needs require *some* climate model. However, as Caran (1994) argues, it is important to recognize that the paleoclimate models we currently apply to Central Texas are not ready to bear the descriptive and explanatory burden which we as prehistorians require of them. Note that we are not arguing that paleoclimate models should not be used. Rather, we argue that they be treated consciously as the provisional, imprecise constructs that they are. Indeed, a productive line of research would be to use climate/culture models to formulate problem-specific hypotheses about the timing of crucial climate thresholds, and to identify proxies capable of showing whether those specific thresholds were crossed.[3]

ANOTHER ENVIRONMENTAL THOUGHT EXPERIMENT

In the absence of a precise climate history, we also argue that one cannot offer a rigorous empirical basis for examining environmental variations that would take place under changing climatic conditions in Central Texas. However, we can examine the relevance of the term "Central Texas" by positing a hypothetical and uniform climatic event that affects the region. By understanding what it would mean to extend a single model of climate change to all of the region, one can appreciate in some detail the extent to which virtually any model of climate change produces a Central Texas environment of extraordinary diversity which, in turn, appears to require an equally diverse history of culture or human adaptation.

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[2]Sotol occurs in stratified context in a hearth dated at about 8000 B.P. at 41UV88 (unpublished data from the Five Burned Rock Midden Sites Project, in progress at the Texas Archeological Research Laboratory).

[3]In Johnson's case, the objective would be to identify the climatic variables that limit sotol and other edible xerophytes, and to identify specific proxies that can address these specific limits. Perhaps a combination of dendroclimatological analyses (cf. Stahle and Cleaveland 1988) of radiocarbon-dated charcoal, analyses of temperature- and moisture-sensitive fauna (cf. Toomey et al. 1993), and epimerization analyses of land snails (cf. Goodfriend and Mitterer 1993) would narrow down the timing of the moisture and temperature thresholds that allow particular xerophytes to flourish.

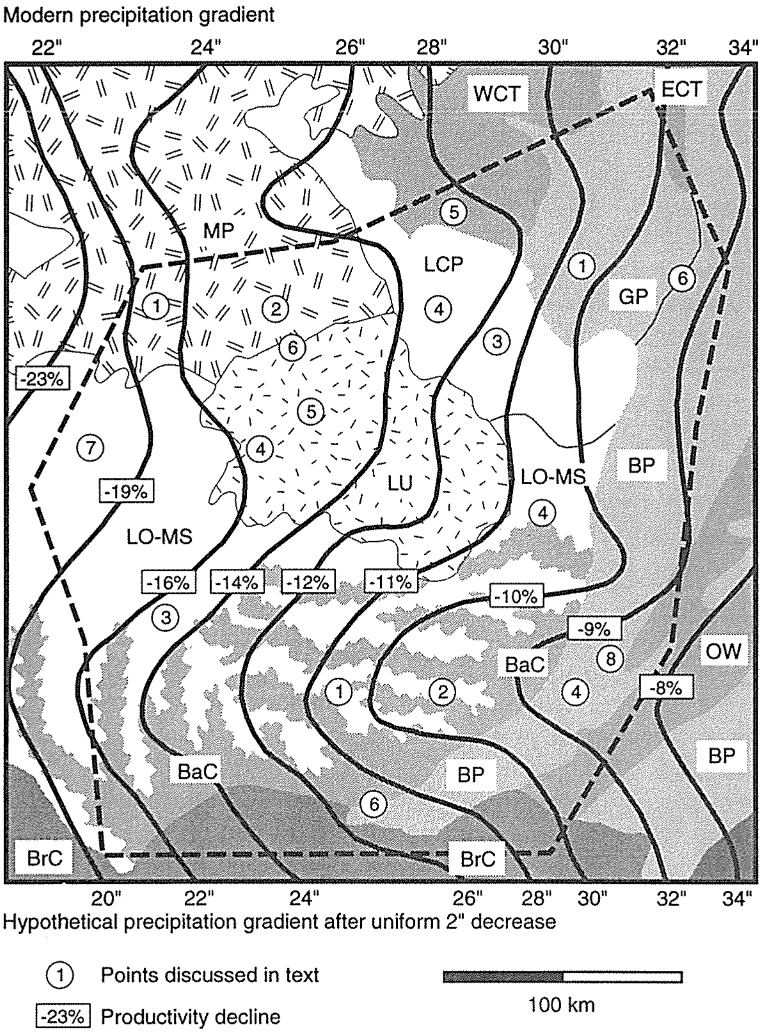

Figure 6. Hypothethical climate change in Prewitt's Central Texas. Uniform precipitation change shifts modern isohyets 2 inches to the east. Productivity declines by 145g/m²/yr at each isohyet. Numbered points are environments discussed in text.

Since moisture gradients are a major determinant of environmental conditions (and a central one in discussions of paleoenvironmental change), consider what happens when the precipitation gradients shift. Suppose that an Altithermal-like event strikes the region, lowering mean annual precipitation by 2 inches (about 5 cm) and shifting the isohyet values to the east.[4] Figure 6 shows the conjunction of natural subregions and precipitation gradients before and after the precipitation shift, and the vegetation productivity losses that would occur at the isohyets. Figure 6 also implicitly shows that shifting the precipitation regime produces a new mosaic that (1) cannot be any more uniform than the previous mosaic, (2) does not simply shift environmental conditions around on the landscape, and (3) presents differential adaptive challenges to people occupying different areas of the region.

Ecological adjustment (sensu Collins and Bousman 1993:55-56) should occur in each natural subregion as a result of starting with the same basic assortment of plants, but changing only precipitation among the nonbiological variables that create natural environments. Thus, ecological adjustment within a given subsubregion would be equivalent to reproducing a drier, less productive version of the existing vegetation regime, which would be roughly equivalent to moving a subsubregion to the east by one pair of isohyets with a concomitant loss of 145 g/m²/yr in net primary above-ground productivity at each isohyet. However, where precipitation (rather than geology, soils, and/or topography) is the limiting variable on vegetation composition, drying could produce basic floristic change in those locations where oscillations around average precipitation falls below thresholds necessary to sustain the major components of the plant populations. Precipitation change could also affect some plants more than others, producing partial floristic change. Vegetation change in any given subsubregion, therefore, could occur along a continuum that ranges from: (1) reduction of total biological productivity with no change in relative frequencies of plant species, to (2) reduction of productivity and changes in species relative frequencies, or to (3) reduction of

[4]This scenario oversimply assumes that other climatic variables do not change and that nonclimatic controls over the locations of isohyet positions keep the isohyets where they are. The implications of this unrealistic assumption arise later, and ultimately reinforce our claims.

productivity with minor to major floristic change in the species composition of the vegetation regime.

The kinds of climate change that archeologists discuss would not occur in any Central Texan's lifespan. However, within the human time-frames that it takes for the precipitation shift to occur, Central Texans would encounter ecological adjustments in terms of increased frequency of resource failures following on dry seasons and decreased frequency of resource failures following on wet seasons. In other words, subsistence tactics for exceptionally wet years would become increasingly unnecessary, subsistence tactics for exceptionally dry years would have to be implemented with increasing frequency, and subsistence tactics for formerly average years would become the decisions implemented in wetter-than-average years. Furthermore, they would encounter cases of partial and/or basic floristic change in terms of changed probabilities of alternative resources in the event that any diminished or lost plant resource (and herbivores that feed on it) was replaced by a new plant resource (and its herbivores). Consequently, back-up and/or alternative tactics for exploiting alternative resources probably would be implemented more frequently. Their ability to sustain their populations would be contingent on their ability to transform their back-up and infrequently used strategies and tactics into more or less typically used strategies, and an ability to recognize alternative resources and incorporate those into their back-up and/or typical practices. The variable subsistence challenges that climate change would present to Central Texans can be illustrated by examining shifts in subsubregions under the initial heuristic assumption that precipitation change leads to ecological adjustment without floristic change.

In the hypothetical scenario, some subregions are simply reproduced to the east (points 1 in Figure 6). In other cases, the eastward shift of isohyets reproduces a relatively small subregion as a relatively large one (points 2) and vice versa (points 3). As a result, the precipitation shift not only moves the isohyets east and changes the amounts of territory subsumed between pairs of isohyets, it also expands and contracts the amount of area that is subject to resource failures that accompany high- and low-magnitude oscillations around mean annual precipitation. In some cases, the precipitation shift cannot simply result in an eastward shift of the natural subsubregions. The precipitation shift at points 4 cannot result in eastward shifts of vegetation regimes because the geologic, edaphic, and topographic characteristics of the subsubregions do not exist to the east.

Consequently, nonbiological elements of the subsubregions limit the extent to which uniform precipitation change can result in uniform environmental change, and the topographic and other environmental controls that modify the shapes of the isohyets ensure that the spatial properties of any given 2 inch precipitation gradient will not be reproduced to the east. The climate shift also creates subsubregions (points 5) that did not previously exist in Central Texas, and ecotones (points 6) between subsubregions that are juxtaposed for the first time. Thus, under conditions of uniform precipitation change: (1) there are changes in the amount of area covered by different portions of the precipitation gradient, (2) some subsubregions are lost as new ones are created, and (3) some spatial juxtapositions of subsubregions are lost as new ones are created. Regardless of whether one deals with prehistory in a framework of culture history or process, these patterns of environmental change would pose adaptive challenges if Central Texans were to successfully weather the climate change.

In many cases, subsubregions shift east to areas of equivalent size and with similar nonbiological environmental characteristics. If people alter their territories to follow the isohyets, then they adapt to climate change by shifting their exploitation zones. They also apply their subsistence practices on slightly different landscapes that otherwise contain the environmental/spatial characteristics with which they are already familiar, and for which they have subsistence practices that require them to simply learn a new landscape. Their primary adaptive challenges are likely to be social if groups to the east do not follow the isohyets and, hence, do not conveniently oblige the immigrants' subsistence goals by creating a residential and exploitation vacuum that circumvents increased competition for a decreasingly productive resource base.

However, if people map onto territories rather than precipitation regimes, they are unlikely to follow the isohyets east (at least until enough subsistence failures accumulate to persuade them otherwise). In this circumstance, former back-up strategies and tactics must become quite regular (albeit, perhaps, not typical) components of year-to-year subsistence activities. Their primary adaptive challenge is to transform subsistence practices for drier-than-average years into strategies for average years, which certainly would involve adjusting mobility patterns. The effects of uniform drying on mobility requirements can be approximated by examining the pattern of change in net primary vegetation productivity that would occur by the end of the precipitation decline.

Although there would be a uniform, region-wide reduction in the *amount* of above-ground productivity, the *percentage* decrease would vary considerably. For example, average productivity in the area between the original 20-22 inch isohyets (point 7 in Figure 6; Table 3) would decline by 19-23 percent across the gradient between isohyets. In contrast, average productivity between the original 34-36 inch isohyets (point 8 in Figure 6) would decline by 8-9 percent. Depending on how directly a percentage decrease in total productivity translates into a percentage increase in the amount of territory needed to harvest a consistent food supply, groups in the west would have to increase their mobility rates much more than that of eastern groups. This pattern would be aggravated in years with worse-than-average precipitation under the new moisture regime. If both areas have years with precipitation 2 inches below their new means, a one-year 145 g/m^2 loss in the west would amount to a productivity loss of 23-31 percent beyond already reduced annual average productivity levels, whereas in the east, the additional loss would be about 9-10 percent.

To accomodate a climate change with a 2 inch decrease in mean annual precipitation with regular 2 inch oscillations below the mean, people in the west would have to adjust their subsistence practices to an environment that averages about 19-23 percent below previous productivity levels, and regularly falls about 38-47 percent below average productivity before the climate change. People in the east, however, would only have to adjust to 8-9 percent average losses, and regular losses of only 16-18 percent below former levels of productivity. Therefore, we would expect not only *average* mobility requirements to increase more in the west, but also *additional* mobility would be necessary to compensate for the increase in drier-than-average years. During the period when mean annual precipitation is declining, climatic thresholds that lead to alteration of mobility patterns would be reached earlier in the west than in the east, and the *timing* of mobility changes from east to west would vary along with the *need* for them. In other words, the gradients for precipitation and productivity (which are parallel because of the latter's dependence on the former) are also mobility gradients in the sense that areas with lower total productivity are by definition areas that produce less above-ground vegetation, and areas with less above-ground vegetation require more mobility to harvest a given quantity of vegetation.

Table 3. Relative productivity losses with 2 inch decrease of mean precipitation and 2 inch oscillation below new mean

Original Mean Annual Precipitation/ Productivity (g/m^2/yr)	New Mean Annual Precipitation/ Productivity (g/m^2/yr)	Change New Mean Productivity	Productivity 2 in Below New Mean	Productivity Change at 2 in Below New Mean: re: New Mean	re: Original
20" / 618	18" / 473	-23 %	328	-31 %	-47 %
22" / 763	20" / 618	-19 %	473	-23 %	-38 %
24" / 908	22" / 763	-16 %	618	-19 %	-31 %
26" / 1054	24" / 909	-14 %	763	-16 %	-28 %
28" / 1200	26" / 1054	-12 %	909	-14 %	-24 %
30" / 1345	28" / 1200	-11 %	1054	-12 %	-22 %
32" / 1490	30" / 1345	-10 %	1200	-11 %	-19 %
34" / 1635	32" / 1490	-9 %	1345	-10 %	-18 %
36" / 1780	34" / 1635	-8%	1490	-9%	-16%

Because the precipitation shift often expands or contracts the area under a given precipitation regime, productivity and mobility gradients will expand or contract accordingly. Thus, the spatial rearrangement of productivity and mobility gradients would not be uniform, requiring people exploiting the same precipitation gradients to differentially adjust their mobility to very different spatial patterns of declining productivity.

The treatment of productivity has, so far, ignored the underlying environmental diversity within which total productivity is reduced. Drainages in Central Texas are better watered than the adjacent uplands because of concentrated flows from springs and/or precipitation, and productivity in drainages would probably decline at a slower rate than it would in the uplands, creating differential declines in productivity within any given subsubregion. Still further, productivity in spring-fed drainages would decline slower than in runoff-fed drainages, producing additional local differences. However, topography (and hence the spatial distribution of springs and drainages) is one of the variables that creates environmental diversity, and some subregions (e.g., the Balcones Canyonlands) are characterized by greater incision than others (e.g., the Live Oak-Mesquite Savanna). As a result, differential upland/drainage productivity losses at the subsub-regional scale would be accompanied by further differences related to the overall drainage pattern at the subregional spatial scale.

Moreover, it is highly unlikely that ecological adjustment from one subsubregion to another would be accomnpanied by proportional species-to-species reduction in productivity. Although each natural subregion is partially defined by a characteristic array of plants, the existence of precipitation gradients within each subregion guarantees that each characteristic species in each subregion occupies a territory varying somewhat from optimal moisture conditions. This means that each species in each subsubregion is closer to, or farther from, the climatic thresholds that determine whether it flourishes, barely survives, or cannot survive. Despite the fact that each subsubregion has the same basic array of characteristic flora, there is considerable, indeed subtle, variation in the proportional representation of characteristic plants. Furthermore, the boundaries between subregions are neither sharp nor impermeable. The major characteristic species in one subregion typically extend beyond subregional boundaries to comprise minor species in adjacent subregions. Thus, variable representation of characteristic flora in a subregion is accompanied by a variable representation of minor species that are characteristic of other subregions.

The different *subsubregions* vary not only as a function of the differential representation of characteristic species: they simultaneously vary as a function of the extent to which the locally peculiar spread of characteristic species in adjacent subsubregions spills over to become a minor component of the vegetation regime. Since all of the species—characteristic and minor—in any given subsubregion occupy different positions relative to their optimal moisture conditions, the decline in precipitation will lead to differential change in proportional species representation by subsubregion as a result of an initial variability in the mix of characteristic and minor species, and the initial positions such species occupy relative to their optimal moisture regimes.

Note, therefore, that our initial heuristic assumption that ecological adjustment is the only process accompanying declining productivity is unrealistic. Floristic change, at least in the form of species changing from minor to major components (and vice versa), should also occur in at least some of the subsubregions. Moisture is a major variable that distinguishes the vegetation of the Live Oak-Mesquite Savanna, the Balcones Canyonlands, and the Lampasas Cut Plains. With more xeric conditions, stream flows would decline in the more ephemeral drainages of the Canyonlands, especially in the westernmost reaches since they are not spring-fed to the degree that the easternmost reaches are. This would create conditions differentially favoring the xeric species of the Savanna habitat, and increase their proportional representation in the Canyonlands (perhaps to the extent they become characteristic rather than minor species in some areas). The trees on the Cut Plains are limited by moisture regime, so floristic change in the arboreal community would be likely. The characteristic species of the Western Cross Timbers are especially limited by precipitation, and the creation of a new subsubregion would largely eliminate them in favor of minor species with greater xeric tolerance. Floristic change would also then be highly probable at the southernmost reaches of the Blackland Prairies and Oak Woodlands. In other words, the productivity of resources with higher thresholds to xeric conditions would be differentially favored over resources with lower thresholds all across the region, and in some cases this would result in substantial floristic change.

At the beginning of this scenario, we spoke in terms of subsubregions (and juxtapositions thereof), but we have now arrived at a discussion cast almost entirely in terms of overlapping environmental gradients and processes that are differentially distributed in space. As a result, even under conditions of uniform precipitation change, the vegetation of Central Texas would undergo productivity changes, ecological adjustment, and changes in species proportions and mixes, all of which would occur highly differentially in space.

Progressive (and, we confess, partial) "decompression" of the environmental information that gets lost when speaking in terms of biotic provinces and natural subregions shows that environmental responses to climate change would be enormously complex, contextually and historically contingent, and, therefore, extremely variable from place to place. The different subsubregions (which are less-simplified, smaller lies than provinces, regions, and subregions) start off with different mixes of geology, soil, topography, and climate, assuring they will have different floral species compositions, which in turn assures that the Central Texas environment cannot respond in a uniform way. If one's version of "Central Texas" is larger than Prewitt's, then our claims may be far too conservative, because a larger version of "Central Texas" will contain more climatic, edaphic, and topographic diversity, and will be characterized by even more diverse responses. Thus, just as there is no quintessentially Central Texas environment today, there could be no quintessentially Central Texas environmental response under realistic conditions of uniform or nonuniform climate change.

IS A PREHISTORY OF CENTRAL TEXAS POSSIBLE?

Moreover, just as there could be no quintessential environmental response, there could be no quintessential adaptive response by Central Texans. Some would have the option of following the isohyets and reproducing their subsistence practices in a new place; others would not. Some would face radical changes in resource productivity and/or resource composition; others would barely notice the difference. Given a wide array of environments and practices for exploiting them, Central Texans would necessarily face highly divergent subsistence challenges under changing climatic conditions. The issue is not whether they *could* meet those challenges: hunter-gatherers are, after all, intelligent, highly-skilled people, and environmental change would not occur so rapidly that their cultural geographies and subsistence practices would become obsolete before they could be fixed.[5] Rather, the issue is whether they would notice a difference in the effectiveness of their strategies and tactics, and reach the same conclusions about how to change them, if necessary. Central Texans who started out with very different subsistence practices from place to place in the region would not respond in a uniform way to climate change because some might have little to respond to, and others would be responding to different problems of different kinds and magnitudes.

In other words, cultural responses to environmental change would take substantially different trajectories from substantially different starting points because hunter-gatherers are smart enough to recognize in advance that some things will work, and others will not. As a result, an accurate history of changing relationships between climate and culture in the region *as a whole* could not rely on "cultures" defined as quintessential sets of traits unless prehistorians are willing to ignore most of the aspects of culture that have to do with subsistence, or to suggest that variable subsistence practices are not particularly relevant to the cultures they are interested in describing and explaining. The long-standing fascination with burned rock middens (BRMs) in Central Texas serves as a case in point.

In recent years, some researchers (Prewitt n.d.; Goode 1991; Johnson and Goode 1994; Johnson 1995) have adopted one or another version of the "sotol hypothesis" for the origin and spread of BRMs, which often are viewed as a quintessentially Central Texan trait. According to this hypothesis,

[5]Especially if among their tactics they had procedures for scouting out resources in bad years, which would be the ideal laboratory for developing new tactics in a changing environment.

BRMs formed as a result of the long-term construction of earth and rock facilities for cooking succulents and semisucculents. However, sotol does not grow well in clayey soils (Dering 1995), and yucca does not grow well in the coarse soils favored by sotol (Johnson 1994). Given the gross distributions of these soils within and beyond Prewitt's Central Texas, a climatic event that increases the range of these plants would do so differentially. For example, in a climate shift favoring xeric plants, sotol would be favored in the sandier soils of the Llano Uplift, whereas yucca would be favored in the clayier soils of the Blackland Prairies. Thus, the regionwide adoption of technologies leading to the formation of BRMs would necessarily be accompanied by subsubregional variations in the mix and amount of succulents available for exploitation. To the extent that different succulents require different procurement, scheduling, and/or processing strategies, regionwide formation of BRMs also would be accompanied by a variety of ways of doing things that lead to forming middens.

Moreover, even if it is true, as Black et al. (1993:27) hypothesize, that BRMs "resulted from a single phenomenon throughout their distribution in time and space," and even if this single phenomenon was the repetitive construction of ovens for cooking succulents (which Black et al. [1993] do not explicitly claim), local solutions to the problem of integrating other resources into the subsistence system would vary from place to place. These solutions would vary as a combined function of the differential spatial and seasonal availability of different succulents, and the differential spatial and seasonal availability of supplementary and back-up resources. As a result, if Black et al. (1993) are correct in claiming that BRMs are typically smaller in the western part of Central Texas because resource density was lower there and led to less repetitive occupation of sites, they are correct because west-Central and east-Central Texans faced substantially different subsistence problems related to the differential productivity of different environments in Central Texas. These problems would have included scheduling, mobility, and the social organization of work, especially with respect to integrating exploitation of other resources into the procedures and schedule for exploiting succulents. Given that there is enormous environmental diversity within the western and eastern portions of Central Texas, the eastern-western division obscures a substantial amount of relevant descriptive and explanatory detail. Consequently, even if it turned out that all BRMs in Central Texas formed through the sequential construction of intersecting ovens used to cook succulents, we would know very little about the role of BRMs in Central Texas prehistory unless and until we also found out how succulent exploitation was integrated into diverse subsistence strategies in diverse environments. Again, it is important to note that if one adopts a version of "Central Texas" that is larger than Prewitt's, our claim is an understatement.

To the extent that BRMs are a quintessentially Central Texan trait, they are very unlikely to fit into a quintessentially Central Texan behavioral pattern.[6] The same is true for the typologically distinct projectile points and other tools that have been a traditional mainstay for defining phases and stages. The reason for this is that to whatever extent burned rock technologies and tools are cultural traits shared universally across the region, changes in their patterns of spatio-temporal distribution do not and cannot refer to the cultural or other phenomena that account for the changes. Making a successful living by hunting and gathering is a pastime for well-trained professionals who cannot survive without well-honed subsistence strategies that (among other things) apply mobility, scheduling, and other organizational skills to a particular landscape according to a well-understood cultural geography. However, subsistence practices and cultural geographies are culture traits, and environmental diversity requires different practices and geographies among the hunter-gatherers occupying Central Texas. Thus, it is virtually certain that the subsistence traits which provided the basis for generation-to-generation transmission of burned rock technologies and various tool types were not universally shared across the region. Consequently, the spatio-temporal distribution of regionally similar artifacts and features in Central Texas *cannot coincide with* a spatio-temporal distribution of regionally similar cultural

[6]Indeed, since Black et al. (1993:28) note that "rock oven cooking extends far beyond the borders of Texas up into Oklahoma, down into Mexico, and west into and beyond the American Southwest," it would be truly extraordinary if the same subsistence activities or systems account for burned rock middens throughout their spatio-temporal distribution.

subsistence traits that were necessary for the reproduction of culture in general.

In fact, a real problem for culture history would be to explain how it is that BRMs occur over most of Prewitt's Central Texas, while many of their culturally associated artifacts do not. Over the period of Archaic midden formation, it is not clear that there actually were any typologically distinct artifacts that were used region-wide. The distributions of projectile point types – the usual index of choice for culture-chronology building and identification of cultural affiliation – do not coincide with Prewitt's (or anyone else's) Central Texas. Figure 7 shows the distribution of three commonly found projectile points (from Turner and Hester 1993). Only one of these covers all of Prewitt's region, but none of them cover all of Suhm's (1960) Central Texas, and all of them cover greatly different areas compared to each other. Interestingly, the area of overlap of at least ten common projectile points covers a relatively small proportion of Prewitt's region, and quite a small proportion of Suhm's.[7] Hence, it is obvious that to whatever extent point types refer to distinct "cultures," different parts of Central Texas must have had different histories of different peoples doing different things in different environments. Indeed, the term "Central Texas" does not refer to an area that is especially relevant to a history that uses projectile points as an index of sociocultural affiliation, because the area contains neither the people nor the behavioral patterns of interest. That is to say, if distinct "cultures" produced distinct projectile points, the prehistory of Central Texas cultures extends well beyond Central Texas, no matter how it is defined.

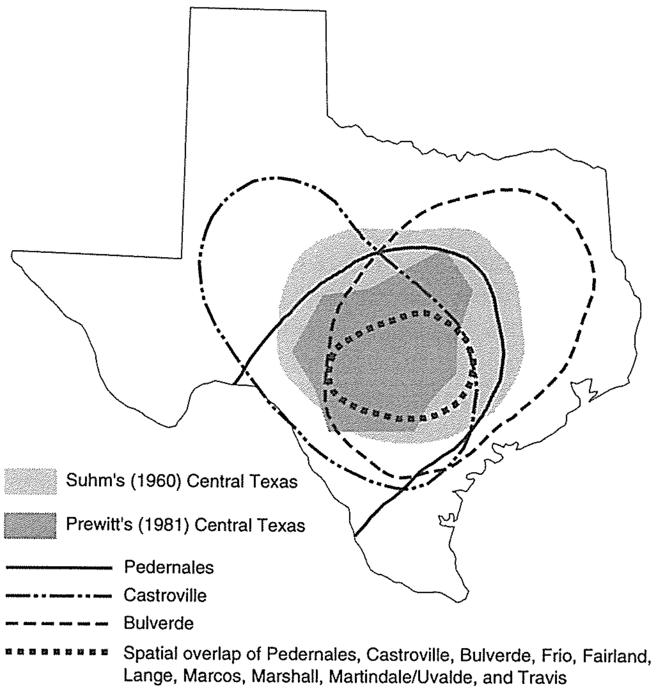

Figure 7. Distribution of selected projectile points relative to Suhm's (1960) and Prewitt's (1981) versions of Central Texas. Point distributions are based on figures in Turner and Hester (1993). Note that spatial overlap of at least 10 point types excludes much of what has been accepted historically as "Central Texas."

CONCLUSIONS

Lewis Binford has been criticized for many things over his career. However, one of the things he was right about from the beginning (Binford 1962, 1965, 1968; see also Wylie 1982) is that it is folly to construct a traditional culture history without either (1) addressing the behavioral systems that composed the culture or (2) anticipating the kinds of data and processes that will explain cultural phenomena because the resulting culture history can only accidentally contain the evidence necessary for successful description and explanation. Phases defined for Central Texas have been roundly and soundly criticized (Peter et al. 1982; Johnson 1987; Black 1989) for failing to meet the criteria needed to establish them as entities that refer to culture-historical units. If our argument is approximately correct, then successful phase-building for Central Texas necessarily will be subject to the problems Binford has noted, because it will not produce culture-historical units that actually refer to any particular entity that can fit successfully into the describe-first/explain-next procedures of traditional culture history (Willey and Phillips 1958; Sabloff and Willey 1967; see Ellis 1994). This is

[7]As this is being written, Prewitt (this volume) is finishing a major re-evaluation of the distribution of projectile points. His findings will undoubtedly modify the basis for Figure 7.

because virtually any culture-historical units that accurately describe regionwide phenomena can do so only by stripping away or ignoring the culture traits that make hunter-gatherers hunter-gatherers rather than merely producers of similar artifacts.

By accurately referring to all Central Texans in terms of the things they universally share (which apparently is little beyond rock ovens if Black et al. [1993] and Turner and Hester [1993] are both correct), well-produced culture-historical units will refer only vacuously to any actual social or other entities: they will refer at best to abstractions, and not to people who actually lived, worked, and died in Central Texas. In recognition of this problem, LeRoy Johnson, who from the 1960s to the late 1980s was at the vanguard of calls to use "proper" methods for defining culture-history units, has progressively abandoned the expectation that phases do or can refer to the same thing regionwide (Johnson and Goode 1994; Johnson 1994, 1995), and has suggested (personal communication to G. L. Ellis) that even if we produced "proper" phases, they would not be good for much. Similarly, if we replaced regionwide "phases" with regionwide "adaptations," we would replace one normative, referentless construct with another: the term "human adaptation" will not refer to *anyone* in Central Texas if we speak broadly and accurately enough to refer to *everyone* in Central Texas.

The term "Central Texas" does not refer to a simple thing. Using the term as if it does transforms both Central Texas and Central Texans into mythical things that can only be described and explained in mythical terms. Central Texas's environments are too diverse. Its environmental responses to climate change would be equally diverse and differentially distributed no matter what climate changes occurred. Hence, its human history must be diverse, and must be expected to have taken different paths in response to climate change. A prehistory of Central Texas appears to be possible only if one is willing and able to deal with it as an area with enormous environmental diversity exploited by people with different subsistence systems and, surely, different large-scale sociocultural affiliations that extended well beyond the region itself. The cost of simplification in Central Texas –whether in culture or processual history– is that only a truth-eliminating brush paints strokes broad enough to cover Central Texas. Thus, speaking in terms of what applies all across Central Texas makes the region's prehistory manageable by making it refer to very little. If ease of manageability is what archeologists want, then the cost of simplification is reasonable. On the other hand, for researchers who, like us, hold the perverse belief that reality resides in the details of variability rather than the abstractions of commonality, the cost of simplification is too high, and it is long past time to reconsider how–or even if–one can continue to use the term "Central Texas" as a meaningful concept around and within which to organize our understanding of prehistory.

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REFERENCES CITED

Arbingast, S. A., L. G. Kennamer, R. H. Ryan, A. Lo, D. L. Karney, C. P. Zlatkovich, M. E. Bonine, and R. G. Steele
1973 *Atlas of Texas*. Revised Edition. Bureau of Business Research, University of Texas at Austin.

Binford, L. R.
1962 Archaeology as Anthropology. *American Antiquity* 28:217-225.
1965 Archaeological Systematics and the Study of Culture Process. *American Antiquity* 31:203-210.
1968 Some Comments on Historical versus Processual Archaeology. *Southwestern Journal of Anthropology* 24:267-275.
1983 *In Pursuit of the Past: Decoding the Archaeological Record.* Thames and Hudson, New York.

Black, S. L.
1989 Central Texas Plateau Prairie. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas,* by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 17-38. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

Black, S. L., K. Jolly, and D. R. Potter
1993 *The Higgins Experiment Field Report.* Wurzbach Project Working Papers. Texas Archeological Research Laboratory, The University of Texas at Austin.

Blair, W. F.
1950 The Biotic Provinces of Texas. *The Texas Journal of Science* 2:93-117.

Blum, M. D.
1987 Late Quaternary Sedimentation in the Upper Pedernales River. Unpublished Masters Thesis, Department of Geology, The University of Texas at Austin.
1990 Climatic and Eustatic Controls on Gulf Coastal Plain Fluvial Sedimentation: An Example from the Quaternary of the Colorado River. *Gulf Coast Section Society for Economic Paleontology and Mineralogy Foundation Eleventh Annual Research Conference, Program with Abstracts,* pp. 71-83.

Blum, M. D. and S. Valastro, Jr.
1989 Response of the Pedernales River of Central Texas to Late Holocene Climatic Change. *Annals of the Association of American Geographers* 79:345-456.

Brown, T., K. L. Killen, H. Simons, and V. Wulfkuhle
1982 *Resource Protection Planning Process for Texas.* Texas Historical Commission, Austin.

Bryant, V. M. and R. G. Holloway
1985 A Late-Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence. In *Pollen Records of Late-Quaternary North American Sediments*, edited by V. M. Bryant and R. G. Holloway, pp. 39-70. American Association of Stratigraphic Palynologists Foundation, Dallas.

Bryant, V. M. and H. J. Shafer
1977 Late Quaternary Paleoenvironment of Texas: A Model for Archeologists. *Bulletin of the Texas Archeological Society* 48:1-26.

Butzer, K. W.
1982 *Archaeology as Human Ecology: Method and Theory for a Contextual Approach.* Cambridge University Press, Cambridge.

Caran, S. C.
1994 Quaternary Paleoenvironmental and Paleoclimatic Reconstruction in the Southern Great Plains: A Discussion and Critique. Paper presented at the 52nd Annual Plains Anthropological Conference and 65th Texas Archeological Society Annual Meeting, Lubbock, Texas.

Collins, M. B.
1991 Thoughts on Future Investigations of Burned Rock Middens. In *The Burned Rock Middens of Texas: An Archeological Symposium,* edited by T. R. Hester, pp. 1-24. Studies in Archeology Number 13. Texas Archeological Research Laboratory, University of Texas at Austin.

Collins, M. B. and C. B. Bousman, with contributions by T. K. Perttula
1993 Quaternary Environments and Archeology in Northeast Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document,* edited by N. A. Kenmotsu and T. K. Perttula, pp. 49-67. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.

Dering, J. P.
1995 Appendix I: Modern and Contact-Period Vegetation in the Area of the Jonas Terrace Site of Northern Medina County. In *The Archeology of the Jonas Terrace Site, 41ME29, of the Southernmost Edwards Plateau*, by L. Johnson. Texas Department of Transportation and Texas Historical Commission, Austin, in press.

Diamond, D. D., D. H. Riskind, and S. L. Orzell.
1987 A Framework for Plant Community Classification and Conservation in Texas. *The Texas Journal of Science* 39:202-221.

Diamond, D. D., and F. E. Smeins
1985 Composition, Classification and Species Response Patterns of Remnant Tallgrass Prairies in Texas. *American Midland Naturalist* 113:294-308.

Dixon, J. R.
1987 *Amphibians and Reptiles of Texas.* Texas A&M University Press, College Station.

Dyksterhuis, E. J.
1946 Vegetation of the Fort Worth Prairie. *Ecological Monographs* 16:1-29.

Elias, S. A.
1994 Insect Fossil Evidence of Late Glacial Environments at the Aubrey Clovis Site, Texas. *Program and Abstracts of the 13th Biennial Meeting,* p. 77. American Quaternary Association. University of Minnesota, Minneapolis.

Ellis, G. L.
1994 Archeological Overview and Theoretical Perspectives. In *Significance Standards for Prehistoric Cultural Resources: A Case Study from Fort Hood, Texas,* by G. L. Ellis, C. Lintz, W. N. Trierweiler, and J. M. Jackson, pp. 41-99. USACERL Technical Report CRC-94/04, Tri-Services Research Center Series. United States Army Construction Engineering Research Laboratory, Urbana, Illinois.

Gardner, K. M.
1992 Modern Environment. In *An Archeological Survey of the Proposed South Bend Reservoir Area: Young, Stephens, and Throckmorton Counties, Texas,* edited by J. W. Saunders, C. S. Mueller-Wille, and D. L. Carlson, pp. 13-17. Archeological Surveys No. 6. Archeological Research Laboratory, Texas A&M University, College Station.

Gehlbach, F. R.
1991 The East-West Transition Zone of Terrestrial Vertebrates in Central Texas: A Biogeographical Analysis. *The Texas Journal of Science* 43:415-427.

Goode, G.
1991 Late Prehistoric Burned Rock Middens in Central Texas. In *The Burned Rock Middens of Texas: An Archeological Symposium,* edited by T. R. Hester, pp. 71-93. Studies in Archeology Number 13. Texas Archeological Research Laboratory, University of Texas at Austin.

Goodfriend, G. A. and R. M. Mitterer
1993 A 45,000-yr Record of a Tropical Lowland Biota: The Land Snail Fauna from Cave Sediments at Coco Ree, Jamaica. *Bulletin of the Geological Society of America* 105:18-29.

Gould, F. W.
1962 *Texas Plants–A Checklist and Ecological Summary.* Texas Agricultural Experiment Station, Texas A&M University, College Station.

Hall, S. A.
1990 Channel Trenching and Climatic Change in the Southern U.S. Great Plains. *Geology* 18:342-345.

Hereford, R.
1984 Climate and Ephemeral-Stream Processes: Twentieth-Century Geomorphology and Alluvial Stratigraphy of the Little Colorado River, Arizona. *Bulletin of the Geological Society of America.* 95:654-668.

Holliday, V. T.
1985 Archaeological Geology of the Lubbock Lake Site, Southern High Plains of Texas. *Bulletin of the Geological Society of America* 96:1483-1492.

1989 Middle Holocene Droughts on the Southern High Plains. *Quaternary Research* 31:74-82.

Humphrey, J. D. and C. R. Ferring
1994 Stable Isotopic Evidence for Latest Pleistocene and Holocene Climatic Change in North-Central Texas. *Quaternary Research* 41:200-213.

Johnson, L.
1987 A Plague of Phases: Recent Sociocultural Taxonomy in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1-26.

1994 *The Life and Times of Toyah-Culture Folk as Seen from the Buckhollow Encampment, Site 41KM16, of Kimble County, Texas.* Office of the State Archeologist Report 38. Texas Department of Transportation and Texas Historical Commission, Austin.

1995 *The Archeology of the Jonas Terrace Site, 41ME29, of the Southernmost Edwards Plateau.* Texas Department of Transportation and Texas Historical Commission, Austin, in press.

Johnson, L. and G. T. Goode
1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archeological Society* 65:1-51.

Kosko, B.
1993 *Fuzzy Thinking: The New Science of Fuzzy Logic.* Hyperion, New York.

Kosso, P.
1991 Method in Archaeology: Middle-Range Theory as Hermeneutics. *American Antiquity* 56:621-627.

Kutac, E. A. and S. C. Caran
1994 *Birds and Other Wildlife of South Central Texas.* University of Texas Press, Austin.

Larkin, T. J. and G. W. Bomar
1983 *Climatic Atlas of Texas.* Publication LP-192. Texas Department of Water Resources, Austin.

Lundelius, E. L., Jr.
1967 Late-Pleistocene and Holocene Faunal History of Central Texas. In *Pleistocene Extinctions,* edited by P. S. Martin and H. E. Wright, Jr., pp. 287-319. Yale University Press, New Haven.

Lyndon B. Johnson School of Public Affairs
1978 *Preserving Texas' Natural Heritage.* Project Report 31. Natural Heritage Policy Research Project, University of Texas at Austin.

Macklin, M. G.
1992 Flood Alluviation and Entrenchment: Holocene Valley-Floor Development and Transformation in the British Uplands. *Bulletin of the Geological Society of America* 104:631-643.

McMahan, C. A., R. G. Frye, and K. L. Brown
1984 *The Vegetation Types of Texas (Including Cropland).* Texas Parks and Wildlife Department, Wildlife Division, Austin.

Meltzer, D. J.
1991 Altithermal Archaeology and Paleoecology at Mustang Springs, on the Southern High Plains of Texas. *American Antiquity* 56:236-267.

Nobel, P. S.
1994 *Remarkable Agaves and Cacti.* Oxford University Press, New York.

Nordt, L. C.
1992 *Archaeological Geology of the Fort Hood Military Reservation, Fort Hood, Texas.* Research Report Number 25, Archaeological Resource Management Series. United States Army, Fort Hood, Texas.

Nordt, L. C., T. W. Boutton, C. T. Hallmark, and M. R. Waters
1994 Late Quaternary Vegetation and Climate Changes in Central Texas Based on the Isotopic Composition of Organic Carbon. *Quaternary Research* 41:109-120.

Owen, G. and D. J. Schmidly
1986 Environmental Variables of Biological Importance in Texas. *The Texas Journal of Science* 38:99-119.

Peter, D., T. R. Hays, and M. A. Demuynck
1982 An Evaluation of the "Phase" Concept. In *Archaeological Investigations at the San Gabriel Reservoir Districts, Central Texas,* Volume 2, compiled and edited by T. R. Hays, pp. 21-1 to 21-18. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.

Potter, D. R.
1995 Past and Present Environments. In *Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas,* by D. R. Potter, S. L. Black, and K. Jolly, pp. 5-17. Archeology along the Wurzbach Parkway, Module 1. Studies in Archeology Number 17. Texas Archeological Research Laboratory, the University of Texas at Austin.

Potter, D. R. and S. L. Black
1995 Conceptual Framework. In *Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas,* by D. R. Potter, S. L. Black, and K. Jolly, pp. 19-37. Archeology along the Wurzbach Parkway, Module 1. Studies in Archeology Number 17. Texas Archeological Research Laboratory, the University of Texas at Austin.

Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archaeological Society* 54: 201-238.

n.d. The Rogers Springs Site: 1974 Investigations. Unpublished manuscript on file, Texas Archeological Research Laboratory, University of Texas at Austin.

Riskind, D. H. and D. D. Diamond
1986 Plant Communities of the Edwards Plateau of Texas: An Overview Emphasizing the Balcones Escarpment Zone Between San Antonio and Austin with Special Attention to Landscape Contrasts and Natural Diversity. In *The Balcones Escarpment: Geology, Hydrology, Ecology and Social Development in Central Texas,* edited by P. L. Abbott and C. M. Woodruff, Jr., pp. 1-15. Published Papers of the Geological Society of America, Annual Meeting, November 9-14, 1986. Comet Reproduction Service, Santa Fe Springs, California.

Sabloff, J. A. and G. R. Willey
1967 The Collapse of Maya Civilization in the Southern Lowlands: A Consideration of History and Process. *Southwestern Journal of Anthropology* 23:311-336.

Spearing, D.
1991 *Roadside Geology of Texas.* Mountain Press Publishing, Missoula, Montana.

Stahle, D. W. and M. K. Cleaveland
1988 Texas Drought History Reconstructed and Analyzed from 1698 to 1980. *Journal of Climate* 1:59-74.

Suhm, D. A.
1960 A Review of Central Texas Archeology. *Bulletin of the Texas Archeological Society* 29:63-107.

Suhm, D. A., A. B. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Taylor, W. W.
1948 A Study of Archaeology. Memoir No. 69. *American Anthropologist* 50(3), Part 2. Reprinted as *A Study of Archaeology*, by Center for Archaeological Investigations, Southern Illinois University at Carbondale, 1983.

Texas Almanac
1994 *Texas Almanac and State Industrial Guide.* A. H. Belo, Dallas.

Toomey, R. S. III, M. D. Blum, and S. Valastro, Jr.
1993 Late Quaternary Climates and Environments of the Edwards Plateau, Texas. *Global and Planetary Change* 7:299-320.

Toomey, R. S. III
1993 Late Pleistocene and Holocene Faunal Changes at Hall's Cave, Kerr County, Texas. Unpublished Ph.D. dissertation, Department of Geology, The University of Texas at Austin.

Turner, E. S. and T. R. Hester
1993 *A Field Guide to Stone Artifacts of Texas Indians.* Second Edition. Gulf Publishing, Houston.

Van Auken, O. W.
1988 Woody Vegetation of the Southeastern Escarpment and Plateau. In *Edwards Plateau Vegetation,* edited by B. B. Amos and F. R. Gehlbach, pp. 1-15. Baylor University Press, Waco, Texas.

Weir, F.
1976 The Central Texas Archaic. Unpublished Ph.D. Dissertation, Department of Anthropology, Washington State University, Pullman.

Willey, G. R. and P. Phillips
1958 *Method and Theory in American Archaeology.* University of Chicago Press, Chicago.

Wylie, M. A.
1982 Postivism and the New Archaeology. Unpublished Ph.D. Dissertation, University Microfilms, Ann Arbor.

The Prehistory of South Texas

Thomas R. Hester

ABSTRACT

The prehistoric archeology of southern Texas is summarized in this paper. The region, often known as the Rio Grande Plain, has a distinctive archeological record in terms of site use patterns and artifact types. From the Paleoindian through the Early Archaic, the cultural patterns of the area are part of broad phenomena crosscutting this and other regions. With the Middle Archaic and Late Archaic, specific regional patterns can be seen; of particular note are major cemetery sites and trade or interaction with other regions. During the Late Prehistoric, regional patterns are present, and the Toyah horizon of Central Texas expands to encompass much of the area. Protohistoric sites of the 16th and 17th centuries are also known. Much remains to be learned about South Texas prehistory, since few sites have been excavated, few radiocarbon dates exist, and specific theoretical goals have not been made explicit.

INTRODUCTION

The southern Texas archeological area (Figure 1) has been the subject of synthesis in a book-length treatment by Hester (1980), an overview of the western Gulf coastal Plain (Story 1985), a paper that dealt with both the interior and coastal portions of this region (Black 1989), and a regional synthesis written in the context of the Loma Sandia (41LK28) analysis (Black 1995). The present paper focuses on the interior of the region, usually referred to as the Rio Grande Plain, the Nueces Plain, or the South Texas Plains. The northern boundary can be placed at the Balcones Escarpment, the western edge set artificially at the Rio Grande, the northeastern boundary in the Guadalupe-San Antonio rivers drainage system, the eastern boundary at the juncture with the coastal bend, some 50-65 km inland from the modern Gulf of Mexico shoreline, and south, at the mouth of the Rio Grande. Black (1989:Figure 19) noted five "biogeographical areas" in the region: the Rio Grande Plain, the Rio Grande Delta, the Nueces-Guadalupe Plain, the Sand Sheet, and the Coastal Bend. As noted above, I will not deal with the coastal bend region in this present synthesis (see Ricklis, this volume). Another suggested set of subdivisions for this region was proposed in the first South Texas Archeological Palaver in 1988. The "South Texas Planning Region" was divided into the Middle Nueces Zone, the Brasada (McGraw et al. 1987), the Sand Sheet, and the Rio Bravo corridor encompassing the archeology of both sides of the Rio Grande. This particular configuration did not include the Rio Grande delta, leaving it as part of the coastal strip extending up the coast from Brownsville.

The earlier syntheses have summarized various facets of the ecology of the South Texas region (see also Jurgens 1980). Hester (1981) has noted the variation in plant and water resources across the region, distinguishing between "high density" (resource) areas and those of "low density." These manifest different archeological records.

The difficulty in describing, in any detail, the hydrology, vegetation, and fauna of the region results from wholesale modification of the South Texas environment during the Historic era. Hester (1980) has outlined these, as has Hall (1985; see also Hall et al. 1982, 1986). The principal changes can be briefly summarized here. First, the mesquite and other thorny shrubs that dominate the "Brush Country" today spread (or at least increased in density) within Historic times (e.g., Fisher 1977:183; Doughty 1983:122-123). However, mesquite was clearly present in riverine zones as early as 6000 B.P. This is based on wood species identification of hearth charcoal done by Holloway (1986); Jurgens (1980) suggests that the typical riverine environmental pattern in that area today was in place by 300 B.C. There is considerable debate in the literature over the extent of mesquite on the Rio Grande Plain, based on early Historic

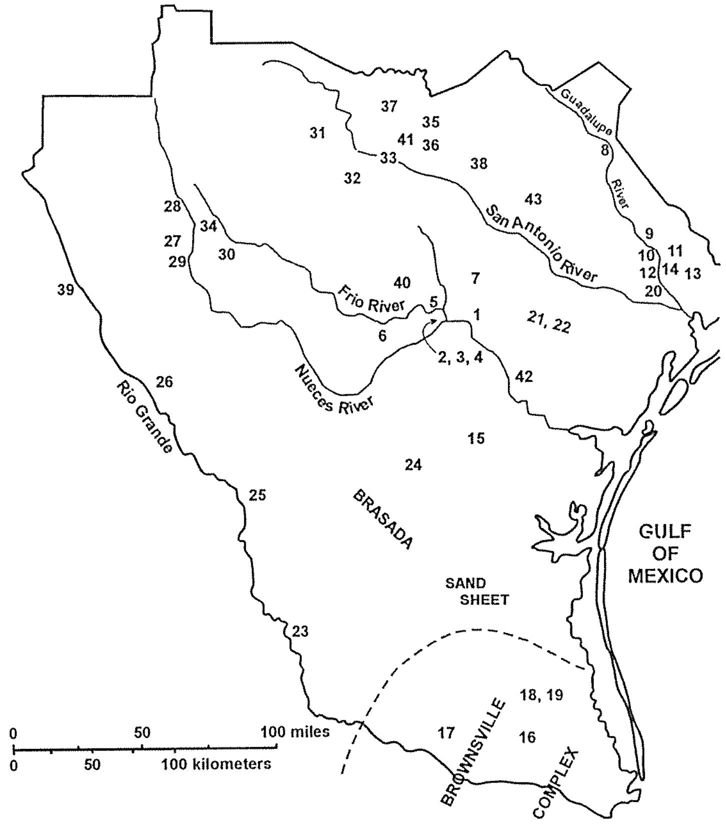


Figure 1. Map of Southern Texas, With Locations of Key Sites and Areas Mentioned in the Text: 1, Loma Sandia (41LK28); 2, 41LK31/32; 3, 41LK201; 4, 41LK51; 5, 41LK67; 6, 41MC222; 7, 41LK106; 8, proposed Cuero Reservoir; 9, 41VT17; 10, 41VT15; 11, J-2 Ranch site (41VT6); 12, Berger Bluff (41GD30); 13, Blue Bayou (41VT94); 14, River Spur (41VT112); 15, Hinojosa (41JW8); 16, Floyd Morris (41CF3); 17, Ayala (41HG1); 18, 41WY40; 19, 41WY42; 20, Coleto Creek; 21, Berclair (41GD4); 22, Berclair Terrace (Buckner Ranch); 23, Falcon Reservoir area (includes 41ZP83 and 41SR174); 24, Duval County area; 25, Laredo area; 26, 41WB56; 27, Chaparrosa Ranch (41ZV10 and Mariposa [41ZV83]); 28, East Chacon survey; 29, 41ZV37; 30, 41ZV155; 31, 41ME34; 32, 41ME19; 33, proposed Applewhite Reservoir (includes 41BX831); 34, 41ZV263; 35, 41BX228; 36, St. Mary's Hall (41BX229); 37, Pavo Real (41BX52); 38, Shrew site (41WN73); 39, Guerrero, Coahuila missions; 40, 41AT111; 41, 41BXl; 42, Lake Corpus Christi area; 43, Haiduk site (41KA23).

accounts. Some report vast grasslands, while others note that mesquite was rather widely distributed (e.g., Inglis 1964; Lehmann 1984; Weniger 1984). Various factors contributed to the spread of mesquite, especially overgrazing and the lowering of the water table. The latter was aggravated with 20th century deep well irrigation. This had the effect of drying up springs that had fed perennial streams, perhaps for millenia. A county park with abandoned bath houses sits, like ancient ruins, adjacent to a 1920s swimming hole, on formerly spring-fed Carrizo Creek (Dimmit County [Brune 1981:165-166]).

The animal population has also been significantly altered. Gone are the bison, pronghorn, bear, wolf, and jaguar (Doughty 1983:76) that were present in southern Texas up to the beginning of the 20th century (Doughty 1983:54). Added to the species list is armadillo (in the 19th century) and javelina; the latter apparently first appeared ca. A.D. 1400 (e.g., at site 41MC222 [Hall et al. 1986:215]), but began to flourish in the 18th century, based on faunal records from Spanish Colonial missions (e.g., Davidson and Valdez 1976). Except for Late Prehistoric sites, faunal preservation is often poor in South Texas. Steele and Hunter (1986) provides a faunal study from three Choke Canyon sites that looks at diet, hunting patterns, and environmental reconstruction, topics not easily dealt with in most faunal assemblages elsewhere in the region.

One aspect of long-term environmental change on the Rio Grande Plain has been the movement of stream channels through time. Rivers like the Nueces and the Frio, and their major tributaries, have often cut widely across their valleys, creating a dendritic pattern. Some channels can be traced and roughly dated by archeological remains on their banks (e.g., at Chaparrosa Ranch [Hester 1978a]). In the Choke Canyon Project, Bunker (1982) studied in detail the movements of the Frio River, and in their unpublished manuscript on the East Chacon Project (Zavala and Uvalde counties), McGraw and Knepper (1983) have proposed shifts in the Nueces River channel since Late Pleistocene times, as well as in its tributaries in their study area.

South Texas archeology is beginning to benefit from geomorphological research, especially in the terraces along the Rio Grande (Collins 1991) and in the Rio Grande Delta (Collins et al. 1989). Other studies were also carried out at Choke Canyon (Bunker 1982) and Loma Sandia (Holliday 1995), but much remains to be done across the region.

Evidence of climatic change in the region is also hard to obtain. Robinson (1982) used phytolith data from Choke Canyon Reservoir to offer a pattern of short vs. tall-grass occurrence through time, perhaps reflecting alternating wet and dry episodes. While tree-ring coring has helped to give drought histories for part of Texas since 1698 (Stahle and Cleaveland 1988), this has had only preliminary application in South Texas (Gunn 1985).

The history of archeology in southern Texas has been reviewed in detail by Mallouf et al. (1977), and most recently by Black (1989:40-44). In essence, little work was done in the region prior to the late 1960s. Since that time, a number of important sites have been excavated (e.g., Montgomery 1978; Highley 1986; Black 1986), a major reservoir study was carried out at Choke Canyon (Live Oak and McMullen counties) providing 12 volumes on the prehistory, history, and ethnohistory of that area, a number of cultural resource management surveys (and occasionally, test excavations) have been done (including a large-scale survey of the proposed Cuero I reservoir [Fox et al. 1974]), and site reports and artifact distributional studies have been reported in the pages of *La Tierra*, the quarterly journal of the Southern Texas Archaeological Association. A series of major surveys, archival studies, and excavations have also taken place along the Medina River in southern Bexar County at the locus of the proposed Applewhite Reservoir (McGraw and Hindes 1987; Thoms 1992). This study area is on the northern periphery of southern Texas, as were the excavations at 41ME34 to the west (Hester 1990a). However, both have chronological data that help to build on the cultural-historical framework of southern Texas.

The native peoples of southern Texas are traditionally labeled as "Coahuiltecans" (Newcomb 1961). However, they included Coahuilteco speakers (Johnson and Campbell 1992), and groups that spoke perhaps six other languages (Goddard 1979) and a language known as Sanan, recently published by Johnson and Campbell (1992). The South Texas hunting and gathering lifeways are hard to reconstruct from Spanish documents. The descriptions by Newcomb (1961) provide a general view of their existence, but for more details, the studies by Campbell, gathered in a volume in 1988, are highly recommended. The Indians of the Rio Grande delta have been studied by Salinas (1990), and McGraw et al. (1991) have shed new light on a number of South Texas groups encountered by the Spanish along the Camino Real and related early trails. The native peoples became culturally extinct in the 18th century (Hester 1989a) as a result of Spanish-introduced diseases, raiding by Apaches and Comanches, the Spanish missionization process, and acculturated new lives as farmers. After the missions were secularized in 1794, many of these lost their lands to "avaricious townspeople" as at San Antonio de Valero (Almaraz 1989:38-39; de la Teja 1995).

THE NATURE OF THE SOUTH TEXAS ARCHEOLOGICAL RECORD

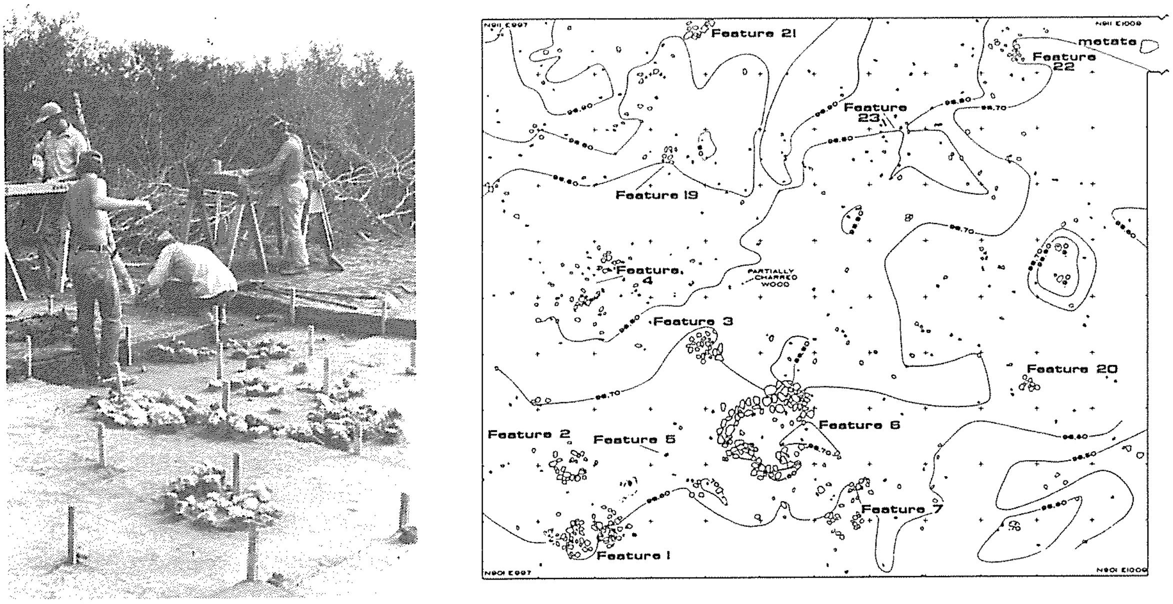
Evidence of human occupation in southern Texas is extremely abundant, yet has proven quite challenging in terms of dating and interpretation. Open occupation sites dominate the site types, usually found to be heavily eroded, with abundant surface debris such as chert flakes, land snails, mussel shells, scattered hearthstones, and eroding hearths. For a detailed discussion of South Texas site types and features within sites (e.g., lithic caches, hearths, pits, bone clusters, and activity areas), see Black (1989:46-48).

These sites have been a boon for artifact-collectors, since large numbers of projectile points are deflated onto a common surface. It is not uncommon for South Texas projectile point collections to range into the many thousands of specimens. Thus, "arrowhead collecting" is a popular pastime, as this author found beginning around age 7! Today, much of the ranchland is leased for hunting, and "arrowhead collecting" is often featured in urban sports pages as an activity to while away the time during deer-hunting. This results in large numbers of projectile points being indiscriminately collected and "exported" to Houston, San Antonio, and beyond by hunters. Of course, local collectors have been active for decades; Shafer and Baxter (1975) point to the absence of points at surface localities in a McMullen County study area (see also Robinson et al. 1992).

The South Texas open camp sites are very difficult to excavate. Unlike Central Texas camp sites where cultural debris is often concentrated in a small area, and where a few test pits can provide chronological information, the typical streamside South Texas open site is really an "occupation zone" (Hester 1981)—long, narrow strips of occupation. Excavations will detect components of different age in horizontally-separated parts of the site, seldom overlapping to any great extent. The task of excavating these kinds of sites was evident at Choke Canyon where small test pits yielded little, and our strategy of open, block excavations (Figures 2-3) improved both recovery and studies of horizontal patterning (supplemented by machine-stripping; see Brown et al. 1982) but they produced far less data than we had expected (Hester 1986a). The same is true for sites on Chaparrosa Ranch, again where block excavations failed to yield little beyond scattered hearths and occasional diagnostics (Hester 1978a; Montgomery 1978). This is not to say that such occupation zones are insignificant and not worthy of excavation. Rather, we have to think in terms of larger blocks and the use of backhoes and geomorphological input for planning excavation placement. By contrast, Late Prehistoric sites in southern Texas are often dense concentrations of features, faunal remains and artifacts, and have been productively studied through the use of block excavations (Black 1986; Highley 1986).

Another common type of site is related to lithic procurement. On the high terraces of the Nueces-Frio drainage systems, Uvalde gravels are extensively exposed. Here, one finds loci of tested cobbles, debitage, and bifaces abandoned during reduction (Hester 1975a). In the Duval County area, Chandler and Lopez (1992) report an outcrop of quartz arenite (Goliad formation) used by Archaic knappers. Along the Rio Grande in the Laredo region, Warren (1989) has reported "lithic reduction sites" in the uplands, along with larger "lithic procurement/quarry sites" that cover up to 1500 acres (see also Miller 1995). Near the Rio Grande, multi-colored Rio Grande gravels are reduced. Such sites in South Texas have not been adequately studied; indeed, sometimes they are not even given site numbers due to their broad horizontal extent (cf. Warren 1989). I would argue, however, that much more could be done with them, especially in terms of defining local lithic reduction sequences (Hester 1975a; Kotter 1980). They should not be ignored or dismissed as unimportant by cultural resource management surveys.

Temporary campsites are often found in the uplands or along high terraces. Characterized by a



a b

Figure 2. Excavation at Site 41LK67, Choke Canyon Reservoir, Southern Texas: a, view of portion of block excavation (1 x 1 meter squares); b, plan of features exposed during excavation (Brown et al. 1982:109).

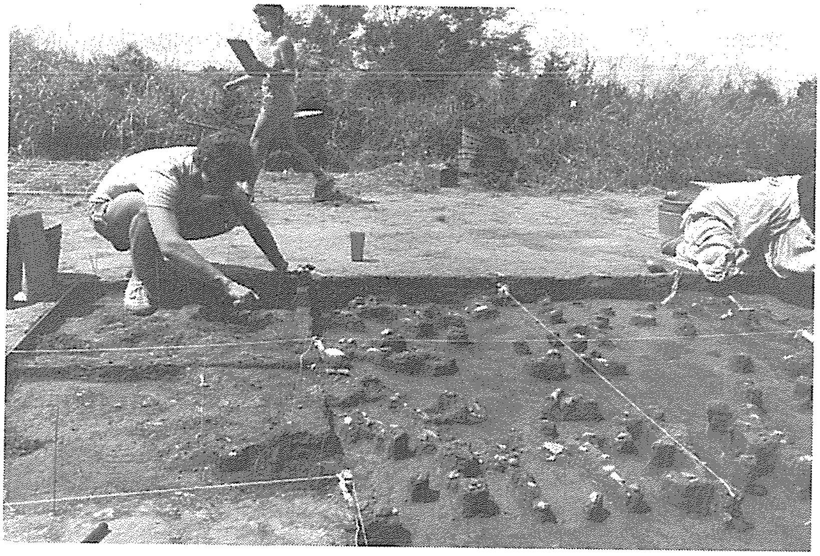


Figure 3. Block Excavation at 41LK201. Partial view showing Toyah horizon artifacts pedestaled in situ. Courtesy of News and Information, The University of Texas at San Antonio.

few hearths or scattered burned rock, flakes and an occasional diagnostic, they are clearly an important part of regional settlement patterns, albeit of speculative function at this time. Warren (1989) also notes "intermediate campsites," which based on his definition appear to represent similar short-term activities.

Deeply stratified open campsites do occur in southern Texas. Excavations at 41LK31/32 at Choke Canyon provide one example (Figure 4; Scott 1982) While little could be contributed to regional culture history at this site, it did yield abundant data on intrasite activities (i.e., a chert-reduction area, and concentrations of mussel and fish remains) and large, well preserved hearths with abundant charcoal for both dating and wood species identification. Such stratified sites also occur in the middle Guadalupe River drainage, including Johnston-Heller (Birmingham and Hester 1976), Willeke (41VT17), and Berger Bluff (41GD30, on Coleto Creek). To date, only Berger Bluff has been partially excavated (D. Brown 1983; K. Brown 1987, n.d.). I have also seen stratified sites at the mouths of major creeks emptying into the Rio Grande in Webb County; no excavations have been done at these.

Cemetery sites are present in southern Texas, and are rather common in the coastal bend. The Loma Sandia site (41LK28 [Taylor and Highley 1995]) is the best known, having yielded a large number of burials with associated mortuary caches. Loma Sandia once appeared to be anomalous, with its concentration of burials and numerous grave goods. Now, we know of two or more such cemeteries in the Falcon Reservoir area of South Texas and adjacent northeastern Mexico, again with many burials and grave goods paralleling those of Loma Sandia. Unfortunately, lack of enforcement of antiquities laws and treaties have left these Falcon sites to the mercies of collectors and looters, and only a couple of devoted avocational archeologists have made the effort to

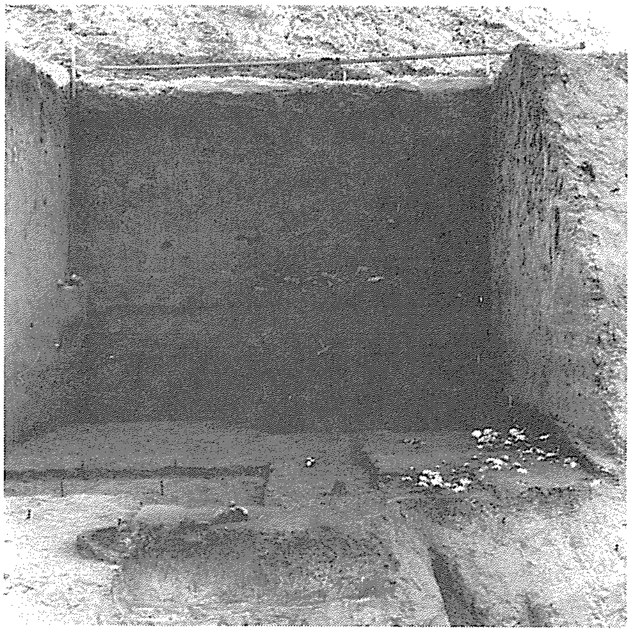


Figure 4. Deeply Buried Occupations at Site 41LK31/32, Choke Canyon Reservoir Project. One occupation level, represented by hearth in profile, dates to ca. 2400 B.C. Earliest occupation is at the base (note the shell accumulation), at ca. 3400 B.C. From Hester (1980:Figure 4.30).

document and scientifically record these burials. This fiasco at Falcon, during low-water episodes in the 1980s and 1990s, is evidence of the failure of the International Boundary and Water Commission to live up to its responsibility to protect archeological sites (although one minor survey was done by O'Neill et al. [1992]) on both sides of this reservoir. None of these kinds of sites were detected by the limited Falcon Reservoir salvage efforts in the early 1950s (e.g., Cason 1952), and despite state and federal laws, and international treaties, motorboat looters have largely erased a critical archeological record.

Other burial sites have been documented in recent years. These include the Haiduk burial (Mitchell et al. 1984), with Late Archaic diagnostics at a site in Karnes County; several disturbed burials at the Shrew site (Labadie 1988); a burial in Lavaca County (Hester 1994a) with an associated Gahagan biface, reflecting trade with East or southeastern Texas; and a Late Prehistoric burial in Frio County (Hester et al. 1993) with an associated Scallorn arrow point. One burial salvaged by James B. Boyd at Falcon Reservoir had a Caracara point (Saunders and Hester 1993; Turner and Hester 1993) deeply embedded in a vertebra; other burials in that area have also yielded Caracara points as mortuary inclusions. We are awaiting radiocarbon dates to help place this point type, and these burials, in the appropriate temporal niche within the Late Prehistoric. Stable isotope studies, designed to reveal dietary information, have also been undertaken by Jeffery Huebner.

Sites with rock art are extremely rare in southern Texas. Overhangs with pictographs are known from Webb County (e.g., Hester 1986b; see Figure 5), and James B. Boyd has photodocumented several pictograph sites on the Mexican side of the Rio Grande in the Falcon Reservoir area. A major petroglyph site known as the Fronton de Piedras Pintas (Morales 1983) lies about 50 km from the border near Paras, Nuevo Leon; it has been visited in recent years by Rose Treviño (Laredo), who has extensive photographic records from the site. Other pictograph sites are known to occur in overhangs or on bluffs along the Nueces River between Uvalde and La Pryor (e.g., the Bee Bluff pictograph and petroglyph site reported by Ray Smith, personal communication, 1987; records on file at TARL). A petroglyph site is also reported by Smith east of Uvalde, just south of the Balcones Escarpment.

At several sites, painted pebbles have been found. These are thought of as typical of Lower Pecos rockshelters (Shafer 1986). However, a

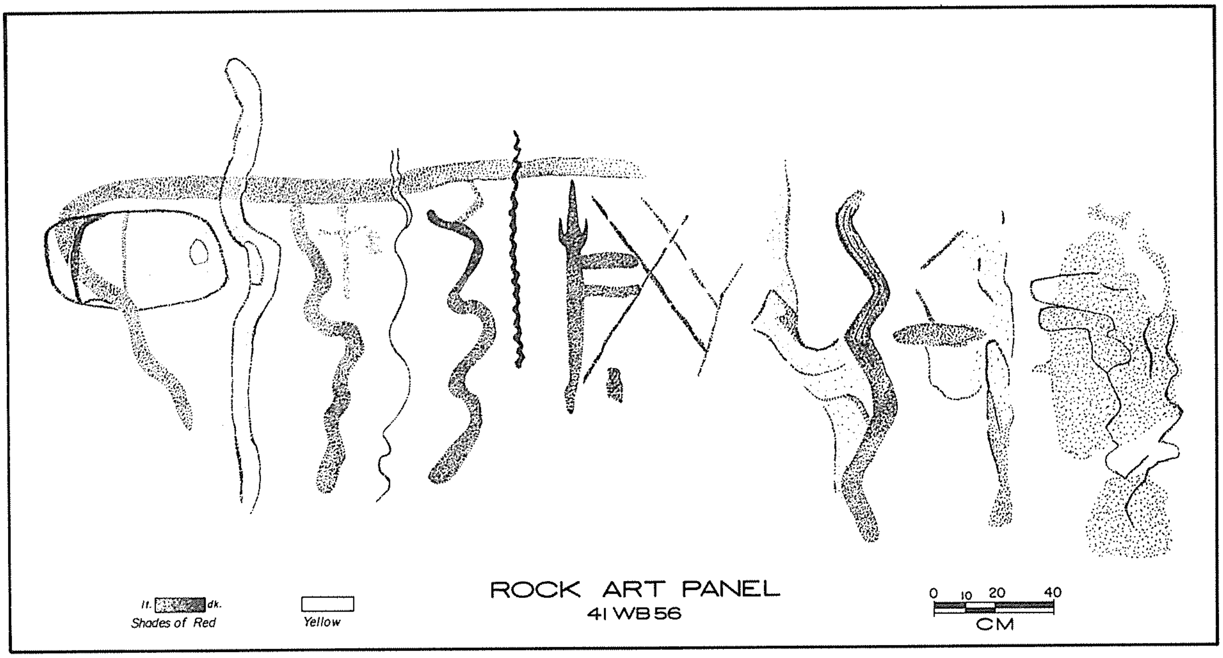


Figure 5. Pictograph Panel at Site 41WB56, Webb County. Note legend regarding colors of the rock art. Drawn by Kathy B. Roemer (from Hester 1988:Figure 1). Courtesy of Southern Texas Archaeological Association.

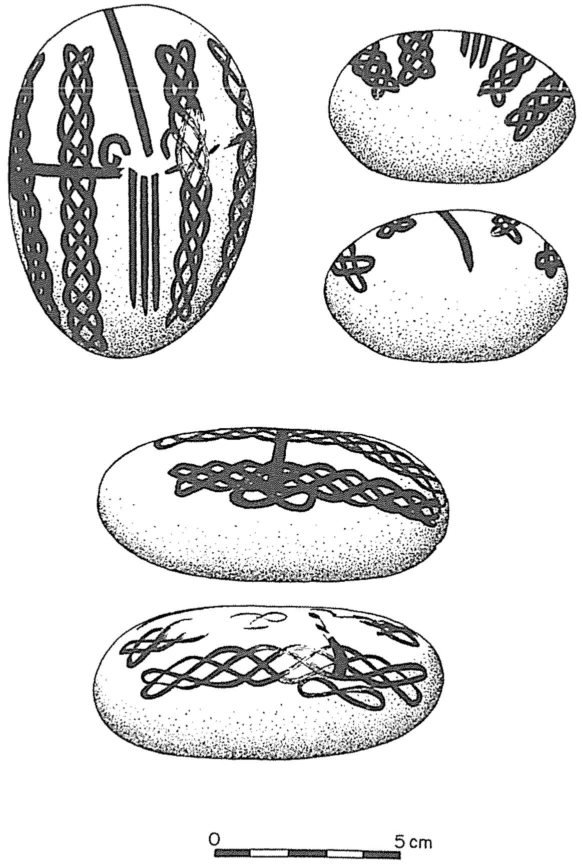


Figure 6. Painted Pebble from Zavala County. Various views are shown; painting is in red. Drawing by Richard McReynolds. Courtesy of H. Ray Smith.

number have now been documented at sites on the coastal plain in southern Uvalde and northern Zavala Counties (Figure 6; Hester 1977a; Ray Smith, personal communication, 1987; records on file at TARL). The date(s) of the rock art sites or the painted pebbles is unknown.

As the South Texas archeological record vanishes, from natural erosion, reservoir projects, urban expansion, relic-collecting, and hobbyist activities, there is a special need to document collections as thoroughly as possible. The members of the Southern Texas Archaeological Association, especially C. K. Chandler, William W. Birmingham, E. H. Schmiedlin, Jimmy L. Mitchell, and others (who have documented, for example, the Bromley Cooper collection in a series of papers) are to be commended for their efforts. Others, like James B. Boyd, are recording and documenting sites and artifacts with great precision, and are openly sharing these data with professional archeologists. This effort needs to be greatly intensified. Unfortunately, there is the erroneous belief among many collectors in the region that professionals can "confiscate" their collections; this is patently untrue, but can restrict documentation tasks. Landowners such as Radcliffe Killam of Laredo have made collections available for documentation (Bettis 1994), while some families have donated major collections for long-term curation and research (e.g., at TARL, the Bromley Cooper and Dr. Pat Riley collections). This is to be especially encouraged.

CULTURAL-HISTORICAL FRAMEWORK

The characteristics of the South Texas archeological record, and the comparative lack of intensive excavations, all contribute to a chronology that remains poorly known. Johnson and Goode (1994) have recently offered a revised chronology for the central part of Texas, derived from more than 70 years of excavations and recent major research efforts that have yielded better stratigraphic and radiocarbon ages. Unfortunately, this cannot be done for southern Texas, nor can we fine-tune the chronology as they have done for Central Texas. What can be presently offered is a general framework for the Paleoindian, Archaic, Late Prehistoric, and Protohistoric periods. Our knowledge of the culture history is improving, both through field and laboratory research and by cross-dating artifact types with other areas, and specific examples are given here. However, we still have to rely on the basic chronological divisions provided by Hall et al. (1986) and by Black (1989).

Paleoindian

It has long been known that fluted points of the Clovis and Folsom types occur in South Texas (Hester 1968, 1977b). The presence of Clovis (Figure 7) suggests that the earliest occupation begins around 11,200 years ago.

In the case of both of these types, intensified collection documentation in South Texas has provided much additional information on their distribution and their variability in morphology and raw

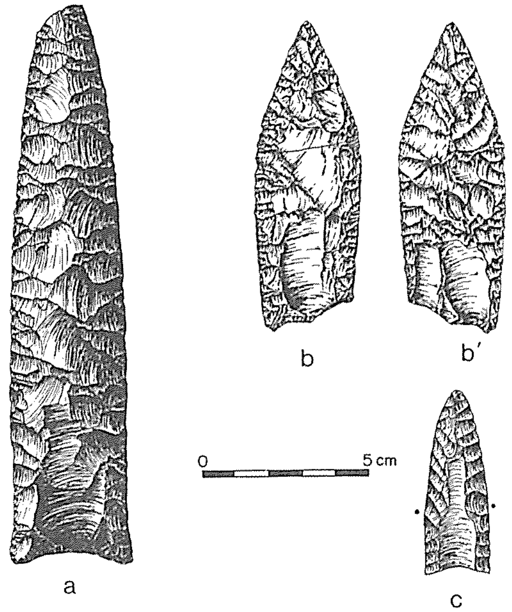


Figure 7. Clovis Points from Southern Texas: a, Nockenut Clovis from Wilson County (Kelly 1988); b-b', unfinished Clovis point from Atasocosa County (Hester, Barber, and Headrick 1993); c, Clovis point from Dimmit County (Turner and Hester 1993). A, drawn by Richard McReynolds; b, b', Pam Headrick; c, Kathy Roemer. Courtesy of Southern Texas Archaeological Association and Gulf Publishing Co.

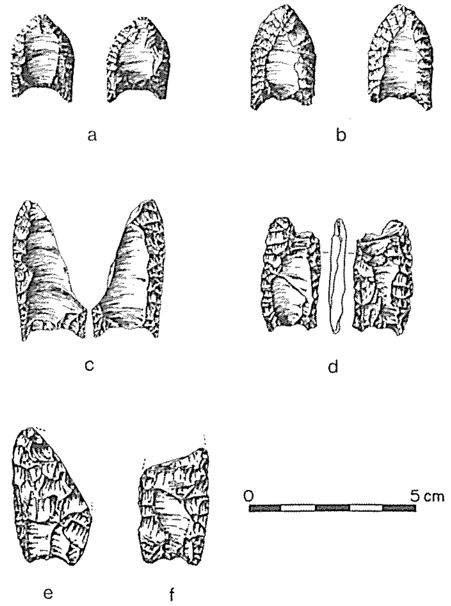


Figure 8. Folsom Points from Southern Texas: a, Zapata County; b, Maverick County; c-d, Webb County; e-f, Falcon Reservoir area (d-f, unfinished Folsoms abandoned in manufacture). A-b, drawings by Richard McReynolds; c-f, drawings by Pam Headrick; a-b, from Chandler and Kumpe (1994a), courtesy, Southern Texas Archaeological Association; c-d, Bettis (1994); e-f, courtesy, James B. Boyd.

material. For example, large Clovis specimens made of Edwards Plateau chert (see Figure 7a) (translucent brown) have been found at sites in Wilson and Dimmit counties (Kelly 1988). Another from Atascosa County provides insight into manufacturing techniques (see Figure 7b-b'; Hester et al. 1993). One Clovis base was found at a locality on Southern Island on the Mexican side of Falcon Reservoir; reportedly, up to 22 other Paleoindian points were collected from that site (notes on file with the author, TARL).

No mammoth kill or butchering sites attributable to Clovis have been found in South Texas, although the Late Pleistocene fauna and possibly associated lithics in the deposits of the Berclair Terrace in Goliad and Bee counties remain an enigma (Sellards 1940). Mammoth remains are commonly found as secondary deposits along South Texas creeks (T. C. Hill, Jr., personal communication, 1971; Kay Hindes, personal communication), as well as in the paleochannel of the Palo Blanco River of Kenedy County (Suhm 1980). Brown (1990) reports the geomorphological context of elephant remains buried in gully fill at the interface of the South Texas-Edwards Plateau regions north of the San Antonio airport. However, no artifacts were found in association with the elephant remains.

Folsom artifacts are also widely reported across the Rio Grande Plain (Figure 8; Chandler and Kumpe 1994a; see also Largent and Waters [1990], although their distribution map is not a wholly accurate representation of the geographical or numerical distribution of Folsom in the area). Numerous brief papers have appeared in *La Tierra* documenting specimens from the region, along the drainage of the Rio Grande (Chandler and Kumpe 1994b; Cole Moore, personal communication; notes on file at TARL) and east and south on the coastal plains (e.g., Chandler and Lopez 1992). Folsom point preforms or failures have been found in collections in Webb County (Bettis 1994; Figure 8c-d) and near Falcon Lake (James B. Boyd, personal communication, 1995; notes on file at TARL; see Figure 8e-f). Aside from localities with two or three Folsom points (Hester 1968), no Folsom camp or kill sites have been located. The nearest, on the edge of the Balcones Escarpment in Bexar

County, is Pavo Real (41BX52 [Henderson and Goode 1991]); Clovis materials are also reported from this site.

Certainly the most intriguing Paleoindian site to have been excavated in the region is Berger Bluff (41GD30) in Goliad County (Brown 1987, n.d.). Buried more than 8 meters below the surface along Coleto Creek (and now indundated by Coleto Creek Reservoir), excavations on a ledge or bench deposit uncovered a hearth, an in situ chipping area, cores, two small pits, and an unfinished (or rejected) triangular biface; there were no projectile point diagnostics. Eight radiocarbon dates were obtained, averaging around 9500 B.P., although both earlier and later dates were obtained. Associated with the cultural material was a considerable bone deposit of small mammals, reptiles, and amphibians. Detailed research by Brown (n.d.) indicates that these were collected and eaten by human foragers, perhaps by what Brown suggests was a task group of women and children. The Berger Bluff fauna, as well as tiny snails obtained by waterscreening, is fully Holocene in character, but with some species that are no longer present in the area today. Three species of snails, now extripated in the Coleto Creek/southern Texas area, are more typical of colder waters, or of marshes more typical of the eastern United States.

Later Paleoindian patterns in southern Texas are represented by large numbers of projectile points (Figure 9; Weir 1956; Hester 1977b, 1987). However, typological problems abound in distinguishing between Plainview (ca. 10,000 B.P.) and Golondrina (ca. 9000 B.P. [Hester 1983]). Clearly, there are points that would fit within the range of Southern Plains Plainview points, and many of the Golondrina forms are quite distinct (Figure 9d-e, but see Figure 10, a cache of Golondrina points from southern Uvalde County, reflective of variation within the type, ranging from the finished form to heavily resharpened ([Hester 1994c:41]). Kelly (1982) provided a statistical approach to distinguishing between the two types, using specimens from South Texas. In addition, there are many parallel-sided points that have been called Plainview (see Figure 9a-b) but which are usually smaller and more narrow than those from the type site and related localities. For example, at St. Mary's Hall in Bexar County, excavations in 1977 revealed a discrete camp site and chipping locality with distinctive points. While they have been called Plainview in several papers (e.g., Hester 1990b), I am now convinced that they are not of this type. My re-assessment is based on stratigraphically-recovered points from the Wilson-Leonard site in Williamson County, where similar points appear to date after Golondrina. Anne Kerr (personal communication, 1995) calls these "St. Mary's Hall points." A better picture of the relationships of several Central and South Texas Late Paleoindian types will be possible upon analysis and publication of the Wilson-Leonard data.

Another Paleoindian type known from Devil's Mouth (Johnson 1964) and Wilson-Leonard (Michael B. Collins, personal communication, 1995) is also present in South Texas. This is the Early Stemmed or "Wilson" type (Turner and Hester 1993). Bettis (1994) reports one specimen from Webb County.

Extremely common in southern Texas is the Angostura type (see Figure 9f-g). Recent excavations in the area of the Applewhite Reservoir in southern Bexar County have uncovered a buried Angostura component radiocarbon dated to approximating 9800

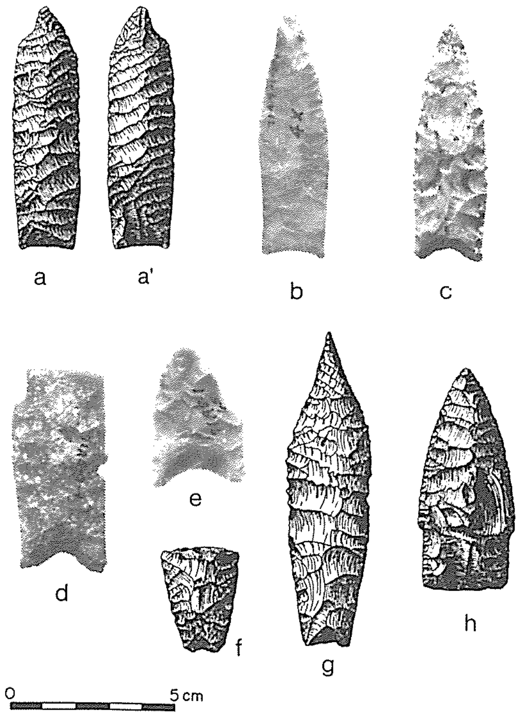


Figure 9. Late Paleoindian Points From Southern Texas: a-a', b, Plainview (Chandler 1994; Hester 1968); c-e, Golondrina (Hester 1968); f-g, Angostura (courtesy, H. Ray Smith); h, Scottsbluff (Chandler and Hindes 1993). Drawings by Richard McReynolds.

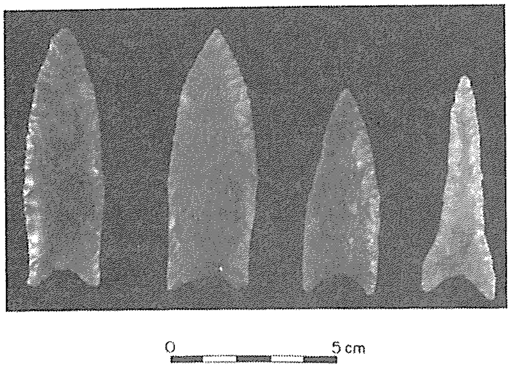


Figure 10. Cache of Golondrina Artifacts from Southern Uvalde County. Courtesy of H. Ray Smith.

B.P. (Thoms and Mandel 1992). This is in line with dates for Angostura from Wilson-Leonard (M. B. Collins, personal communication, 1995). Possibly related to Angostura is the Early Stemmed Lanceolate form (Turner and Hester 1993) found in some numbers in Victoria County (Birmingham and Hester 1976), and perhaps in the Late Paleoindian/Early Archaic cache reported from Loma Sandia (Taylor and Highley 1995).

Scottsbluff points (see Figure 9h) typical of the Plains and into eastern Texas (Turner and Hester 1993), are scattered across southern Texas (Hester and Hill 1971a; Chandler and Hindes 1993), with a notable concentration in the Victoria County area. Based on cross-dating with the Plains, these are thought to date around 8800-8400 B.P. (Gunnerson 1987).

A typological problem that is present in South Texas Paleoindian studies involves the so-called Lerma type (as defined by MacNeish 1958). These narrow, bipointed specimens may or may not be of Paleoindian age (Turner and Hester 1993). An unpublished manuscript by the late T. C. Kelly (1989) remains the best effort to assemble data on the Lerma form in southern Texas and northeastern Mexico. A point classified as Lerma was found at the base of a stratified site on the Nueces River (41ZV263) by Gibson (1981), but is not chronometrically dated.

The best opportunity in southern Texas to find the Late Paleoindian forms in context, and to gain other than typological or distributional data for them, are the deep sites noted earlier in Victoria County, especially Johnston-Heller and Willeke. Work at the River Spur site (41VT112) in 1993 (Cloud et al. 1994) suggested that this was a stratified Paleoindian site. However, excavations by Michael B. Collins and myself in June-July, 1995, indicate that these materials were in a lag (secondary) deposit.

Early Archaic

In dealing with the Early Archaic, I draw heavily from a paper prepared for a conference on the Archaic of southern North America (Hester 1989b). We are still a long way from having a sufficient number of excavated sites and applicable radiocarbon dates to develop a detailed description and chronology of this early period in southern Texas.

To summarize the Early Archaic patterns in the 1989 paper, I offered definitions of two widespread horizons. The first was termed the "Early Corner Notched Horizon," followed by the "Early Basal Notched Horizon" (the latter has affinities to the Calf Creek horizon in Oklahoma and Arkansas [Wyckoff 1995]). Dating of these horizons parallel the chronological parameters provided in Central and lower Pecos Texas for related phenomena (see papers by Collins and Turpin, this volume). My goal in offering these two concepts was to emphasize the broad cross-regional distributions of the index-marker projectile points of these horizons in the Texas-Mexico borderlands.

In southern Texas, the "Early Corner Notched Horizon" is most poorly known. It is typified by corner-notched dart points with recurved or notched bases. Typologically, these would fit within the Martindale-Uvalde-Baker-Bandy continuum (Figure 11a-c; see also McReynolds 1993), and to some specimens of the Gower type (Ricklis and Cox 1991). While points of this horizon are seen in collections from the region (e.g., Hester and Whatley 1992), their site distribution is little understood. In the excavations at Choke Canyon reservoir, site 41LK51 yielded a Bandy-style point, along with thin triangular bifaces, and from a context 20 cm below a radiocarbon assay of 5130-4450 B.C. At Chaparrosa Ranch, points of this horizon are on high terraces overlooking Turkey and Chaparrosa creeks. As noted above, settlement patterns for the Early Archaic are unknown; perhaps these peoples operated as small bands, highly mobile and wide-ranging due to the arid climate inferred for part of this time frame (McKinney 1981; Story 1985). McGraw and Knepper (1983) in their survey of the East Chacon area found Guadalupe tools to

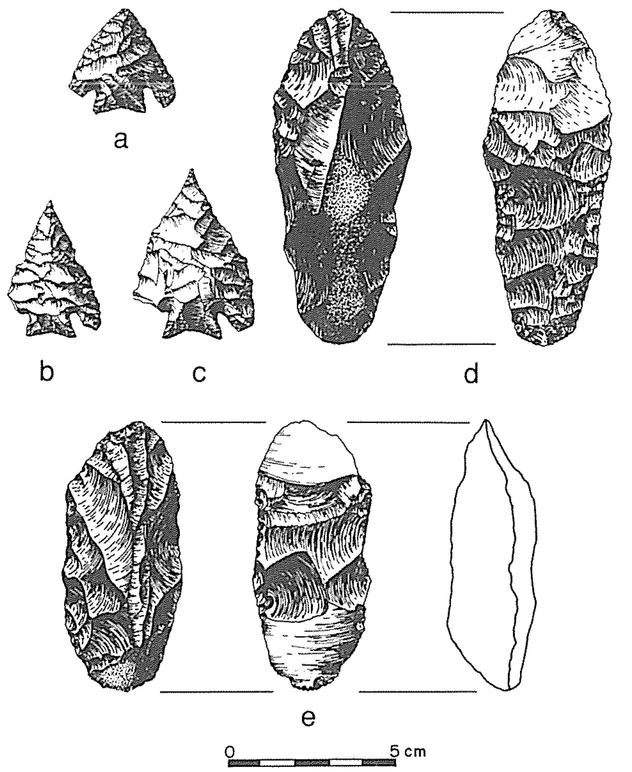


Figure 11. Artifacts from the "Early Corner Notched Horizon" in Southern Texas: a, Atascosa County; b-c, Bexar County (McReynolds 1993); d-e, Guadalupe tools from Choke Canyon (Hall et al. 1982: Figures 75-76). Drawings of a-c by Richard McReynolds.

be "water-proximate," while the general Early Archaic settlement paralleled that of the previously mentioned Chaparrosa Ranch and the Paleoindian site distribution in this area.

The "Early Corner Notched" horizon markers may encompass the bifurcated base points found by Thoms (1992) at the Richard Beene site (41BX831), with a radiocarbon date of about 7000 B.P. Interestingly, James Karbula (personal communication, 1995) has found what appear to be identical points at the Eckols site in Travis County, stratigraphically below a component with Martindale points (Karbula 1993). It may be that these bifurcated points are a Central Texas, not a South Texas, form, but this is just speculation given the meagre data on hand. From typological cross-dating, the temporal span of the "Early Corner-Notched Horizon" may be from ca. 6000-3500 B.C.

Associated with this earliest Archaic horizon appear to be Guadalupe tools (see Figure 11d-e; Hester and Kohnitz 1975; see also Prewitt 1981:78). Alhough found mostly in the San Antonio-Guadalupe River basins (Black and McGraw 1985), they also occur along the Rio Grande, along the middle Nueces drainage (Brown 1985, 1989; Nightengale et al. 1989), and in the Zavala County region (Highley 1984). Based on radiocarbon dates for Guadalupe tools along the southern edge of the Balcones Escarpment, they fall somewhere in the range of 3300-4700 B.C. (e.g., Hester 1990a:1).

The subsequent "Early Basal Notched Horizon" includes specimens with deep basal notches, large barbs, and distinctive long stems (Figure 12a-g). The recognized types include Bell and Andice of the Calf Creek horizon. Early Triangular bifaces are probably also part of this horizon (Hester and Whatley 1992); some of these are preforms for Bell/Andice, others may have been used as knives (Black and McGraw 1985), and yet others bear impact flutes indicative of their use as dart points. Based on my excavations in Uvalde County (at the La Jita and Smith sites [Hester 1971; Hester et al. 1989]), it looks as if the Early Triangular form may first appear in the "Early Corner Notched Horizon," and perhaps continue into the later horizon.

The "Early Basal Notched Horizon" extends from the southern Texas coast, across the Rio Grande Plain, and into northeastern Mexico east of the Sierra Madre Oriental (Chandler and Kumpe 1993; James B. Boyd collection; notes on file at TARL). Fox and Hester (1976) reported Andice points from 41VT17 in Victoria County, and Bell/Andice are noted in several papers in *La Tierra* as derived from surface contexts in South Texas (e.g., Hester and Whatley 1992; Chandler and Kumpe 1993). Ricklis and Cox (1991) report Bell points from the McKinzie site (41NU221) at the mouth of the Nueces River; these specimens, and three unstemmed points, are linked to radiocarbon assays of ca. 3000-3600 B.C. (see Ricklis, this volume). In general, the "Early Basal Notched Horizon" likely dates in this rough time frame. Other recognizable traits of this horizon are large unifacial "Clear Fork" tools (Hester and Kohnitz 1975), as well as smaller forms (Hall et al. 1982:Figure 79) and multi-notched "eccentric" Bell/Andice specimens, found as far south as Falcon Reservoir (see

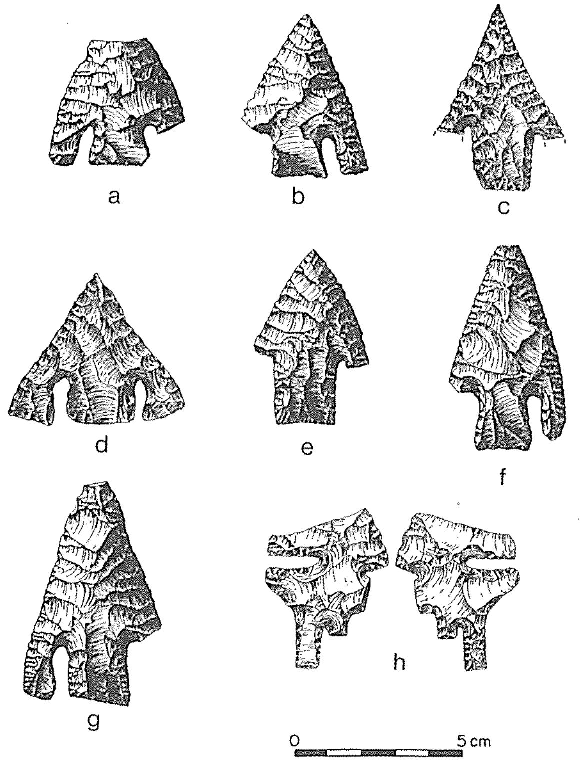


Figure 12. Artifacts from the "Early Basal Notched Horizon" in Southern Texas: a-g, points of the Calf Creek horizon (a-b, Starr County; c, McMullen County; d, 41VT6; e, 41ZP83, f, Zapata County; g, 41SR174. Drawings a-b, e-f from Chandler and Kumpe [1993]; c-d from Turner and Hester [1993]); h, multi-notched Calf Creek "eccentric" (Southern Island, Falcon Reservoir [Hester 1990c]). Drawn by Richard McReynolds, a, b, e-g; c-d, Kathy Roemer; h, Pam Headrick. Courtesy Southern Texas Archaeological Association, and Gulf Publishing Co., Houston.

Figure 12h; Hester 1990c). In the Falcon Reservoir, the large Andice/Bell stems are sometimes reworked into projectile points (Boyd Collection; notes on file at TARL).

Although Johnson and Goode (1994:5) include the latter part of this range in their Central Texas "Middle Archaic," I prefer to follow Hall et al. (1986) in defining the South Texas Middle Archaic period with the onset of specific regional cultural patterns ca. 2500 B.C., emphasizing unstemmed dart points and smaller bifacial and unifacial beveled tools. Of course, the way in which I have modeled these two horizons, in defining broad cultural patterns across several parts of Texas, may be too simplistic as we learn more about the southern Texas Early Archaic. For example, at site 41LK31/32, the early occupation dated at 3380-3350 B.C. yielded diagnostics of neither horizon. While there were several well-defined features, abundant mussel and *Rabdotus* shell, cores, debitage and faunal remains, the only "formal" artifacts were three unstemmed thin biface fragments (Hall et al. 1986:397). The diet appeared to focus on freshwater mussel, *Rabdotus* snails, turtles, and freshwater drum (Scott 1982).

Middle Archaic

Hall et al. (1986) date the Middle Archaic between 2500-400 B.C. As just noted above, this period represents a regional material culture pattern easily seen in the archeological record. Triangular dart points, known as Tortugas and Abasolo (Figure 13a-b), dominate the projectile point assemblage. Some of them may have been used as "knives;" however, studies of triangular point assemblages from South Texas by Karbula (1990) and Bettis (1994) reveal high frequencies of impact fractures at the tip. Another regionally-specific type is Carrizo (Turner and Hester 1993), illustrated in Figure 13c. Utilitarian lithics include smaller unifacial distally-beveled tools (the *Dimmit* form [Figure 14] of Nunley and Hester [1966]), in some areas made in high frequencies from gray quartzite (Hester et al. 1973; see also Inman et al. 1995). Some distally-beveled tools are also bifacial. There is much reworking and resharpening of these tools, which appear to have been used largely in woodworking tasks (Hester et al. 1973; see Howard [1973] for experimental data). Along the Rio Grande between Eagle Pass and Falcon Reservoir, the artifacts are often made on cortex flakes, with the dorsal side flaked, and the ventral side remaining as cortex (Chandler 1974). While Hall et al. (1982:Figure 79) have proposed a sequence of these distally-beveled forms, focusing on Early vs. Late Archaic (Figure 15), it is likely that localized examples of these tools, along with extensive resharpening and other modification (e.g., for hafting) have left a functional and technological morass that will require much research to sort out. One example is the Nueces tool (see Figure 13e-f; Hester, White, and White 1969; Nightengale et al. 1989; Turner and Hester 1993), which can be lunate to trapezoidal in outline, largely reflecting the extent of resharpening of the beveled bit.

Middle Archaic sites, especially in the northern part of South Texas (Nunley and Hester 1969),

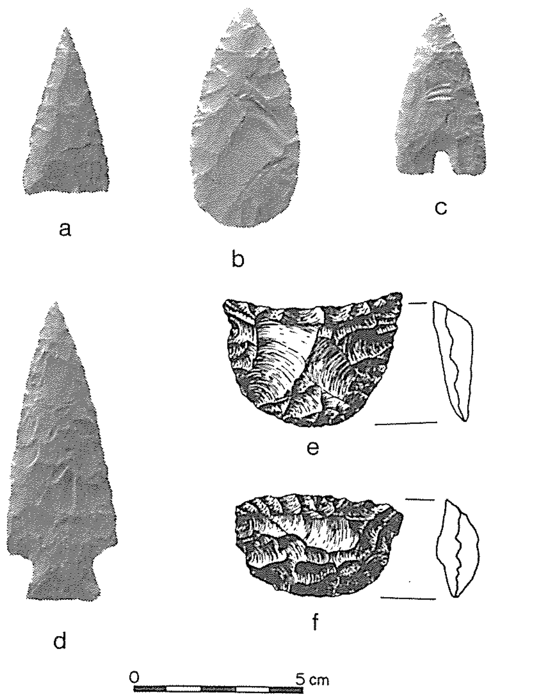


Figure 13. Middle and Late Middle Archaic Artifacts from Southern Texas: a, Tortugas point; b, Abasolo point; c, Carrizo point; d, Lange point. A-d, Loma Sandia (Taylor and Highley 1995); e,f, Nueces tools (Hall et al. 1982:Figure 73).

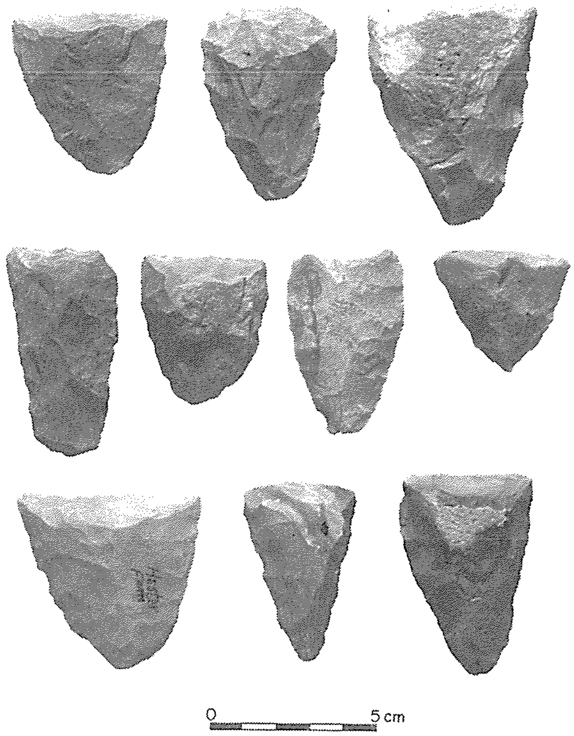


Figure 14. Distally-beveled Tools from Southern Texas (from 41DM14 and other Dimmit County sites). These are unifacial "gouges" of the form termed *Dimmit* by Nunley and Hester (1966).

are often identified by the presence of stemmed points that can be cross-dated with Central Texas (Pedernales, Lange; see Figure 13d), the lower Pecos (Langtry), and the central coastal plain (Morhiss). Assemblages that include Middle Archaic materials (and those of both earlier and later periods) are published from the middle Nueces drainage (Ward 1984; Woerner and Highley 1983; Nightengale et al. 1989), western South Texas (e.g., 41DM59 [Hester and Whatley 1992]), the Shrew site (Labadie 1988), and Falcon Lake (Kotter 1980; Saunders 1985). Many of the tubular sandstone pipes (Figure 16) found across South Texas may also date to this era (Hester 1969; Chandler and Kumpe 1993). A buried and as yet unexplored Middle Archaic component appears to be present at 41ZV37 (Inman et al. 1995), with one radiocarbon date of 1831-1880 B.C. (Tx8112-calibrated); a unifacial distally-beveled tool (Clear Fork uniface) was associated with this component.

Settlement patterns in the Choke Canyon and Chaparrosa study areas, along with those at East Chacon (McGraw and Knepper 1983) suggest that Middle Archaic open camp sites are to be found along present or former stream channels. In later Middle Archaic times, sites are present on floodplains, low terraces, and natural levees of present stream courses. Middle and Late Archaic sites in Starr County have been characterized by Nunley and Hester (1975:13) as "gallery" (on terraces or arroyo banks) and "bower" (in hilly areas overlooking the arroyos and their tributaries).

Dietary information is meagre, due to poor faunal preservation. However, data from Choke Canyon (e.g., Scott 1982), recovered from wood species identification of charcoal from well-constructed hearths, suggest use of the beans and nuts of mesquite, acacia, oak, and hackberry. Hall et al. (1986) surmise that it is during this time that plant resources drew heavy emphasis, as reflected by an increase in formal hearths, earth ovens, and burned rock accumulations

Disposal of the dead in the Middle Archaic, especially late in this period (ca. 600-800 B.C.),

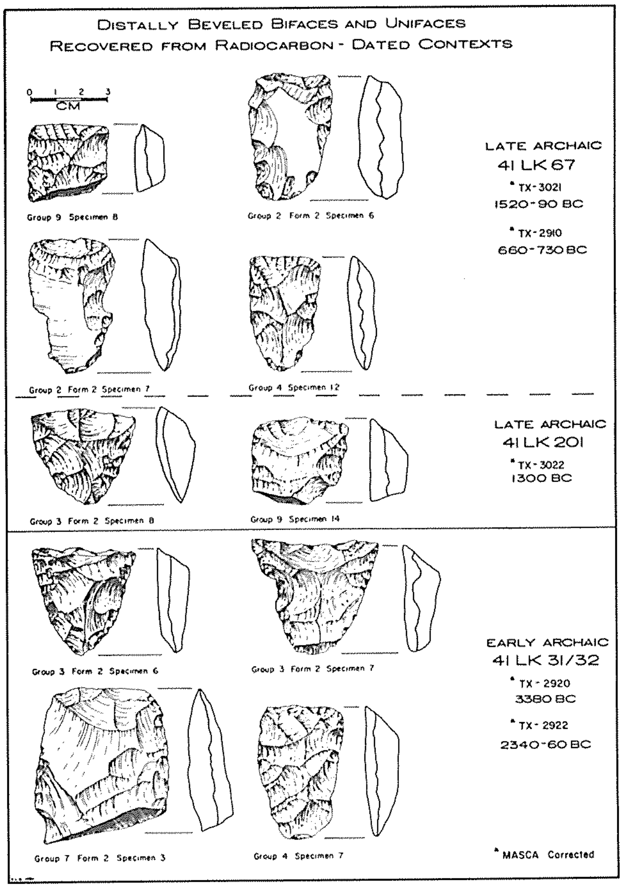


Figure 15. Sequence of Distally-beveled Tools from Choke Canyon Reservoir (from Hall et al. 1982:Figure 79). Courtesy, Center for Archaeological Research, The University of Texas at San Antonio.

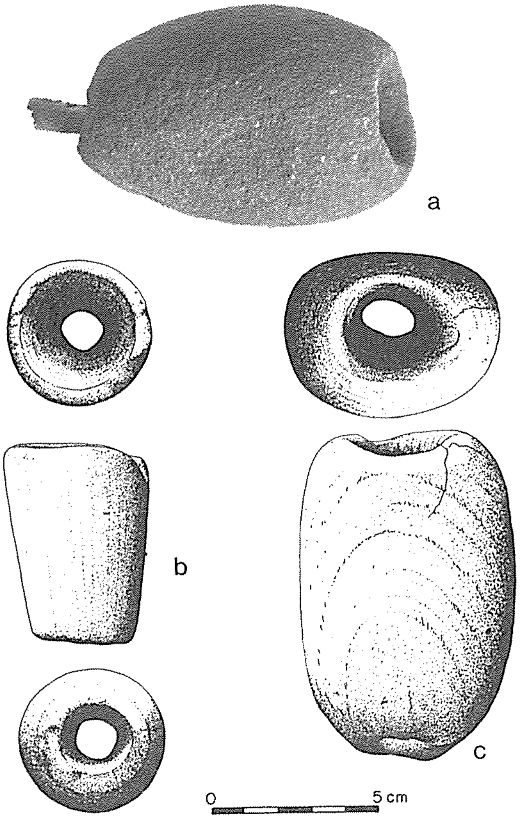


Figure 16. Tubular Stone Pipes from Southern Texas: a, stone pipe with bone smoking tube (Loma Sandia, Feature 226A [Taylor and Highley 1995]); b, Zapata County; c, Rio Salado, Tamaulipas (Falcon Lake area [Chandler and Kumpe 1994b]; drawn by Richard McReynolds. Courtesy, Southern Texas Archaeological Association, Texas Archeological Research Laboratory, and Texas Department of Transportation.

apparently involved cemeteries. Loma Sandia stands out as the best known example (Taylor and Highley 1995), with 205 burials, and more than 400 features documented at the site, many of these including clusters of grave goods found with individual burials (Figure 17). Contents of these clusters, often tightly packed as if in a net, hide bag, or basket, included triangular points (Tortugas, though with larger and smaller forms, and Abasolo), Lange, Morhiss, and Pedernales points, medium sized "gouges" (mostly unifacial distally-beveled tools), flakes, cores, fragments of marine shell (including conch), tabular pieces of sandstone (it seems like just about everyone had to be buried with small pieces of unmodified sandstone), and tubular sandstone pipes (see Hester 1980:116). In contrast to the dates for Tortugas points at this site, a single assay from 41ME34 puts a Tortugas-like point at 3362-3398 B.C. (calibrated); Hester (1990a:1) does not consider it to be Early Triangular, although the dates are more in line with that form.

However, there are apparently other cemeteries in the region, based on as-yet unpublished data from Falcon Reservoir. The Southern Island site (sites?), on the Mexican side of the river, has yielded many burials with numerous grave goods. These include tubular stone pipes and triangular dart points (as at Loma Sandia), along with *Oliva* shells, and bone beads.

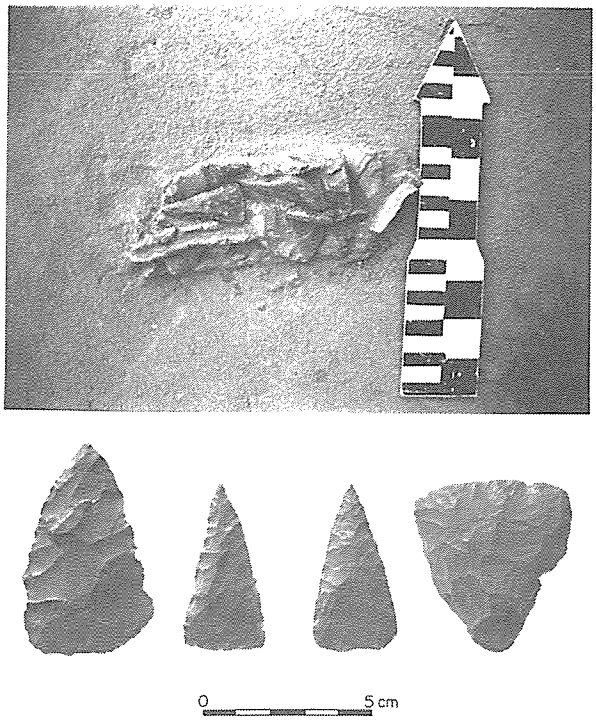


Figure 17. Artifacts from Mortuary Context at Loma Sandia (41LK28), Feature 11-D (Taylor and Highley 1995:Figure 31): left to right, triangular biface; Tortugas points; distally-beveled tool. Courtesy, Texas Archeological Research Laboratory and Texas Department of Transportation.

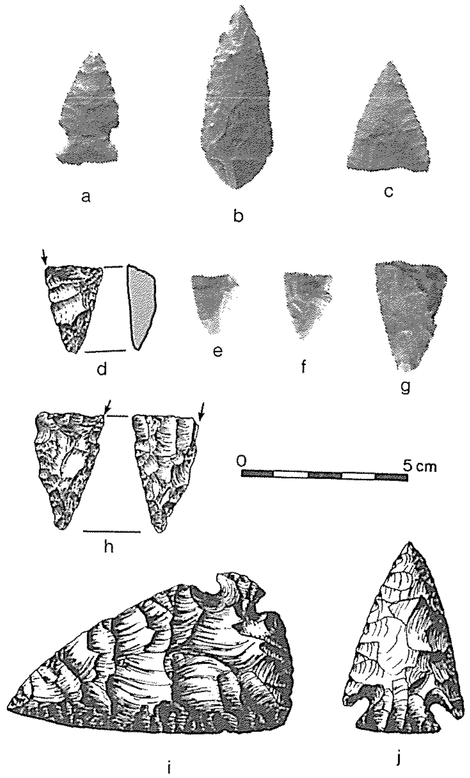


Figure 18. Late Archaic Artifacts from Southern Texas: a, Ensor; b, Desmuke; c, Matamoros (a-c, Loma Sandia [Taylor and Highley 1995]); d-h, Olmos bifaces (Duval County [from Turner and Hester (1993]), i, corner tang biface; j, Marcos point (i-j, Haiduk site [Mitchell et al. 1984]; drawn by Richard McReynolds). Courtesy, Texas Archeological Research Laboratory, Texas Department of Transportation, Southern Texas Archaeological Association, and Gulf Publishing Co., Houston.

Late Archaic

The Late Archaic is better known, dating from 400 B.C. to around A.D. 600/700. Several excavated components have been published or at least described in preliminary fashion. For example, at 41ZV10 in western South Texas, Hester (1978a) found Shumla, Ensor (Figure 18a), Marcos, and Montell points, stratigraphically below Late Prehistoric occupations. Interestingly, the Marcos and Shumla points were in deposits below those containing Ensor and Montell. The Shumla type, best known from the Lower Pecos, is also a widespread marker of the Late Archaic in southern Texas. A very high percentage of the South Texas specimens are made of heat-treated chert (Hester and Collins 1974). Olmos bifaces, small triangular gouge-like tools with specialized resharpening techniques, apparently date mainly to the Late Archaic although they may have continued to be used in Late Prehistoric times (see Figure 18d-h [Shafer and Hester 1971]).

At Choke Canyon, 44 sites yielded diagnostics of the Late Archaic, including Ensor, Frio, Ellis, Fairland, and Marcos points. Sites have extensive deposits of fire-cracked rock, both hearths and earth ovens (these continue from the latter part of the Middle Archaic), and grinding implements (manos, metates) are commonly found. These may reflect further intensification of the exploitation of mesquite and acacia beans (as well as other plant resources) after these species appeared (and spread?) during the Middle Archaic. However, at site 41LK67, Feature 8 was found, a large accumulation of fire-cracked rock (55 kg), with considerable quantitities of mussel shell, and Brown et al. (1982) note that "the cooking of mussels may have been at least one of the functions" (Feature 8 was radiocarbon dated at 400 B.C.). At Choke Canyon, Middle and Late Archaic faunal remains suggest exploitation of small animals (rodents, rabbits, turtles, fish, lizards, and snakes) and deer. *Rabdotus* snails and mussel shells are common, reflecting their collection as food sources.

Late Archaic camp sites are almost always located adjacent to present stream channels or adjacent sloughs (e.g., Kelly 1979; Highley 1986; McGraw and Knepper 1983; Warren 1986). There is clear evidence of lithic procurement sites as very common occurrences in Late and Middle Archaic times on high terraces and ridges containing Rio Grande gravels (Kelly 1979; Warren 1986) or Uvalde gravels (Hester 1975a; Davis 1992). There is no doubt that these same chert resources were also used in Paleoindian and Early Archaic times (e.g., Berger and Associates 1989). In areas where these outcrops did not occur (e.g., McGraw 1979:24), stream pebbles, gravels, silicified wood, and quartzite were exploited.

Elsewhere in southern Texas, especially in Webb and La Salle counties, Desmuke, Matamoros, and Catan points appear to be markers of the Late Archaic (see Figure 18b-c), along with Olmos tools. I suspect that we will eventually find (as the data suggest from 41ZV10) that the Late Archaic can be broken into two parts, or that it would be wise to use the concept of a "terminal Archaic" for sites with Ensor, Frio, Catan, and Matamoros points in particular. This is because they often show up in the early Late Prehistoric sites in the region (cf. Creel et al. 1979).

Cemeteries may have continued to be used in this period, as they did on the Texas coastal bend (e.g., the Oso cemetery, 41NU2) and in Bexar County (41BX1; Lukowski 1987). However, isolated burials with grave goods provide other insights into burial patterns. On the lower Nueces, in the area of present Lake Corpus Christi, a single burial associated with Ensor points was found (Hester 1989c). In Karnes County, the Rudy Haiduk site burial, with corner-tang bifaces, Marcos points (see Figure 18i-j), and other Late Archaic indicators has been published (Mitchell et al. 1984), and another, with an Ensor point in the chest area, was reported by Huebner et al. (1995). A burial found by McGraw (1983) in a Holocene Rio Grande terrace south of Laredo may also date to this period. The disturbed burials at the Shrew site are likely Late Archaic (Labadie [1988:110] places Burial 1, with the associated large triangular, edge-polished biface [Figure 19a], in the "latter part of the Archaic").

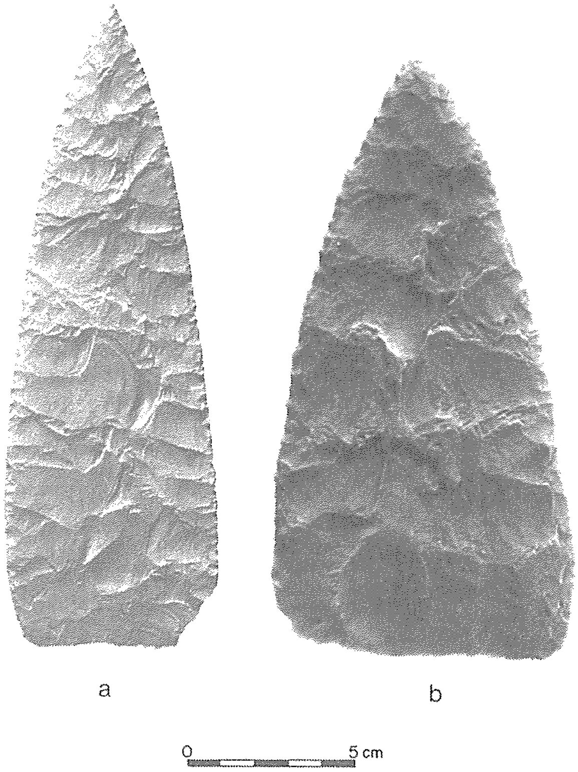


Figure 19. Large Triangular Bifaces from Southern Texas: a, 41WN73, Shrew Site (Labadie 1988); b, 41AT111 (Hester and Barber 1990). Courtesy, Texas Department of Transportation and Southern Texas Archaeological Association.

There may have been increased trade with Central Texas in the Late Archaic. Large, small-stemmed bifaces (Figure 20a-b; Hester and Green 1972) are found on an occasional basis, including a specimen from Frio County, and one with a cache of 50 bifaces (Figure 20c-g), many made of Edwards chert (Michael B. Collins, personal communication, 1995), found with a burial at Falcon Reservoir in late 1994. Large triangular bifaces (see Figure 19b) of Edwards chert are found in several areas of South Texas (e.g., the Riley cache [Figure 21]; Miller 1993; see also Hester and Barber 1990).

Late Prehistoric

The Late Prehistoric in southern Texas has been extensively studied and published on (see

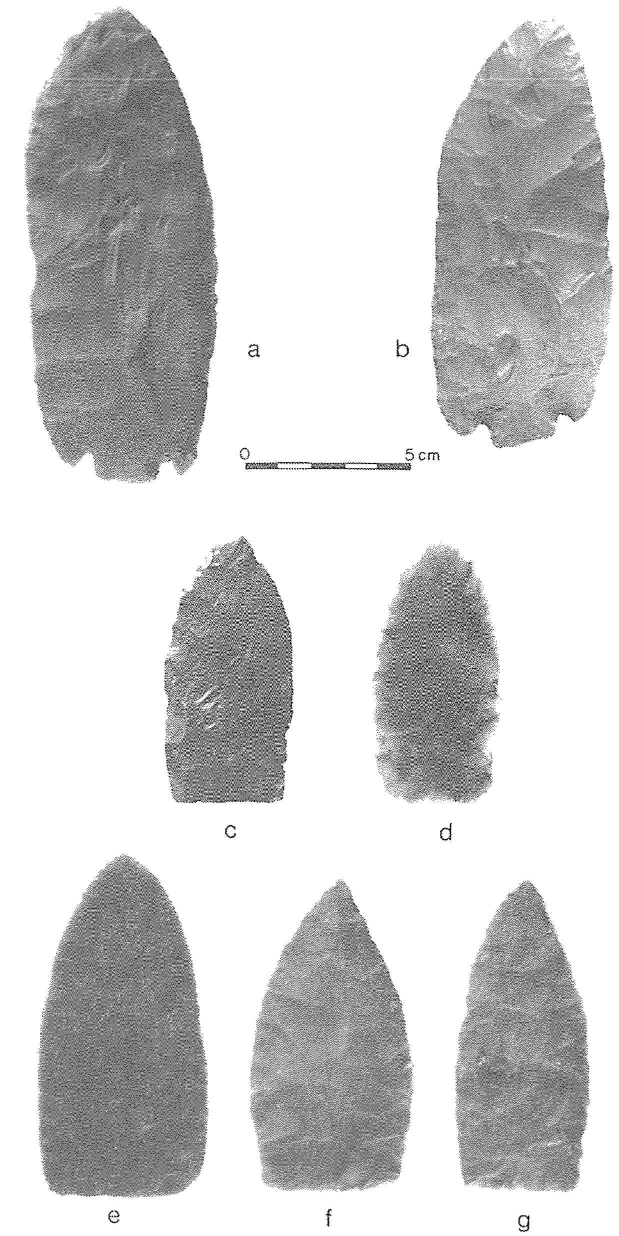


Figure 20. Selected Specimens from Cache at Falcon Lake: a, stemmed biface from Falcon Lake cache; b, specimen from San Saba County (Hester and Green 1972): compare with a; c-g, selected triangular bifaces from cache (c-d, Rio Grande gravels; a, e-g, Edwards chert). Courtesy of Cynthia Scott and James B. Boyd.

Black 1986, 1989; Highley 1986 for summaries). It shares cultural patterns with Central Texas to a certain extent, especially in the occurrence of the Toyah horizon in the region (Black 1986). The earlier parts of the Late Prehistoric are less clear. For example, "dart points" such as Ensor, Matamoros, Catan, and Zavala often occur in what are otherwise Late Prehistoric contexts, some even in very late contexts. These are small points and surely could have been used with the bow and arrow. Whether they were "recycled" by Late Prehistoric hunters, or were made and used as part of the bow and arrow system is hard to tell (evidence for the latter comes from 41LK106 [Creel et al. 1979]).

If we use the Central Texas sequence as an analogy, we can argue that Edwards and Scallorn points (Figure 22a-c) represent the first diagnostics of the Late Prehistoric period. At Blue Bayou (41VT94), Huebner and Comuzzie (1992) report a Scallorn point in a Late Prehistoric cemetery radiocarbon-dated in the 6th century A.D. Another Scallorn point (Figure 22c) was found with a burial in Frio County (Hester et al. 1993). Scallorn points, and arrow points resembling Edwards (Turner and Hester 1993), are widespread in South Texas, but we have so little on their cultural context that it is unclear as to their affinity with Central Texas. This is further complicated by their apparent co-occurrence with Perdiz points at sites like 41ZV155 (Tortuga Flat [Inman n.d.]), and with pottery, straight-stemmed arrow points, and late radiocarbon dates at 41MC222 (Hall et al. 1986). A distinctive artifact that does appear at this time is the arrow shaft straightener (Figure 22d), made of limestone, and often broken from repeated reheating in the arrow-straightening process (Turner and Hester 1993).

The introduction of pottery is another thorny issue. Once it was thought that bone-tempered pottery was introduced by the Spanish missionaries (Suhm et al. 1954). Subsequently, Hester and Hill (1971b) conclusively demonstrated the prehistoric origins of this pottery (see also Black 1982). It has been assumed that it was largely introduced via the Toyah horizon (Black 1986). However, at 41LK106 (Creel et al. 1979), there is bone-tempered pottery associated with Matamoros points at a hearth in Unit B. Though not directly radiocarbon dated, other dates for the Late Prehistoric at 41LK106 are comparatively early, ca. A.D. 860-1250.

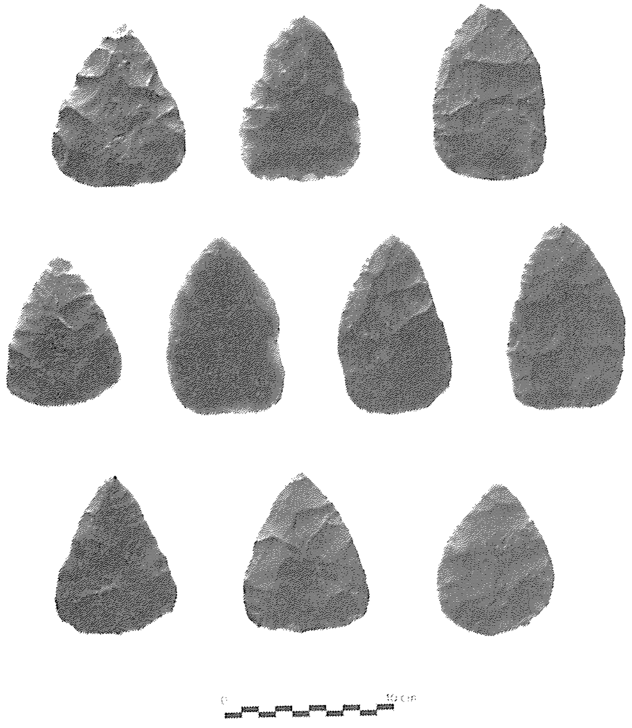


Figure 21. Selected Specimens from the Riley Cache, Atascosa County, Southern Texas (see Miller 1993). All specimens are of Edwards chert.

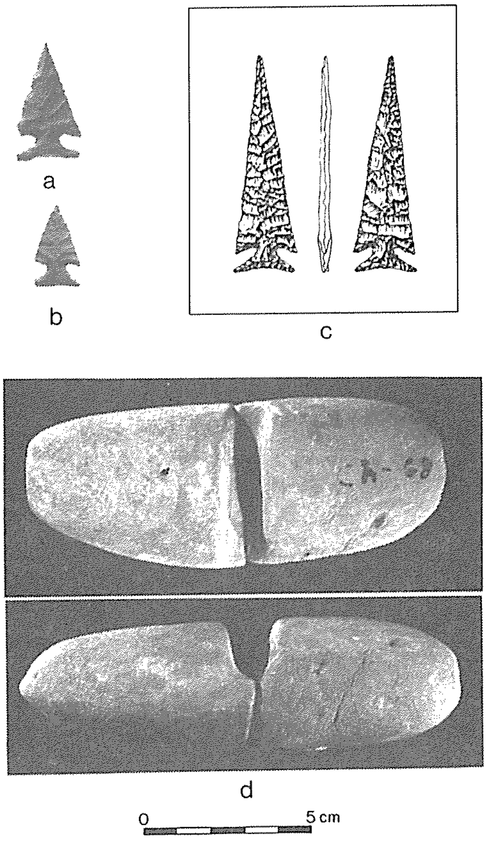


Figure 22. Late Prehistoric Artifacts from Southern Texas: a, Edwards; b, Scallorn (a-b, Loma Sandia [Taylor and Highley 1995]); c, Scallorn point associated with a burial in Frio County (Hester et al. 1993; drawn by Pam Headrick); d, arrow shaft straightener from Briscoe Ranch, Dimmit County (top and side views; courtesy Dr. Dorothy M. Brown [Hester and Brown 1988]). Courtesy, Texas Archeological Research Laboratory; Texas Department of Transportation; and the Southern Texas Archaeological Association.

Further uncertainties about Late Prehistoric internal chronology are seen along the Rio Grande below Laredo. Here, Starr points are common, but undated. They apparently have several variants about which little is known. Another type, Caracara (Figure 23; Saunders and Hester 1993; see also Fox 1979:Figure 17), is also undated but recent burials with associated Caracara points found at Falcon Reservoir may yield radiocarbon assays. Toyah points are also found with some frequency in that area, and are occasionally seen at other South Texas sites. These are assumed to date very late in the Late Prehistoric period, but we know nothing about what cultural pattern they might represent.

Across southern Texas, including portions of the coastal bend (Ricklis, this volume), the best documented Late Prehistoric pattern is the Toyah horizon (Black 1986), dating between A.D. 1250/1300 to 1600/1650. Several Toyah open camp sites have been excavated, including: Hinojosa (41JW8; Black 1986), 41LK201 (Highley 1986), 41ME19 (Hester and Kelly 1976), and the material culture reported from surface contexts at Berclair (41GD4; Hester and Parker 1970). Cultural traits include Perdiz points (Figure 24), small end scrapers (sometimes made on blades), flake knives (again, some made on blades), beveled knives (Figure 25; see Brown et al. 1982) bone-tempered (Leon Plain) pottery (Figure 26), perforators made on flakes, ceramic figurines, and perhaps pipes, marine shell and freshwater mussel shell ornaments, tubular bird bone beads, and spatulate objects made on bison bone fragments (see Figure 24j).

Faunal remains are well preserved at these sites, with up to 45 taxa represented. While there is abundant bison bone, white-

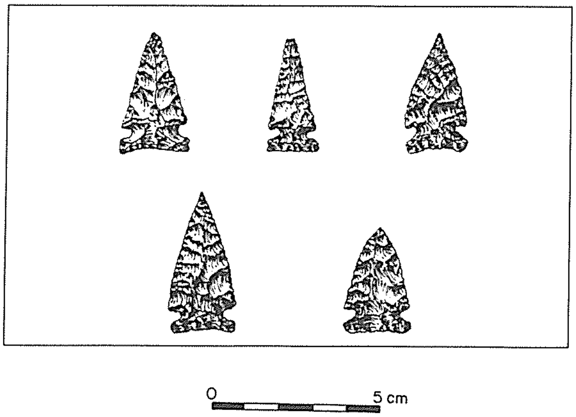


Figure 23. Caracara Points from the Falcon Lake Vicinity (from Saunders and Hester 1993 and Turner and Hester 1993) Drawings by Kathy Roemer. Courtesy of the Southern Texas Archaeological Association, and Gulf Publishing Co., Houston.

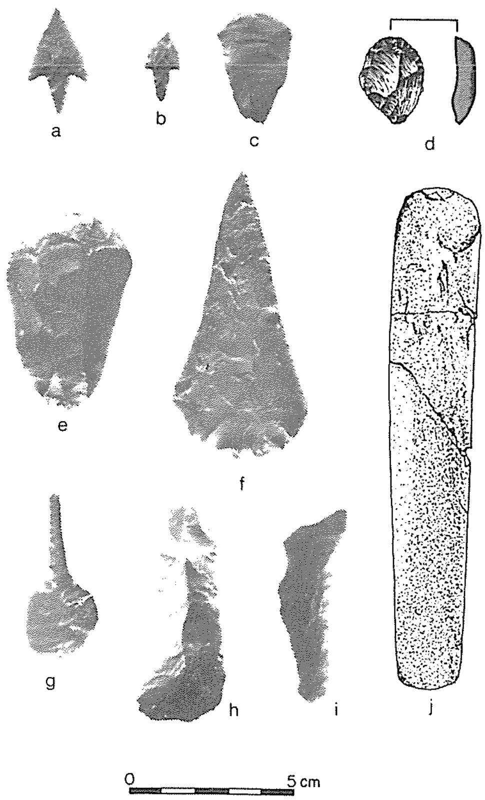


Figure 24. Artifacts of the Toyah Horizon from Southern Texas: a-b, Perdiz points; c-e, end scrapers; f, beveled knife; g, perforator made on flake; h, i, flake-blade knives; j, bone spatulate object (a-c, h-i from 41GD4 [Hester and Parker 1970]; d, 41JW8 [Turner and Hester 1993]; e-g, 41LK201 [Highley 1986]; j, 41VT66 [Huebner 1987]). Courtesy, Center for Archaeological Research, The University of Texas at San Antonio, and Southern Texas Archaeological Association.

tail deer may have been more extensively hunted, along with pronghorn and a variety of smaller game. Processing areas and bone discard locales are noted at 41LK201 and 41JW8. Turtles, freshwater mussels, and land snails continue to be a part of the diet.

Toyah sites are located along present stream channels or nearby sloughs (e.g., 41LK201), sometimes buried just below the surface of natural levees paralleling the streams. This is a pattern for other Late Prehistoric sites in much of southern Texas (e.g., Mariposa [Montgomery 1978] and in the East Chacon study area [McGraw and Knepper 1983]).

Black (1986, 1989) reasons that the Toyah archeological record represents either population

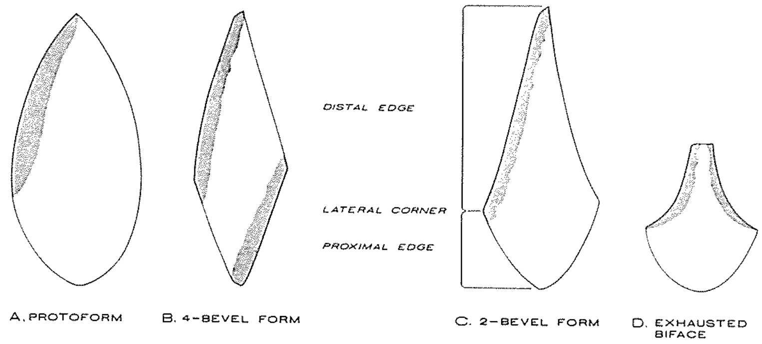


Figure 25. Beveled Knife Forms in Southern Texas (from Brown et al. 1982:Figure 22). Drawn by Kenneth M. Brown. Courtesy, Center for Archaeological Research, The University of Texas at San Antonio.

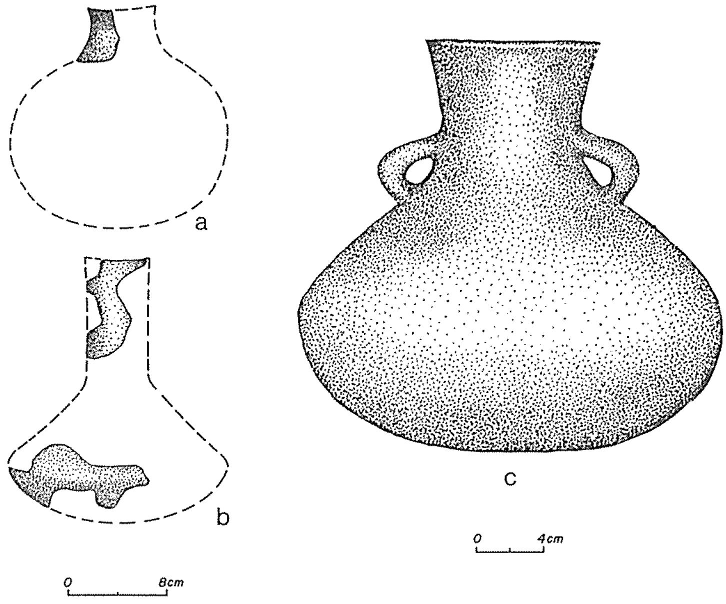


Figure 26. Pottery from Southern Texas: a, olla with fugitive red filming; b, bottle; c, olla (41LK201 [Highley 1986:Figure 38a-b and Figure 40]). Courtesy, Center for Archaeological Research, The University of Texas at San Antonio.

movement or the cultural diffusion of traits (perhaps largely associated with bison hunting practices). He favors the latter idea (see also Hester 1975b), and thus proposes the use of the term "horizon" when referring to Toyah manifestations.

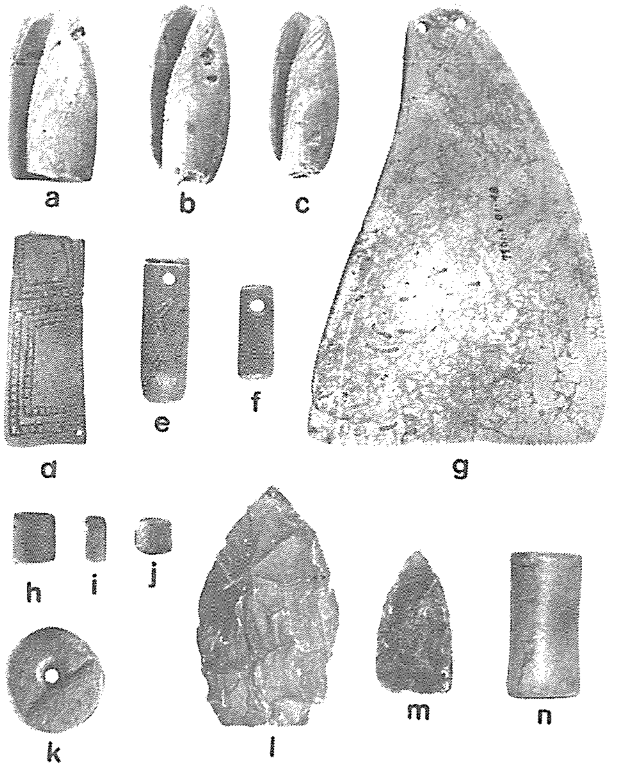
Supportive of Black's argument is the presence of selected Toyah traits in contemporary Late Prehistoric sites in parts of South Texas. For example, in the Chaparrosa Ranch area, along Tortugas Creek in Zavala County, and south into Webb, Zapata, and other counties, sites often yield Perdiz points, bone-tempered pottery, beveled knives, or some combination of Toyah traits (e.g. 41ZV155 [Inman n.d.]). However, the whole assemblage is not present at South Texas sites, and often, bison is absent (or poorly represented) in the faunal list (e.g., 41ZV10 [Hester 1978a]).

There are also sites like 41MC222 (Skillet Mountain #4 [Hall et al. 1986]) in the Choke Canyon area that have produced bison (indeed, it appears to be a bison-butchering station), and bone-tempered pottery, but stemmed arrow points that are not Perdiz, as well as the absence of beveled knives, end scrapers, etc. Scallorn and Edwards points are also present.

I suspect that native peoples of Late Prehistoric times had adopted all or some of the traits of the Central Texas Toyah, or even that Central Texas hunting parties ventured onto the coastal plain (cf. Hester and Parker 1970). The uneven diffusion of Toyah traits across the region indicates that they should be considered horizon-markers, and not part of a "phase" (Johnson 1987).

The latter part of the Late Prehistoric, which includes Toyah, also has evidence of South Texas connections to a north-south Plains trade network. Recognizable remnants of such trade are the bits of Idaho (Malad) obsidian that show up in southern Texas at this time (Hester et al. 1991).

Equally intriguing as a problem of cultural interaction is the archeological record in the Rio Grande delta during the Late Prehistoric (Hester 1969, 1988, 1994b). Numerous sites and their assemblages have been recorded and studied by A. E. Anderson (1932), Richard S. MacNeish (1958), and others (Prewitt 1974; Hester 1978b, 1994b). This cultural pattern, known as the Brownsville Complex (see Ricklis, this volume) is noted for manufacture of great numbers of shell ornaments (Figure 27a-c, g). Numerous artifacts of bone were also made (Figure 27d-f, h-j). The Brownsville Complex groups utilized clay dunes for camp sites and for cemeteries (e.g., Hester et al. 1969; Prewitt 1974). They were hunters (using Cameron and



igure 27. Selected Artifacts of the Brownsville Complex. Specimens from the Floyd Morris and Ayala sites in Cameron and Hidalgo counties (Collins et al. 1969; Hester 1969): a-c, *Oliva* shell tinkler and beads; d-f, carved bone pendant; g, conch shell pendant (length is 16.4 cm); h-j, tubular bone beads; k, disk-shaped stone bead; l-m, triangular bifaces; n, jadeite bead from Mexican source. From Hester (1980:Figure 4.10).

Starr points [Turner and Hester 1993]), gatherers and fishers, but we know little else about them (Kibler [1994:62] suggests they were "logistical collectors;" see also Ricklis [1990]).

Anderson, early in his research, also noted the occasional discovery of artifacts from what he termed the "Huaxtec" (notes on file at TARL). In 1917, he recorded a conch whorl ornament with an engraved human face that was clearly not locally made. He also found several large pottery vessels, or portions thereof, and knew enough about Mexican cultures to link these to the "Huaxtec." These identifications were confirmed and the vessels partially illustrated by Mason (1935; Hester 1988:3). Ekholm (1944) published what is still the definitive study of archeology in the Huasteca region, and he also noted the presence of vessels from this Mesoamerican culture in the Rio Grande delta. In MacNeish's (1958) survey of Tamaulipas, along the coastal plain south of Brownsville, he revisited some of Anderson's sites and found more Huastecan pottery.

In addition to the Mesoamerican ceramics, Anderson also collected several bits of obsidian and some pieces of jadeite and serpentine. These, too, were items of material culture exotic to the lower Rio Grande Delta. Later studies, such as excavation of the Floyd Morris cemetery site in Cameron County (Collins et al. 1969), uncovered a large tubular jadeite bead (see Figure 27n) with Brownsville Complex materials. Surveys by R. J. Mallouf yielded two additional obsidian flakes in Willacy County (41WY40), and Day (1981) recovered several obsidian flakes from 41WY72.

Where did these artifacts originate and how did they get to the Rio Grande delta? The ceramics include ollas, bowls, and many fragments of vessels and sherds. Some have black-on-white decoration, while others are polychrome. These are clearly from the Huasteca, and date to Periods V and VI of Ekholm's (1944) sequence. This is the Early and Late Postclassic, from ca. A.D. 1000-1520 (Willey 1966:90). In terms of context, they come from at least 16 sites. Most of the complete vessels occurred with burials, although Anderson and MacNeish both collected Huastecan sherds from delta sites with no apparent burial associations. One of the ollas came from a site known as Tanque Salado (Figure 28), likely associated with a female burial. On it is a motif almost identical to one illustrated on a Huastecan vessel in Ekholm (1944:Figure 131). Another olla was found with a child's burial (Cayo Atascoso clay dune site) in 1928 in Cameron County. Three other vessels, all from the Tamaulipan side of the delta, were with or near burials; they included a Huastecan bowl and substantial portions of two ollas from the Loma de la Pesca and La Loma Atravasada sites.

The polychromes, described as Tancol Polychrome by Ekholm (1944:433), and the Huasteca Black-on-White, are probably all from Period VI, dated between A.D. 1200-1520. However, a corrugated sherd may date to the Las Flores phase, or Period V, the Early Postclassic (ca. A.D. 1000-1200, again based on Ekholm's study (1944:395).

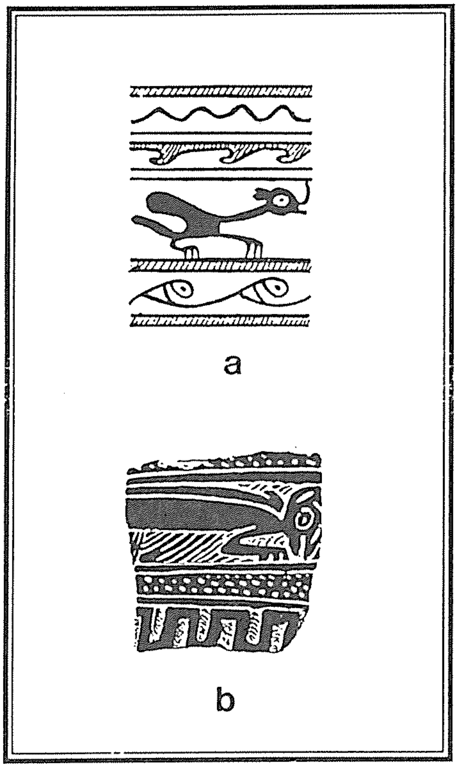


Figure 28. Comparisons of Design Elements on Huastecan Pottery and Vessel Found in the Brownsville Complex: a, portion of a design from an olla found at Tanque Salado (A. E. Anderson Collection); b, design element from a Huastecan vessel reported by Ekholm (1944:Figure 131).

The geologic sources of several obsidian flakes from the delta have been pinned down with precision, with the techniques of nuclear chemistry used by the Texas Obsidian Project (Figure 29; Hester et al. 1991). For example, a tiny flake of black opaque obsidian found by Anderson in Cameron County is linked to the Zacualtipan source in the state of Hidalgo. Seven obsidian flakes from 41WY72 are all of green obsidian (Day 1981). Visually, these appeared to be from the Pachuca, or Cerro de las Navajas source, the most famous in ancient Mexico. X-ray fluorescene analysis confirmed this (Kibler 1994:16). Finally, two flakes found by Mallouf at 41WY40, have also been identified as to source, although when we first analyzed them in the late 1970s, their source was unknown. Recently, however, David O. Brown of Austin, provided obsidian samples from a source known as Ojos Zarcos in Queretaro state not far from Guanajuato. Colleagues at the Lawrence Berkeley Laboratory, used precise x-ray fluorescence analysis (PXRF [Giauque et al. 1993]), and convincingly linked it to the 41WY40 specimens.

The jadeite and serpentine artifacts found in the delta area include a tiny celt-like specimen and a piece of worked serpentine. There is also the tubular bead noted earlier from the Floyd Morris site in Cameron County, along with what Anderson described as a spherical or jade(ite) bead no longer available for study. The geologic sources of these are unknown. They would have to come from beyond the Huasteca, perhaps in Oaxaca or any number of other areas where jadeite and serpentine are known in central and southern Mexico. What is important here is their occurrence; though they are not true jade, they are "green stone" of the sort very important in Mesoamerican cultures.

What processes might have been involved in trade or contact between the Brownsville Complex and ancient Mesoamerica? First of all, it is safe to say that the main conduit was the Huastecan culture, the northern edge of which is about 500 km down the Gulf coast from the delta (Figure 29). During the Early Postclassic, the Huasteca maintained trade relations with the Toltec empire. Late Postclassic Huastecan culture was part of the Aztec empire amd paid tribute to them (Hosler and Stresser-Pean 1992). Clearly, then, the region was closely linked with central Mexico. In the Late Postclassic, it is equally clear that the well-known Aztec traders, known as the *pochteca*, interacted with the Huastecs. Indeed, it is said that the markets of the Huasteca competed with those of Aztec Tenochtitlan (Fagan 1984:66). Throughout the Postclassic the Huastec merchants could have obtained obsidian and jade through Toltec or Aztec trade networks.

But how and why did these Huastecan commodities reach the Brownsville Complex? There are a series of frontier Mesoamerican villages in the Sierra de Tamaulipas dug by MacNeish (1958) and Stresser-Pean (1977). At first glance, they look to be likely intermediaries. MacNeish (1958) notes Huastecan Period VI "trade ware" in late sites in the Sierra de Tamaulipas, and Stresser-Pean's (1977) study of the site of San Antonio Nogalar in the southern Sierra de Tamaulipas also illustrates late Huastecan ceramics.

There is also the broad flat coastal plain east of the Sierra de Tamaulipas that could have been traversed by Huastec merchants, or perhaps travel

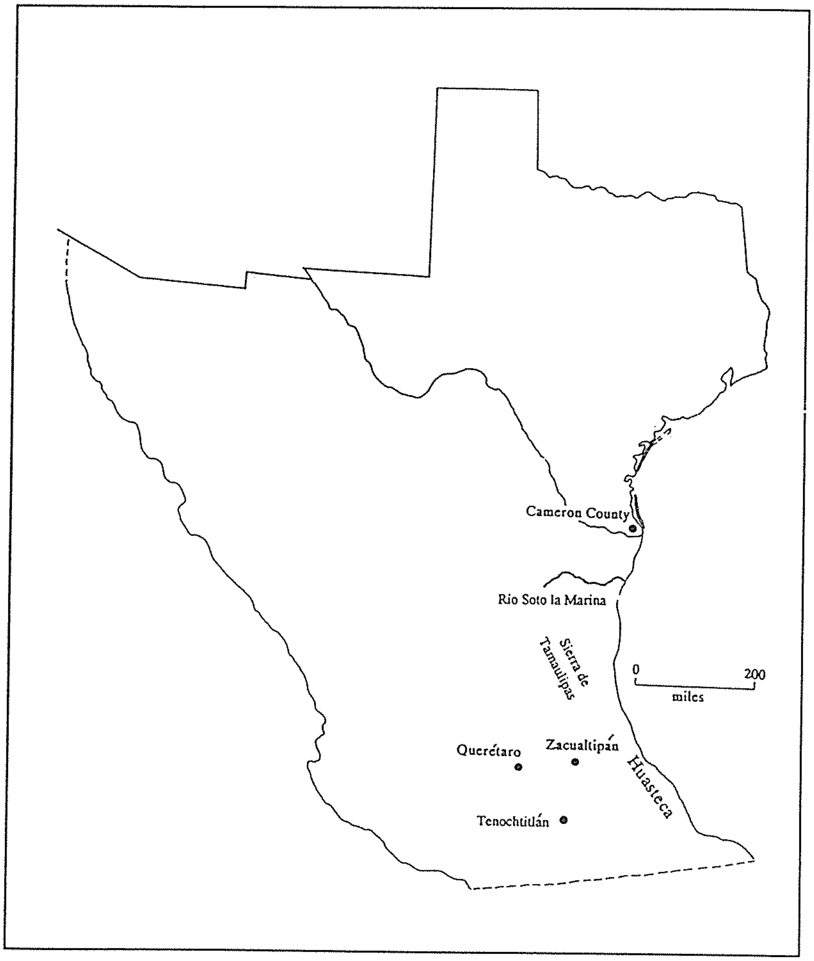


Figure 29. Map Showing Location of Geologic Sources of Obsidian From Brownsville Complex Sites (from Hester 1994b:Figure 2). Courtesy, Southern Texas Archaeological Association.

was by boat along the coast. MacNeish (1947) found what he termed Huastecan campsites north of the Rio Soto la Marina and near the Laguna Madre, only 250 km south of the Rio Grande. What drew the Huastecans north to the delta? I believe it was the shell ornament production of the Brownsville Complex. We cannot yet resolve the "chicken-or-the egg" dilemma of which came first—the shell beads or the Huastecs? Doubtless the hunters and gatherers making the prodigious numbers of shell ornaments were after more than a few pots, obsidian flakes, and poor quality jadeite! There were surely other commodities that have not been preserved. And, were the Huastecs only interested in the shell beads for themselves? Brownsville-style *Oliva* tinklers occur among the Huasteca (Ekholm 1944), are depicted on Huasteca stone sculpture, and MacNeish (1947) states that Brownsville Complex shell ornaments are common in Huasteca sites. But are these from the delta or made by the Huastecs themselves from Gulf coast shell in their region? We cannot answer this question with the paucity of modern excavation data from the Huasteca or the Rio Grande delta. It is interesting to note that one commodity specially favored by the Aztecs for their Tenochtitlan markets were marine shells and marine shell ornaments, perhaps largely supplied through Huastec tribute.

Protohistoric

Adkins and Adkins (1982:242) define "protohistory" as "the transition period between the prehistoric and historic periods denoting a phase for which few written records are available, and for which most evidence is derived from archaeology." In the archeology of the Plains, the Protohistoric concept is often used (e.g., Baugh 1986). It includes sites up to ca. 1750 at which Southwestern Indian and some European trade goods appear, but recognizes that Euro-american explorers and settlers had not yet entered the area in sufficient numbers to have "impacted the economy of the Southern Plains peoples" (Baugh 1986:183). This is exactly what we have in South Texas in the 16th and 17th centuries, before the Spanish explorers and mission system "impacted the economy" of the Late Prehistoric groups.

There are a number of sites that fall into this era. Especially well known are several in Zavala County (Hester and Hill 1975) with radiocarbon dates in this time frame. Only 60 km to the west, missions were established at what is now Guerrero, Coahuila, in the early 18th century (Eaton 1981), drawing their neophytes in part from this very area. Thus, in South Texas, the Protohistoric period seems an apt term for Native American sites dating after Cabeza de Vaca's unfortunate shipwreck, and the even more unfortunate arrival of Spaniards in the 1600s. These initial entries had no lasting effect on the native groups (unless it was the initial introduction of disease, so rampant in the 18th century), and left few written records about them. Strictly speaking, the native cultures at this time are neither Late Prehistoric nor Historic, and thus despite the views of some colleagues (McGraw et al. 1991:116, 118; Hindes 1995), I think the Protohistoric is a cultural-historical concept; absolute dates are not significant, but rather it is the potential to address important issues of culture process that is important about this period. Once we learn more about this critical time frame, we can talk with more clarity about the continuity, or lack thereof, of native culture into the mission setting (Hester 1989d). For example, given the long tradition of making bone-tempered pottery in South Texas, extending back to A.D. 800-1000, I think it is confusing to refer to the mission-era bone-tempered material as "Goliad," unless it has designs or motifs that are definitely of mission origin. Clearly, the Toyah ceramic traditions were still in place south of San Antonio and towards the coast. Such pottery seems to have disappeared, however, at the Protohistoric sites in the Chaparrosa Ranch area, perhaps one reason no bone-tempered ware is present in the Guerrero missions.

CONCLUDING REMARKS

This paper has attempted to summarize the present status of research in South Texas prehistory. There are numerous reports in the CRM literature that I have doubtless missed, and I apologize to their authors for these inadvertent exclusions. Many, however, contain either negative evidence or limited information, and I simply did not have room, within the scope of this paper, to include these results.

The cultural-historical emphasis of much of this paper provides the only logical way that we have to organize the available archeological data. As noted on several occasions, we have few large projects on which to draw for discussions of settlement, subsistence, and behavioral change (e.g., Hall et al. 1986; Fox et al. 1974). Other sets of archeological data, such as those from Chaparrosa Ranch, have been presented in preliminary summaries (Hester 1978a), but have still not been analyzed in a complete and comprehensive manner.

An effort was made in the late 1980s to use a different approach to the synthesis of archeological information from Central, lower Pecos, and southern Texas (Hester et al. 1989). The Southwest Division Corps of Engineers, working with the Arkansas Archeological Survey, commissioned overviews of the major parts of the Southwest and Southern Plains. The concept of "adaptation types" (Fitzhugh 1975) was employed (Hester 1989e), and while there were problems with this approach, I think some useful new viewpoints were obtained.

For example, the "specialized hunter" adaptation type reflected the focus (we assume) of Clovis and Folsom as well as those of the Toyah horizon at the other end of the time spectrum. "Holocene hunters and foragers" encompassed the cultural patterns of South Texas peoples from Late Paleoindian times up through the Late Holocene, including the early Late Prehistoric and the Protohistoric. Lumping the archeological phenomena of southern Texas into these broad groups does have a certain appeal! However, to look at issues like climate change, shifts in resource focus, and the spread of horizons (or ethnic groups/phases), we still must press on with obtaining the empirical data so badly needed for future progress in understanding the ancient cultures of this region. We do not have enough substantive information to enter even a simple debate over whether these peoples were "collectors" or "foragers" (cf. Bettinger 1991; see also Bousman et al. 1990). Using the geoarcheological approach has much potential for understanding site formation processes. Improved data recovery methods, such as fine-mesh water-screening and flotation, may lead to better samples of botanical remains (as we are now learning by processing old soil samples from Central Texas burned rock middens; Stephen L. Black, personal communication, 1995). Long-term microwear research of lithic tools, with experimental components, is vital; casual observations and ruminations about edge-beveling and function are no longer sufficient to study the use and curation of tools. Ethnohistoric research pioneered by T. N. Campbell needs to be continued through careful scholarship. Yet with this, and more, in the final appraisal, we need more well excavated, stratified sites, and more chronometric dates for associated cultural and ecological remains.

REFERENCES CITED

Adkins, L. and R. A. Adkins
1982 *A Thesaurus of British Archaeology*. David and Charles, London.

Almaraz, F. D., Jr.
1989 *The San Antonio Missions and Their System of Land Tenure*. University of Texas Press, Austin.

Anderson, A. E.
1932 Artifacts of the Rio Grande Delta Region. *Bulletin of the Texas Archeological and Paleontological Society* 4:29-31.

Baugh, T. G.
1986 Cultural History and Protohistoric Societies in the Southern Plains. In Current Trends in Southern Plains Archaeology, edited by T. G. Baugh, pp. 167-187. Memoir 21, *Plains Anthropologist* 31(114), Part 2.

Berger, L. and Associates, Inc.
1989 *Phase I Archaeological Survey, Federal Correctional Institution Site, Three Rivers, Live Oak County, Texas*. Louis Berger and Associates, Inc., East Orange, New Jersey.

Bettinger, R. L.
1991 *Hunter-Gatherers: Archaeological and Evolutionary Theory*. Plenum Press, New York.

Bettis, A. C., Jr.
1994 Chipped Stone Tools from the Killam Ranch, Webb County, Texas. Manuscript on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Birmingham, W. W. and T. R. Hester
1976 Late Pleistocene Archaeological Remains from the Johnston-Heller Site, Texas Coastal Plain. In *Papers on Paleo-Indian Archaeology in Texas, I*, edited by T. R. Hester, pp. 15-33. Special Report 3. Center for Archaeological Research, The University of Texas at San Antonio.

Black, S. L.
1982 Prehistoric Ceramic Artifacts. In *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*, by G. D. Hall, S. L. Black, and C. Graves, pp. 390-452. Choke Canyon Series 5. Center for Archaeological Research, The University of Texas at San Antonio.

1986 *The Clemente and Herminia Hinojosa Site, 41JW 8: A Toyah Horizon Campsite in Southern Texas*. Special Report 18. Center for Archaeological Research, The University of Texas at San Antonio.

1989 South Texas Plains. In *From the Gulf to the Rio Grande: Human Adapation in Central, South and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. Reinhard, and L. C. Bement, pp. 39-62. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1995 Archaeological and Ethnohistoric Background. In *Archeological Investigations at the Loma Sandia Site (41LK28), A Prehistoric Cemetery and Campsite in Live Oak County, Texas*, by A. J. Taylor and C. L. Highley, pp. 31-45. Studies in Archeology 20. Texas Archeological Research Laboratory, The University of Texas at Austin.

Black, S. L. and A. J. McGraw
1985 *The Panther Springs Creek Site: Cultural Change and Continuity Within the Upper Salado Creek Watershed, South-Central Texas*. Archaeological Survey Report 100. Center for Archaeological Research, The University of Texas at San Antonio.

Bousman, C. B., S. A. Tomka, and G. L. Bailey
1990 *Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*. Report of Investigations No. 76. Prewitt and Associates, Inc., Austin.

Brown, D. O.
1983 *The Berger Bluff Site (41GD30A): Excavations in the Upper Deposit, 1979*. Archaeological Survey Report 115. Center for Archaeological Research, The University of Texas at San Antonio.

Brown, K. M.
1985 Three Caches of Guadalupe Tools from South Texas. *Bulletin of the Texas Archeological Society* 56:75-125.
1989 The Bingaman Cache of Stone Tools from Webb County. *La Tierra* 16(3):8-28.
1990 Depositional Context of the San Antonio Airport Proboscidean Site. Manuscript on file with the author.
n.d. Berger Bluff. In *The New Handbook of Texas*. Texas State Historical Association, Austin, in press.

Brown, K. M., D. R. Potter, G. D. Hall, and S. L. Black
1982 *Excavations at 41LK67, A Prehistoric Site in the Choke Canyon Reservoir, South Texas*. Choke Canyon Series 7. Center for Archaeological Research, The University of Texas at San Antonio.

Brune, G.
1981 *Springs of Texas, Volume 1*. Branch-Smith, Inc., Fort Worth.

Bunker, R. C.
1982 The Geomorphic Framework of Human Occupation in the Frio River Valley, Choke Canyon Reservoir Area, Live Oak and McMullen Counties, Texas. In *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*, by G. D. Hall, S. L. Black, and C. Graves, pp. 498-517. Choke Canyon Series 5. Center for Archaeological Research, The University of Texas at San Antonio.

Campbell, T. N.
1988 *The Indians of Southern Texas and Northeastern Mexico. Selected Writings of Thomas Nolan Campbell*. Texas Archeological Research Laboratory, The University of Texas at Austin.

Cason, J. F.
1952 Report on Archeological Salvage in Falcon Reservoir, Season of 1952. *Bulletin of the Texas Archeological Society* 23:218-259.

Chandler, C. K.
1974 Use Wear Analysis of "Clear Fork" Tools from the Falcon Reservoir Area, Southern Texas. *La Tierra* 1(4):15-21.
1994 Paleo-Indian Projectile Points from the Olmos Basin in San Antonio, Texas. *La Tierra* 21(1):11-19.

Chandler, C. K. and K. Hindes
1993 Scottsbluff Points from Atascosa, Frio and McMullen Counties, South-Central Texas. *La Tierra* 20(1):31-36.

Chandler, C. K. and D. Kumpe
1993 Stemmed Points With Massive Barbs from the Lower Rio Grande Valley. *La Tierra* 20(3):26-28.

Chandler, C. K. and D. Kumpe *(Continued)*
1994a Folsom Points from Deep South and Southwest Texas. *La Tierra* 21(3):6-9.
1994b Tubular Stone Pipes from the Lower Rio Grande Valley. *La Tierra* 21(3):14-21.

Chandler, C. K. and L. Lopez
1992 A Quarry Site in Western Duval County. *La Tierra* 19(2):12-13.

Cloud, W. A., R. J. Mallouf, E. A. Vogt, Jr., W. W. Birmingham, and E. H. Schmiedlin
1994 The River Spur Site: Paleoindian Occupation in the Texas Coastal Prairie. *Current Research in the Pleistocene* 11:25-27.

Collins, M. B.
1991 Observations on the Geomorphology of the Location of the Proposed International Bridge Facility, Eagle Pass, Maverick County, Texas. Report submitted to Groves and Associates, San Antonio, Texas.

Collins, M. B., G. D. Hall, and C. B. Bousman
1989 Archaeological Applications of Geochronological Techniques in Southern Texas. *La Tierra* 16(1):14-27.

Collins, M. B., T. R. Hester, and F. A. Weir
1969 Two Prehistoric Cemetery Sites in the Lower Rio Grande Valley of Texas, Part I. *Bulletin of the Texas Archeological Society* 40:119-146.

Creel, D. C., A. J. McGraw, F. Valdez, Jr., and T. C. Kelly
1979 *Excavations at Site 41LK 106: A Prehistoric Occupation Site in Live Oak County, Texas*. Archaeological Survey Report 62. Center for Archaeological Research, The University of Texas at San Antonio.

Davidson, B. and F. Valdez, Jr.
1976 Subsistence Data from San Juan Bautista and San Bernardo-East. In *The Archaeology and Ethnohistory of the Gateway Area: Middle Rio Grande of Texas. Report of the 1976 Investigations*, assembled by R. E. W. Adams. The University of Texas at San Antonio.

Davis, M. W.
1992 *Archeological Sites Along the Camino Columbia: A Proposed Toll Road in Webb County, Texas*. Archeology Series 12 (Draft). Hicks and Company, Austin.

Day, D. W.
1981 *An Assessment of Archeological Sites 41WY71 and 41WY72, Willacy County, Texas*. Reports of Investigations No. 15. Prewitt and Associates, Inc., Austin.

de la Teja, J. F.
1995 *San Antonio de Bexar: A Community on New Spain's Northern Frontier*. University of New Mexico Press, Albuquerque.

Doughty, R. W.
1983 *Wildlife and Man in Texas: Environmental Change and Conservation*. Texas A&M University Press, College Station.

Eaton, J. D.
1981 *Guerrero, Coahuila, Mexico. A Guide to the Town and Missions*. Report 4, Archaeology and History of the San Juan Bautista Mission Area, Coahuila and Texas. Center for Archaeological Research, The University of Texas at San Antonio.

Ekholm, G. F.
1944 Excavations at Tampico and Panuco in the Huasteca, Mexico. *Anthropological Papers* XXXVIII, Part V. American Museum of Natural History, New York.

Fagan, B.
1984 *The Aztecs*. W. H. Freeman, New York.

Fisher, C. E.
1977 Mesquite and Modern Man in Southwestern North America. In *Mesquite, Its Biology in Two Desert Shrub Ecosystems*, edited by B. B. Simpson, pp. 177-188. Dowden, Hutchinson, and Ross, Inc., Stroudsburg, Pennsylvania.

Fitzhugh, W. E.
1975 A Comparative Approach to Northern Maritime Adaptations. In *Prehistoric Maritime Adaptations of the Circumpolar Zone*, edited by W. E. Fitzhugh, pp. 339-386. Mouton Publishers, The Hague.

Fox, A. A. and T. R. Hester
1976 *An Archaeological Survey of Coleto Creek, Victoria and Goliad Counties, Texas*. Archaeological Survey Report 18. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, A. A., E. H. Schmiedlin, and J. L. Mitchell
1978 Preliminary Report on the J-2 Ranch (41VT6), Victoria County, Texas. *La Tierra* 5(3):2-14.

Fox, D. E. (with the collaboration of T. R. Hester)
1979 *An Intensive Survey of Sixteen Prehistoric Archaeological Sites in Starr County, Texas*. Archaeological Survey Report 72. Center for Archaeological Research, The University of Texas at San Antonio.

Fox, D. E., R. J. Mallouf, N. O'Malley, and W. M. Sorrow
1974 *Archeological Resources of the Proposed Cuero I Reservoir, Dewitt and Gonzales Counties, Texas*. Archeological Survey Report 12. Texas Historical Commission and Texas Water Development Board, Austin.

Giauque, R. D., F. Asaro, F. H. Stross, and T. R. Hester
1993 High-Precision Non-Destructive X-Ray Fluorescence Method Applicable to Establishing the Provenance of Obsidian Artifacts. *X-Ray Spectometry* 22:44-53.

Goddard, I.
1979 The Languages of South Texas and the Lower Rio Grande. In *The Languages of Native America*, edited by L. Campbell and M. Mithun, pp. 355-389. University of Texas Press, Austin.

Gunn, J.
1985 Tree Ring Study 1. Korus #3 Post Oak. *Texas Climate Bulletin*, September, pp. 7-10. ECS Corporation, San Antonio.

Gunnerson, J. H.
1987 *Archaeology of the High Plains*. Cultural Resource Series 19. Bureau of Land Management, Colorado State Office, Denver.

Hall, G. D.
1985 Comparative Ecologies: The Texas Chaparral Versus the Australian Outback. *La Tierra* 12(3):6-19.

Hall, G. D., S. L. Black, and C. Graves
1982 *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*. Choke Canyon Series 5. Center for Archaeological Research, The University of Texas at San Antonio.

Hall, G. D., T. R. Hester, and S. L. Black
1986 *The Prehistoric Sites at Choke Canyon Reservoir, Southern Texas: Results of Phase II Archaeological Investigations*. Choke Canyon Series 10. Center for Archaeological Research, The University of Texas at San Antonio.

Henderson, J. and G. T. Goode
1991 Pavo Real: An Early Paleoindian Site in South-Central Texas. *Current Research in the Pleistocene* 8:26-28.

Hester, T. R.
1968 Folsom Points from Southwest Texas. *Plains Anthropologist* 13(40):117.

1969 The Floyd Morris and Ayala Sites: A Discussion of Burial Practices in the Rio Grande Valley and the Lower Texas Coast. *Bulletin of the Texas Archeological Society* 40:157-166.

1971 Archeological Investigations at the La Jita Site, Uvalde County, Texas. *Bulletin of the Texas Archeological Society* 42:51-148.

1975a Chipped Stone Industries of the Rio Grande Plain of Texas: Some Preliminary Observations. *The Texas Journal of Science* 26(1-2):213-222.

Hester, T. R. *(Continued)*
1975b Late Prehistoric Cultural Patterns Along the Lower Rio Grande of Texas. *Bulletin of the Texas Archeological Society* 46:107-126.

1977a A Painted Pebble from a Site on the Nueces River, Southern Texas. *Bulletin of the Texas Archeological Society* 48:139-144.

1977b The Current Status of Paleo-Indian Studies in Southern Texas and Northeastern Mexico. In Paleo-Indian Lifeways, edited by E. Johnson. *The Museum Journal* 17:169-186. Museum of Texas Tech University, Lubbock.

1978a *Background to the Archaeology of Chaparrosa Ranch, Southern Texas. Volume 1: Studies in the Archaeology of Chaparrosa Ranch.* Special Report 6. Center for Archaeological Research, The University of Texas at San Antonio.

1978b The Archaeology of the Lower Rio Grande Valley of Texas. In *Proceedings, An Exploration of a Common Legacy: A Conference on Border Architecture*, pp. 66-81. Texas Historical Commission, Austin.

1980 *Digging into South Texas Prehistory.* Corona Publishing, San Antonio.

1981 Tradition and Diversity Among the Prehistoric Hunters and Gatherers of Southern Texas. *Plains Anthropologist* 26(92):119-128.

1983 Late Paleo-Indian Occupations at Baker Cave, Southwestern Texas. *Bulletin of the Texas Archeological Society* 53:101-119.

1986a The Archaeology of Greater South Texas in 1986: An Overview. *La Tierra* 13(3):2-5.

1986b A Rock Art Site in Southern Texas. *La Tierra* 13(4):2-4.

1987 Problems and Progress in Paleo-Indian Studies in Southern Texas. *La Tierra* 14(1):2-4.

1988 Mesoamerican Artifact Occurrence in Southern, Central, and Western Texas: An Update. *La Tierra* 15(4):2-6.

1989a Historic Native American Populations. In *From the Gulf to the Rio Grande: Human Adapation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. Reinhard, and L. C. Bement, pp. 77-84. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1989b The Archaic of the Texas-Mexico Borderlands. Paper presented at the symposium, The Archaic of Southern North America, October, 1989. Manuscript on file with the author.

1989c A Late Archaic Burial from the Lower Nueces River Drainage, Live Oak County, Texas. *La Tierra* 16(2):2-3.

Hester, T. R. *(Continued)*
1989d Perspective on the Material Culture of the Mission Indians of the Texas-Northeastern Mexico Borderlands. In *Columbian Consequences, Volume l: Archaeological and Historical Perspectives on the Spanish Borderlands West*, edited by D. H. Thomas, pp. 213-229. Smithsonian Insitution Press, Washington, D.C.

1989e An Archeological Synthesis. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. Reinhard, and L. C. Bement, pp. 115-128. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

1990a Radiocarbon Dates from Archaeological Excavations in Medina County. *La Tierra* 17(4):1-3.

1990b Plainview Artifacts at the St. Mary's Hall Site, South Central Texas. *Current Research in the Pleistocene* 7:14-17.

1990c Early Archaic "Eccentric" Lithic Artifacts in Southern and Central Texas. *La Tierra* 17(3):1-5.

1994a Large Triangular Bifaces as Grave Goods in Southern Texas: An Example from 41LC4. *La Tierra* 21(4):1-3.

1994b The Contexts of Trade Between the Brownsville Complex and Mesoamerican Cultures: A Preliminary Study. *La Tierra* 21(2):1-4.

1994c Lithic Typology: Background, Goals and A Personal Perspective. *Lithic Technology* 18(1 & 2):36-45.

Hester, T. R. (editor)
1979 *A Preliminary Archaeological and Historical Assessment of the Proposed Tenneco Pipeline: Hidalgo to Victoria Counties, Texas.* Archaeological Survey Report 51. Center for Archaeological Research, The University of Texas at San Antonio.

Hester, T. R., F. Asaro, F. Stross, H. Michel, A. C. Kerr, and P. Headrick
1991 An Overview of the Results of the Texas Obsidian Project. *La Tierra* 18(1):4-7.

Hester, T. R. and B. D. Barber
1990 A Large Biface from Atascosa County, With Comments on the Function of Such Artifacts in Prehistoric South Texas. *La Tierra* 17(2):2-4.

Hester, T. R., B. D. Barber, and P. Headrick
1993 Insights into Clovis Technology: A Clovis Point from Atascosa County, Southern Texas. *La Tierra* 20(3):3-5.

Hester, T. R., S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement
1989 *From the Gulf to the Rio Grande: Human Adaptation in Central, South and Lower Pecos Texas*. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

Hester, T. R. and D. M. Brown
1985 A Cache of Bifaces from Southern Texas. *La Tierra* 12(4):3-5.

Hester, T. R., D. Gilbow, and A. D. Albee
1973 A Functional Analysis of "Clear Fork" Artifacts from the Rio Grande Plain of Texas. *American Antiquity* 38(1):90-96.

Hester, T. R. and L. M. Green
1972 Functional Analysis of Large Bifaces from San Saba County, Texas. *The Texas Journal of Science* 24(3):343-350.

Hester, T. R. and T. C. Hill, Jr.
1971a Notes on Scottsbluff Points from the Texas Coastal Plain. *Southwestern Lore* 37(1):27-33.
1971b An Initial Study of a Prehistoric Ceramic Tradition in Southern Texas. *Plains Anthropologist* 16(52):195-203.
1975 *Some Aspects of Late Prehistoric and Protohistoric Archaeology in Southern Texas*. Special Report 1. Center for Archaeological Research, The University of Texas at San Antonio.

Hester, T. R., J. A. Huebner, P. Maslyk, C. Ward, and J. Hageman
1989 Excavations at Two Sites in Uvalde County, South Central Texas. *La Tierra* 16(3):3-7.

Hester, T. R. and T. C. Kelly
1976 *Archaeological Investigations Near Natalia, Medina County, Texas*. Archaeological Survey Report 20. Center for Archaeological Research, The University of Texas at San Antonio.

Hester, T. R. and H. Kohnitz
1975 Chronology and Placement of "Guadalupe" Tools. *La Tierra* 2(2):22-25.

Hester, T. R. and R. C. Parker
1970 The Berclair Site: A Late Prehistoric Component in Goliad County, Southern Texas. *Bulletin of the Texas Archeological Society* 44:1-23.

Hester, T. R., F. H. Stross, and D. M. Brown
1988 Arrow Shaft Straighteners in Southern Texas and Some California Ethnographic Comparisons. *La Tierra* 15(3):1-5.

Hester, T. R. and C. M. Whatley
1992 Chipped Stone Artifacts from Site 41DM59, Dimmit County, Southern Texas. *La Tierra* 19(3):1-7.

Hester, T. R., L. White, and J. White
1969 Archeological Materials from the Outline Site (41 LS 3) and Other Sites in La Salle County, Texas. *The Texas Journal of Science* 21(2):131-166.

Hester, T. R., D. Wilson, and P. Headrick
1993 An Austin Phase Burial from Frio County, Southern Texas: Archaeology and Physical Anthropology. *La Tierra* 20(1):5-8.

Highley, L.
1984 Guadalupe Tools from Zavala County. *La Tierra* 11(1):28-35.

Highley, C. L.
1986 *Archaeological Investigations at 41LK 201, Choke Canyon Reservoir, Southern Texas*. Choke Canyon Series 11. Center for Archaeological Research, The University of Texas at San Antonio.

Hindes, K. V.
1995 Native American and European Contact in the Lower Medina River Valley. *La Tierra* 22(2):25-33.

Holliday, V. T.
1995 Geoarchaeology. In *Archeological Investigations at the Loma Sandia Site (41LK28), A Prehistoric Cemetery and Campsite in Live Oak County, Texas*, by A. J. Taylor and C. L. Highley, pp. 19-30. Studies in Archeology 20. Texas Archeological Research Laboratory, The University of Texas at Austin.

Holloway, R. G.
1986 Macrobotanical Analysis of Phase II Materials from the Choke Canyon Reservoir Area, Texas. In *The Prehistoric Sites of Choke Canyon Reservoir, Southern Texas: Results of Phase II Investigations*, by G. D. Hall, T. R. Hester, and S. L. Black, pp. 437-451. Choke Canyon Series 10. Center for Archaeological Research, The University of Texas at San Antonio.

Hosler, D. and G. Stresser-Pean
1992 The Huastec Region: A Second Locus for the Production of Bronze Alloys in Ancient Mesoamerica. *Science* 257:1215-1220.

Howard, C. D.
1973 A Study of the Clear Fork Gouge. *Bulletin of the Texas Archeological Society* 44:51-60.

Huebner, J. A.
1987 A Toyah Horizon Bone Tool from Victoria County, Texas. *La Tierra* 14(4):5-15.

Huebner, J. A., R. Blackburn, C. K. Chandler, J. L. Mitchell, and E. H. Schmiedlin
1995 Human Burial Recovery from 41KA89. *La Tierra*, in press.

Huebner, J. A. and A. G. Comuzzie
1992 *The Archeology and Bioarcheology of Blue Bayou: A Late Archaic and Late Prehistoric Mortuary Locality in Victoria County, Texas*. Studies in Archeology 9. Texas Archeological Research Laboratory, The University of Texas at Austin.

Inman, B.
n.d. Archeological Investigations at the Tortuga Flat Site (41ZV155), Zavala County, Southern Texas. Manuscript on file with the author.

Inman, B, T. R. Hester, and T. C. Hill, Jr.
1995 Test Excavations at the Errol Jonsson #1 Site, 41ZV37, South Texas. *La Tierra* 22(1):17-32.

Inglis, J. M.
1964 *A History of Vegetation on the Rio Grande Plain*. Bulletin 45. Texas Parks and Wildlife Department, Austin.

Johnson, L., Jr.
1964 *The Devil's Mouth Site: A Stratified Campsite at Amistad Reservoir, Val Verde County, Texas*. Archeology Series 6. Department of Anthropology, The University of Texas, Austin.

1987 A Plague of Phases: Recent Sociocultural Taxonomy in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1-26.

Johnson, L. and T. N. Campbell
1992 Sanan: Traces of a Previously Unknown Aboriginal Language in Colonial Coahuila and Texas. *Plains Anthropologist* 37(140):185-212.

Johnson, L. and G. T. Goode
1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archeological Society* 65:1-51.

Jurgens, C. J.
1980 Food and the Environment — A Model of Potential Resource Variation for Portions of the Choke Canyon Reservoir Area of South Texas. Unpublished M.A. thesis, Department of Anthropology, Texas Tech University, Lubbock.

Karbula, J.
1991 Knives or Projectile Points? Manuscript on file with the author.

1993 The Eckols Site: Continuing Studies. *Newsletter of the Friends of the Texas Archeological Research Laboratory* 1(2):29.

Kelly, T.C.
1982 Criteria for Classification of Plainview and Golondrina Projectile Points. *La Tierra* 9(3):2-25.

1988 The Nockenut Clovis Point. *La Tierra* 15(4):7-18.

1989 The Lerma Projectile Point Problem. Manuscript on file with the author.

Kelly, T. C. (with the collaboration of T. R. Hester)
1979 *An Archaeological Reconnaissance of the Palafox Mining Area, Webb County, Southern Texas*. Archaeological Survey Report 71. Center for Archaeological Research, The University of Texas at San Antonio.

Kibler, K.
1994 *Archeological and Geomorphological Investigations at Prehistoric Sites 41WY50 and 41WY60, Willacy County, Texas*. Reports of Investigations No. 95. Prewitt and Associates, Inc., Austin.

Kotter, S. M.
1980 *Archeological Assessments at Site 41ZP73, Falcon State Recreation Area, Zapata County, Texas*. Reports of Investigations No. 9. Prewitt and Associates, Inc., Austin.

Labadie, J. H.
1988 *Archaeological Excavations at the Shrew Site, 41WN73, Wilson County, Southern Texas*. Contract Reports in Archaeology 2. Texas State Department of Highways and Public Transportation, Austin.

Largent, F. B. and M. R. Waters
1990 The Distribution of Folsom Points in Texas. *Current Research in the Pleistocene* 7:27-28.

Lehmann, V. W.
1984 *Bobwhites in the Rio Grande Plain of Texas*. Texas A&M University Press, College Station.

Lukowski, P.
1987 *Archaeological Investigations at 41BX1, Bexar County, Texas*. Archaeological Survey Report 115. Center for Archaeological Research, The University of Texas at San Antonio.

MacNeish, R. S.
1947 A Preliminary Report on Coastal Tamaulipas. *American Antiquity* 13(1):1-15.

1958 Preliminary Archaeological Investigations in the Sierra de Tamaulipas, Mexico. *Transactions of the American Philosophical Society* 48(6). American Philosophical Society, Philadelphia.

McGraw, A. J.

1979 *A Preliminary Archaeological Survey for the Conquista Project in Gonzales, Atascosa and Live Oak Counties, Texas.* Archaeological Survey Report 76. Center for Archaeological Research, The University of Texas at San Antonio.

1983 *Arroyo de los Muertos and Other Prehistoric Terrace Sites Along the Rio Grande, Laredo, Texas.* Archaeological Survey Report 106. Center for Archaeological Research, The University of Texas at San Antonio.

1984 *Archaeology in the South Texas Sand Sheet: A Study of Chevron Properties in Brooks County.* Archaeological Survey Report 129. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. J., J. W. Clark, Jr., and E. A. Robbins (editors)

1991 *A Texas Legacy: The Old San Antonio Road and the Caminos Reales, A Tricentennial History, 1691-1991.* Texas State Department of Highways and Public Transportation, Austin.

McGraw, A. J. and K. Hindes

1987 *Chipped Stone and Adobe: A Cultural Resources Assessment of the Proposed Applewhite Reservoir, Bexar County, Texas.* Archaeological Survey Report 163. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. J., B. J. Van Note, and C. J. Jones

1987 *Archaeology of the Brasada: A Cultural Resource Assessment of the Chevron Resources Company Property in Northeastern Duval County, Texas.* Archaeological Survey Report 113. Center for Archaeological Research, The University of Texas at San Antonio.

McGraw, A. J. and D. Knepper

1983 *The East Chacon Project: 11,000 Years of Prehistory Along the Upper Nueces River, Southern Texas.* Archaeological Survey Report 125. Center for Archaeological Research, The University of Texas at San Antonio.

McKinney, W. W.

1981 Early Holocene Adaptations in Central and Southwestern Texas: The Problem of the Paleo-Indian-Archaic Transition. *Bulletin of the Texas Archeological Society* 52:91-120.

McReynolds, R.

1993 Some Examples of Bandy Points. *La Tierra* 20(3):9-16.

Mallouf, R. J., B. J. Baskin, and K. L. Killen

1977 *A Predictive Assessment of Cultural Resources in Hidalgo and Willacy Counties, Texas.* Archeological Survey Report 23. Office of the State Archeologist, Texas Historical Commission, Austin.

Mason, J. A.

1935 The Place of Texas in Pre-Columbian Relationships Between the United States and Mexico. *Bulletin of the Texas Archeological and Paleontological Society* 7:29-46.

Miller, K. A.

1993 A Study of Prehistoric Biface Caches from Texas. Unpublished M.A. thesis, Department of Anthropology, The University of Texas at Austin.

1995 *Archaeological Investigations of a Proposed Wastewater Line to Service Colonia Larga Vista Near Laredo, Webb County, Texas.* SWCA, Inc. Environmental Consultants, Austin.

Mitchell, J. L. , C. K. Chandler, and T. C. Kelly

1984 The Rudy Haiduk Site (41 KA 23): A Late Archaic Burial in Karnes County, Texas. *La Tierra* 11(2):12-39.

Montgomery, J. L.

1978 *The Mariposa Site: A Late Prehistoric Site on the Rio Grande Plain of Texas.* Special Report 6(2). Center for Archaeological Research, The University of Texas at San Antonio.

Morales, J. O.

1983 *Testimonios el Fronton de Piedras Pintas y los Aborigenes del Nuevo Reyno de Leon.* Edicion Auspiciada, Universidad Autonoma de Nuevo Leon, Monterrey.

Newcomb, W. W., Jr.

1961 *The Indians of Texas from Prehistoric to Modern Times.* University of Texas Press, Austin.

Nightengale, B. A., C. L. Highley, and S. C. Caran

1989 *Continuing Cultural Resource Assessments in the San Miguel Prospect 1988 Season, Atascosa and McMullen Counties, Texas.* Studies in Archeology 3. Texas Archeological Research Laboratory, The University of Texas at Austin.

Nunley, P. and T. R. Hester

1966 Preliminary Archeological Investigations in Dimmit County, Texas. *The Texas Journal of Science* 18(3):233-253.

1975 *An Assessment of Archaeological Resources in Portions of Starr County, Texas.* Archaeological Survey Report 7. Center for Archaeological Research, The University of Texas at San Antonio.

O'Neill, P. L., F. M. Oglesby, W. N. Trierweiler, and C. Lintz
1992 *A Cultural Resource Survey at Falcon Reservoir, Zapata County, Texas*. Mariah Associates, Inc., Austin.

Prewitt, E. R.
1974 Preliminary Archeological Investigations in the Rio Grande Delta Area of Texas. *Bulletin of the Texas Archeological Society* 45:55-65.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-90.

Ricklis, R. A.
1990 A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Coast: A Case Study in the Roots of Adaptive Change. Unpublished Ph.D. dissertation, Department of Geography, The University of Texas at Austin.

Ricklis, R. A. and K. A. Cox
1991 Toward a Chronology of Adaptive Change During the Archaic of the Texas Coastal Bend Area. *La Tierra* 18(2):13-31.

Robinson, D. G., M. W. Davis, K. Hindes, S. C. Caran, and S. A. Turpin
1992 *Intensive Survey of the San Miguel Lignite Mine Extension: 1991 Season, Atascosa and McMullen Counties, Texas*. Technical Series 29 (draft). Texas Archeological Research Laboratory, The University of Texas at Austin.

Robinson, R. L.
1982 Biosilica Analysis of Three Prehistoric Sites in the Choke Canyon Reservoir, Live Oak County, Texas: Preliminary Summary of Climatic Implications. In *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*, by G. D. Hall, S. L. Black, and C. Graves, pp. 597-610. Choke Canyon Series 5. Center for Archaeological Research, The University of Texas at San Antonio.

Salinas, M.
1990 *Indians of the Rio Grande Delta*. The University of Texas Press, Austin.

Saunders, R. K.
1985 Recovery of Drowned Rio Grande River Artifacts, Zapata and Starr Counties, South Texas. *La Tierra* 12(2):6-20.

Saunders, R. K. and T. R. Hester
1993 A Typological Study of Side-Notched Arrow Points from the Falcon Lake Region of Texas and Mexico. *La Tierra* 20(2):22-31.

Scott, R. F., IV
1982 *Excavations at Sites 41 LK 31/32 and 41 LK 202 in the Choke Canyon Reservoir, South Texas. Part I: Prehistoric Investigations*. Choke Canyon Series 8. Center for Archaeological Research, The University of Texas at San Antonio.

Sellards, E. H.
1940 Pleistocene Artifacts and Associated Fossils from Bee County, Texas. *Bulletin of the Geological Society of America* 51:1627-1657.

Schmiedlin, E. H.
1993 Investigation of a Toyah Horizon Site in Karnes County, Texas. *The Cache* 1:33-45. Office of the State Archeologist, Texas Historical Commission, Austin.

Shafer, H. J.
1986 *Ancient Texans: Rock Art and Lifeways Along the Lower Pecos*. Texas Monthly Press, Austin.

Shafer, H. J. and E. P. Baxter
1975 *An Archeological Survey of the Lignite Project, Atascosa and McMullen Counties, Texas*. Report 7. Anthropology Laboratory, Texas A&M University, College Station.

Shafer, H. J. and T. R. Hester
1971 *A Study of the Function and Technology of Certain Bifacial Tools from Southern Texas*. Archeological Report 20. Texas Historical Survey Committee, Austin.

Stahle, D. W. and M. C. Cleaveland
1988 Texas Drought History Reconstructed and Analyzed from 1698 to 1980. *Journal of Climate* 1:59-74.

Steele, D. G. and C. A. Hunter
1986 Analysis of Vertebrate Faunal Remains from 41 MC 222 and 41 MC 226, McMullen County, Texas. In *The Prehistoric Sites of Choke Canyon Reservoir, Southern Texas: Results of Phase II Archaeological Investigations*, by G. D. Hall, T. R. Hester, and S. L. Black, pp. 452-502. Choke Canyon Series 10. Center for Archaeological Research, The University of Texas at San Antonio.

Story, D. A.
1985 Adaptive Strategies of Archaic Cultures of the West Gulf Coastal Plain. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 19-56. Anthropological Papers 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Stresser-Pean, G.
1977 *San Antonio Nogalar*. Etudes Mesoamericaines, Vol. III. Mexico City, D. F.

Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25 (whole volume).

Suhm, R.
1980 The La Paloma Mammoth Site, Kenedy County, Texas. In *Papers on the Archaeology of the Texas Coast*, edited by L. Highley and T. R. Hester, pp. 79-103. Special Report 11. Center for Archaeological Research, The University of Texas at San Antonio.

Taylor, A. J. and C. L. Highley
1995 *Archeological Investigations at the Loma Sandia Site (41LK28): A Prehistoric Cemetery and Campsite in Live Oak County, Texas*. 2 Vols. Studies in Archeology 20. Texas Archeological Research Laboratory, The University of Texas at Austin.

Thoms, A. V.
1992 Late Pleistocene and Early Holocene Regional Land Use Patterns: A Perspective from the Preliminary Results of Archaeological Studies at the Richard Beene Site, 41BX831, Lower Medina River, South Texas. In *Guidebook, 10th Annual Meeting, South-Central Friends of the Pleistocene: Late Cenozoic Alluvial Stratigraphy and Prehistory of the Inner Gulf Coastal Plain, South-Central Texas*. Quaternary Research Center Series 4 (draft). Lubbock Lake Landmark, Texas Tech University, Lubbock.

Thoms, A. and R. Mandel
1992 The Richard Beene Site: A Deeply Stratified Paleoindian to Late Prehistoric Occupation Site in South-Central Texas. *Current Research in the Pleistocene* 9:42-44.

Turner, E. S. and T. R. Hester
1993 *A Field Guide to Stone Artifacts of Texas Indians*. Second edition. Gulf Publishing, Houston.

Ward, P. M.
1984 A Statistical Analysis of Archaic Projectile Points from the Nueces River Area of Central South Texas: The Brom Cooper Collection. *La Tierra* 11: 14-20.

Warren, J. E.
1986 *Los Quemados: Archeological Testing at the Highway 359 Sanitary Landfill in Laredo, Webb County, Texas*. Report 143. James E. Warren, George West, Texas.
1989 *An Archeological Context for the Lower Rio Grande Laterials Archeological Region of Southern Texas and Northeastern Mexico*. Report 185. James E. Warren, George West, Texas.
1992 *A Cultural Resources Survey of Lake Casa Blanca State Park, Webb County, Texas*. Report 284. Archaeology Consultants, Inc., George West, Texas.

Weir, F. A.
1956 Surface Artifacts from La Perdida, Starr County, Texas. *Bulletin of the Texas Archeological Society* 26:59-78.

Weniger, D.
1984 *The Explorer's Texas: The Lands and Waters*. Eakin Press, Austin.

Willey, G. R.
1966 *An Introduction to American Archaeology. Volume I, North and Middle America*. Prentice-Hall, Englewood Cliffs, New Jersey.

Woerner, M. C. and L. Highley
1983 The Bromley F. Cooper Collection of Pre-Archaic and Archaic Dart Points from McMullen County. *La Tierra* 10(1):3-28.

Wyckoff, D. G.
1995 A Summary of the Calf Creek Horizon in Oklahoma. *Bulletin of the Oklahoma Anthropological Society* XLII:179-210.

The Palo Duro Complex: Redefining the Early Ceramic Period in the Caprock Canyonlands

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ABSTRACT

When the Palo Duro complex was first defined in 1978, it appeared to represent a group of hunting–oriented peoples who obtained a few Jornada Mogollon pots in trade. Recent excavations at the Kent Creek and Sam Wahl sites have revealed rectangular and circular pithouses, storage pits, large baking pits, and substantial ground stone assemblages. The evidence suggests that Palo Duro peoples may have been under considerable influence from, and maintained ties with, the Jornada Mogollon region, but the nature and extent of Plains Woodland influence/interactions is not well defined. The complex is reinterpreted as representing peoples who subsisted primarily by collecting, processing, and storing wild plant foods (perhaps also involving limited horticulture?) during seasonal occupations in the Caprock Canyonlands. The emphasis on plant foods may be related to increasingly mesic conditions after A.D. 500, while the onset of xeric conditions and increasing numbers of bison after A.D. 1100 may have necessitated shifts in human subsistence and settlement strategies that ultimately led to the disappearance of the Palo Duro complex.

INTRODUCTION

Paleoclimatic interpretations for the Southern Plains suggest that the the Early Ceramic, or Late Prehistoric I, period was probably wetter than the preceding Late Archaic period, and it appears that conditions were generally less favorable for bison. While the precise relationships between climate, vegetation, and bison may never be fully understood, a general decline in the number of bison in the Southern Plains may have occurred around A.D. 500, and populations probably remained relatively low until around A.D. 1200 (Dillehay 1974:187). Just prior to or during this time, two major events, the westward spread of Eastern Woodland culture and the eastward spread of Southwestern Puebloan culture, had a significant and widespread impact on the peoples of the Southern Plains. The two traditions met, or perhaps collided, along the eastern margins of the Llano Estacado, and this canyonland region, herein termed the Caprock Canyonlands, apparently played a prominent role in the cultural developments and interactions during the first millenium A.D.

The Woodland tradition spread eastward from the upper Midwest into the Great Plains, arriving in North Central Oklahoma by A.D. 100–300, and in South Central Oklahoma prior to A.D. 450. There are a number of diagnostic traits, such as "corner–notched dart and arrow points, shell disc beads, burial in mounds or ossuaries, an increase in the frequency of ground stones, and the appearance of tools associated with horticulture," but it is the distinctive cord-marked pottery vessels (elongated forms with conoidal bottoms) that is the hallmark of the Woodland tradition (Vehik 1984:175). Not all of these diagnostic traits are manifest in the Oklahoma Plains Woodland sites, however, and it is not until ca. A.D. 800 that good evidence for agriculture and semipermanent villages appears (Vehik 1984:195–197). Despite the absence of definite evidence for pre–A.D. 800 agriculture, it is notable that most of the Woodland complexes in the Southern Plains are thought to have begun between A.D. 100–500 (Hofman and Brooks 1989). Other researchers have noted that agriculture probably appeared in the Plains during this time. In the Chaquaqua Plateau of southeastern Colorado, for example, Campbell (1976:53–54) suggests a date of A.D. 500 for the appearance of maize.

The Woodland tradition had spread into the Delaware Canyon area of West Central Oklahoma by around A.D. 50–250 (Ferring 1982, 1986), and archeological evidence from sites on the Thurmond

Ranch (Thurmond 1991) and the Swift Horse site (Briscoe 1987) indicates that it had spread into western Oklahoma as early as A.D. 200–400. A thermoluminescence date of A.D. 520 on a cord-marked sherd from the Tascosa Creek site is the earliest occurrence of Woodland pottery in the Texas Panhandle, but absolute chronological evidence is limited, and Woodland occupations probably began somewhat earlier. The appearance of the Woodland tradition in the Panhandle Plains occurred at approximately the same time as the disappearance of the Late Archaic bison–hunting lifestyle, around A.D. 500. The Plains Woodland remains in the Texas Panhandle are called the Lake Creek complex (Hughes 1962, 1991).

At about this same time, the Jornada Mogollon culture of South Central New Mexico, Trans–Pecos Texas, and northern Chihuahua (Lehmer 1948) expanded across all of southeastern New Mexico and onto the western edge of the Llano Estacado. This eastern extension of the Jornada Mogollon (Corley 1965a, 1965b; Leslie 1979) may represent the spread of Jornada Mogollon peoples, or at least considerable expansion of their cultural influence among neighboring peoples. Additional Southwestern influence, indicated by the sporadic occurrence of Mogollon brownware pottery (see Miller, this volume), may be traced all across the southern Llano Estacado, particularly around large playas or pluvial lakes, and into the southern Caprock Canyonlands. First recognized at a small rockshelter in Swisher County, Texas, the Palo Duro complex (Willey and Hughes 1978b) appeared to represent a group of hunter–gatherers who simply obtained brownware pottery in trade, directly or indirectly, with Jornada peoples. More recent archeological findings of residential base camps with pithouses and storage facilities at the Kent Creek (Cruse 1992) and the Sam Wahl (Boyd et al. 1994) sites are changing our perceptions about who the Palo Duro peoples were, and it now appears that the Jornada Mogollon influence involved much more than just pottery (see Hughes 1991).

Although there are many similarities between the Plains Woodland–tradition Lake Creek complex and the Jornada Mogollon–influenced Palo Duro complex, the differences in these manifestations have been interpreted as evidence that two groups of people occupied the Texas Panhandle Plains during the first millenium A.D. Assuming that the distribution of pottery traditions represents the maximum extent of cultural influence (e.g., the extent of exchange networks, diffusion of technology, or even the spread of related peoples), Couzzourt (1982, 1985) and Hughes (1991) interpret the archeological data to indicate that a cultural boundary between Woodland and Southwestern–influenced peoples existed along the drainage divide between the Canadian and Red rivers. As early as the 1940s, Krieger (1946, 1978) observed the existence of this cultural boundary, and suggested that it represented the southern limit of Central Plains–tradition complexes or influence. It is notable that brownware pottery occurs in very few sites in the Canadian River drainage, while it is much more common to the south in the Red River and Brazos River drainages. Conversely, while sites yielding Woodland pottery are common in the Canadian River valley, only a few are found in the northern tributaries of the upper Red River, and none are known south of the Prairie Dog Town Fork. Consequently, defining the relationships between the Palo Duro and the nearby Plains Woodland and Southwestern cultural phases and complexes is critical to understanding the Late Prehistoric I period (ca. A.D. 500-1100/1200) in the Caprock Canyonlands.

The goals of this paper are as follows: (1) to describe briefly the Caprock Canyonlands as an archeologically significant ecological subregion; (2) to summarize the Late Holocene culture history and paleoclimatic reconstructions for the Caprock Canyonlands; (3) to identify pertinent regional cultural phases and complexes that surround the Palo Duro complex; (4) to identify the important archeological remains that are attributed to the Palo Duro complex; (5) to reevaluate and redefine the Palo Duro complex in light of recent archeological finds; and (6) to speculate on the intercultural relationships between Palo Duro peoples and the cultures around them.

This paper evolved out of the ongoing cultural resources studies at Lake Alan Henry, a municipal–use water reservoir built for the City of Lubbock, Texas. From 1987 to 1993, Prewitt and Associates, Inc. of Austin, Texas, conducted a series of archeological surveys, testing, and data recovery efforts within the 11,280 acre project area on the Double Mountain Fork of the Brazos River in Garza and Kent counties, Texas. Each phase of work resulted in a separate archeological report, but the publication of a regional synthetic archeological overview was planned for the conclusion of these studies. The extensive research done in conjuction with the regional synthesis, which is scheduled to be published this year (Boyd et al. 1996), concentrates on redefining the culture history of the Caprock Canyonlands. One of the more significant contributions of this study is a thorough reevaluation of the Early Ceramic period Palo Duro complex, which is the subject of this article.

THE CAPROCK CANYONLANDS: ENVIRONMENTAL DIVERSITY, PALEOENVIRONMENT, AND CULTURE HISTORY

One of the important conclusions that was reached during the course of the Lake Alan Henry archeological investigations is that the traditional view of the Texas Panhandle Plains environment and ecology is an oversimplification that obscures some very important concepts that have significant bearing on archeological interpretations. The traditional archeological view is that the Texas Southern Plains is comprised of only two regions—the High Plains and Lower Plains. The High Plains and Lower Plains are distinct in many ways, and each is broadly characterized by its own geology and physiography, climate and hydrology, and flora and fauna. What became apparent during the course of the investigations at Lake Alan Henry, however, is that the archeology of the project area did not fit neatly with that of either the High Plains or Lower Plains. The greatest similiarities were seen in other project areas located in the rugged canyonlands along the Caprock Escarpment, but not to the west in the vast expanses of Llano Estacado flatlands or to the east in the rolling hills that comprise most of the Lower Plains. Emerging from this research, then, was the concept of the Caprock Escarpment as its own archeological region; one that is intimately related to, but yet distinctive from, the archeology of the High Plains and most of the Lower Plains.

The southern end of the High Plains, which is physically separated from the central Great Plains by the wide Canadian River valley, is an isolated plateau called the Llano Estacado. It is the single dominating physiographic feature in the southern Great Plains. It is a flat, nearly featureless plain broken only by occasional ephemeral stream valleys (or draws) and small basins called playas (that seasonally hold rainwater) or pluvial lakes (that intersect the underlying Ogallala groundwater aquifer). To the east of the Llano Estacado is the Lower Plains, a region that is largely comprised of undulating or rolling hills of soft Permian mudstones that have been severely eroded. Hence, other names that have been used for this region include the Redbed Plains, Eroded Plains, Rolling Plains, Western Rolling Plains, and Low Rolling Plains.

While the notion that the High Plains and Lower Plains are environmentally unique is accurate, it is a gross oversimpification. Sandwiched between the Llano Estacado and the Lower Plains is the Caprock Escarpment that constitutes the eastern edge of headward stream erosion eating away at the High Plains plateau. The Caprock Escarpment is often thought of as a single dividing line, but it is more realistically viewed as a long, north–south strip of rugged canyonlands that separates the High Plains from the Rolling Plains. The Caprock Canyonlands generally coincide with exposures of Tertiary Ogallala and Triassic Dockum Group formations on any state geological map. Because the Ogallala caliche and Triassic sandstones are more resistant to erosion than anything above or below, differential erosion has resulted in the formation of a rugged canyonland topography. The term "Caprock Canyonlands" is a fitting name for this north–south corridor that divides the High Plains from the Rolling Plains (Figure 1).

Caprock Canyonlands is a term borrowed from Flores (1990), whose book *Caprock Canyonlands: Journeys into the Heart of the Southern Plains* is a treatise on the unique ecological character of the rugged canyons along the Caprock Escarpment. Notably, the Natural Heritage Policy Research Project, a Texas ecology project sponsored by the Lyndon B. Johnson School of Public Affairs, calls this area the "Escarpment Breaks" and recognizes that it is a distinct ecological subregion. In addition, the National Park Service recognized the ecological importance of the escarpment canyonlands as early as the 1920s and, in 1934, they considered the development of a million acre "National Park of the Plains" that focused on the canyonlands of the Red River (including Palo Duro Canyon). For various political reasons (Flores 1990:160–165), the National Park Service never followed up on any of its proposals, but the State of Texas has created two small parks along the Caprock Escarpment—the

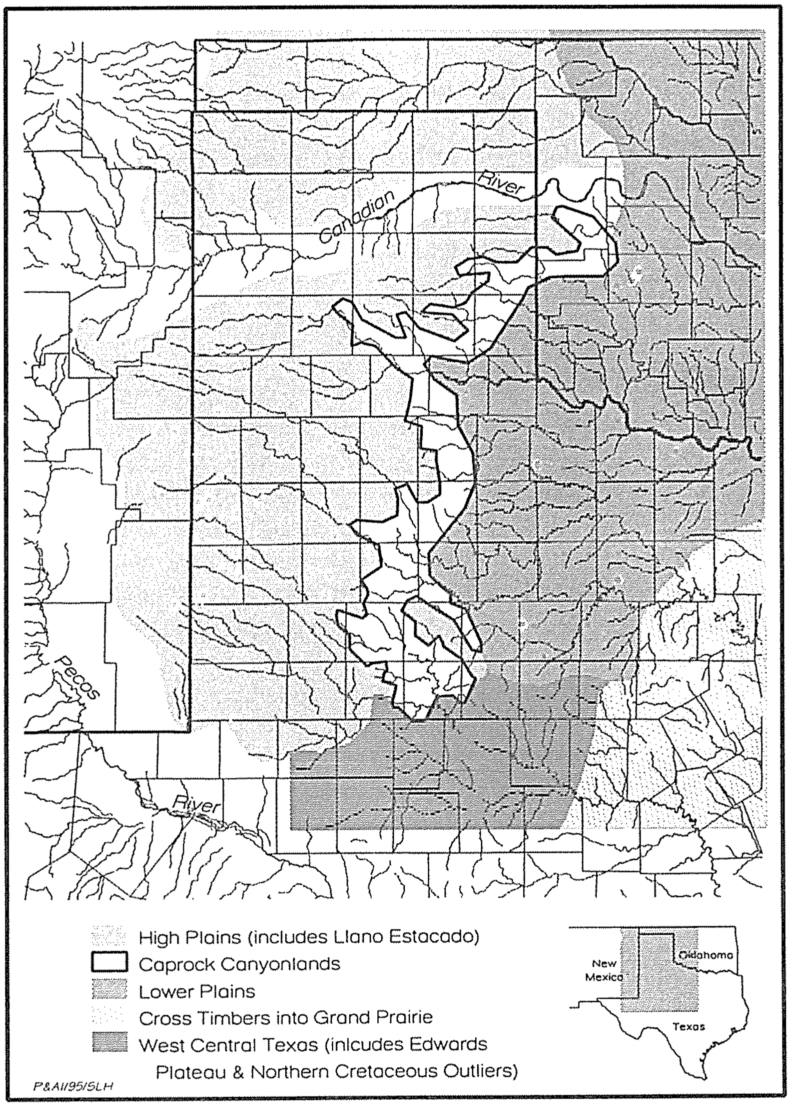


Figure 1. Ecological/archeological regions within the Texas Panhandle Plains. The Caprock Canyonlands subregion is defined based on a combination of topography (Raisz 1957), surface geology (Curtis and Ham 1972; Renfro 1973; Williams and McAllister 1979), vegetation areas (Arbingast et al. 1973), and geographic regions (Johnson 1931).

16,400 acre Palo Duro Canyon State Park, and the 13,906 acre Caprock Canyons State Park. Just as modern man finds the Caprock Canyonlands to be unique and inviting, so too did the prehistoric Native Americans living in the Southern Plains, and it is not surprising to find that the archeology of this subregion also is unique. This is not an entirely new revelation, but the culture history synthesis by Boyd et al. (1996) is the first attempt to formalize the concept of the Caprock Canyonlands as a unique archeological subregion.

The environmental characteristics of the Caprock Canyonlands, and the many subtleties that distinguish it from the High Plains and Lower Plains, are not described in detail here. What is important is the recognition of the fact that, because of its geologic and geomorphic history, the Caprock Canyonlands was an oasis in an otherwise arid landscape. For prehistoric peoples, the canyonlands provided more abundant (in terms of quality and quantity) and predictable resources than could be found anywhere else in the Southern Plains—natural shelter, firewood, raw lithic materials, plant and animal foods, and, most importantly, water. Freshwater springs emerging primarily from the Ogallala aquifer, and to a lesser extent from Triassic and Quaternary aquifers, are common all along the Caprock Escarpment, and major riverine systems were generally well–watered in prehistoric times. Prior to the depletion of groundwater aquifers in the twentieth century, such springs and spring–fed tributaries provided abundant water and lush vegetation that attracted man and beast. Water has always been, and still is, the single most critical resource dictating the distribution of plant, animal, and human communities throughout the Southern Plains. Prehistoric peoples recognized this fact, and they adapted their lifestyles and settlement patterns accordingly.

In contrast to the well–watered canyonlands, surface water over most of the Llano Estacado was (with a few exceptions such as major pluvial lakes or spring–fed draw segments) sporadically distributed, subject to considerable seasonal fluctuation, and generally unpredictable. The same is true of the Lower Plains, but the water supply there also suffers from one additional problem. Any surface or groundwater that passes through the Permian redbed country becomes chlorinated, often to the point of being unpalatable because it is several times more salty than sea water. Because of this, it is likely that there were large areas of the Lower Plains where little or no potable water could be found during prehistoric times.

The resource–rich Caprock Canyonlands played a major role in the development and evolution of cultures in the Southern Plains. The escarpment area seems to have been a critical zone, in terms of subsistence and settlement, for many different prehistoric populations over many thousands of years. In a simplistic fashion, the Caprock Canyonlands may be viewed as a home base for many cultures whose seasonally oriented activities extended over a much larger territory that included the Llano Estacado and Lower Plains.

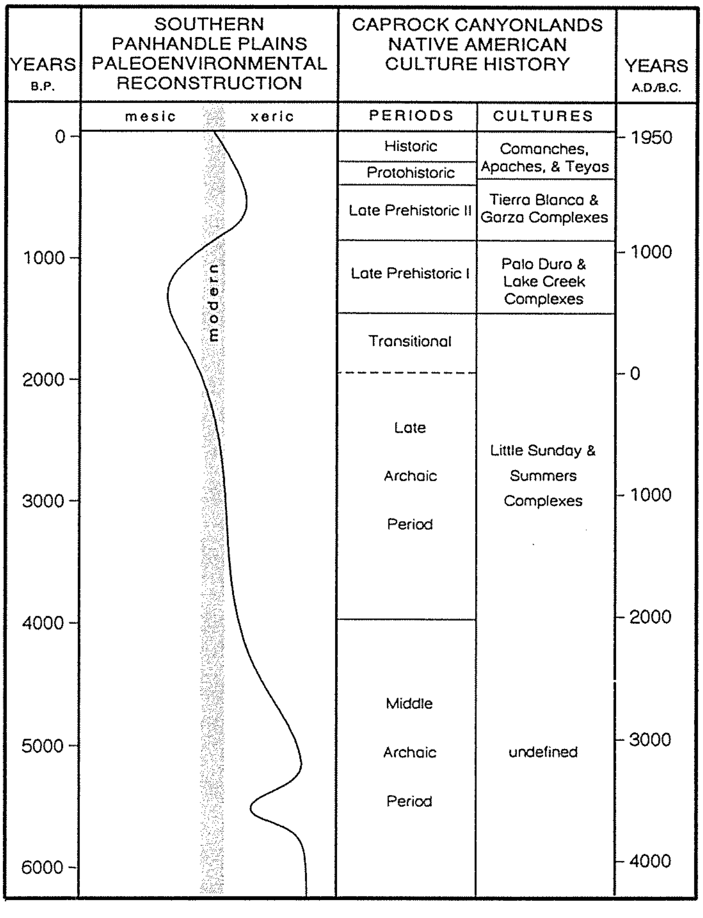


Figure 2. Comparison of the Middle to Late Holocene paleoclimatic reconstruction for the southern Panhandle Plains and the culture history of the Caprock Canyonlands (from Boyd et al., 1996).

Boyd et al. (1996) reviewed the regional paleonvironmental and cultural data for the Middle to Late Holocene in the southern Panhandle Plains and Caprock Canyonlands, and summaries of their interpretations are presented in Figure 2. The various lines of evidence that form the foundation of these interpretations are not presented here, but it is notable that the paleoenvironmental reconstruction and culture history are in general agreement with studies done throughout the Southern Plains. The focus of the remainder of this paper is the Late Prehistoric I cultural period from prior to A.D. 500 to ca. A.D. 1100–1200.

REGIONAL CULTURAL COMPLEXES AND PHASES DURING THE LATE PREHISTORIC I PERIOD

The Late Prehistoric I period was a time of dynamic cultural interaction in the Southern Plains, and the cultural conditions and changes that characterize the Palo Duro complex cannot be fully understood without a brief mention of the archeological manifestations defined for surrounding areas (Figure 3 and Table 1). The Late Prehistoric I period in the Caprock Canyonlands spans the entire Plains Woodland stage of cultural development in the Texas Panhandle (i.e., the Lake Creek complex), and the latter part of the period is contemporaneous with late Plains Woodland/formative Plains Village occupations in western Oklahoma (i.e., the Custer phase) and with unknown cultural groups in West Central Texas (i.e., the Blow Out Mountain phase). This period also coincides with the Southwestern pithouse periods in southeastern New Mexico and far western Texas (i.e., the El Paso and Doña Ana phases of the Jornada branch of the Mogollon; the Querecho and Maljamar phases of the eastern extension of the Jornada Mogollon; and the 18 Mile and Mesita Negra phases of the Middle Pecos), and ends at the time of the pithouse to surface pueblo transition. The reader is referred to Bell

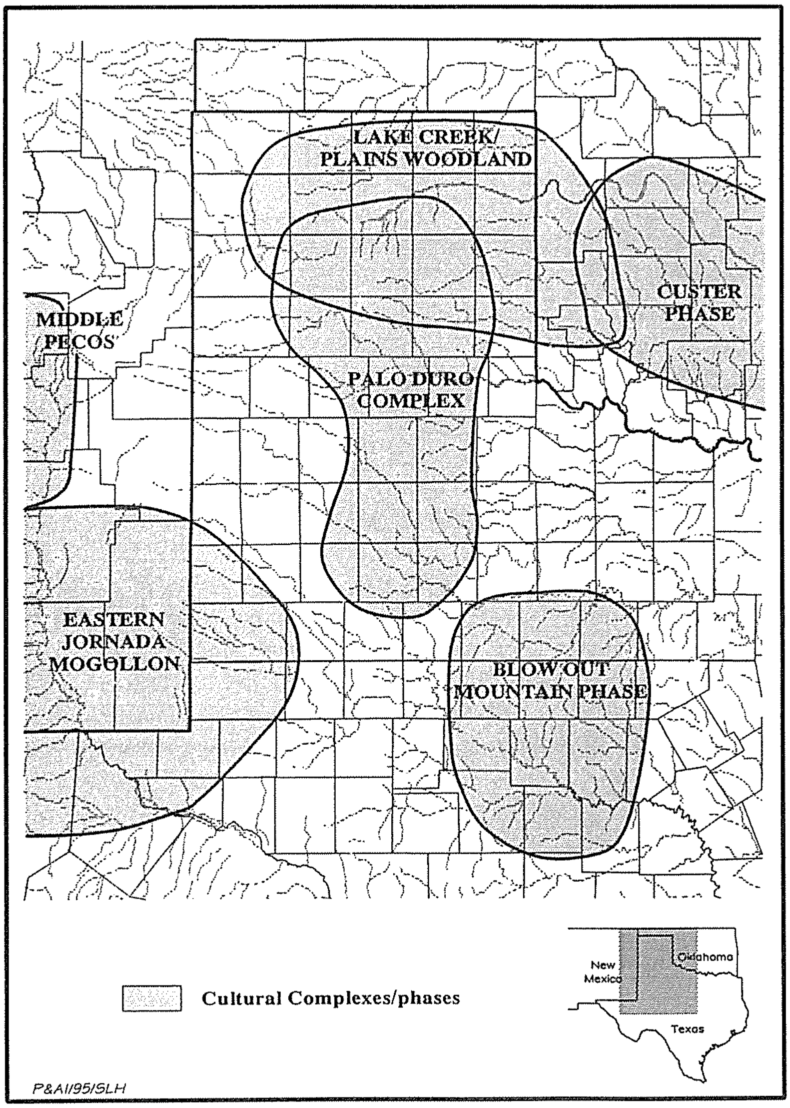


Figure 3. Map of Late Prehistoric I culture complexes and phases in and around the Texas Panhandle Plains.

(1984), Brooks (1989), Creel (1990), Corley (1965a), Hofman (1975, 1978, 1984a, 1984b), Hofman and Brooks (1989), Hughes (1991), Jelinek (1967), Lehmer (1948), Leslie (1979), LeBlanc and Whalen (1980), and Lintz (1982, 1984, 1986) for general information on these and other Plains Woodland and Plains Village manifestations in the southern Great Plains.

Many sites in the Caprock Canyonlands and surrounding areas date to the Late Prehistoric I period and are of considerable importance for defining the Palo Duro complex (Figure 4). Many of the sites have been attributed to the Palo Duro complex, but a large number of sites in the Texas Panhandle and western Oklahoma have evidence of contemporaneous Plains Woodland occupations. Plains Woodland sites in the Texas Panhandle are attributed to the Lake Creek complex (Hughes 1962, 1991). A detailed summary of the Lake Creek complex is beyond the scope of this paper (see Boyd et al. 1996), but this manifestation is discussed later because it is critical to defining the nature of the interaction between Plains Woodland and Palo Duro Complex peoples.

ARCHEOLOGICAL REMAINS OF THE PALO DURO COMPLEX

Based on the 1973–1974 excavations at Deadman's Shelter in Mackenzie Reservoir, Willey and Hughes (1978b) proposed that the site was representative of a widespread cultural manifestion characterized mainly by Mogollon brownwares and early corner– and basal–notched arrow points. Many other sites in the Red River drainage had produced similar materials and were thought to be related to this new "Palo Duro complex" (Willey and Hughes 1978b:190). A few more Palo Duro sites have been investigated since that time, including some in the Brazos River drainage, and the complex now covers a larger area than was originally proposed (see Figure 4 and Table 1). The chronology of the Palo Duro complex is known primarily from radiocarbon dates from eight sites (Table 2).

Most of the Palo Duro sites that have been tested or excavated may be grouped into one of two site type categories—campsites or rockshelters—and there appears to be considerable variability in site function within these groups. Recent investigations have added a third category, that of

Table 1. Selected Late Prehistoric I sites in and around the Texas Panhandle Plains

No.*	Site Name (Number)	Late Prehistoric I Cultural Affiliation	Reference
Residential Bases			
1	Kent Creek (41HL66)	Palo Duro complex	Cruse 1992
2	Sam Wahl (41GR291)	Palo Duro complex	Boyd et al. 1994
3	Buffalo Lake (PPHM-A2042)	Palo Duro complex (?)	Hays 1986
4	Tahoka Lake	Palo Duro complex (?)	Lee Johnson, personal communication 1993
5	Greenbelt (41DY17)	Lake Creek complex	Campbell 1983
6	Duncan Ranch (41HC124)	Lake Creek complex	Gustafson 1994a, 1994b
7	Merchant (LCAS-E4)	Eastern Jornada Mogollon	Leslie 1965
8	Laguna Plata (LA-5148)	Eastern Jornada Mogollon	Lea County Archeological Society 1971; Runyan 1972
9	Boot Hill (LCAS-B5)	Eastern Jornada Mogollon	Corley and Leslie 1960
10	Salt Cedar (41AD2)	Eastern Jornada Mogollon	Collins 1968
11	King Ranch (LA 26764)	Middle Pecos or Eastern Jornada Mogollon	Wiseman 1981, 1988
12	Fox Place (LA 68188)	Middle Pecos or Eastern Jornada Mogollon	Wiseman, personal communication 1993
Campsites			
13	Chalk Hollow (PPHM-A883)	Palo Duro compelx	Wedel 1975
14	Blue Clay (41BI42)	Palo Duro complex	Willey et al. 1978
15	County Line (41BI33)	Palo Duro complex (?)	Willey and Hughes 1978a
16	Cat Hollow (41GR303B)	Palo Duro complex	Boyd et al. 1994
17	Gobbler Creek Bridge (41GR383)	Palo Duro complex (?)	Boyd et al. 1994
18	South Sage Creek (41KT33)	Palo Duro complex	Boyd et al. 1992
19	Fatheree (41GY32)	Palo Duro/Lake Creek complexes	Hughes et al. 1978
20	Maintenance Barn (PPHM-A1543	Palo Duro complex	Couzzourt 1982
21	South Ridge (PPHM-A1568)	Palo Duro complex	Etchieson 1979
22	Floydada Country Club (41FL1)	Palo Duro complex	Word 1963, 1991
23	Montgomery (41FL17)	Palo Duro complex (?)	Word 1965; Northern 1979
24	Big Spring (41HW2)	Palo Duro complex (?)	Sommer 1971
25	Lake Creek (PPHM-A48)	Lake Creek complex	Hughes 1962
26	Tascosa Creek (PPHM-A2060)	Lake Creek complex	Couzzourt 1985
27	Sanford Reservoir unnamed (41MO5)	Lake Creek complex	Green 1986
28	Sanford Reservoir unnamed (41PT29)	Lake Creek complex	Green 1986
29	Night Storm (41RB21)	Lake Creek complex	Hughes et al. 1978
30	Sandy Ridge (41HF5)	Lake Creek complex	Quigg, Lintz, Oglesby, Earls et al. 1993
31	Swift Horse (34RM501)	Lake Creek complex (?)	Briscoe 1987, 1989
32	Beaver Dam (34RM208)	Plains Woodland	Thurmond 1988a, 1988b, 1988c, 1991
33	Middle Cheyenne (PPHM-A2082)	Lake Creek complex	Couzzourt 1982, 1985
34	Carrizozo Bridge (34CI199)	Plains Woodland	Saunders 1983
35	East Levee (41TG91)	Blow Out Mountain phase	Creel 1990
Rockshelters			
36	Deadman's Shelter (41SW23)	Palo Duro complex	Willey and Hughes 1978b
37	Boren Shelter No. 2 (41GR559)	Palo Duro Complex	Boyd et al. 1994
38	Canyon City Club Cave (PPHM-A251)	Palo Duro complex	Hughes 1969
39	Blue Spring Shelter (PPYM-A485)	Palo Duro complex	Hughes 1978

*Numbers are key to site locations shown on Figure 3.

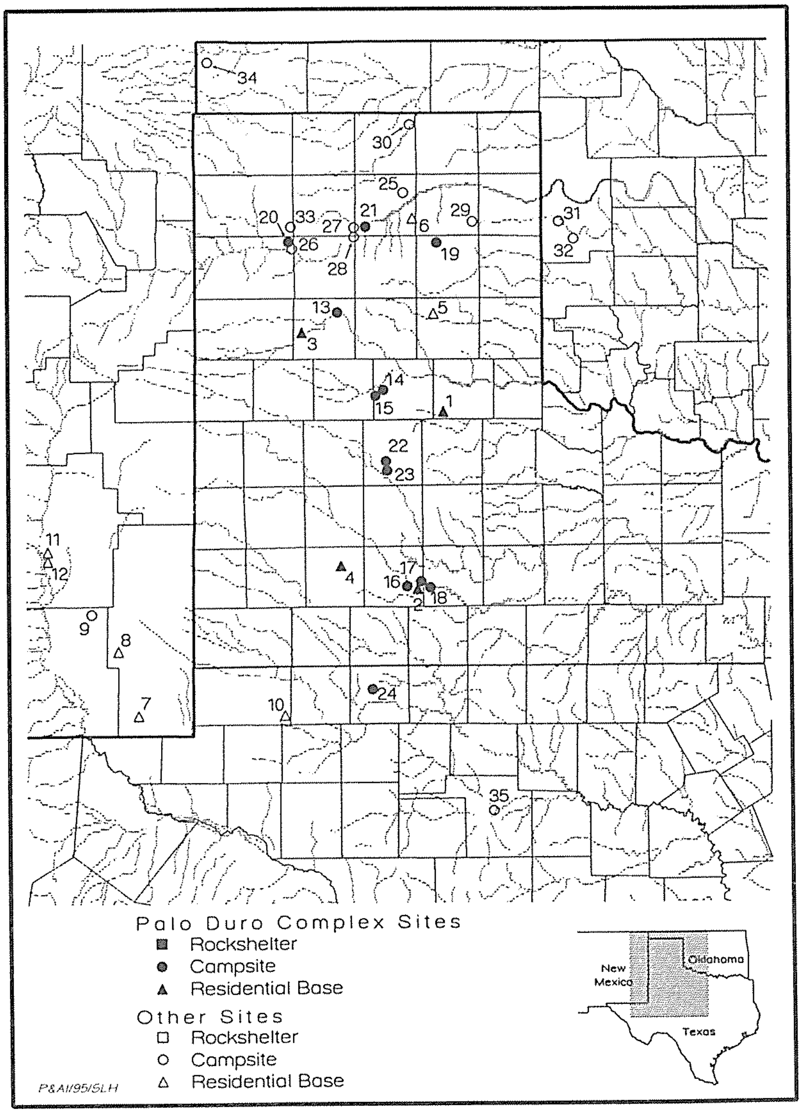


Figure 4. Map of selected Late Prehistoric I sites in the Texas Panhandle Plains and surrounding areas.

residential bases, to the site type inventory, also adding a new dimension to the settlement pattern. A fourth class of archeological remains, that of human burials, also has important implications for defining the complex. Each of these site types is discussed below.

Residential Bases

The Kent Creek and Sam Wahl sites are the only two sites that have been positively identified as residential bases of the Palo Duro complex. Two other sites that have not been adequately investigated have been tentatively proposed as possible residential bases of the Palo Duro complex. These two sites are important because they highlight the fact that there may be many other Palo Duro residential base sites that have not yet been identified.

Hays (1986:10–11, 20) identifies a probable Palo Duro complex site (PPHM–A2042) in the Buffalo Lake National Wildlife Refuge, Randall County, Texas. This site was initially visited in 1980 by Hughes (Jack T. Hughes fieldnotes, February 6, 1980), who observed a greater density of cultural materials (e.g., bone fragments, fire–cracked quartzite, burned caliche, and lithic debris) than seen at any other site in the Refuge. Artifacts observed or collected consist of dart points, arrow points (including some Deadman's), bifaces, unifaces, ground stones, and sherds of Mogollon brownware. A test pit indicated that substantial buried deposits exist. Of particular importance, Hughes noted that several depressions at the site were probably pithouses. Without further testing, however, the interpretation that the site represents a Palo Duro pithouse village is tentative.

Tahoka Lake, a large pluvial lake in Lynn County, Texas, also has been suggested as a possible location of a pithouse site that might be related to the Palo Duro complex (see Boyd 1995a, 1995b). Lee Johnson (personal communication, 1992) remembered seeing possible pithouse depressions and Mogollon ceramics in the vicinity of Tahoka Lake many years ago, prior to the complete cultivation of the area. Lacking an adequate archeological investigation, however, it is impossible to evaluate the potential for the existence of a Palo Duro pithouse site near Tahoka Lake. Surface collections from a site 5 km south of Tahoka Lake have yielded corner–notched and stemmed arrow

Table 2. Summary of Radiocarbon Dates for Sites of the Palo Duro Complex

Site Name, Number, Component, and Reference	Lab No., Material, and Provenience	Uncorrected Date B.P.	Uncorrected Date A.D.	delta ^{13}C%	Corrected Age B.P.	Corrected Age A.D.	Calibrated Age Range A.D.*
Residential Bases							
Kent Creek site 41HL66 Cruse 1992:57, 64	Tx-5323 Charcoal, Structure 1 floor	1240±120	710±120	—	1256±127	—	665-977
	Tx-5665 Charcoal, Feature 5, upper	840±250	1110±250	—	856±253	—	902-1393
	Tx-5709 Charcoal, Feature 5, lower	1160±80	790±80	—	1176±90	—	733-985
Sam Wahl site 41GR291 Early Occupation period Boyd et al. 1994:Table 6	Beta-61498 Charcoal, Feature 17	1210±80	—	-22.6	1250±80	—	686-936
	Beta-61499/CAMS-5824 Charcoal, Feature 19	—	—	—	1390±60	—	610-688
	Beta-59822 Charcoal, Feature 29	1370±90	—	-24.7	1380±90	—	603-766
	Beta-61501 Charcoal, Feature 37	980±80	—	-25.1	970±80	—	997-1189
	Beta-59823 Charcoal Feature 37	1020±90	—	-24.5	1030±90	—	900-1151
	Beta-61500 Charcoal, Feature 41	1180±80	—	-23.5	1200±80	—	693-979
Campsites							
Cat Hollow site 41GR303B Lower Zone Boyd et al. 1994:Table 28	Tx-6295 Sediment, Feature 8	1150±50	—	-18.6	1250±50	—	690-871

Table 2. *(Continued)*

Site Name, Number, Component, and Reference	Lab No., Material, and Provenience	Uncorrected Date B.P.	Uncorrected Date A.D.	delta ^{13}C%	Corrected Age B.P.	Corrected Age A.D.	Calibrated Age Range A.D.*
Campsites *(Continued)*							
Cat Hollow site *(Continued)*	Beta-59827/CAMS-5168 Charcoal, nonfeature	—	—	—	1880±50	—	73-229
Chalk Hollow site PPHM-A883 Upper Midden Wedel 1975:273	—	—	—	—	—	—	400-850** (uncorrected/ uncalibrated)
Rockshelters							
Deadman's Shelter 41SW23, Area II Strata B and D Willey and Hughes 1978b: 187, 189	SI-1897 Charcoal, Stratum B	1485±70	465±70	—	1501±81	—	(432-645)
	SI-1898 Charcoal, Stratum B	1240±65	710±65	—	1256±76	—	(686-883)
	SI-1899 Charcoal, Statum D	1740±40	210±40	—	(1756±57)	—	(236-383)
	SI-1900 Charcoal, Stratum D	1830±60	120±60	—	(1846±72)	—	(79-319)
	SI-1901 Charcoal, Stratum D	630±140	1320±140	—	—	—	***
Boren Shelter No. 2 41GR559 Lower Shelter Boyd et al. 1994:Table 54	BX-14449 Charcoal, Feature 5	1155±210	—	-23.3	1180±210	—	652-1146

Table 2. *(Continued)*

Site Name, Number, Component, and Reference	Lab No., Material, and Provenience	Uncorrected Date B.P.	Uncorrected Date A.D.	delta $^{13}C\%$	Corrected Age B.P.	Corrected Age A.D.	Calibrated Age Range A.D.*
Rockshelters *(Continued)*							
Boren Shelter No. 2 *(Continued)*							
	Beta-60261 Charcoal, Feature 16	1920±70	—	-24.9	1930±70	—	4-209
	Beta-60262 Charcoal, Feature 13/26	1730±80	—	-25.4	1730±80	—	238-418
	Beta-59831 Charcoal, Feature 22	1320±110	—	-26.5	1300±110	—	645-875
	Beta-59832 Charcoal, Feature 24	1520±90	—	-24.5	1530±90	—	425-641
Canyon City Club Cave PPHM-A251 Levels 3 and 4 Hughes 1969:Table 1	WIS-408 Charcoal, Level 3	620±45	1330±45	—	—	—	***
	WIS-402 Charcoal, Level 3	1260±55	690±55	—	(1276±68)	—	(666-866)
	WIS-404 Charcoal, Level 4	1650±55	300±55	—	(1666±68)	—	(262-529)
	WIS-414 Charcoal, Level 4	1250±60	700±60	—	(1266±72)	—	(672-874)
Blue Spring Shelter PPHM-A485 Palo Duro levels Hughes 1978:43	—	—	—	—	—	—	815-1100**** (uncorrected/ uncalibrated)

Table 2. *(Continued)*

Site Name, Number, Component, and Reference	Lab No., Material, and Provenience	Uncorrected Date B.P.	Uncorrected Date A.D.	delta $^{13}C\%$	Corrected Age B.P.	Corrected Age A.D.	Calibrated Age Range A.D.*
Burial							
Sam Wahl site 41GR291 Boyd et al. 1994:Table 6	Beta-61496 Bone, Feature 23	1530±60	—	-13.6	1720±60	—	256-415

*Unless otherwise stated, all ages represent the calibrated 1-sigma age range using Dataset #2 in CALIB version 3.03 (Stuiver and Reimer 1993). Corrections and calibrations in parentheses are based on estimated $\delta^{13}C$ values of -24.00 for fossil charcoal (Stuiver and Polach 1977).

**Wedel's (1975) estimate of the age of the upper midden based on six uncorrected radiocarbon dates.

***Date is out of stratigraphic sequence and is considered erroneous by the original investigator.

****Hughes's (1978) estimate of age of the Palo Duro levels based on an unspecified number of dates.

points, indicating the presence of Late Prehistoric I occupations, but no pottery was found (Riggs 1965). Watts (1963:1-4) notes that undifferentiated brownwares have been found near Tahoka Lake and at many other lake sites on the southern Llano Estacado. Watts' (1963) study is quite outdated, but another ceramic distribution study is in progress (Wiseman et al. 1994) that eventually should provide much more detailed information on Southwestern wares on the Llano Estacado. Given the limited data available at this time, the presence of Palo Duro complex occupations on the southern Llano Estacado cannot be discounted.

Both of the sites that have been identified confidently as residential bases of the Palo Duro complex have been investigated intensively. The Kent Creek site, located along a spring–fed tributary of the North Pease River in southeastern Hall County, was excavated in 1985/1986 by Cruse (1992), and was the first site where habitation structures were identified. The early occupation period at the Sam Wahl site, located in the canyonlands along the Double Mountain Fork of the Brazos River in Garza County, was identified as a residential base based on excavations by Boyd et al. (1994). The similarities and differences between these two sites have important implications for defining the Palo Duro complex.

Kent Creek Site (41HL66)

The 62 m² of hand excavations at the Kent Creek site uncovered two complete rectangular pithouses, a possible third structure, and five extramural features (Figure 5). The latter consist of two oval pits (one clay-lined and one clay-capped) that may have functioned as storage facilities, a small rock–lined hearth, an unlined hearth, and a large baking pit (80 cm diameter, 30 cm deep) filled with ash, charcoal, and burned rocks. Charcoal from the lower and upper portions of the baking pit provided calibrated radiocarbon age ranges of A.D. 733–985 and A.D. 902–1393, respectively. Two postholes located just outside Structure 1 could represent extramural activities, or they may be related to the structure.

Structure 1 is a rectangular (4.3 x 3.3 m) pithouse with an east–facing entryway centered along one long wall. Interior features include a trough or step–down just inside the house (probably a water trap), a large posthole just off–center, three other postholes along the front and side walls, and two clusters of burned caliche rocks lying on the floor that are thought to be heating ovens. A subfloor human burial (see Burials below) also was found in the center of Structure 1, but the house was abandoned at the time the individual was interred, and the burial pit could have destroyed a central hearth. Charcoal from the floor of Structure 1 was radiocarbon dated to A.D. 665–977, providing an approximate age for the occupation of the pithouse and the subfloor burial.

Structure 2 is a rectangular (2.3 x 3.3 m) house with a west–facing entryway and no interior features except for shallow "troughs" or depressions all along the front and back walls (possible water traps). The floor of this structure was virtually devoid of artifacts.

Because of their differences, Structure 1 is interpreted as a habitation while Structure 2 is thought to represent a storage facility, but they both exhibit some similar characteristics. Both structures have clay–plastered entryways, approximately 1 m wide

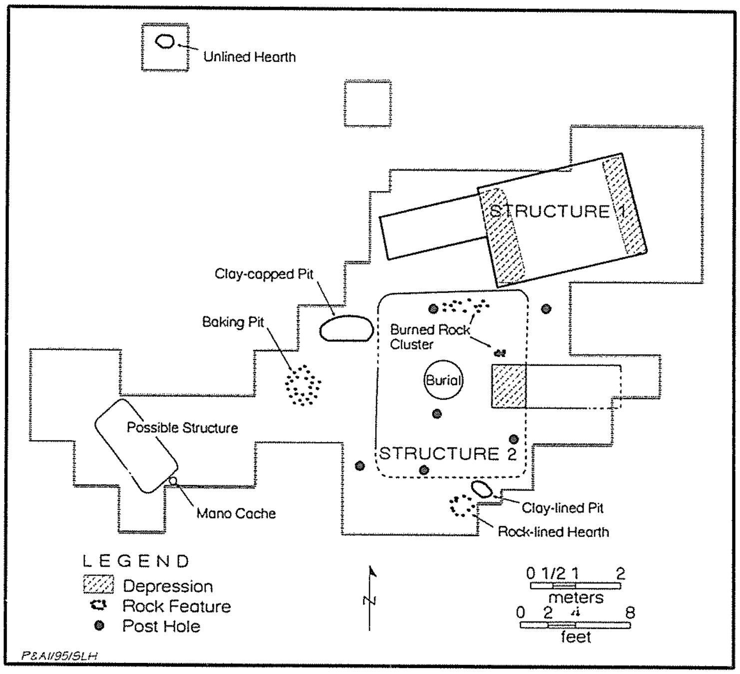


Figure 5. Map of structures and features at the Kent Creek site (modified from Cruse 1992:Figure 6).

and over 2 m long, in the form of ramps that gradually slope upward from the floor level. The pithouses are shallow, with floor levels at ca. 35 cm below the ground surface. Some erosional beveling of the landform probably has occurred, but it is unlikely that the houses were dug down much more than 50 cm, and some form of superstructure must have extended above ground. Pieces of daub recovered from the fill of Structure 1 suggested that it may have had a wattle–and–daub superstructure. Patches of clay/gravel and large rocks with plaster remnants found in the fill may indicate that Structure 2 had a partial masonry superstructure.

The possible structure is a small (190 x 85 cm) subrectangular depression with cobbles, gravel, and daub fragments mixed in its fill, and a mano cache (n=3) along one end. Since it is too small to have been a habitation, this possible structure may have served as a storage facility or perhaps a small grinding shelter.

The precise duration of the occupations at the Kent Creek site is not well established since there are only three radiocarbon dates (see Table 2). The two dates from the baking pit are problematic. They may indicate reuse of the feature at different times, but two use episodes some several hundred years apart does not seem likely. The 1–sigma ranges for these two dates do overlap somewhat, at A.D. 902–985, and the feature might date to this time. Another interpretion is that the older date is accurate while the upper sample may have been contaminated by younger carbon. The latter seems most likely since the standard deviation for the upper baking pit sample is quite large (i.e., ± 250 years). Since the earlier baking pit date is very close to the date for Structure 1, it is suggested that the site occupations occurred primarily around A.D. 700–1000. Cruse (1992:124) calibrated an average of the three dates and concluded that the site was occupied between A.D. 690–1010, and the total duration of the occupations may have been between 100–300 years.

Over 13,000 artifacts were collected from Kent Creek, including 57 arrow points (Deadman's and Scallorn are the only identifiable types), 12 dart points (some identified as Ellis), a variety of other chipped lithic tools (bifaces, unifaces, drills, gouges, and spokeshaves), cores and debitage, 20 manos and 8 metate fragments, and 34 brownware sherds. Of the latter, most were identified as Jornada Brown, Roswell Brown, or Middle Pecos Micaceous Brown, while one sherd is unlike any varieties of Jornada Mogollon pottery and could represent a locally made brownware. The faunal assemblage indicates that the inhabitants killed and ate more deer and/or antelope than any other animals, and only one bison element was recovered. Other animals that may have been utilized for food include skunks, rabbits, and turtles, while snake, prairie dog, and other rodent remains are probably intrusive. Pollen analyses provided somewhat equivocal results (and a preservation bias is likely), but slightly higher concentrations of Cheno–ams were observed in some features. Charred plant remains recovered from extramural features indicate that goosefoot and purslane may have been food resources, and juniper and cottonwood/willow were used as firewood. In addition, charred oak acorns were recovered from the fill of the burial, from a trough depression inside Structure 2, and from the possible structure. Although the species was not identified, it is likely that these represent the use of shin oak (*Quercus havardii*) as a food resource. The number of analyzed pollen and flotation samples was minimal, and Cruse (1992:141) notes that "the possibility that horticulture was practiced cannot be ruled out."

The Kent Creek site is interpreted as a multifunctional residential village but its size (i.e., the number of pithouses present) is unknown because the excavated area represents only a small portion of a much larger site. The primary activities that are evident at the site are hunting and processing of small– to medium–sized animals; procurement, processing, and possibly storage of plant foods; and a full range of lithic tool manufacture and maintenance.

Sam Wahl Site (41GR291)

The Sam Wahl site was discovered in 1987 (Boyd et al. 1989) and tested in 1988 (Boyd et al. 1990). Diagnostic and unusual artifacts recovered consist of four arrow points (including one Scallorn and one Deadman's), an untyped dart point, two plain brownware sherds (cf. Jornada or Roswell Brown), and a fragment of a pendant made of nonlocal kaolinite that is visually identical to the hydrothermally altered kaolinite found at Burro Mesa in Big Bend National Park (Alex 1990). No radiocarbon dates were obtained, and a thermoluminescence date on a burned rock yielded an erroneous

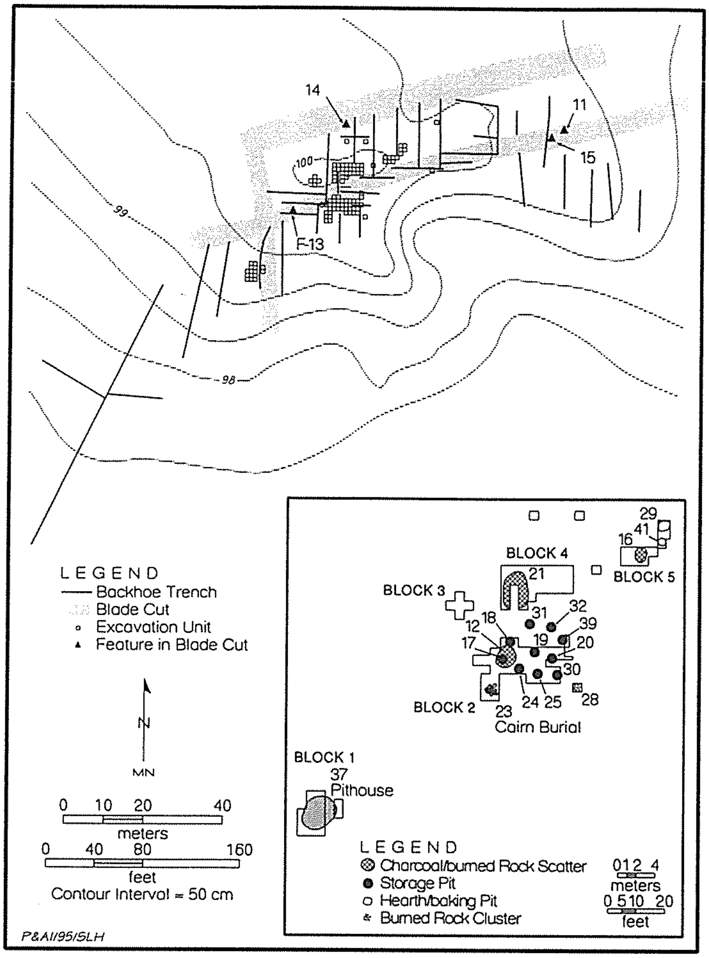


Figure 6. Map of the north–central portion of 41GR291 showing locations of data recovery mechanical excavations, hand excavations, and cultural features.

age. The site occupations were considered to date to Late Prehistoric I times and to represent a manifestation of the Palo Duro complex.

Data recovery excavations in 1992 consisted of extensive mechanical excavations (three long maintainer blade cuts and 36 backhoe trenches) and hand excavation of 106 1x1 m units (Figure 6). The extensive mechanical excavations were done in an effort to locate buried structures and features and these were quite successful. Many of the features that were critical for accurately interpreting the site (i.e., the pithouse and storage pit features) were first encountered in maintainer bladecuts and backhoe trenches, and they might not have been discovered otherwise.

By the end of the data recovery investigations, 37 cultural features had been documented and 3,970 artifacts had been recovered. Site chronology is established by 11 radiocarbon dates that indicate numerous occupations over a long period of time (Figure 7). When the features, calibrated radiocarbon dates, and artifacts were analyzed, it was clear that they were separable into three time periods that were defined as separate analysis units.

A burial component consists of a single cairn–covered burial (discussed below) that is radiocarbon dated to ca. A.D. 230 to 400. This burial is some two centuries earlier than, and may be unrelated to, the earliest occupational evidence at the site. The late occupation period is defined by 1,916 artifacts and two features that are radiocarbon dated to ca. A.D. 1150/1200 to 1350/1400. This later occupation postdates the Palo Duro complex and appears to have been quite different from the earlier occupations.

The early occupation period is attributed to the Palo Duro complex and is represented by 1,445 artifacts

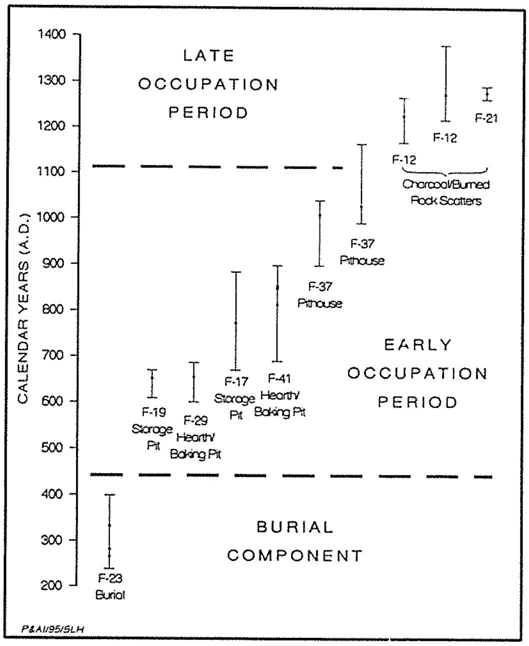


Figure 7. Graph of calibrated radiocarbon dates from the Sam Wahl site.

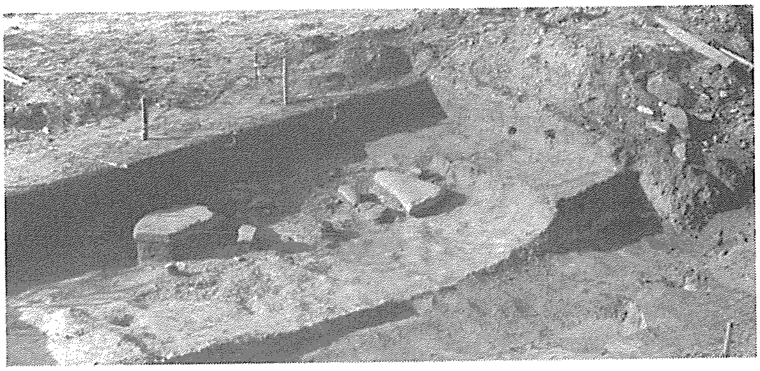


Figure 8. Overview of excavated pithouse at the Sam Wahl site (looking northwest). The two largest rocks are upside–down metates.

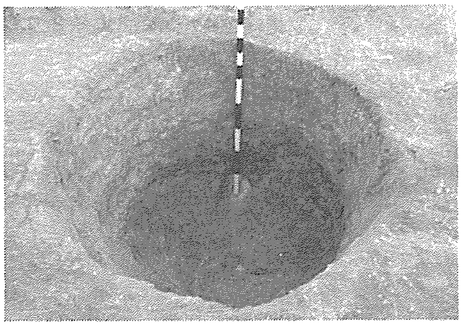
and a feature complex that consists of a pithouse, 10 storage pits, and two baking pits that are radiocarbon dated to ca. A.D. 600 to 1050/1100. The pithouse (Feature 37) is a 3 x 3.5 m oval, basin–shaped depression that was dug down ca. 40 cm below the former ground surface into the bedrock substrate (Figure 8). Two large oval–basin metates were found cached (i.e., stored upside down) inside the pithouse, and a third slab–type metate in the structure (found in the backhoe trench) also may have been cached. Subtle burned areas in the central floor of the pithouse may represent an interior hearth(s); no definite entryway was identified, but it may have been to the southwest. Charred mesquite beans were recovered from the floor of the pithouse.

The 10 storage pits (Features 17-20, 24-25, 30-32, and 39) are all quite similar in morphology, being round in plan view and ranging in diameter from 85–110 cm and 50–80 cm deep with rounded to flat bottoms and sides that taper slightly inward (Figure 9). All of the pits are intrusive ca. 40–60 cm into bedrock, and two had large oval–basin metates cached (again upside down) at the top of the pit. The fill of these features is generally fairly clean sandy sediment (except for one that may have been backfilled with trash), and there is little doubt that they represent storage pits. They are all clustered into a relatively small 8 x 8 m area (see Figure 6), and it is hypothesized that they were located in this particular spot and dug into the bedrock in order to provide rodent-proof storage. The estimated storage capacities of these pits range from 0.24–0.31 m^3 for the smallest to 0.53–0.68 m^3 for the largest. Flotation samples did not provide definitive evidence of what was being stored, but charred grass seeds (four taxa) were abundant and may represent the use of grass linings inside the pits.

Other features associated with the early occupation period include two baking pits that presumably were used to cook some type of plant food. Unfortunately, flotation of the feature fill failed to yield any definitive macrobotanical evidence of what plants were being cooked. Notably, the rocks used in the construction of one of the baking pits included 25 recycled ground stone fragments (mano, metate, and indeterminate fragments) representing 31 percent of the total rocks.

In addition to the pithouse/storage pit/baking pit complex, two bedrock mortars were found 170 m southwest of the pithouse. Although these features cannot be directly dated, they are indirectly associated with the early occupation period because a broken pestle was found on the floor of the

a



b

Figure 9. Storage pit (Feature 17) at various stages of excavation: (a) Half–excavated pit; (b) completely excavated pit.

pithouse. This provides circumstantial evidence that mortars were used at approximately the same time as the pithouse.

One of the late occupation period features (Feature 12) is of particular importance and is radiocarbon dated to ca. A.D. 1200. It is a well–defined, ovate (2 x 3 m) charcoal–stained area that is superimposed on top of, and definitely postdates, two of the storage pits (Features 17 and 18). A small charcoal–filled pit along one edge of the stain appears to represent an in situ unlined hearth. This feature is interpreted as representing an ephemeral surface house with a small interior fireplace. If this interpretation is correct, then the occupants of the Sam Wahl site may have shifted from living in pithouses during Palo Duro times to living in surface houses after ca. A.D. 1100.

The early occupation is interpreted as a small pithouse village of the Palo Duro complex. Plant procurement, processing, and storage were major activities. Except for the mesquite beans found in the pithouse, the specific plants that might have been utilized are not well documented. Charred remains of some other plants, such as *Chenopodium* and cucurbit seeds, may represent food resources, but their archeological contexts do not confirm this interpretation. The charred cucurbit seeds cannot be identified to species and probably represent a wild species (such as Buffalo Gourd) rather than a cultivated variety, but the absence of domesticated plants in the macrobotanical samples from 41GR291 cannot be interpreted as an absence of agriculture altogether. Since the absence of cultigen remains could be due to differential preservation or plant–processing techniques that did not result in charred remains, the question of whether the early occupants were involved in farming must remain open.

The archeological evidence (primarily the features and artifacts) suggests that there were dramatic changes in site function and subsistence activities around A.D. 1100. In general, the early occupation period is characterized by a greater dependence upon plant processing (i.e., more and larger ground stone tools), and the late occupation period is characterized by a greater reliance upon hunting (i.e., more arrow points) and an increase in the manufacture of chipped stone tools (i.e., more unmodified debitage). It is hypothesized that the increasing importance of hunting activities and the shift from pithouses to surface houses are related to climatic changes that occurred around A.D. 1100. There is not enough evidence to determine whether the late occupation represents a late variant of the Palo Duro complex or something else entirely.

Campsites and Rockshelters

Twelve campsites and four rockshelters that have been tested/excavated constitute the bulk of the archeological data for the Palo Duro complex. Boyd et al. (1996) present individual site summaries for Palo Duro campsites and rockshelters, but they are only discussed briefly as a group here.

Subsurface investigations at many open campsites have produced definable Palo Duro components with artifact assemblages that are useful for comparative purposes, while investigations at other campsites have yielded only minimal evidence of Palo Duro occupations (Table 3). The level of work at these sites varies from minimal testing with scattered units, to comprehensive excavations involving large blocks of contiguous units. The discreteness of the Palo Duro components or occupations, and the quality of the data reporting, also range from very good to very poor. Thus, one must take into account the quality and quantity of the archeological data when evaluating the interpretations offered by various investigators. To illustrate the differences, it is notable that only five of the campsites meet the following criteria: (1) have discrete Palo Duro components with definable artifact assemblages of over 1,000 specimens, (2) have had more than 30 m^2 of hand excavation, and (3) have adequately reported excavation data that are useful for comparative purposes. As discussed later, however, it is clear that the campsites vary considerably in terms of site function and intensity of use/occupation.

One point in regard to open campsite investigations is worth stressing. Most campsites attributed to the Palo Duro complex were investigated before pithouse structures were recognized as an important component of the complex. The existence of residential base villages has been realized only within the last decade, and archeologists were not consciously searching for such evidence prior to this time. Cruse (1992) excavated at the Kent Creek site for quite some time before accidentally discovering the pithouses there, and a substantial mechanical testing effort at the Sam Wahl site was specifically designed to search for buried houses. Since the pithouses at these sites were undetectable on the surface, it is very possible that many of the

Table 3. Summary of Campsites Attributed to the Palo Duro Complex

Site/Component	Area Excavated (m^2)	No. of Dates	Total No. of Artifacts in Palo Duro Assemblage	Diagnostic Artifacts		Assessment of	
				Points	Brownware Sherds	Palo Duro Component	Data Quality
Chalk Hollow, upper midden	11	6	?	x	x	good	none
Blue Clay	65	—	1,701	x	x	good	good
County Line	70	—	1,492	x		good	good
Cat Hollow	27	2	623	x		good	fair
Gobbler Creek Bridge	53	3	2,160	x		good	good
South Sage Creek	62	1	2,052	x	x	good	good
Fatheree, Area 1	7	—	213	x	x	fair	fair
Maintenance Barn	28	—	?	x	x	poor	fair
South Ridge, East	32	—	1,077	x	x	good	good
Floydada Country Club	108	—	?	x	x	poor	poor
Montgomery	>20	—	?	x	x	poor	poor
Big Spring	15	—	?	x	x	unknown	fair

*See Table 1 for references to site investigations

Component
good = discrete component
fair = may be discrete component but investigations are limited
poor = component is mixed or otherwise poorly defined
unknown = possible Palo Duro component cannot be adequately defined

Data Quality
good = data adequately reported and sample size is adequate
fair = data adequately reported but sample size is small
poor = assemblages are not defined/definable
none = no data are reported

campsites listed in Table 3 are actually residential bases. Sites that have a wide diversity of features and artifact types, brownware ceramics, and large ground stone tool assemblages are particularly likely to be residential bases.

The South Sage Creek site is an example of a site that has many interesting characteristics that indicate it is a good candidate for a possible residential base. It is the only other site in the region that has yielded a complete large basin metate, like those found in association with the pithouse and storage pits at the Sam Wahl site. Unfortunately, the South Sage Creek site was not recognized as a Palo Duro complex site at the time that the data recovery work was planned and, without realizing the potential for structural remains, the investigation strategy was quite different from that employed at the Sam Wahl site.

Four rockshelters in the Caprock Canyonlands contain evidence of occupations by Palo Duro peoples or date to Palo Duro complex times. The archeological evidence suggests that the canyonland rockshelters were used in different ways by Palo Duro peoples (Table 4). Occupations at Boren Shelter No. 2 (lower shelter) were brief and periodic, generating little cultural debris (only 28 artifacts excluding debitage). Occupations at the Canyon City Club Cave also appear to have been brief and generated few artifacts (44 excluding debitage), but the greater number of projectile points and bones indicates that hunting was a primary activity. In contrast, a higher frequency of artifacts (643 excluding debitage) indicates that occupations at Deadman's Shelter were much more intensive (i.e., of longer duration and more frequent). While hunting is well represented (i.e, points account for 15 percent of all artifacts), the number of manos and metates is exceptionally high (17 percent of all artifacts). In addition, the total artifact assemblage from Deadman's is quite varied, and certainly denotes a wide range of activities. Consequently, the data are interpreted to mean that occupations at Deadman's Shelter were more like those at multifunctional campsites or residential bases than those at the other rockshelters.

Burials

Human burials in the Southern Plains are particularly important because they provide direct evidence of cultural behavior that is very different from the subsistence activities documented at most sites. There are only 10 burial locations in the region that include burials dating to Late Prehistoric I times and have a bearing on defining or understanding the Palo Duro complex (Figure 10). Of these, only seven burials at five localities are definitely or possibly affiliated with the Palo Duro complex.

The burial of an adult male, in an almost extended position with its legs semiflexed in an oval pit inside Deadman's Shelter, is described by Willey and Hughes (1978b:154, 190). The skeleton was accompanied by the following artifacts as grave offerings: a complete terrapin (mud turtle) shell, two mussel shells, and nine modified deer bones (an awl, an ulna, and seven neatly stacked split metapodial halves). The burial apparently occurred during or near the end of Statum D times, radiocarbon dated to A.D. 79–383 (see Table 2). Based on similarities in cranial measurements, Willey (1978) indicated that the Deadman's cranium was most similar to skeletal populations at Pecos Pueblo, and

Table 4. Comparison of Palo Duro Complex Components at Rockshelters

Attributes	Deadman's Shelter (all strata)	Canyon City Club Cave (Level 4)	Boren Shelter No. 2 (Lower Shelter)
Shelter size (m^2)	35-50 (estimated)**	16.7	<30
Area excavated (m^2) including areas outside shelter	30	41.8	15 (inside only)
No. of artifacts (excluding debitage)	630	44	28
No. of debitage	3,720	?	88
No. of faunal elements	2,000+	1,844	482
No. of points/manos and metates	96/108	13/4	1/0

*See Table 1 for references to site investigations. Blue Spring Shelter is excluded from this table because no excavation data have been reported.

**The size of the shelter is estimated because dimensions are not given and the shelter was not completely excavated.

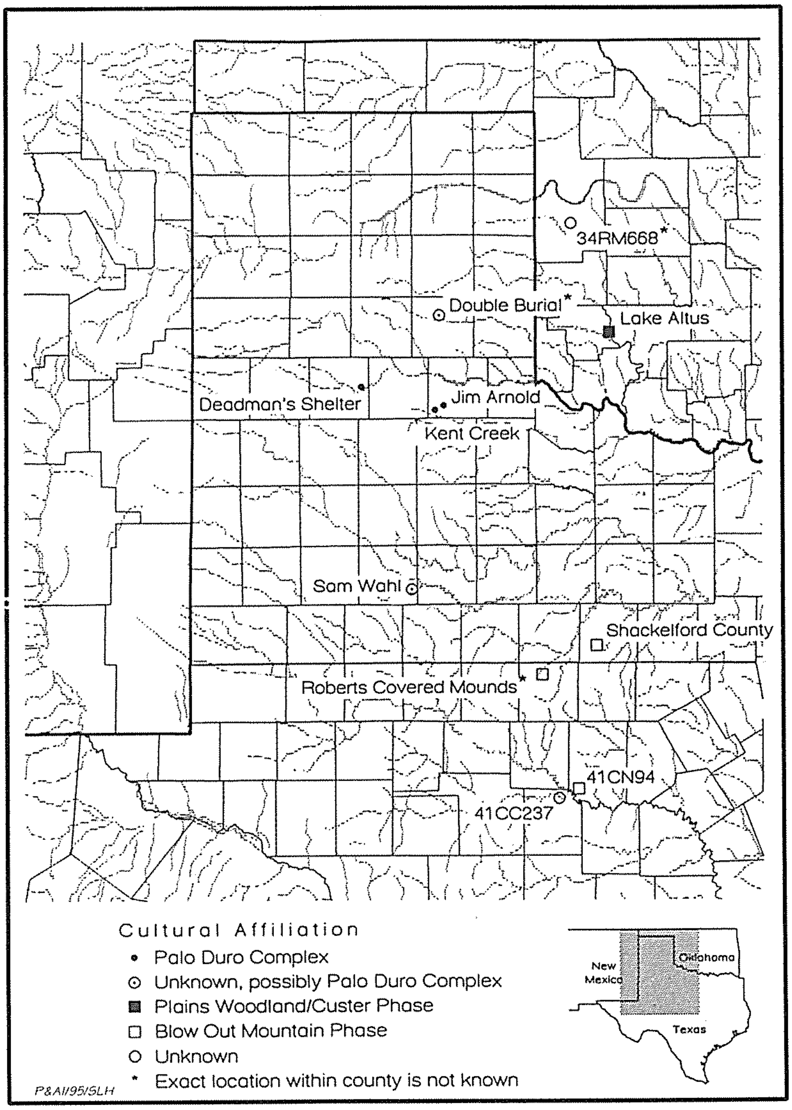


Figure 10. Map of selected Late Prehistoric I burials in the Texas Panhandle Plains.

pendants. The tip of an arrow point was found beneath the skeleton, and since the grave fill was otherwise devoid of cultural material, Cruse (1992:55) speculated that an arrow wound may have been the cause of death. Since the pit was dug into the floor and the gravelly fill was piled up above the level of the floor, the pithouse must have been abandoned immediately after the interment. Thus, a radiocarbon date on charcoal from the floor of Structure 1 places the approximate age of the interment at A.D. 665–977 (see Table 2).

The Jim Arnold site, also located along Kent Creek in Hall County, consists of a ca. 60 cm thick cultural zone exposed in a gravel pit. Two separate but closely spaced burial pits observed in the wall of the gravel pit were subsequently investigated by Tunnell (1964). Both burials had been disturbed by gravel operations and subsequent slumping of the edges of the gravel pit walls. Hence, the skeletal materials and artifacts that were recovered are incomplete, but sufficient information was salvaged to indicate the nature of the graves. Burial 1, a young adult female, had been dislodged from the burial pit, but four modified deer bones (two awls and two awl fragments) were found with the redeposited skeletal remains. Burial 2, an adult male, was partially intact, probably in a semiflexed position, inside an oval pit. Associated grave offerings, which were found in situ, consisted of six modified deer bones (three awls and three split metapodial halves), three mussel shells (two unworked valves and one with notches along its ventral edge), and a bifacial chert knife.

The graves at the Jim Arnold site, located within 1 meter of each other, are similar in that

to Middle Woodland and Kansas Hopewell populations. He tentatively suggested a possible genetic affiliation representing a mixture of Southwestern and Woodland traits.

The burial of an adult female, tightly flexed in a circular pit in the floor of Structure 1 at the Kent Creek site (see Figure 5), contained four modified deer bones (one awl and three split metapodial halves) and three modified mussel shells as grave offerings. One of the mussel valves had a ground edge and may have been used as a scraper, while the other two had drilled holes, were found in the skeleton's chest area, and probably were worn as both were primary interments in shallow oval pits, both were in identical stratigraphic contexts with identical pit fill, and both contained modified deer bones. Tunnell (1964) noted that the burial pits were intrusive into a sterile zone from the bottom of the overlying cultural zone. No investigation of the cultural zone was made, but flint artifacts and bison bones were noted and dart points were found on the surface. Tunnell (1964) could not determine their age and cultural affiliation, but subsequent researchers (Hughes 1991; Miller 1992; Willey and Hughes 1978b:190) have indicated that the Jim Arnold burials are probably associated with the Palo Duro complex, and noted that the burial site is located less than 2 km from the Kent Creek site. Lacking a radiocarbon date or any temporally diagnostic artifacts, the assignment of this burial to the Palo Duro complex is based only on similarities in mortuary offerings.

The four burials described above are considered to be affiliated with the Palo Duro complex, and they exhibit many similar mortuary characteristics. All are primary burials containing modified deer bones as grave offerings, and three of the burials contained a combination of deer bone awls, split deer metapodials (awl preforms), and modified and unmodifed mussel shells. The burials differ in pit shape (round to oval) and in skeletal placement within the pits (nearly extended to tightly flexed), but differences in their intrasite contexts (one in a house, two in open campsites, and one in a rockshelter) may account for some of this variability.

Two individuals buried in a single cairn–covered pit in Donley County were excavated in 1938 (Witte 1955). Both were buried in flexed positions, but one was reported to have been placed "head downward" on top of a "carefully prepared sitting burial" (Witte 1955:85). The skeletons represent adults (sex not determined) that had apparently been killed. Two arrow points were found among the ribs and left scapula of the first individual, and five arrow points were found in the torso and pelvic areas of the second person. The points, several of which have impact breaks, are quite similar to Deadman's points in that they have corner to basal notches and long prominent barbs (see Witte 1955:Plate 13), but the burial specimens are generally larger (i.e., longer and wider with slightly broader expanding stems) and have serrated blades. No grave offerings were present, but the points indicate that the burial dates to the Late Prehistoric I period. Although its precise location is not stated, the Double Burial site is located between 50 and 100 km north of the Kent Creek site.

The Double Burial is undated, but the associated points indicate that it is probably contemporaneous with, and perhaps related to, the Palo Duro complex. This was suggested by Willey and Hughes (1978b:190) based primarily on the similarities of the burial points to the Deadman's arrow point style. This interpretation is plausible, but the fact that these two individuals probably were killed by arrows tipped with Deadman's–like points is equally important. An alternative interpretation is that these individuals may have been killed by people of the Palo Duro culture rather than having been Palo Duro peoples themselves, and this possibility also has been noted by Lintz (1986:225).

The only other burial that might possibly be associated with the Palo Duro complex is one found at the Sam Wahl site. It is a single, cairn–covered human interment (Feature 23 in Figure 6) that is radiocarbon dated to A.D. 256–415. The human skeletal materials were found in an oval pit and are interpreted as a secondary (i.e, bundle) burial of a middle–aged male. The bones were extremely fragmented and jumbled, and their context (in a tight cluster in one portion of the pit) suggested that they might have been confined inside an organic container such as a basket or a hide bag. The only grave inclusions were a ground and faceted piece of hematite (i.e., paint stone), and a 6 cm long Scallorn arrow point. The latter was found in a context suggesting that an arrow had been laid over the bone cluster.

Since the Sam Wahl site burial dates to the transitional Archaic period and is earlier than the earliest documented occupations at the site, it is possible that the burial is not associated with the Palo Duro complex at all. This interpretation is supported by the fact that the Sam Wahl burial is quite different from the three Palo Duro burials described above, none of which are secondary cairn burials. An alternative interpretation is that the burial is affiliated with the early Palo Duro complex. Three lines of circumstantial evidence suggest that this interpretation is tenable: (1) the burial at the Sam Wahl site is approximately contemporaneous with the Palo Duro complex burial at Deadman's Shelter; (2) the associated Scallorn arrow point, although unusually large, would not be stylistically out of place in the Palo Duro complex; and (3) the burial was found at a pithouse village of the Palo Duro complex. Based on the current evidence, however, the cultural affiliation of the burial from the Sam Wahl site is debatable, and the possibility that it represents a burial of a transitional Archaic or even a Plains Woodland (i.e., Lake Creek) individual cannot be discounted.

REDEFINITION OF THE PALO DURO COMPLEX

Chronology

Many components attributed to the Palo Duro complex have been radiocarbon dated (Figure 11; see Table 2). Occupations that are attributable to the Palo Duro complex may have begun during transitional Archaic times (ca. A.D. 0–500), but are definitely recognizable by at least A.D. 500. Palo Duro occupations apparently continued until around A.D. 1100, but they seem to disappear quite suddenly. Thus, the Palo Duro complex is contemporaneous with the Plains Woodland occupations in the northern Texas Panhandle (i.e., the Lake Creek complex) and western Oklahoma, the Blow Out Mountain phase of West Central Texas, and the pithouse phases of the Jornada Mogollon and Middle Pecos areas.

Subsistence and Site Function

Material Culture

A comparison of artifacts recovered from residential base camps, rockshelters, and campsites of the Palo Duro complex indicates that there are some significant similarities and differences between and among these site types. The data presented in Tables 5 and 6 show that the Palo Duro material culture is extremely diverse overall, but that there are some sites, presumably where limited or special activities occurred, where the diversity is rather low. The site data may be compared using the artifact diversity index (see Table 6) as a crude representation of the variability in activities that occurred on–site. Not surprisingly, the residential bases have the widest range of activity diversity with 15–16 of the 17 artifact categories represented. Deadman's Shelter also has a high activity diversity with 15 categories represented, while all of the campsites exhibit moderate artifact diversities with between 10 and 13 categories represented. Boren Shelter No. 2 has the lowest artifact diversity with only 9 of the 17 categories represented.

Two other calculations presented in Table 6 are useful for further comparing and contrasting these components. One is the total artifact density, calculated as the number of artifacts per m² of excavation, and the other is the adjusted artifact density, calculated as the number of artifacts (excluding unmodified debitage) per m² of excavation. These artifact densities are considered to be crude measures of the relative intensity and/or duration of occupation.

The Kent Creek site and Deadman's Shelter have much higher total artifact densities than do any

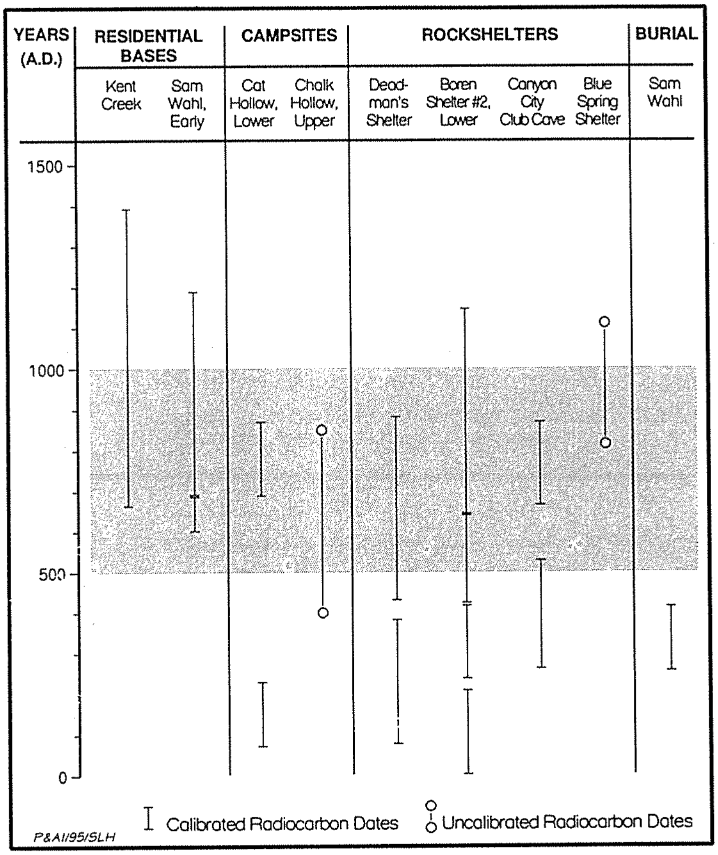


Figure 11. Graph of radiocarbon dates for Palo Duro complex components.

Table 5. Summary of Artifact Assemblages Attributed to Selected Palo Duro Complex Components

	Residential Bases		Rockshelters		Campsites						
Artifact Class	Kent Creek	Sam Wahl, Early Occupation	Deadman's Shelter	Boren No. 2, Lower Shelter	Blue Clay	County Line	Cat Hollow, Lower Zone	Gobbler Creek Bridge	Fatheree Area 1	South Ridge, East End	South Sage Creek
Arrow points	80	4	81	1	6	23	—	1	11	17	10
Dart Points	12	1	15	—	4	3	1	1	5	2	—
Perforators/drills	2	1	3	—	3	1	—	—	2	—	2
Gouges	2	3	—	—	2	—	4	2	—	—	—
Bifaces	43	5	56	1	12	22	4	25	4	8	6
Cobble tools/choppers	8	17	30	1	6	14	13	10	1	1	10
Unifaces	36	31	40	5	27	54	18	11	7	15	27
Cores	91	33	25	11	7	27	22	29	—	18	40
Edge-modified flakes	34	16	166	5	68	126	10	56	7	17	137
Umodified debitage	12,990	1,242	3,720	88	1,490	1,209	539	1,968	164	965	1,775
Hammerstones	2	1	1	3	1	3	—	5	2	3	4
Manos	20	15	20	—	—	4	5	15	3	9	12
Metates	8	53	86	—	20	5	5	35	6	4	26
Pestles	—	3	—	—	—	—	1	—	—	—	—
Other ground stones	—	7	5	—	7	1	—	—	—	—	—
Pottery sherds	34	8	29	—	47	—	—	—	1	18	6
Modified bones	—	—	21	—	—	—	—	—	—	—	—
Modified shells	2	2	4	1	—	—	—	1	—	—	2
Other	4[2]	3[3]	48[3]	—	1[3]	—	1[3]	1[4]	—	—	—
Total Artifacts	13,368	1,445	4,350	116	1,701	1,492	623	2,160	213	1,077	2,057

[1]Artifact assemblages include all materials representing Palo Duro components but exclude artifacts associated with burials at the Kent Creek, Sam Wahl, and Deadman's Shelter sites.
[2]Daub fragments.
[3]Modified hematite paint stone fragments.
[4]A manuport identified as a probable pestle.

Table 6. Comparison of Artifact Assemblages Attributed to Selected Palo Duro Components

	Residential Bases		Rockshelters		Campsites						
Artifact Class	Kent Creek	Sam Wahl, Early Occupation	Deadman's Shelter	Boren No. 2, Lower Shelter	Blue Clay	County Line	Cat Hollow, Lower Zone	Gobbler Creek Bridge	Fatheree Area 1	South Ridge, East End	South Sage Creek
Total Artifacts	13,368	1,445	4,350	116	1,701	1,492	623	2,160	194*	1,077	2,057
Total Artifacts (excluding debitage)	378	203	630	28	211	283	84	192	30*	112	282
Area Excavated (m^2)	62	94	30	15	65	70	27	53	7	32	62
Activity Diversity Index (# of artifact categories represented, excluding dart point and other)	14	16	15	9	13	12	10	12	11	11	13
Total Artifact Density (# artifacts/m^2)	215.6	15.4	145.0	7.7	26.2	21.3	23.1	40.8	27.7	33.7	33.2
Adjusted Artiact Density (# non-debitage artifacts/m^2)	6.1	2.2	21.0	1.9	3.3	4.0	3.1	3.6	4.3	3.5	4.5
Projectile Point/ Grinding Tool Index (# points/# manos, metates, and pestles)	3.3	<0.1	0.9	**	0.5	2.9	<0.1	<0.1	1.8	1.5	0.3

*Total number of artifacts adjusted to exclude 19 surface specimens.
**Sample too small for a valid index.

of the other sites. As discussed below, this may be due to differences in site function or in the total duration and intensity of the occupations, but one other factor also plays a role in the unusually high artifact density seen at Kent Creek. The Kent Creek site has a significantly higher percentage of unmodified debitage (accounting for 97 percent of all artifacts recovered) than does Deadman's Shelter (debitage represents 86 percent of all artifacts) or any of the other sites (debitage represents 76–91 percent of all artifacts). The differential availability of lithic source materials seems to be a partial explanation for the higher total artifact density at Kent Creek, because it is the only site where good quality chert is immediately available and abundant. Tecovas jasper, which is found in the stream terrace gravels exposed on–site, comprises over 90 percent of all the stone artifacts at Kent Creek and most of the corticate debitage represents stream–worn gravels (Cruse 1992:72 and Table 2). Because the Kent Creek occupants were sitting on a chert source area, it is not surprising that they would generate a higher percentage of waste lithic debris than would people in areas located much farther from good quality lithic sources.

The immediate availability of lithic material is only a partial explanation for this phenomenon, because when the adjusted artifact densities are compared, the Kent Creek site falls to second place, but it still appears to have been used more intensively than most of the other sites. The adjusted artifact density indicates that the most intensively occupied site is Deadman's Shelter, and the radiocarbon dates suggest that this may be due in part to the long duration of repeated occupations there (perhaps as much as 500–800 years). The spatial confinement of activities within the rockshelter also may have played a role in that refuse accumulation would be expected to be much more concentrated.

The Kent Creek site, with the second highest adjusted artifact density, has radiocarbon dates that indicate this residential base was occupied for at least 200–400 years and perhaps as long as 400–600 years. In contrast to Kent Creek, the least intensively used site (except for Boren Shelter No. 2) is Sam Wahl, and its radiocarbon dates indicate that it was occupied repeatedly for a long time, perhaps as much as 450 years during the early occupation period (see Figure 11). Thus, one must suspect that the differences in the artifact densities at these two sites are related primarily to site function rather than the duration of the occupations.

Another calculation useful for identifying site function is the projectile point/grinding tool index (see Table 6), calculated as the number of projectile points divided by the number of grinding tools (manos, metates, and pestles only). The projectile point/grinding tool index is a crude measure of the relative importance of hunting vs. plant processing within each component. When the adjusted artifact densities are compared with the projectile point/grinding tool indexes, the Palo Duro components display considerable variability that may be attributed to differential site function and use intensity (Figure 12).

Somewhat surprisingly, the Kent Creek site has the highest representation of hunting activities while the Sam Wahl site is at the opposite end of the spectrum. The vast difference between these two residential bases is interpreted as evidence that these two residential bases functioned quite differently. While the diversity of artifacts indicates that

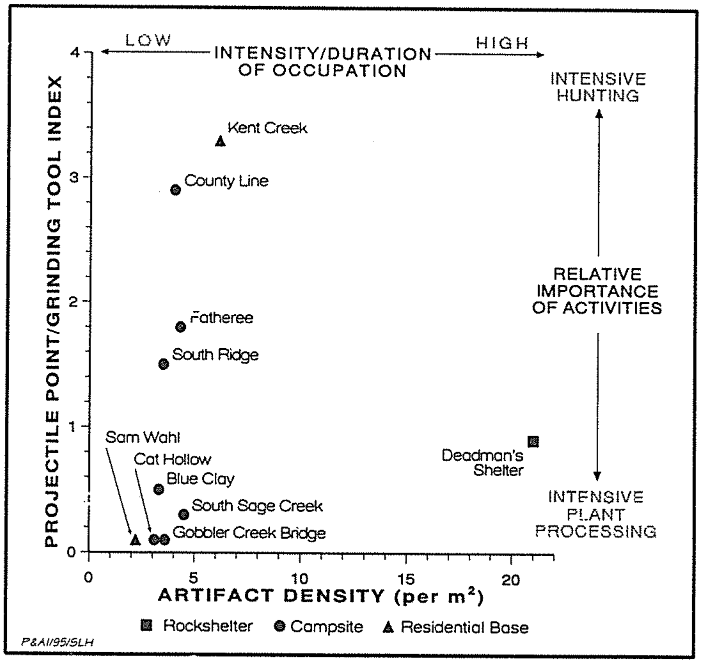


Figure 12. Comparison of artifact density and projectile point/grinding tool indexes for Palo Duro components.

both sites were multifunctional, the data presented in Figure 12, along with other lines of evidence discussed below, support the interpretation that the Sam Wahl site was a specialized residential base and that the primary activities there were related to the processing, storage, and utilization of plant foods. The low artifact density at Sam Wahl is further explained by the fact that these activities would have generated much less residue, particularly chipped stones, than would hunting activities.

All of the Palo Duro campsites exhibit similar artifact densities but vary considerably in terms of site function. While hunting activities are fairly well represented at the County Line, Fatheree, and South Ridge sites, plant processing was very much the dominant activity at the Blue Clay, South Sage Creek, Gobbler Creek Bridge, and Cat Hollow sites. In this regard, the latter sites are more like the Sam Wahl site than they are the other campsites.

The chipped stone tool assemblages from Palo Duro sites (see Table 5) can be characterized as being rather homogeneous, but the relative frequencies of artifacts vary considerably from site to site. When only the chipped stone tools (i.e., projectile points, drills, gouges, bifaces, cobble tools, unifaces, and edge–modified flakes) are considered, and sites with stone tool samples of less than 50 specimens are excluded, some interesting patterns emerge. Unifaces and edge–modified flakes are the most common tools, and they respectively constitute between 10–40 percent and 20–53 percent of all chipped stone tools in a single site. Most of these tools cannot be attributed to specific functions, but they occur in relatively high frequencies both in sites where activities were mainly hunting oriented and in sites where plant processing was the dominant activity. Projectile points, bifaces, and cobble tools are less common in general but are quite variable from site to site, respectively constituting between 2–43 percent, 3–24 percent, and 2–26 percent of the chipped stones at any one type of site. There is a tendency for cobble tools to be much better represented at plant–processing sites, and it has been suggested that these tools may have been used to refurbish (i.e., peck the surfaces of) grinding stones (Boyd et al. 1994:78–79, 145). Two classes, drills and gouges, are generally rare and respectively make up between 0–5 percent and 0–8 percent of chipped stone tools at any one site.

Most of the gouges found at Palo Duro sites are Clear Fork–type unifaces (Turner and Hester 1985:205–208), and they usually have some evidence of haft wear. There is a tendency, albeit weak, for these tools to be better represented at sites where intensive plant processing occurred. If gouges were used for wood working, as has been suggested for South Texas (Hester et al. 1973), then it is possible that they were used as adzes for making and maintaining digging sticks or other wooden tools. Alternatively, gouges could have been used to tip the ends of some type of multipurpose scraping/planing tool or digging stick (Ray 1941:161–162). Of particular interest, Clear Fork gouges have been found in sufficient frequencies and at enough Palo Duro complex sites to dispel the popular notion that they are diagnostic Archaic tools in the Panhandle Plains (e.g., Bagot and Hughes 1979:50; Etchieson et al. 1977:33, 35, 1978:83, 1979:353; D. Hughes 1984:116; J. Hughes 1991:19).

Dart points are present at some sites, and despite the possibility of earlier components in some cases, there seems to be growing evidence for the contemporaneous use of dart and arrow points in the Southern Plains between ca. A.D. 200 and A.D. 500 (see Boyd et al. 1996). The arrow points associated with the Palo Duro complex are characterized as early corner–notched and stemmed forms that are usually typed as Scallorn and Deadman's, respectively. However, arrow point assemblages also are characterized by a great deal of variability, and there are seldom few specimens from any one site that can be considered classic Scallorn or Deadman's forms. One need only look at the early arrow point forms from the Sam Wahl, Kent Creek, and Deadman's Shelter sites (Figures 13-15) to see the diversity in gross morphology. Points typed as Deadman's generally have the diagnostic long slender barbs and long straight or bulbous stems, but other variations include specimens with shorter, often reworked, barbs and wider Scallorn–like expanding stems. Most of the points typed as Scallorn do not fit the classic wide–stemmed form illustrated by Turner and Hester (1985:189), but conform more closely to the *coryell* and *eddy* varieties illustrated by Jelks (1962:Figure 13). The Scallorn and Scallorn–like specimens from Palo Duro sites often appear to be nothing more than reworked Deadman's points with the barbs shortened or removed altogether.

Ground stone tools are obviously well represented at some Palo Duro sites (see Table 5),

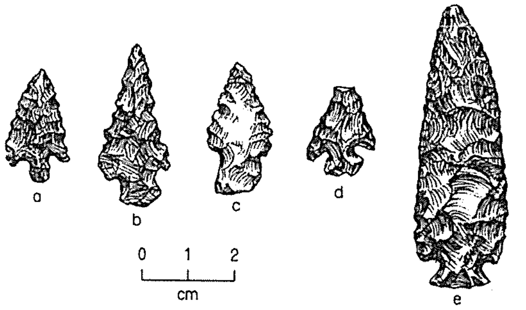


Figure 13. Early arrow points from the Sam Wahl site: a, Bonham; b-e, Scallorn. A barb fragment, typed as Deadman's, is not illustrated. Specimen e is associated with the cairn burial.

but the assemblage from Sam Wahl is rather unique in comparison with the other sites. There appear to be three sets of grinding tools repesented at the Sam Wahl site. One set consists of the thin oval pestles used with pointed–oval bedrock mortars. These may be tools for grinding mesquite beans, as has been suggested for mortars (bedrock and portable) and pestles throughout the southwestern United States (Bell and Castetter 1937). The abundance of pestles at Mesilla phase sites in the Tularosa Basin is considered to be evidence of extensive mesquite processing (Carmichael 1986:220), and it is possible that bedrock mortars, which are common in the Caprock Canyonlands, may have been used in a similar fashion.

The second set of grinding tools consists of flat–faced manos, usually sandstone, used with flat–slab metates, and the third set consists of convex–faced manos, usually quartzite, used with oval–basin metates. The latter set is the best represented of the grinding tools at the Sam Wahl site. Caching (or storing) of complete large oval–basin metates may indicate that this grinding tool kit was the most important in terms of the amount of materials being processed at Sam Wahl.

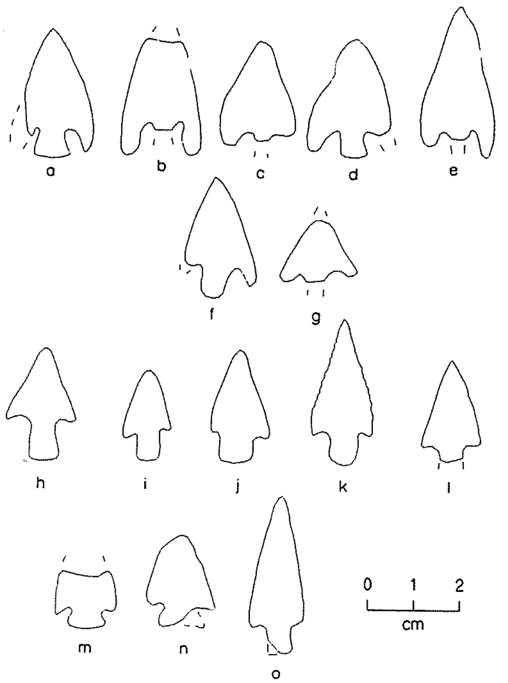


Figure 14. Scallorn and Deadman's arrow points from the Kent Creek site: a-g, Deadman's; h-o, Scallorn. Drawn from selected specimens illustrated in Cruse (1992:Figure 18).

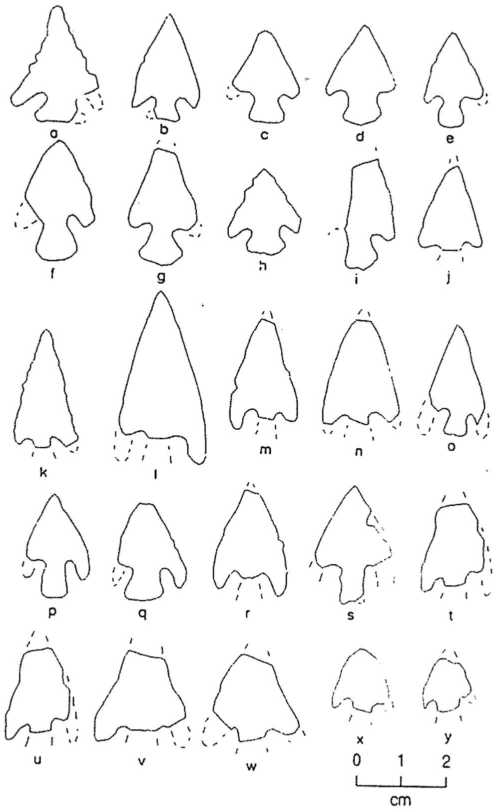


Figure 15. Scallorn and Deadman's arrow points from Deadman's Shelter: a-j, Scallorn; k-y, Deadman's. Drawn from selected specimens illustrated in Willey and Hughes (1978:Figures 54 and 55).

Although less abundant, the grinding tools from the Kent Creek site do exhibit roughly the same morphological variability as do those from Sam Wahl. At Kent Creek, no complete metates were found, but the fragments represent both slab and basin types (one fragment of a thick slab with a deeply worn concavity), and the manos are either oval in shape with flat or convex faces or they are rectangular with flat faces. Two of the rectangular manos have beveled faces.

When the ground stone assemblages from the residential bases are compared by material type and completeness, an interesting pattern emerges (Table 7). Metate fragments heavily dominate the assemblage at Sam Wahl, but they are only moderately abundant at the Kent Creek site. In addition, most of the metate fragments at Sam Wahl were recycled (i.e., reused as hearthstones), while none of those at Kent Creek were found in recycled contexts. Since Triassic sandstones and Quaternary gravel outcrops are immediately available at both sites, the distance to material sources is not a factor affecting the frequency of grinding tools. Thus, some other factor must account for these differences. While it is possible that grinding activities were simply more important at Sam Wahl than at Kent Creek, this explanation is not totally satisfactory. Schlanger (1990, 1991) has observed that complete and fragmentary ground stones are considerably more abundant in villages sites that were occupied for longer periods of time. The early occupations at the Sam Wahl site lasted for some 400 years or more (based on six radiocarbon dates), certainly long enough for numerous grinding implements to have been broken and recycled. The chronology of the Kent Creek site is less precise (see discussion above), but it may have been reoccupied for only one or two centuries. If this is the case, then the lower

Table 7. Comparison of Grinding Assemblages from the Sam Wahl and Kent Creek Sites

	Sam Wahl Site, Early Occupation				Kent Creek Site			
	Sandstone		Quartzite		Sandstone		Quartzite	
Tool Class	#	%	#	%	#	%	#	%
Manos								
Complete	1	1.3	5	6.4	6	21.4	2	7.2
Fragments	4	5.1	5	6.4	6	21.4	6	21.4
Metates								
Complete	5	6.4	—	—	—	—	—	—
Fragments	48	61.5	—	—	8	28.6	—	—
Pestles								
Complete	—	—	—	—	—	—	—	—
Fragments	3	3.8	—	—	—	—	—	—
Other								
Complete	—	—	—	—	—	—	—	—
Fragments	7	9.0	—	—	—	—	—	—
Subtotals	68	87.2	10	12.8	20	71.4	8	28.6
GRAND TOTALS	78	(100.0)			28	(100.0)		

frequency of grinding tool recycling could be a function of time rather than evidence that grinding activities were less important at Kent Creek. As discussed later (see "Seasonality, Residential Mobility, and Settlement Pattern" below), differential abandonment processes (i.e., planned vs. unplanned) are evident at these sites and at dwellings within these sites.

The results of a study of ground stone tools in the Jornada Mogollon area by Calamia (1991) support the interpretations that the Sam Wahl and Kent Creek sites are both residential bases but that their functions are somewhat different. It was observed that complete manos are much more common in special–activity sites, while broken manos are more common in residential bases. Calamia (1991:Figure 8) shows that only ca. 38 percent of the manos found at Jornada Mogollon residential bases are complete, compared to ca. 77 percent complete manos at special–activity sites. The higher frequency of broken manos at residential bases is thought to be related to the greater intensity and/or duration of occupations that occurred there. The percentages of whole manos at the Sam Wahl and Kent Creek sites (ca. 40 percent at each) are very close to the figure given for Jornada Mogollon residential bases.

Calamia (1991:Figures 2–7) also uses mano size as an indirect measure of residential mobility and intensity of plant processing in the Jornada region. He demonstrates that manos are generally smaller at special–activity sites than at residential bases and that there is a general increase in the size of manos through time (from the Archaic period to the El Paso phase). Other researchers have suggested that increasing mano size is a reflection of increasing dependence upon plant foods in general and horticulture in particular (e.g., Mauldin 1991, 1993).

When the mano size data for the Sam Wahl and Kent Creek sites are compared (Table 8), another interesting pattern emerges (acknowledging that the sample sizes are quite small and thus interpretations are tentative). Although ground stones are most abundant at the Sam Wahl site, the manos there are considerably smaller than those at the Kent Creek site. These data may indicate that grinding activities were more intensive at the Kent Creek site but that the overall duration of occupations was longer at the Sam Wahl site. If the site occupations were sequential, these data could reflect increasing dependence upon plant resources through time, as is suggested for the Jornada area. But there is no

Table 8. Comparison of Mano Size Data for Palo Duro Complex Residential Bases

Attributes	Sam Wahl (Early Occupation)	Kent Creek
Sample Size (# of whole manos)	6	8
Size Range (minimum-maximum, cm)		
Length	7.1-11.4	9.7-14.0
Width	5.4-8.5	8.3-9.9
Thickness	2.9-6.2	2.6-5.7
Mean Size (cm)		
Length	9.0	11.6
Width	7.2	8.7
Thickness	4.6	3.5
Mean Length/Width Ratio	1.25	1.34
Mean Grinding Surface Area (cm^2)*	66.5	101.38

*Grinding area is an approximation that is figured as length times width. It slightly overestimates the grinding areas of most manos because they are subrectangular, oval, or round rather than rectangular or square.

evidence indicating that the Kent Creek site occupations are dominantly later than those at the Sam Wahl site. In fact, the chronometric evidence points to the contrary, and it appears that the Palo Duro components are more or less contemporaneous, but that occupations of the Sam Wahl site continued later (i.e., the post–A.D. 1100 late occupation period) than at the Kent Creek site. If the Palo Duro occupations at these sites were indeed contemporaneous (perhaps with Sam Wahl being occupied more frequently), then the data may be interpreted as representing differences in site function. This interpretation is preferred, and it is possible that differences in the grinding tools between these sites are due to the processing of different plants (see "Faunal and Floral Remains" below).

The ceramics from Palo Duro sites are interesting for a variety of reasons. Sherds are usually absent or rare in most sites (see Table 5), accounting for less than 9 percent of all artifacts (excluding debitage), but sherds are quite common at the Blue Clay and South Ridge sites, where they comprise 22 percent and 16 percent of all artifacts (excluding debitage), respectively. The total absence of pottery sherds in some Palo Duro sites could be due to limited investigations, but their absence at other sites that have produced large artifact samples is intriguing. The fact that no sherds were found at the County Line and Gobbler Creek Bridge sites, despite fairly extensive investigations, may indicate that pottery was not being used by the inhabitants. From a functional perspective, one should not expect pottery to be present at every site occupied by Palo Duro peoples, and it should not be surprising to find special–activity sites with no pottery.

The brownware pottery found at Palo Duro sites is generally classifiable as belonging to the Jornada Mogollon tradition. Detailed visual analyses by Southwestern ceramicists (i.e., Jack Hedrick, Regge Wiseman, and Helene Warren) have identified several different varieties that probably represent different source areas within southeastern New Mexico and/or western Texas. The types that have been specifically identified are Jornada Brown (and/or Alma Plain), Roswell Brown, Middle Pecos Micaceous Brown, South Pecos Brown, and McKenzie Brown. Some researchers recognize many regional variations of Jornada Mogollon brownwares and are willing to make visual type identifications in some cases, while others think that few or no types may be identified accurately by visual examinations alone. Petrographic studies of brownwares from several Palo Duro sites, however, generally support the visual type identifications made by various ceramic experts.

Petrographic studies of Palo Duro complex brownwares include two sherds from 41BI265 (Etchieson et al. 1977:64); three sherds from Deadman's Shelter, six from the Kent Creek site, and three from the South Sage Creek site (Robinson 1992); and five sherds from the Sam Wahl site (Robinson 1994). These petrographic data indicate that there is considerable compositional variability in the brownwares, representing different source areas. These studies also have confirmed that almost all of this pottery is of non-local origin and was made in the Jornada Mogollon or Middle Pecos areas. As yet, there have been no convincing studies to indicate that brownware pottery was made in the Caprock Canyonlands or Southern Llano Estacado, although occasional sherds that do not match any varieties of Jornada brownware are considered to be possible candidates for locally made wares (e.g., one sherd at Kent Creek was identified as possibly being of local manufacture).

There may be some evidence, albeit weak, for temporal differentiation of brownware types. Thicker brownwares tempered with crushed igneous rocks primarily containing quartz and feldspars, such as the Jornada Brown/Alma Plain found at Deadman's Shelter, appear to be the earliest brownwares in the Texas Panhandle Plains, perhaps dating as early as A.D. 100–300. Thinner sherds with more–variable crushed rock tempers may be later. In particular, some sherds found at the Kent Creek and South Sage Creek sites contain significant quantities of biotite (see Robinson 1992, 1994), and have been tentatively identified as Middle Pecos Micaceous Brown, while some distinctive sherds from the Sam Wahl site have been tentatively identified as South Pecos Brown. According to Jelinek (1967), these wares were manufactured in the Middle Pecos area between A.D. 800-1300.

There are some interesting patterns in the distribution of bone and mussel shell artifacts. Most notable is the presence of modified deer bones (primarily metapodial awls and awl blanks), and modified and unmodified mussel shells (scrapers, pendants, and shell blanks) in human burials. As mentioned above, the use of these items as mortuary offerings is intriguing, but their significance is not understood. Excluding burial contexts, the distribution of modified bones within Palo Duro sites (see Table 5) is almost certainly related to differential preservation rather than differing site function. The total absence of modified bones in residential bases and campsites does not mean that no bone artifacts were used at these sites. Since bones are generally sparse and poorly preserved in open sites, it is reasonable to assume that bone tools could have been deposited but subsequently lost to deterioration.

Modified bones are found in only one site, the intensively occupied Deadman's Shelter, where bone preservation was very good. Since differential preservation does not seem to be a factor in any of the rockshelters, one may assume that bone tools were not commonly used and/or discarded in the ephemerally occupied rockshelters. The 21 bone artifacts that were found at Deadman's Shelter include: awls and awl blanks made of split deer metapodials, polished deer antler tips (flaking tools?), and unidentifiable fragments that were cut, polished, and/or incised. One fragment with two drilled holes in it may have been a pendant.

Mussel shell fragments are common in many Palo Duro sites (see "Faunal and Floral Remains" below), and differential preservation is less likely to have been a factor affecting the distribution of shell artifacts. Mussel shells occasionally were used as scrapers, but the most common forms of modification (such as cut edges, drilled holes, notches, and surface etching) probably represent shell jewelry or waste debris as a by–product of the manufacture of shell jewelry. Evidence for the use of shell jewelry and/or the manufacture of shell ornaments was found at the South Sage Creek, Sam Wahl, and Kent Creek sites.

Features

A comparison of feature types for Palo Duro complex sites (Table 9) shows a wide range of generalized and specific activities and supports the differential site functions seen in Figure 12. As expected, the diversity of features is greatest for the residential bases and is somewhat less variable for campsites and rockshelters. There are some obvious correlations, such as the presence of pithouses and storage pits only at residential bases, but the most ubiquitous features at all sites are rock–lined and unlined hearths, burned rock clusters, and baking pits. While the former types are considered general heating/cooking features, the baking pits are more substantial rock–lined or rock–filled pits that are interpreted as plant–cooking ovens (see Boyd et al. [1994:38–43, 135–138] for descriptions of baking pits found at Lake Alan Henry). Baking pits were found at the Gobbler Creek Bridge and Cat Hollow sites, along with large quantities of burned rocks thought to be residue discarded during pit baking. Because of the tremendous quantities of burned rocks at these sites, they are interpreted as specialized plant–processing campsites.

There is considerable variability in the architecture of the roughly contemporaneous pithouses at the Kent Creek and Sam Wahl sites (Table 10). These pithouses include both ovate and rectangular forms, their sizes vary somewhat with floor areas ranging from 7.6 to 14.2 m^2, and the entry directions are all different. As described earlier, there also are many differences in the interior features and in the construction of the superstructures.

Faunal and Floral Remains

Faunal remains provide substantial evidence for the use of animals as food resources by Palo Duro peoples. The animal bones recovered from various sites, summarized in Table 11, generally have been treated in one of three ways: they have been completely ignored during analysis; they have been identified by taxa and listed but not analyzed; or they have been identified by taxa and analyzed for evidence of modification (e.g., burning and butchering), and their distributions have been carefully studied. This differential treatment helps explain many of the question marks that appear in Table 11. It also is important to realize that in many cases, particularly when dealing with rodents and other burrowing animals and with rockshelter assemblages, it is unclear whether animals were introduced into sites by natural processes rather than human activity.

The largest faunal assemblages are from the Kent Creek site and Deadman's Shelter. At both of these sites, deer is the only medium–large animal recognized as having been a significant food resource while bison is poorly represented. A wide variety of other small animals are present, but their relative importance as food resources is

Table 9. Comparison of Features Associated with Palo Duro Complex Components

	Residential Bases		Rockshelters		
Feature Type	Kent Creek	Sam Wahl	Deadman's	Boren No. 2	Various Campsites
Pithouse (habitation)	x	x			
Pithouse (storage)	x				
Small pitroom	?				
Storage pit	x	x			
Bedrock mortar		x			x
Baking pit	x	x			x
Unlined hearth	x		x	x	x
Rock-lined hearth	x		x	x	x
Burned rock cluster/scatter*		?		x	x
Fire-cracked rock cluster**		?			
Hearth fill dump				x	
Wind deflector				x	
Human burial	x	?	x		
No. of Feature Types Represented	6-7	4-7	3	5	5

*Burned rock cluster/scatter is a catchall type that includes many undefined burned rock features.
**Fire-cracked rock features are distinguished by the presence of heat-fractured quartzite rocks and may represent boiling stone dumps.

comparatively low or unclear. In contrast to these sites, the faunal evidence indicates that rabbits and rodents were the most frequently eaten animals at Boren Shelter No. 2.

The faunal assemblages at all of the other sites are either so meager that they are uninterpretable (and they are likely to be biased by differential preservation) or they are just large enough to provide some interpretable information. When the probably intrusive animal bones are weeded out and burning/butchering are taken into account, the minimum numbers of individuals for specific taxa are so low that it is impossible to determine the relative dietary importance of various animals. Thus, even though they were carefully analyzed, many of these smaller faunal assemblages produced little more than a grocery list of animals that were likely to have been or definitely were hunted. The faunal remains from the Chalk Hollow site, although apparently a sizable and interesting assemblage, have not been analyzed at all.

Freshwater mussel shells are consistently present in Palo Duro sites, and there is some evidence that they may have been utilized as food. For example, heated hinge fragments (presumably heated to cause the live mussel to open) were recovered from the South Sage Creek site. Mussel remains have not been found in sufficient quantities, however, to suggest that they were an important food resource. They certainly were never used by Palo Duro peoples to the extent that they were in other areas. Large accumulations of shells in the East Levee site, 41TG91 (Creel 1990), near San Angelo, and at sites at Lake O. H. Ivie (Treece et al. 1993:519–523), indicate that mussels were an important food for peoples in the Colorado and Concho river valleys, but there is no such evidence for the Caprock Canyonlands. In fact, the relatively high frequency of modified mussel shells and single unmodified valves (but never whole mussels) in Palo Duro complex sites and burials suggests that the shells themselves may have been much more important than the mussels.

Table 10. Architectural Variability in Pithouses of the Palo Duro Complex

Attributes	Kent Creek Site Pithouse 1	Kent Creek Site Pithouse 2	Sam Wahl Site Pithouse
Shape	rectangular	rectangular	ovate
Size (m)	4.3x3.3	3.3x2.3	3.5x3
Floor area (m²)	14.2	7.6	10.5
Entry direction	east	west	southeast (?)
Entry type	plastered ramp	plastered ramp	unknown
Depth (cm)*	35+	33+	45+
Interior Features			
Troughs (or water traps?)	yes	yes	no
Large postholes	yes	no	no
Small postholes	yes	no	uncertain
Hearth	no**	no	probable
Rock clusters/ovens	yes	no	no
Exterior postholes	no	no	uncertain
Probable type of superstructure	wattle and daub	stone masonry	very ephemeral, jacal-like

*Depths represent minimum estimates of how deep the floors were excavated from the original ground surface.
**No interior hearth was found, but a post-abandonment subfloor burial in the center of the structure could have destroyed a hearth.

Palynological samples have been taken and analyzed from several Palo Duro sites (i.e., the Kent Creek, Sam Wahl, and Gobbler Creek Bridge sites), but the fossil pollen in these samples consistently has been found to be seriously degraded, and the data are generally considered unusable for economic (or paleoenvironmental) interpretations (Bryant 1993; Dering 1994; Dering and Bryant 1992; Jones 1990). Phytoliths have been extracted from feature sediments at Lake Alan Henry sites, but the resulting data are generally not useful for subsistence interpretations. Unlike pollen, the phytoliths have been found to be well preserved, but the interpretations are limited by the current state of the art (primarily the inability to recognize specific taxa and the lack of comparative collections, but phytolith analysis has improved considerably in recent years). One notable exception is that calcium oxylate crystals found in sediments associated with a baking pit at the Gobbler Creek Bridge site are thought to be from prickly pear (Cummings 1990:541).

Macrobotanical remains recovered from sediment flotation provide the most useful evidence for interpreting the plants that were or may have been used as food resources (Table 12). Carbonized seeds of many different plants have been recovered from sediments in a variety of contexts (e.g., on pithouse floors, in storage pits and baking pits, and in nonfeature samples), and in all cases the charring is thought to be the result of human activities (as opposed to natural fires). The question, then, is which plants were used as food and which plants may have been burned accidentally or used in some other manner, such as for fuel? The data presented in Table 12 show various plant taxa as being either present or moderately abundant in charred form but do not attempt to make a judgment as to why the seeds were burned. Various analysts generally address these questions on a case by case basis, taking many factors into account (e.g., the nature of the plant, the frequency of charred seed occurrence

Table 11. Comparison of Faunal Evidence for Use of Specific Food Resources at Palo Duro Complex Sites

	Residential Bases		Rockshelters		Campsites						
Common Name	Kent Creek	Sam Wahl, Early Occupation	Deadman's Shelter	Boren No. 2, Lower Shelter	Blue Clay	County Line	Cat Hollow, Lower Zone	Gobbler Creek Bridge	Fatheree Area 1	South Ridge, East End	South Sage Creek
Deer	2		1			?			?	?	
Antelope	3	?	3						?		
Deer/Antelope							?				
Bison	3		3		?	?	?		?	?	
Canid				?							
Coyote			?								
Fox			?								
Badger			?								
Skunk	?		?								
Raccoon			?								
Ringtail			?								
Rabbits	?	?	?	2	?		?	x	?	?	
Rodents			?	2		?			?		?
Birds			?	?		?					
Land Turtles	?								?	?	
Water Turtle	?										
Snakes	x		?							?	
Lizard				?							
Toads/Frogs			?	?							
Freshwater Fish		3	3							?	
Freshwater Mussels	?	?	?	?	?	?	?	?	?	?	?
No. of Specimens/ Type of Analysis	627/C	29/C*	3,000+/I	482/C	342/C	188/C	16/C*	4/C*	291/C	833/C	1/C*

Interpretations of the relative importance of resources are based on frequency of occurrence within class and evidence of modification:
1 = intensive (may represent a major food resource)
2 = moderate (may represent an important food resource)
3 = low (may represent a minor food resource)
? = unknown (probably used as a food resource but importance is unknown)
x = none (present in the assemblage but probably not a food resource, e.g., burrowing rodents)
TYPE OF ANALYSIS: C = complete faunal analysis (noting evidence of burning, butchering, etc.); I = incomplete faunal analysis (species identification only).
*Poor preservation is noted as a possible source of bias.

Table 12. Comparison of Macrobotanical Evidence for Use of Specific Plant Foods at Palo Duro Complex Components*

	Residential Bases		Rockshelter
Common and Scientific Name	Kent Creek	Sam Wahl, Early Occupation	Boren No. 2, Lower Shelter
Goosefoot (*Chenopodium* sp.)	x	x	x
Pigweed (*Amaranthus* sp.)		?	
Prickly poppy (*Argemone* sp.)		?	
Purslane (*Portulaca* sp.)	?	x	?
Bottle gourd (Cucurbitacaea)		?	?
Carpet weed (*Mollugo verticillata*)		?	
Skullcap (*Scutellaria* sp.)			x
Mesquite (*Prosopis glandulosa*)		x	?
Oak (*Quercus* sp., probably shin oak)	x		
Lotebush (*Ziziphus obtusifolia*)		?	
Hackberry (*Celtis reticulata*)		x	x
Brome grass (*Bromus* sp.)		o	
Paspalum (*Paspalum* sp.)		o	x
Dropseed (*Sporobolus* sp.)		o	
Panic grass (*Panicum* sp.)		o	?
Number of flotation samples analyzed	4	14	10

*Macrobotanical evidence consists of carbonized seeds recovered from flotation (charred wood is not included). A few flotation samples from the Gobbler Creek Bridge and South Sage Creek sites were analyzed, but no carbonized seeds were recovered.
? = presence noted in one or more samples.
x = moderately abundant; found in multiple samples from different types of features.
o = recovered only in storage pits; may be evidence of grass lining rather than food.

in various contexts, and ethnographic evidence for utilization of plants).

While any of the taxa listed may represent food resources, the taxa that are most abundant (in terms of the quantity of charred seeds from individual samples and the ubiquity of their occurrence in multiple samples from different types of features) are more likely to have been used for food. Of all of the taxa listed, however, only the mesquite beans and shin oak acorns have been found in archeological contexts that strongly suggest they were used for food. Dering (1994:335–341) provides an interesting discussion of the probable use of mesquite at the Sam Wahl site, and Cruse (1992:121) discusses shin oak acorns found at the Kent Creek site.

It also is notable that *Chenopodium* is much more abundant than any other taxa and is associated with three types of features (i.e., pithouse, storage pits, and baking pits) at the Sam Wahl site. Dering (1994:341) suggests that the ubiquity of charred goosefoot at the Sam Wahl site, in contrast to its absence at other Lake Alan Henry sites, is evidence that goosefoot was being processed as food. While goosefoot was very abundant in one storage pit flotation sample, it was not found in sufficient quantity or consistency in other storage pit samples to indicate that it was the principal plant food that was being stored.

In addition to the evidence for food use, Dering (1994:340–341) observed that four species of grass seeds consistently were found in storage pits at the Sam Wahl site, but they were not recovered in any other type of feature. He speculated that this may be evidence that the pits had been lined with grass, rather than that grass seeds were being stored in the pits.

There is no definitive evidence for the range of plant foods that might have been processed in the baking pits (see Hines et al. [1994] for a detailed discussion of pit roasting) at residential bases or at specialized campsites, or what season(s) of the year they might have been used. There are a multitude of possibilities, however, such as baking pits having been used: (1) during one time of the year for cooking a particular plant, (2) during one time of the year for cooking a variety of different plants, (3) during multiple seasons for cooking a few specific plants, or (4) during multiple seasons for cooking a wide variety of plant foods. It is likely that the baking pits were used primarily during the late spring, summer, and fall, when a wide range of wild plant foods (e.g., seeds, beans, berries, tubers, and tunas and pads) are available for exploitation. Given the paucity of direct evidence, it is impossible to know whether these ovens were multiseasonal and multifunctional (i.e., used for cooking many plant foods as they became available), or season and resource–specific (i.e., used primarily for cooking some superabundant plant food during one particular season).

Based on ethnographic evidence for arid and semiarid environments (e.g., Basehart 1960; Castetter and Opler 1936:35–38; Pennington 1963; Sonnichen 1958), many different plants were cooked in pit ovens, but the principal ones were agave, sotol, prickly pear, yucca, and corn. Agave is not found in the Caprock Canyonlands today and probably never ranged that far north. Sotol, although not found there today, may have been present there in the past since its current range has been seriously altered by modern ranching practices (see Boyd et al. 1994:264). Prickly pear and yucca are ubiquitous in the area today and probably were abundant in Palo Duro times as well. Although it is not known whether the Palo Duro peoples practiced horticulture, corn is yet another possible plant food that was oven roasted.

Although their contemporaneity has been demonstrated by the radiocarbon dates from the Sam Wahl site, it is not known if the grinding tools, baking pits, and storage pits were used together as part of an integrated technology for some specific resource(s) or if they were used independently for different resources. Some foods may have been ground before being cooked, or vice versa, and these foods may or may not have then been stored for future use. It also is possible that many plants were ground while only a few were cooked and/or stored. Again, the possibilities are numerous, and there is no hard evidence to support any one interpretation.

Besides the possible oven–baked plant resources mentioned above, a wide range of other plants may have been important food resources (including but not limited to all of the plants listed in Table 12). Boyd et al. (1994:264–266) provide a detailed discussion of the various plants that could have been significant food resources in the Caprock Canyonlands and Rolling Plains. The plants and plant parts that may have been sufficiently abundant and nutritious to have been utilized intensively as food resources by Palo Duro peoples are (in no particular order): seeds of various grasses and flowering plants (e.g., dropgrass and Cheno–ams); various roots and tubers (e.g., buffalo gourds and prairie turnip); pads, stalks, fruits, and/or bulbs of desert succulents and cacti (e.g., yucca, sotol, prickly pear, and cholla); various cucurbits (e.g., bottle gourds); acorns of shin oak and possibly live oak (remnant groves of live oak are present at Lake Alan Henry); possibly pecan or hickory nuts (charred *Carya* sp. wood from a hearth at 41GR484 indicates that pecan or hickory was once in the Lake Alan Henry area); and mesquite beans. There are undoubtedly many other plants that might have been important food resources, but they are perhaps less obvious in the ethnographic or archeological records. A variety of horticultural crops (e.g., corn, squash, and beans) should not be discounted as possible food resources despite their absence in the archeological record.

Of all the plants mentioned above, shin oak and mesquite warrant further consideration as having been important or staple sources of food for Palo Duro peoples. The extent of shin oak distribution in the Caprock Canyonlands today is not well known, but it is confined mainly to areas where sandy calcareous soils predominate and in areas where limestone crops out. Assuming that its distribution was similar in the past, one may only speculate that shin oak may have been sufficiently abundant in some areas to have comprised a significant food resource for Palo Duro peoples. The occurrence of charred acorns, tentatively identified as shin oak because it is the only species that grows in the immediate vicinity today, in several feature contexts at the Kent Creek site is intriguing evidence. Since shin oak is not a particularly good fuel source, the acorns are not likely to have been introduced incidentally or accidentally. Although the use of shin oak acorns for food is not well documented ethnographically, its use by prehistoric peoples in and around the northern Llano Estacado has been suggested by various researchers (e.g., Collins 1971:76; Leslie 1979:185).

Mesquite, on the other hand, is well documented in the ethnographic literature as a staple resource for many peoples in the southwestern United States and northern Mexico (Bell and Castetter 1937:21–33), along the Texas Coast and in Central Texas (Covey 1961:66, 86–87, 100), and in the Rio Grande delta (Salinas 1990:117–119). Although direct archeological evidence is limited, mesquite has been suggested as having been an important resource throughout the Jornada Mogollon region (Brethauer 1979; Carmichael 1986:220; Leslie 1979:186), and even the historic Comanche and Kiowa of the Texas Panhandle Plains utilized mesquite beans as food (Carlson and Jones 1940:530; Galvin 1970:30–31; Vestal and Schultes 1939:33–34). Nutritional data compiled by Hiles (1993) indicate that mesquite pods and beans are very high in protein, carbohydrates, fiber, and sugar.

Boyd et al. (1994:265–266) dispel the myth that mesquite was not present or rare in the Texas Panhandle Plains prior to late nineteenth century ranching. The distribution of mesquite has certainly increased dramatically due to historic and modern ranching and agricultural practices (Flores 1990:60–61; Kirkpatrick 1992:141). Its rapid spread into new areas (such as uplands) that were once devoid of mesquite is the source for the common misconception that "there was no mesquite before ranchers came." However, early historic accounts (e.g., Bailey 1951:105, 121; Foreman 1937:97; Parker 1984:170–171, 184) clearly indicate that mesquite trees were very abundant in riverine environments prior to cattle grazing (and overgrazing), root plowing and chaining, and control of range fires. The mid–nineteenth century distribution of mesquite suggests that it was abundant throught the Caprock Canyonlands in prehistory, and it is the best candidate for having been a staple resource (but not necessarily the only one) for Palo Duro peoples. It also should be noted that charred mesquite beans should not be expected to be common in the archeological record even if they were extensively utilized. Most ethnographic accounts indicate that beans were crushed and ground before being cooked. If they were not cooked in pod or bean form, the chances of their being charred, and hence preserved in the archeological record, are much lower.

Five main interpretations can be derived from the Palo Duro Complex subsistence data. First, bison hunting and use of bison as a food resource are poorly documented. That bison were present during Late Prehistoric I times is unquestionable since bison remains dating to this time are found in many sites. Bison remains are exceedingly rare, however, compared to the preceding Late Archaic period, and even at sites where the artifactual evidence indicates that hunting was an important activity, the principal game animals appear to have been deer and smaller animals. In addition, no bison kill or butchering localities are known for the Palo Duro complex, and it appears unlikely that any form of communal bison hunting occurred. From this, one may infer that bison were somewhat scarce in, but never absent from, the Caprock Canyonlands during Palo Duro times (assuming that people would have hunted them much more if large populations were present). While a general scarcity of bison remains has been noted for the Southern Plains between A.D. 500 and 1200 (Dillehay 1974), this does not preclude the possibility that bison were abundant in other areas at this time. Treece et al. (1993:523–524) note that bison remains dating to this time period are well represented in sites at Lake O. H. Ivie in West Central Texas.

The second major point is that multiple lines of evidence indicate that the primary subsistence resources for Palo Duro peoples were plant foods. Although hunting activities are fairly well represented at some sites, some evidence for the use of plant foods is found at all Palo Duro sites, and it is overwhelmingly dominant in many components. The contemporaneous use of storage pits, baking pits, at least two kinds of portable grinding tool kits (i.e., mano/metate sets), and bedrock mortars/pestles at residential bases, all denote a heavy emphasis on plant foods. The activities that occurred at these sites were often of sufficient duration to warrant the construction of pithouses, and it is likely that these residential villages were occupied on a seasonal basis.

Third, while a wide range of plant foods probably was utilized, it may be hypothesized that, just as they were important in the Jornada Mogollon and Eastern Jornada areas, mesquite beans and shin oak acorns also may have been important foods for Palo Duro complex peoples. Many Eastern Jornada campsites may have been occupied by people harvesting these foods, and Leslie (1979:185–186) notes that "acorns and mesquite beans mature at about the same time (August–early September) but vary in different areas and different years; the two foods were possibly harvested at the same time when possible." The same may be true for peoples living in the Caprock Canyonlands.

The fourth point is that in spite of the absence of domesticated plant remains or definite agricultural tools, the possibility that Palo Duro peoples practiced some form of limited horticulture must be considered. The introduction of domesticated plants into the southwestern United States has been characterized as a "monumental nonevent" that had "little immediate impact on native human populations" (Minnis 1985:310). It was the intensification of agricultural production, rather than its mere introduction, that had significant and widespread impacts upon prehistoric economies. Following Bronson's (1977) terminology (cited in Minnis 1985:338), it may be suggested that Palo Duro peoples were not agriculturalists ("those dependent upon cultivated plants"), but that they could have been cultivators ("those for whom crops are not necessarily major economic items"). Lacking definitive evidence, it can only be suggested that limited plant cultivation may have been incorporated into a seasonal pattern of resource collection (Minnis 1985:331). Certainly, it is likely that Palo Duro peoples were at least aware of farming since agricultural systems were well established in the Southwest by A.D. 500–700 (Minnis 1985:310; Woodbury and Zubrow 1979:50–51), in the Central Plains by A.D. 900 (Adair 1988:114), and in South Central Oklahoma (Vehik 1984:196) and Northeast Texas (Perttula 1992:13; Perttula and Bruseth 1983:17) by A.D. 800. Ford (1985:352, 362–364) suggests that the Southern Plains may have been a corridor for the continued eastward spread of cultigens (specifically maize and beans), and presumably farming technologies, from the American Southwest. If so, the Palo Duro complex may have even played some critical role in the diffusion process.

The final major point is that there is ample evidence for considerable variability in site function. This has been observed not only between different types of sites but also between sites of a single type. The differences between the contemporaneous pithouse occupations at the Kent Creek and Sam Wahl sites are particularly notable. This diversity of site function is indicative of a high degree of residential mobility within the Palo Duro complex, which in turn is suggestive of a seasonal organization of subsistence activities.

Seasonality, Residential Mobility, and Settlement Pattern

Reconstructing the settlement pattern of the Palo Duro culture is a daunting task given the paucity of definitive seasonality data and the constraints imposed by the small sample of sites that have been adequately investigated. Limited inferences may be made, but they are based largely on indirect and circumstantial evidence. Thus, the interpretations offered in this section are tentative and should be viewed cautiously and critically.

It can be stated with some degree of confidence that the Palo Duro complex peoples organized their subsistence activities on a seasonal basis. This interpretation is based in large part on the fact that the distribution, abundance, usefulness, and predictability of various plant and animal resources in the Caprock Canyonlands varies according to the seasons and certainly did so in prehistoric times as well. When the residential bases, rockshelters, and campsites are considered together, the adaptive strategy of Palo Duro complex peoples must be viewed as extremely mobile and dominantly plant-oriented. The discovery of pithouses and substantial storage facilities at sites in the Caprock Canyonlands constitutes new evidence requiring a total reevaluation of the settlement pattern of Palo Duro complex people.

As discussed below, it may be inferred from the archeological evidence that Palo Duro peoples maintained a high degree of residential mobility in response to seasonal changes in the availability of food resources. Although the seasonality of their occupations is speculative, rockshelters and campsites probably represent habitation sites that were occupied at different times of the year than were the residential bases. Two types of Palo Duro rockshelters have been noted: some, such as Boren Shelter No. 2, were used only on an ephemeral basis, while others, such as Deadman's Shelter, were intensively occupied. It is notable that the material culture from Deadman's Shelter mimics that from the residential bases, and denotes the considerable importance of grinding plant foods and hunting deer and smaller animals. There is no convincing direct evidence for seasonality, but it is likely that there was winter or cold–weather use of larger rockshelters as short–term residential bases, and ephemeral use of smaller rockshelters by smaller groups (families or task groups?) during various seasons, perhaps mainly as temporary havens from inclement weather.

Campsites range from multifunctional locations where hunting was an important component (e.g., the County Line site) to very specialized activity areas where grinding and cooking of plant foods were nearly exclusive activities (e.g., the Cat Hollow and Gobbler Creek Bridge sites). It is likely that some of this variation in subsistence activities is related to different seasons of occupation. Again, there is no good evidence for seasonality, but most of the plants that would have been cooked at the specialized plant–processing localities ripen or are ready for harvest during the late spring to fall. The absence of storage pits at campsites suggests that they were not occupied during the winter. If the plant foods that were processed were intended for storage, one might expect that some of these plant–processing campsites would be located in close proximity to residential bases. This does seem to be the case at Lake Alan Henry, as evidenced by the close proximity of the Cat Hollow and Sam Wahl sites.

The two residential bases also appear to have functioned in different ways. At the Sam Wahl site, baking, grinding, and storage of plant foods were extremely important activities, but the use of animal resources appears to have been minimal. At Kent Creek, grinding, cooking, and storage of plant foods also are evident and represent important activities, but hunting of deer and smaller animals was significantly more important than at Sam Wahl. The differences in storage techniques used at these sites are particularly notable and probably relate to variations in site function. While pit storage is well represented at the Sam Wahl site, it is only minimally represented at Kent Creek where above-ground storage may have been more common. As discussed below, however, it is somewhat difficult to translate the apparent functional differences between these sites directly into interpretations of the seasonality of occupation.

Perhaps of equal or greater importance to the recognition of the variability between the residential bases is the fact that the Kent Creek and Sam Wahl sites are, in many ways, more similar than they are different. The presence of permanent habitation structures and storage facilities at both of these sites provides considerable evidence for speculating on the seasonal orientation of subsistence activities. From a theoretical perspective, pithouse dwellings generally imply some degree of residential mobility and seasonal organization of activities, storage generally implies seasonal changes in resource availability, and subterranean food storage implies the use of plant foods. These concepts are important for understanding the Palo Duro culture's settlement pattern, and warrant more consideration.

In the southwestern United States, recent research has emphasized the importance of understanding residential mobility (e.g., Carmichael 1990; Nelson and LeBlanc 1986; Whalen and Gilman 1990). Shifting away from the view that pithouses are evidence of sedentism, most researchers now embrace the view that the pithouse period may have been characterized by considerable and varying degrees of residential mobility (e.g., O'Laughlin 1980, 1993; Whalen 1977, 1978, 1980). Bearing in mind that "hunter–gatherer adaptations come in many kinds, with many levels of mobility" (Whalen and Gilman 1990:73), some inferences can be made about the nature of residential mobility in the Texas Panhandle Plains during the latter half of the first millenium A.D. Gilman (1987:548) states that "pithouse structures are the most adaptive and useful choice of habitation under conditions of biseasonal settlement systems, dependence upon stored foods, and cold season sedentism." If this idea holds true beyond the Southwest, then the pithouse occupations at the Kent Creek and Sam Wahl sites can be interpreted as having been at least seasonal, and possibly biseasonal, residences. However, it should not be assumed that the mere presence of pithouses is indicative of a single site function or a particular season of occupation. This assumption does not seem to be valid for the Jornada Mogollon region (Carmichael 1986:218), nor is it particularly tenable for the Caprock Canyonlands. In fact, until archeological data prove otherwise, it is probably safer to assume that differences in architectural styles, storage facilities, artifact assemblages, and macrobotanical remains could relate directly to variations in site function and/or the seasonality of occupation.

Storage in general, and subterranean storage in particular, has been interpreted as evidence of seasonally oriented resource distribution and residential mobility (Binford 1990; DeBoer 1988; Goland 1983; Ingold 1983; O'Laughlin 1993; Raymer 1988; Ward 1985). Boyd et al. (1994:262) provide a more detailed discussion of the implications of storage at the Sam Wahl site, but a few major ethnographic observations need to be considered: (1) bulk food storage generally occurs at the locality where the resource is procured or harvested; (2) subterranean storage in temperate climates almost always involves storage of plant foods (both wild and domesticated); (3) one important function of pit storage is to conceal foodstuffs during periods of site abandonment; (4) stored foods are usually consumed at or near the storage locality; and (5) consumption of stored foods most often occurs during the winter—the lean season when most food resources are scarce.

Based on these observations, one possible scenario is that the Sam Wahl and Kent Creek sites were occupied between late summer and late fall when plant foods were harvested and stored. Archeological evidence for the use of mesquite beans (and possibly goosefoot) at Sam Wahl and the use of shin oak acorns (and possibly goosefoot) at Kent Creek support this interpretation. The use of storage implies that the sites also may have been occupied during the middle to late winter, at which time the stored foods were consumed. It is more speculative, however, to infer whether the sites were occupied continuously from fall through winter, or whether they may have been abandoned during late fall to early winter and reoccupied during mid- to late winter. Assuming that one function of subterranean storage was for concealment, the predominant use of storage pits at Sam Wahl may be interpreted as evidence that the site was temporarily abandoned during late fall/early winter. In contrast, the predominant use of above-ground storage at Kent Creek could mean that this site was not temporarily abandoned during this time, perhaps because the inhabitants had greater access to other resources such as game animals. Thus, it is possible that differences in site abandonment could have been at least partially responsible for some of the archeological differences between the Kent Creek and Sam Wahl sites.

Numerous ethnoarcheological and archeological case studies (e.g., Cameron and Tomka 1993) suggest that the caching of complete and fully functional metates at the Sam Wahl site may be evidence of planned abandonment on an episodic or, more likely, seasonal basis. Schlanger (1990, 1991) notes that complete tools are often found in use contexts (i.e., cached or left in primary activity areas) within village sites, presumably because the last abandonment was perceived as temporary by the final inhabitants. The last inhabitants at Sam Wahl, who left the metates stored upside down on storage pits and inside the pithouse, probably left fully expecting to return to the site.

In contrast, Structure No. 1 at the Kent Creek site may have been abandoned hastily and its inhabitants left with no intention of returning. This pithouse probably was abandoned permanently upon the death and burial of one of its occupants. Cruse (1992:136 and Figure 27) was able to define two distinct activity areas (a lithic work area and a food storage/processing area) based on the distribution of artifacts within the structure. Some of the tools that were left behind, including a mano and a side scraper, were complete. This does not necessarily mean that no usable artifacts were salvaged from the house, but it does suggest that the final abandoment was unplanned and disorderly. Brooks (1993) notes similarly well defined artifact patterning in the interior of a Plains Village period Washita River phase house which had burned. The burning of the house could have been accidental, but it seems more likely that it was intentional upon the death of a child occupant who was buried inside. In either case, the abandonment was unplanned, and the house–floor artifacts, including a grinding basin and five manos, were left in their primary contexts reflecting the locations of household activities.

If limited horticulture was incorporated into their subsistence base, Palo Duro peoples might have occupied the villages on a biseasonal basis. The people may have occupied the villages during planting season in early spring, abandoned the site while foraging and hunting during the summer, and returned in the late fall to harvest the crop and stay through the winter. A simplistic model of prereservation Western Apache horticulture, as defined by Welch (1991), is useful for understanding one way in which such subsistence activities might have been scheduled. No genetic affiliation with Athapaskan–speaking peoples is intended nor is it suggested that this model is a direct analog for Palo Duro culture adaptation. It is simply one possible scenario for how Palo Duro peoples might have organized a biseasonal adaptation involving limited horticulture.

According to Welch (1991:78), the pre-reservation Western Apaches' diet consisted of "roughly equal amounts of cultivated, gathered, and hunted foods." He states that:

> ...Apache horticulturalists integrated cultivation with foraging through scheduling and resource procurement task groups (see Binford 1980). When a food source failed, greater emphasis could be placed on the other two, or on raiding. Family clusters based loosely on clan affiliations were the main settlement and subsistence units. These clusters contributed labor to the cultivation (mainly maize and cucurbits)...The cultivation cycle began as early as March and as late as July with digging out silted irrigation ditches and clearing and planting fields. The very old and young sometimes remained at the farmsteads to weed, protect, and irrigate the crops while others descended to harvest cactus fruits and other late spring and early summer foods. Additional gathering took place until the band reunited in early September to harvest and store food for late winter and early spring and to prepare for fall hunting [Welch 1991:78, 81].

The concentration of Palo Duro sites in the Caprock Canyonlands suggests that these people made this area their home for most of the year because it offered the most abundant and predictable food resources and the widest range of other essential resources such as wood and water. When, why, and how often they moved about within the canyonland environment and adjacent regions is still a mystery because too many pieces of the puzzle, particularly good subsistence and seasonality data, are still missing. At this point, one can only speculate on the precise manner in which residential bases, rockshelters, and campsites fit together to form a coherent picture of the adaptive strategy of the Palo Duro peoples.

Geographic Range and Intercultural Relationships

The vast majority of sites and components attributed to the Palo Duro complex are located in the escarpment breaks along the Prairie Dog Town Fork of the Red River and the Double Mountain Fork of the Brazos River. This constitutes the core area of the Palo Duro complex. Besides the Palo Duro sites that have already been discussed (see Table 1), other possible Palo Duro components that have not been tested may be present at Lake Alan Henry (41GR256 in Boyd et al. 1989:Table 12) and in Caprock Canyons State Park (41BI365 in Bagot and Hughes 1979:Figure 43; 41BI265 in Etchieson et al. 1977:Figure 23). Since Palo Duro components have been found in all three of the intensively surveyed canyonland areas (i.e., Mackenzie Reservoir, Caprock Canyons State Park, and Lake Alan Henry), one must speculate that the complex may be well represented all along the Caprock Escarpment, including the intervening areas that have yet to be studied. So little archeological work has been done over most of the Caprock Canyonlands that our view is limited to a few little windows into the landscape. Extrapolating site data from these intensive survey areas, however, there is likely to be a very high density of Palo Duro complex sites in other areas of the canyonlands, particularly along all major tributaries. One must also realize that for every Palo Duro complex site that has been identified, many more probably go unrecognized because the prehistoric cultural activities did not generate, or the archeologists failed to find, any diagnostic residue.

As mentioned above, the northern boundary of the Palo Duro complex seems to overlap with the southern boundary of the Lake Creek complex. Couzzourt (1988:47) states that "Deadman points, characteristic to diagnostic of the Palo Duro Culture, are rare to absent in the northern Panhandle, though they do occur, as do some seemingly 'intermediate' types between corner–notched and base–notched types." Mogollon brownwares also are relatively rare in the Canadian River valley (as compared to the Caprock Canyonlands), but a few Palo Duro components are found in the upper headwaters of the Prairie Dog Town Fork (i.e., upstream of Palo Duro Canyon State Park as far as Buffalo Lake) and even into the Lake Meredith area of the Canadian River (see Figures 3 and 4). Thus, the area of overlap is the drainage divide between the Canadian River and Prairie Dog Town Fork, and it is this zone that has been proposed as a territorial border between the Plains Woodland and Southwestern–influenced cultures (Couzzourt 1982; Cruse 1992; Hughes 1991; Krieger 1946, 1978).

The evidence for violence and intercultural conflict seems to support the existence of a cultural boundary between Palo Duro and Lake Creek/ Plains Woodland peoples. The Palo Duro woman who was buried, presumably by her relatives, in the pithouse at the Kent Creek hamlet probably was killed by non–Palo Duro peoples. The cultural identity of the two men who were killed and buried together in a single grave in Donley County is uncertain, but they may have been killed by members of the Palo Duro group. Could they have been Lake Creek or Plains Woodland peoples?

Other Plains Woodland or transitional Archaic burials to the northeast of the Palo Duro area also have evidence of violence. Numerous human burials exposed by shoreline erosion at Lake Altus, in Greer County, Oklahoma, represent cemeteries dating to the Plains Woodland period and into the Custer phase (Agogino and Button 1985; Boyd 1982; Button and Agogino 1986, 1987). These burials occur mainly as primary (usually flexed) skeletons in isolated graves but also include a few secondary burials and one primary interment of five individuals. Although many of the burials contained no artifacts and have not been dated, they are found at sites dominated by Late Prehistoric I materials, including abundant cord-marked pottery. Cord-marked sherds have been found in the fill of two of the burials, and sherds from one were identified as Stafford Cordmarked, a diagnostic type of the Custer phase (Boyd 1982:10–16). In addition, a single burial is dated to A.D. 470–650 (uncalibrated), and the multiple interment of five individuals is dated to A.D. 590–770 (uncalibrated) (Button and Agogino 1987:19, 31). While the pottery suggests that these cemeteries might be affiliated with the Custer phase, the dates indicate that some of the burials are earlier. Which cultural complex or period the Lake Altus burials are assigned to is a matter of semantics and the lack of chronological control. Of particular importance, however, are the two clear cases of violence within the Lake Altus cemeteries. One individual, possibly a bundle burial, had an untyped fragmentary arrow point embedded in its ulna (Boyd 1982:15–16; LeVick and LeVick 1966). One of the individuals in the multiple burial had a fatal blow to the head, and the composition of the multiple burial group—an elderly male (with the head injury), a middle–aged female, two juvenile males, and a female child—led Button and Agogino (1987:30–31) to speculate that the entire group had been killed.

Another multiple burial in western Oklahoma provides evidence for violence during the transitional Archaic period. Gettys (1991) reports that Burial 2 at 34RM668 consisted of three flexed skeletons in a single interment. One of the individuals was beheaded prior to burial, and corner– and side–notched dart points associated with two individuals are interpreted as the cause of death. Two radiocarbon dates on bone collagen indicate that these individuals were killed and buried between A.D. 210–440 (Oklahoma Archeological Survey 1993). This multiple burial, which is approximately contemporaneous with the Sam Wahl site burial, provides evidence for intercultural conflict immediately preceding or perhaps early in Palo Duro complex times.

The archeological evidence indicates that intercultural conflicts had begun at least by the first few centuries after Christ and continued throughout the first millenium A.D. While there is no indisputable evidence indicating that the Palo Duro and Lake Creek/Plains Woodland peoples were enemies, both groups were engaged in conflicts of some type and it seems likely that this might have been the case. If the Double Burial victims were Plains Woodland folks who were killed by Palo Duro peoples, the evidence argues for a cultural boundary between Palo Duro and Lake Creek/Plains Woodland peoples somewhere in the vicinity of the Prairie Dog Town Fork of the Red River.

The few Palo Duro components found along the Canadian River (i.e, the South Ridge, the Maintenance barn, and Fatheree sites) are located well inside the area where Lake Creek occupations are common. Given the possibility of warfare between these cultures, this phenomenon is somewhat difficult to explain. These sites indicate that Palo Duro peoples ventured into the Canadian River valley, but it is not known if this represents an unusual occurrence or if there may have been consistent overlap and/or periodic fluctuation in the territorial boundary. The presence of occasional brownware sherds in some Lake Creek components could indicate that there was some form of exchange between the two groups.

There are many possible explanations of the relationship between the Palo Duro and Lake Creek (and other Plains Woodland) peoples, and a few of them are offered here, as food for thought: (1) the Palo Duro and Lake Creek peoples were never enemies, their territories overlapped and they interacted frequently, and other groups were responsible for the violence; (2) the Palo Duro and Lake Creek peoples were long–time enemies who came from very different cultural traditions, the territorial boundary between them fluctuated, and the Palo Duro culture extended into the Canadian River at some time; (3) the Palo Duro and Lake Creek peoples may have coexisted peacefully for some time, but hostilities developed near the end of the Late Prehistoric I period; or (4) the Palo Duro and Plains Woodland cultural traditions actually represent many different groups (rather than just two) who interacted with each other in various ways (as allies or enemies) at different times.

The extent of the Palo Duro complex to the east is uncertain. Diagnostic Palo Duro artifacts were not recovered in the surveys and testing at Truscott (Etchieson et al. 1978) and Crowell (Etchieson et al. 1979) reservoirs, nor have they been reported elsewhere in the Texas Rolling Plains. Thus, it is not certain whether Palo Duro peoples avoided the region or perhaps ventured there occasionally but left behind no diagnostic artifacts that archeologists have recognized. It does seem unlikely that residential bases would be common in some parts of the Texas Rolling Plains. Even if some riverine areas had sufficient fresh water and other resources to support such occupations, these areas would have been isolated oases within a sea of saline water and sparse resources. And, being outside their primary territory, such isolated villages would have been much more vulnerable to attack.

It is not known whether the Palo Duro complex extends south into the canyonlands of the upper Colorado River drainage. Little archeological work has been reported immediately south of Lake Alan Henry, but one gets the impression that Deadman's–like points and Mogollon pottery are rare. No pottery or early stemmed arrow points were found during the recent survey and testing at Mitchell Reservoir, but Scallorn–like points indicate that some occupations occurred during Late Prehistoric I times (Lintz, Oglesby, and Treece 1993; Lintz et al. 1991). There are not sufficient archeological data to indicate whether the upper Colorado River (in Borden, Dawson, Howard, Mitchell, and Scurry counties) was or was not occupied by Palo Duro peoples. The Big Spring site (Sommer 1971) in Howard County, for example, has produced artifacts similar to those of the Palo Duro complex, but the context and age of these materials are not certain. If this site represents a Palo Duro component, which is possible, it would provide evidence that the complex does extend into the upper Colorado River drainage.

Immediately southeast of the Palo Duro complex is the aceramic Blow Out Mountain phase. It is possible that this poorly defined cultural entity is misrepresented because the apparent absence of ceramics is due to inadequate archeological sampling. The Blow Out Mountain phase appears to be different from the Palo Duro complex in some ways, but the projectile points are similar. While no true Deadman's points are reported in the area, the arrow points of the Blow Out Mountain phase include stemmed Bonham–like varieties that look like Deadman's with shorter barbs or without barbs (cf. Creel 1990:Figure 42; Wulfkuhle 1986:Figure 132), and they are quite similar to many of the stemmed points found at Palo Duro sites. Not much is known about the Blow Out Mountain phase because the East Levee site (41TG91) is the only site that has been investigated intensively (Creel 1990), except for burials. Thus, it is quite speculative to comment on the relationship between the Palo Duro and Blow Out Mountain cultures at this time.

A large number of excavated burials have been attributed to the Blow Out Mountain phase, and they constitute an important data base. Unfortunately, published data are nonexistent or inadequate for most of these burials, and none have been radiocarbon dated. In the 1930s, Cyrus Ray (1932, 1933, 1936, 1946) investigated numerous burials found on prominent hills and ridges, both as isolated cairn–covered burials, and as large rock cairns containing individual and multiple graves. These "covered mounds" or "stone cist mounds" as Ray (1932, 1933) called them, represent cemeteries that usually contain primary burials in flexed positions, but cremated remains are sometimes present as well. Many burials in the region are found inside rock–lined cists, but most contain few grave goods and no diagnostics. Hence, their association with the Blow Out Mountain phase is tentative and is based on the fact that some of the burials have stemmed (Bonham–like) arrow points associated with them. It is interesting that Ray (1933:23) suggests a Southwestern origin for the cist–lined graves observed in many of the Abilene–area burial mounds, but the diversity of Blow Out Mountain mortuary traits (e.g., lined and unlined graves, with and without cairns, containing primary interments, bundle burials, and cremations) has not been studied in any detail. What is important, however, is that the stemmed points in Blow Out Mountain burials are somewhat similar to points found in the Palo Duro complex, and the contexts of many of the points indicate that they represent the cause of death rather than grave offerings.

The Roberts Covered Mound no. 3 (probably in Taylor County) is a good example of a Blow Out Mountain phase cemetery, and Ray (1933) reports that this mound contained 10 individual interments. Two were bundle burials, found in the upper part of the mound, and one of these had a stemmed (Alba–like) arrow point associated with it (Ray 1933:Plate 8). The other eight were primary flexed burials in individual cists, and very few artifacts were found in association (i.e, a bison toe bone and a bone awl are the only items mentioned). Five of the primary burials had no mandibles, and their absence could not be attributed to any form of disturbance. Ray (1933:19–20) suggested that the jaws had been taken as war trophies. A mandible also was missing from one cist grave in the nearby Alexander Mound (Ray 1933:22).

Forrester (1951) reports similar findings in a series of burials in Shackelford County. A total of 18 individuals were found in four separate burial areas, or "burial plots," within 300 yards along a creek terrace. Of particular interest, two young males in Burial Plot II (a single grave) had been killed. Both had stemmed arrow points found in contexts indicating that they were the cause of death. One individual was missing his hands and feet, and cut marks on the distal end of the ulna suggest that they were removed as war trophies. In addition, the charred mandible of a child was found in the chest area of one skeleton, indicating that this war trophy had been worn as a pendant.

Of nine individuals in Burial Plot III, which is similar to Ray's (1933) covered–mound cemeteries, two adult males (Skeletons 4 and 5) were buried with grave offerings reminiscent of those in Palo Duro complex burials (i.e., mussel shells and deer bone tools). A stemmed arrow point was found in association with one man (Skeleton 4) who had been buried in a single grave with three other people (Skeltons 1–3 are an elderly female and two infants). The point has proximal and distal breaks that appear to be impact related (the proximal break is almost identical to the one on the arrow point embedded in the humerus of Skeleton 2 in Burial Plot II), and the point probably represents the cause of death. If this interpretation is correct, it is quite possible that the other three individuals buried in the same grave also were killed.

None of the Shackelford County burials have been radiocarbon dated, but the association with early style arrow points indicates that they date to Late Prehistoric I times, and also suggest a likely affiliation with the Blow Out Mountain phase (Creel 1990:17). These points are basically similar to the Alba, Bonham, and Sabinal styles, but they do not quite fit into a single type. Forrester (1987) has since suggested that they be called Moran points.

Several cairn burials have been found in and near Lake O. H. Ivie in Concho, Coleman, and Runnels counties, and two date to Late Prehistoric I times. Although it is not yet reported in detail, Lintz et al. (1993:647–649) mention a burial excavated by the Concho Valley Archeological Society at 41CN94 that is similar to the Shackelford County burials and yielded a Sabinal arrow point (J. A. Jaquier, 1993 personal communication). At 41CC237, a child cremation and a bundle burial of an adult male probably were interred at the same time in a single cairn–covered grave (Lintz et al. 1993:649–659). Although the artifacts found in the burial pit (i.e., thin bifacial preforms, unifacial tools, debitage, modified limonite fragments, and 19 *Olivella* shell beads) are not temporally sensitive, a radiocarbon date of A.D. 280–570 (calibrated) was obtained on bone collagen from the adult skeleton. A possible cut mark observed on one rib may be evidence of dismemberment, and the mandible is notably absent from the burial.

The evidence for violence in Blow Out Mountain phase burials (and in culturally unassigned burials such as at 41CC237) is intriguing, but it is too early to draw any firm conclusions. Perhaps the Palo Duro peoples were engaged in conflicts with peoples to the south and southeast, as well as with groups to the north and northeast? The taking of human jaws as war trophies attests to the intensity of the hostilities, which had perhaps escalated to the point of all–out warfare.

To the west and southwest of the Palo Duro complex are the Middle Pecos and Eastern Jornada Mogollon culture areas. Lying between is a sizable portion of the Llano Estacado which, one would think based on the paucity of published archeological data, was virtually uninhabited.

While this perception may be true to an exent, there is evidence that people traversed the Llano using southeastward–flowing drainages as highways, and there is evidence for more than ephemeral Late Prehistoric occupations at some large playa and pluvial lakes on the southern Llano. The only well–documented Late Prehistoric playa lake site in the southern Llano Estacado is the Salt Cedar site (Collins 1968). Occupations at this residential base, which currently marks the easternmost edge of the Eastern Jornada Mogollon, date primarily after A.D. 1100, but may have begun during Late Prehistoric I times.

Based on survey evidence alone, it may be speculated that the Palo Duro complex extends up onto the eastern edge of the southern Llano Estacado. The possibility that a Palo Duro component may be present in Lynn County has been mentioned, and early stemmed arrow points and Jornada brownware pottery have been found at several playa lake sites in Lubbock County (Brown 1985, 1990a, 1990b, 1991a, 1991b, n.d.). The presence of Palo Duro occupations on the southern Llano has yet to be confirmed through excavations, but it is possible that at least a few components did exist around playa and pluvial lakes. If this is the case, there is still much to be learned about how these High Plains sites fit into the overall Palo Duro subsistence and settlement pattern.

Despite the geographic gap in the regional data, the Palo Duro complex contains definite evidence, in the form of brownware pottery, that there was some transfer of material culture from the Jornada Mogollon area across the southern Llano Estacado and into the Caprock Canyonlands. There also is other circumstantial evidence for some form of cultural interaction and exchange of ideas between Jornada Mogollon and Palo Duro peoples. It is this author's opinion, apparently one that is also shared by Cruse (1992) and Hughes (1991), that the interaction between these groups was direct, that the Jornada influence upon the Palo Duro culture was quite strong and consistent through time, and that it involved much more than just the acquisition of pots. The nature and extent of the interaction between the Eastern Jornada peoples and the Palo Duro culture is a research problem that is likely to be controversial. Although the ideas discussed below admittedly are speculative, it is hoped that they will spur debate between Southwestern and Southern Plains archeologists.

Pottery constitutes the only direct evidence for influence from the Jornada Mogollon area. Almost all of the pottery sherds found at Palo Duro sites are identified generically as some variety of Jornada Mogollon brownware. Most are tempered with crushed igneous rocks and are indisputably of nonlocal origin when found in the Texas Panhandle Plains. The varieties that have been identified (i.e., Jornada Brown, Alma Plain, El Paso Brown, Roswell Brown, South Pecos Brown, Middle Pecos Micaceous, and McKenzie Brown) were manufactured in the Jornada Mogollon or Middle Pecos areas, and very few brownware sherds have been identified as possibly being locally-made wares. The consistent presence of small quantities of nonlocal brownwares in many Texas sites indicates that the Palo Duro peoples maintained at least periodic contact with Jornada Mogollon peoples over a long period of time. Pottery sherds are not very abundant, but sometimes as many as four vessels are represented at a single Palo Duro site. Ceramics are sufficiently scarce to indicate that the supply of pots was rather limited, perhaps because Palo Duro groups did not make journeys to the Jornada region on an annual or regular basis, or perhaps because of the high labor cost involved in transporting large, fragile vessels over long distances on foot. Exactly how the pots made their way into the Panhandle Plains region is not known. Although intermediary groups could have been involved, the relatively short distance between the Caprock Canyonlands and the Pecos River valley (i.e., 250–300 km) suggests that Palo Duro peoples acquired pots directly from the Eastern Jornada groups.

Other evidence for the Palo Duro complex having been influenced by the Jornada Mogollon culture is circumstantial, but it is nonetheless strong. The architectural similarities between the Palo Duro and Eastern Jornada pithouses are particularly intriguing. Various researchers have noted similarities between the Palo Duro pithouses and those of the Jornada Mogollon area, while noting the lack of similarities with houses of nearby Plains Woodland and Plains Village complexes (Boyd 1995a, 1995b; Boyd et al. 1994:116–117, 260; Cruse 1992:127–129; Hughes 1991:26). Although rectangular and circular pithouses are found among many cultures and the shape alone is not diagnostic, when the combination of traits is considered, the closest architectural parallels are clearly to the west and southwest rather than to the north or east. It is notable also that pithouses in the Jornada Mogollon area exhibit considerable architectural variability, and if the sample of three is any indication, so do the pithouses of the Palo Duro complex.

Rectangular structures—both surface and pithouses—are known for Southern Plains Woodland and Plains Village complexes but they are very different from those at the Kent Creek site (Boyd et al. 1994:116). In contrast, Cruse (1992:127–129) notes that many architectural traits observed for the Kent Creek pithouses are similar to those seen in Jornada Mogollon pithouses. Particularly diagnostic are the ramped entryways, which are a common feature in Jornada pithouses but are not seen in any Plains Woodland or Plains Village houses. Other architectural parallels between Kent Creek and Mogollon pithouses include small trough features/steps just inside the entryway, comparable variability in interior floor area, the use of a single large roof support post, and the practice of subfloor burials inside houses.

In addition, there is one example that shows a striking parallel between Kent Creek and the Jornada area. A rectangular pithouse (Pitroom R–2) excavated at the Merchant site in Lea County, New Mexico, is very similar in size, shape, and entry configuration to Structure 2 at Kent Creek (cf. Leslie 1965:Figure 3 with Cruse 1992:Figures 6 and 10). Unfortunately, there are no radiocarbon dates directly associated with either structure, and Leslie's (1965) assessment that the Merchant site dates to the fifteenth century is based solely on a few decorated pottery sherds (which make up only a small percentage of the total ceramic assemblage) and could be very misleading. Cruse (1992:129) notes that the elongated trough features along the front and back walls of Structure 2 are unique to the Kent Creek pithouses.

Similarly, the ephemeral pithouse at the Sam Wahl site has no analogs in nearby Plains Woodland or Plains Village complexes, but very similar round to oval structures are present in the Keystone Dam area near El Paso (Carmichael 1985:142–149; O'Laughlin 1980:135–149) and at the Fox Place and King Ranch sites near Roswell (Wiseman 1981:174–175, 1988:229, 1993 personal communication). The Keystone Dam structures date earlier (ca. 550 B.C. to A.D. 150) than the Sam Wahl pithouse, while the King Ranch structures are later (ca. A.D. 1150–1300). No dates have been published for the Fox Place pithouses. Southwestern pithouse occupations are continually being pushed back earlier in time, and it seems likely that Jornada Mogollon pithouses will prove to be the prototypes for those in the Caprock Canyonlands.

There also are broad similarities in the subsistence strategies and settlement patterns of the Palo Duro and Eastern Jornada peoples. Mesquite and shin oak have been identified as probable staple foods utilized by both groups. Except for a slightly lower rainfall and minor differences in plant and animal communities, the Mescalero Escarpment on the west edge of the Llano Estacado is in many ways similar to the Caprock Escarpment. Consequently, it should not be surprising that human populations adapted to these areas in a similar manner. Many of the subsistence and settlement pattern characteristics proposed for the Eastern Jornada area are similar to adaptive strategies that Palo Duro peoples may have employed in the Caprock Canyonlands. Leslie (1979) notes that the Querecho–Maljamar phases are characterized by pithouse villages and seasonal campsites, a heavy dependence upon plant foods, the predominant use of oval–basin metates and convex–faced manos, and the dominant use of a variety of corner–notched arrow points.

The same amount of variability in arrow point morphology within the Palo Duro complex is evident in the arrow points of the pithouse period in the Eastern Jornada area (Leslie 1978). The corner– and basal–notched stemmed arrow points of the Palo Duro complex are very similar to, and exhibit the same range of variability as, Leslie's (1978) Types 3A through 3E, including occasional serrated blades. These points are associated with Leslie's (1978:Figure 13) Querecho phase, although the dates that he gives for this phase are probably far too young. Jelinek (1967:103–105, 110) also documents a similar variety of points in the Late Archaic through Late 18 Mile phases and notes that serration is most strongly associated with pithouse occupations of the Early 18 Mile through Early Mesita Negra phases (i.e., A.D. 800–1100).

Similarly, the most common points associated with the Blow Out Mountain phase are a variety of stemmed points that do not fit neatly into a single type but are similar to arrow points of the Palo Duro complex and Eastern Jornada areas (i.e., Type 3D in Leslie [1978]). Regardless of the names one assigns to them, there seems to be some morphological continuity between the stemmed arrow points of the Palo Duro complex, the Blow Out Mountain phase, the Eastern Jornada, and Middle Pecos areas. While corner–notched dart points (i.e., Ellis–like) of the Panhandle Plains Late Archaic bison hunters may be the prototypes for ubiquitious Scallorn–like arrow points of the Lake Creek and Palo Duro complexes, the unusual Deadman's arrow points seem to appear suddenly and rather early (probably before A.D. 500). There is no precursor evident among Southern Plains Late Archaic points, and it is possible that the prototype for Deadman's points may be found in the Shumla dart points of the Lower Pecos and South Texas areas. Shumla–like dart points are present, but rare, throughout much of the Jornada area at least as far west as Las Cruces, New Mexico (MacNeish 1993:179). In addition, the corner–notched to stemmed (and sometimes serrated) Pendejo points found in southern New Mexico (along with Shumla and Hueco points) are quite similar to the early stemmed arrow points found in the Caprock Canyonlands and West Central Texas. In the Jornada area, Pendejo points are found in the Late Archaic and in the Mesilla phase (MacNeish 1993:183–184), and they could be the prototype for similar arrow points in the Palo Duro complex and Blow Out Mountain phase.

The rather sudden appearance of Deadman's–like arrow points may only signal the adoption of the bow and arrow by indigenous groups, or it may mark the appearance of new peoples in the Caprock Canyonlands (i.e., the Palo Duro complex) and in West Central Texas (i.e., the Blow Out Mountain phase). This author prefers the latter interpretation and suggests that strong evidence for the arrival of new peoples is found in the burials throughout the region. A growing amount of evidence—some definitive, some circumstantial—denotes the formation of territorial boundaries and increasingly widespread violence among many Southern Plains cultures during the first millenium A.D. These events set the stage for the escalating warfare seen during later Plains Village times (Brooks 1994).

If Palo Duro peoples were newcomers to the Caprock Canyonlands sometime between A.D. 1 and 500, where did they come from? Perhaps Krieger (1946:80–82) was on the right track some 50 years ago when he observed that there was virtually no difference in the archeology of the New Mexico and Texas portions of the southern Llano Estacado. He suggested that the southern High Plains had been "actually inhabited by Puebloans, if only seasonally" (Krieger 1946:80). Given the evidence for cultural influence from the west, one must look to the Jornada Mogollon region (including its eastern extension east of the Pecos River) as the most likely area of origin for many cultural traits of the Palo Duro complex. It is not suggested that Palo Duro peoples were direct lineal descendants of Jornada Mogollon peoples. Although this certainly is one possibility, there simply is not enough evidence to support such a statement. There is sufficient evidence, however, to suggest that Palo Duro peoples may have been descendants of hunther–gatherers who, having lived in close contact with Jornada Mogollon peoples in what is now southeastern New Mexico and far western Texas, migrated east or northeastward onto the Southern Plains.

What became of the Palo Duro complex is equally problematic and perplexing. Without going into the myriad of possibilities regarding the fate of this culture, the most logical idea is one that links the Palo Duro complex (and perhaps the Blow Out Mountain phase) with the Toyah phase of Central and South Texas. Shafer (1977) originally proposed that the Toyah culture was derived from Southern Plains bison–hunting peoples who migrated southward. Johnson (1994:271–281) recently elaborated upon this idea and proposes that the classic Toyah phase retains enough subtle traits, primarily in pottery styles and manufacturing techniques, to link it to the Jornada Mogollon cultural tradition. While much of its material culture represents classic Plains bison–hunting gear (i.e., the beveled Harahey skinning knives and Plains–style hafted end scrapers), the pointed–stemmed Perdiz point is distinctive, and its logical prototype is found in the stemmed arrow points of the Blow Out Mountain culture. Johnson (1994) suggests that Toyah peoples are descendants of groups who made Jornada Mogollon–tradition pottery, slightly modified their stemmed arrow points into the distinctive Perdiz style, and adopted a Plains bison–hunting lifestyle. He also suggests that the Mogollon influence may have been indirect and that the earliest Toyah peoples could have come from the Southern Plains rather than from the Jornada Mogollon region.

I would further modify Johnson's (1994) hypothesis and suggest that the Blow Out Mountain phase is somehow related to the Palo Duro complex. Although purely conjectural, these manifestations may prove to be northern and southern variants of the same cultural tradition. The stemmed

Bonham–like arrow points that characterize the Blow Out Mountain phase are little more than modified Deadman's points, but the latter represent the earliest narrow–stemmed arrow point form in the Texas Panhandle Plains. Consequently, the Deadman's point is the logical prototype for the stemmed Blow Out Mountain points and ultimately, if Johnson (1994) is correct, for Perdiz points as well. Although it will be difficult to prove that the Palo Duro complex and the Blow Out Mountain phase are ancestral to the Toyah phase, this is an hypothesis worth testing.

One possible scenario is that, as the climate dried and bison populations increased in the Southern Plains around A.D. 1100–1300, peoples of the Palo Duro complex and the Blow Out Mountain phase quickly adopted a Plains bison–hunting lifestyle and material culture, and they began to migrate southward. This migration may have been spurred, in a domino effect, by pressures from southward–migrating Athapascan–speaking peoples who moved from the Central Plains into the Southern Plains around A.D. 1300–1400 (but this is another story altogether!). The wide geographic range and the extreme archeological variability that characterize the Toyah phase may be partially explained if these proto–Toyah peoples spread throughout Central and South Texas within one or two centuries and eventually displaced or assimilated with, but adopted traits from, many of the indigenous groups.

SUMMARY OF CONCLUSIONS

The Palo Duro complex has been redefined in light of recent archeological finds. The complex dates to the period between A.D. 500 and A.D. 1100–1200, and a wide range of activities and site functions are inferred for the three types of habitation sites that are recognized. The Kent Creek and Sam Wahl sites are identified as residential bases where people lived in pithouses while procuring, processing, storing, and consuming a wide range of wild plant foods. Mesquite beans and shin oak acorns have been identified as possible staples, but other plants such as goosefoot and buffalo gourds also may have been important foods. Although no cultigens have been found, this does not preclude the possibility that limited horticulture was practiced at residential sites. Occupations at these villages were at least seasonal (i.e., during late summer to fall harvest and into winter) and may have been biseasonal (i.e., during planting and then again during fall harvest and into winter).

Palo Duro peoples lived in rockshelters and open camps at various times of the year and for different reasons. Rockshelters were occupied on a sporadic and ephemeral basis, or were more intensively used and may then have served as relatively permanent bases. Some campsites were little more than specialized processing sites where baking and grinding of plant foods were the primary activities, while others were multifunctional bases where considerable hunting and processing of animals was done. Deer and small animals appear to have been the principal game animals. Bison were hunted but they do not appear to have been a major food resource, and the evidence suggests that populations may have been relatively low.

Palo Duro culture is now viewed as representing semisedentary peoples who maintained a high degree of residential mobility in order to exploit a wide range of resources that were locally available and abundant on a seasonal basis. Sites of this complex are found mainly in the Caprock Canyonlands, an ecological subregion that offered the most predictable and widest range of subsistence resources (i.e., water, plants, and animals) within a relatively arid landscape. The home territory for Palo Duro peoples was in the upper drainages of the Red and Brazos rivers, although they may have ranged on occasion north into the Canadian River valley, east into the Rolling Plains, south into the upper Colorado River drainage, and west onto the Llano Estacado.

Human burials provide evidence of widespread violence in and around the Caprock Canyonlands during the Late Prehistoric I period, and the Palo Duro culture may have come into periodic contact with enemy peoples to the north and east (i.e., Lake Creek or Plains Woodland groups) and to the south and southeast (i.e., Blow Out Mountain and other undefined groups). Palo Duro peoples did maintain some form of cultural contact with the Jornada Mogollon peoples of southeastern New Mexico and western Texas over a long period of time. There appears to be a significant amount of Jornada Mogollon cultural influence across the southern Llano Estacado and into the Caprock Canyonlands, and the Palo Duro complex exhibits many traits (e.g., imported brownware pottery and pithouse architectural styles) that were derived, whether directly or indirectly, from the Jornada Mogollon region. In addition, the similarities between the subsistence and settlement patterns proposed for the Palo Duro complex and those proposed for their eastern Jornada Mogollon neighbors may be more than a mere coincidence. In summary, it is unclear whether the Palo Duro complex represents an actual migration of Jornada Mogollon or related peoples, or whether it simply represents indigenous Southern Plains people who came under the widespread influence of Jornada Mogollon culture, or something much more complex.

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REFERENCES CITED

Adair, M. J.
1988 *Prehistoric Agriculture in the Central Plains*. Publications in Anthropology No. 15. University of Kansas, Lawrence.

Agogino, G. and V. T. Button
1985 *A Secondary Burial of Human Cranial Fragments from 34GR6, a Prehistoric Cemetery on the Shoreline of Lake Altus, Greer County, Oklahoma*. U.S. Department of the Interior, Bureau of Reclamation, Southwest Region, Amarillo.

Alex, T. C.
1990 The Search for the Elusive Kaolinite: Prehistoric Utilization of a Lithic Resource for Ornamental Artifacts. In *Papers from the Third Symposium on Resources of the Chihuahuan Desert Region*, pp. 163–168. Chihuahuan Desert Research Institute, Alpine, Texas.

Arbingast, S. A., L. G. Kennamer, R. H. Ryan, A. Lo, D. L. Karney, C. P. Zlatkovich, M. E. Bonine, and R. G. Steele
1973 *Atlas of Texas*. Bureau of Business Research, The University of Texas at Austin.

Bagot, J. T. and J. T. Hughes
1979 *Archeological Inventory of a Portion of Caprock Canyons State Park in Briscoe County, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

Bailey, C. H.
1951 The Texan Santa Fe Trail. *Panhandle–Plains Historical Review* 24 (entire volume).

Basehart, H. W.
1960 *Mescalero Apache Subsistence Patterns and Socio–Political Organization, Section I: Mescalero–Chiricahua Land Claims Project*. The University of New Mexico, Albuquerque.

Bell, R. E.
1984 The Plains Villagers: The Washita River. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 307–324. Academic Press, New York.

Bell, W. H. and E. F. Castetter
1937 *The Utilization of Mesquite and Screwbean by the Aborigines in the American Southwest*. University of New Mexico Bulletin No. 314. Ethnobiological Studies in the American Southwest, Biology Series 5(2). University of New Mexico Press, Albuquerque.

Binford, L. R.
1980 Willow Smoke and Dogs' Tails: Hunter–Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4–20.

Binford, L. R. *(Continued)*

1990 Mobility, Housing and Environment: A Comparative Study. *Journal of Anthropological Research* 46(2):119–152.

Boyd, D. K.

1982 *Human Skeletal Remains from 34GR6, Greer County, Oklahoma.* Department of the Interior, Bureau of Reclamation, Southwest Region, Amarillo.

1995a Rethinking the Palo Duro Complex: Jornada Mogollon Influence in the Texas Southern Plains? *Transactions of the 30th Regional Archeological Symposium for Southeastern New Mexico and Western Texas.* Clarendon Archeological Society, Clarendon, Texas. In press.

1995b Archeological Investigations at the Sam Wahl Site: Jornada Mogollon Influence in the Texas Southern Plains? In *Jornada Mogollon Archeology: Proceedings of the Eighth Jornada Conference, 1993.* Human Systems Research, Tularosa, New Mexico. In preparation.

Boyd, D. K., J. T. Abbott, W. A. Bryan, C. M. Garvey, S. A. Tomka, and R. C. Fields

1990 *Phase II Investigations at Prehistoric and Rock Art Sites, Justiceburg Reservoir, Garza and Kent Counties, Texas.* Reports of Investigations No. 71. 2 Vols. Prewitt and Associates, Inc., Austin.

Boyd, D. K., M. D. Freeman, M. D. Blum, E. R. Prewitt, and J. M. Quigg

1989 *Phase I Cultural Resources Investigations at Justiceburg Reservoir on the Double Mountain Fork of the Brazos River, Garza and Kent Counties, Texas.* Reports of Investigations No. 66. 2 Vols. Prewitt and Associates, Inc., Austin.

Boyd, D. K., J. Peck, S. A. Tomka, K. W. Kibler, and M. D. Freeman

1994 *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3.* Reports of Investigations No. 93. Prewitt and Associates, Inc., Austin.

Boyd, D. K., S. A. Tomka, and M. D. Freeman

1996 *Caprock Canyonlands Archeology: A Synthesis of the Late Prehistory and History of Lake Alan Henry and the Caprock Escarpment.* Prewitt and Associates, Inc., Austin. In preparation.

Boyd, D. K., S. A. Tomka, C. B. Bousman, K. M. Gardner, and M. D. Freeman

1992 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1.* Reports of Investigations No. 84. Prewitt and Associates, Inc., Austin.

Brethauer, D. P.

1979 The Possible Role of Mesquite as a Food Resource in the Jornada Mogollon Region. In *Jornada Mogollon Archaeology: Proceedings of the First Jornada Conference*, edited by P. H. Beckett and R. N. Wiseman, pp. 67–80. Historic Preservation Bureau, State Planning Office, Santa Fe, and Cultural Resources Management Division, New Mexico State University, Las Cruces.

Briscoe, J.

1987 *Analysis of Cultural Materials from the Swift Horse Site, an Early Plains Woodland Site on the Black Kettle National Grasslands, Roger Mills County, Oklahoma.* Briscoe Consulting Services, Butler, Oklahoma.

1989 Chronology and Distribution of Lake Creek Focus/Complex: Information from the Swift Horse Site. In *In Light of Past Experience: Papers in Honor of Jack T. Hughes*, edited by B. C. Roper, pp. 105–115. Publication No. 5. Panhandle Archeological Society, Amarillo.

Bronson, B.

1977 The Earliest Farmers: Demography as Cause and Consequence. In *Origins of Agriculture*, edited by C. A. Reed, pp. 23–48. Mouton, The Hague.

Brooks, R. L.

1989 Village Farming Societies. In *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*, by J. L. Hofman, R. L. Brooks, J. S. Hays, D. W. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein, pp. 71–90. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

1993 Household Abandonment among Sedentary Plains Societies: Behavioral Sequences and Consequences in the Interpretation of the Archeological Record. In *Abandonment of Settlements and Regions: Ethnoarchaeological and Archaeological Approaches*, edited by C. M. Cameron and S. A. Tomka, pp. 178–187. Cambridge University Press, Cambridge.

1994 Warfare on the Southern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 317–323. Smithsonian Institution Press, Washington, D.C.

Brown, C.

1985 A Tale of Two Sites: A (41LU34) and B (41LU29). *Transactions of the 20th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 143–155.

1990a SPAS–LU–10: Report #1—Middle Archaic. *South Plains Archeological Society Newsletter* 102.

Brown, C. *(Continued)*
1990b SPAS–LU–10: Report #2—Late Archaic. *South Plains Archeological Society Newsletter* 103.

1991a SPAS–LU–10: Report #3—Arrow Points—Manos—Core Knives—Perforators. *South Plains Archeological Society Newsletter* 104.

1991b SPAS–LU–10: Report #4. *South Plains Archeological Society Newsletter* 105.

n.d. A Lubbock County Site: 41LU75. Unpublished MS on file with the author.

Bryant, V. M.
1993 Pollen Analysis of Archeological Sediments from 41KT53. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*, by D. K. Boyd, J. Peck, S. A. Tomka, and K. W. Kibler, pp. 435–443. Reports of Investigations No. 88. Prewitt and Associates, Inc., Austin.

Button, V. T., and G. Agogino
1986 *A Report on Additional Human Skeletal Material Exposed by Reservoir Induced Erosion at Lake Altus, Southwestern Oklahoma.* U.S. Department of the Interior, Bureau of Reclamation, Southwest Region, Amarillo.

1987 Human Skeletal Material Exposed by Reservoir–Induced Erosion at Lake Altus, Southwestern Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 36:15–37.

Calamia, M. A.
1991 Ground Stone Variability among Jornada Mogollon Sites and Its Implications for Interpreting Residential Mobility. In *Mogollon V*, edited by P. Beckett, pp. 119–132. COAS Publishing and Research, Las Cruces.

Cameron, C. M., and S. A. Tomka (editors)
1993 *Abandonment of Settlements and Regions: Ethnoarchaeological and Archaeological Approaches.* Cambridge University Press, Cambridge.

Campbell, R. G.
1976 *The Panhandle Aspect of the Chaquaqua Plateau.* University Graduate Studies 11. Texas Tech University, Lubbock.

Campbell, T. J.
1983 The Greenbelt Site: An Example of Variation among Prehistoric Plains Village Sites in the Texas Panhandle. Unpublished Master's thesis, Department of Anthropology, Texas Tech University, Lubbock.

Carlson, G. G. and V. H. Jones
1940 Some Notes on Uses of Plants by the Comanche Indians. *Papers of the Michigan Academy of Science, Arts, and Letters* 25:517–542.

Carmichael, D. L.
1985 *Archeological Excavations at Two Prehistoric Campsites Near Keystone Dam, El Paso, Texas.* Occasional Papers No. 14. New Mexico State University, Las Cruces.

1986 *Archaeological Survey in the Southern Tularosa Basin of New Mexico.* Historic and Natural Resources Report No. 3. Environmental Management Office, Directorate of Engineering and Housing, United States Army Air Defense Artillery Center, Fort Bliss, Texas.

1990 Patterns of Residential Mobility and Sedentism in the Jornada Mogollon Area. In *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 122–134. Westview Press, Boulder, Colorado.

Castetter, E. F. and M. E. Opler
1936 *The Ethnobiology of the Chiricahua and Mescalero Apache. A. The Use of Plants for Foods, Beverages, and Narcotics.* The University of New Mexico Bulletin, Biological Series 4(5). University of New Mexico Press, Albuquerque.

Collins, M. B.
1968 The Andrews Lake Locality: New Archeological Data from the Southern Llano Estacado, Texas. Unpublished Master's thesis, Department of Anthropology, The University of Texas at Austin.

1971 A Review of Llano Estacado Archaeology and Ethnohistory. *Plains Anthropologist* 16(52):85–104.

Corley, J. A.
1965a Proposed Eastern Extension of the Jornada Branch of the Mogollon. *Transactions of the First Regional Symposium for Southeastern New Mexico and Western Texas*: 31–36.

1965b Proposed Eastern Extension of the Jornada Branch of the Mogollon. *Bulletin of the Lea County Archeological Society* 1:30–36.

Corley, J. A. and R. H. Leslie
1960 *The Boot Hill Site: L.C.A.S. B–5, a Preliminary Report.* Reprinted 1965. Bulletin 2. Lea County Archeological Society, Hobbs, New Mexico.

Couzzourt, J. E.
1982 Archaeological Testing at Cal Farley's Boys Ranch, Oldham County, Texas. *Transactions of the 17th Regional Archeological Symposium for Southeastern New Mexico and Western Texas.* Midland Archeological Society, Midland, Texas.

1985 Preliminary Report: Testing at the Tascosa Creek Site, Oldham County, Texas. *Transactions of the Twentieth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 65–142.

1988 The Tascosa Creek Site: New Developments and Dates. *Transactions of the 23rd Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 44–79.

Covey, C. (translator)
1961 *Cabeza De Vaca's Adventures in the Unknown Interior of America*. University of New Mexico Press, Albuquerque.

Creel, D. G.
1990 *Excavations at 41TG91, Tom Green County, Texas*. Publications in Archaeology Report No. 38. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.

Cruse, J. B.
1992 *Archeological Investigations at the Kent Creek Site (41HL66): Evidence of Mogollon Influence on the Southern Plains*. Publication No. 6. Panhandle Archeological Society, Amarillo.

Cummings, L. S.
1990 Phytolith and Pollen Analysis: A Feasibility Study. In *Phase II Investigations at Prehistoric and Rock Art Sites, Justiceburg Reservoir, Garza and Kent Counties, Texas*, by D. K. Boyd, J. T. Abbott, W. A. Bryan, C. M. Garvey, S. A. Tomka, and R. C. Fields, pp. 533–550. 2 Vols. Reports of Investigations No. 71. Prewitt and Associates, Inc., Austin.

Curtis, N. M., Jr. and W. E. Ham
1972 *Geology and Earth Resources of Oklahoma: An Atlas of Maps and Cross Sections*. Education Publication No. 1. Oklahoma Geological Survey, Norman.

DeBoer, W. R.
1988 Subterranean Storage and the Organization of Surplus: The View from Eastern North America. *Southeastern Archaeology* 7(1):1–20.

Dering, J. P.
1994 Analysis of Plant Remains from 41GR291 and 41GR559. In *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3*, by D. K. Boyd, J. Peck, S. A. Tomka, K. W. Kibler, and M. D. Freeman, pp. 331–345. Reports of Investigations No. 93. Prewitt and Associates, Inc., Austin.

Dering, P. and V. M. Bryant, Jr.
1992 Pollen Analysis of Archeological Sediments from Justiceburg Reservoir. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1*, by D. K. Boyd, C. B. Bousman, S. A. Tomka, K. M. Gardner, and M. D. Freeman, pp. 211–220. Reports of Investigations No. 84. Prewitt and Associates, Inc., Austin.

Dillehay, T. D.
1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19(65):180–196.

Etchieson, G. M.
1979 *Archeological Testing at the South Ridge Site, Lake Meredith Recreation Area, Hutchinson County, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

Etchieson, G. M., R. D. Speer, and J. T. Hughes
1977 *An Archeological Survey of Certain Tracts in and near Caprock Canyons State Park in Eastern Briscoe County, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

1978 *Archeological Investigations in the Truscott Reservoir Area, King and Knox Counties, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

1979 *Archeological Investigations in the Crowell Reservoir Area, Cottle, Foard, King and Knox Counties, Texas*. Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

Ferring, C. R.
1986 Late Holocene Cultural Ecology in the Southern Plains: Perspectives from Delaware Canyon, Oklahoma. In Current Trends in Southern Plains Archaeology, edited by T. G. Baugh, pp. 55–82. *Plains Anthropologist* 31(114, Pt. 2), Memoir 21.

Ferring, C. R. (editor)
1982 *The Late Holocene Prehistory of Delaware Canyon, Oklahoma*. Contributions in Archeology 1. Institute of Applied Sciences, North Texas State University, Denton.

Flores, D. L.
1990 *Caprock Canyonlands: Journeys into the Heart of the Southern Plains*. University of Texas Press, Austin.

Ford, R. I.
1985 Patterns of Prehistoric Food Production in North America. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 341–364. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Foreman, G. (editor)
1937 *Adventures on the Red River: Report on the Exploration of the Headwaters of the Red River by Captain Randolph B. Marcy and Captain G. B. McClellan*. University of Oklahoma Press, Norman.

Forrester, R. E.
1951 A Series of Eighteen Indian Skeletons Excavated in Shackelford County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 22:132–143.
1987 The Moran Point from North–Central Texas. *Bulletin of the Oklahoma Anthropological Society* 36:131–136.

Galvin, J. (editor)
1970 *Through the Country of the Comanche Indians in the Fall of the Year 1845: The Journal of a U.S. Army Expedition Led by Lieutenant James W. Abert of the Topographical Engineers*. John Howell Books, San Francisco.

Gettys, F.
1991 Salvage Excavation in Roger Mills County. *Oklahoma Archeological Survey Newsletter* 11(3).

Gilman, P. A.
1987 Architecture as Artifact: Pit Structures and Pueblos in the American Southwest. *American Antiquity* 52(3):538–564.

Goland, C. A.
1983 The Ecological Context of Hunter–Gatherer Storage Strategies. Unpublished Master's thesis, Department of Anthropology, University of North Carolina, Chapel Hill.

Green, F. E.
1986 *Report on Archaeological Salvage in the Sanford Reservoir Area*. Publication No. 4. Panhandle Archeological Society, Amarillo.

Gustafson, A. A.
1994a The Duncan Ranch Site 1: A Late Woodland/Incipient Antelope Creek Phase Site. Paper presented at the 30th annual meeting of the Southwestern Federation of Archeological Societies, Clarendon, Texas.
1994b The Duncan Ranch Site 1: Evidence for Late Woodland Transition to Antelope Creek Phase Development. Paper presented at the 59th annual meeting of the Society for American Archeology, Anaheim, California.

Hays, J. S.
1986 *An Archeological Survey of Portions of the Buffalo Lake National Wildlife Refuge, Randall County, Texas*. United States Department of the Interior, Bureau of Reclamation, Southwest Region.

Hester, T. R., D. Gilbow, and A. D. Albee
1973 A Functional Analysis of "Clear Fork" Artifacts from the Rio Grande Plain, Texas. *American Antiquity* 38(1):90–96.

Hiles, H.
1993 *Guide to Protein and Nutritional Values of Plants Used by Native Americans of the Southwest*. Southwest Research Native, Fairacres, New Mexico.

Hines, M. H., S. A. Tomka, and K. W. Kibler
1994 *Data Recovery at the Wind Canyon Site, 41HZ119, Hudspeth County, Texas*. Reports of Investigations No. 99. Prewitt and Associates, Inc., Austin.

Hofman, J. L.
1975 A Study of Custer–Washita River Foci Relationships. *Plains Anthropologist* 20(67):41–51.
1978 The Development and Northern Relationships of Two Archeological Phases in the Southern Plains Subarea. In *The Central Plains Tradition: Internal Development and External Relationships*, edited by D. J. Blakeslee, pp. 6–35. Report No. 11. Office of the State Archeologist, Iowa City.
1984a The Plains Villagers: The Custer Phase. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 287–305. Academic Press, New York.
1984b The Western Protohistoric: A Summary of the Edwards and Wheeler Complexes. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 347–362. Academic Press, New York.

Hofman, J. L., and R. L. Brooks
1989 Prehistoric Culture History: Woodland Complexes in the Southern Great Plains. In *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*, by J. L. Hofman, R. L. Brooks, J. S. Hays, D. H. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein, pp. 61–70. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Hughes, D. T.
1984 The Foragers: Western Oklahoma. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 109–117. Academic Press, New York.

Hughes, J. T.
1962 Lake Creek: A Woodland Site in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 32:65–84.
1969 The Canyon City Club Cave in the Panhandle of Texas. Ms. on file, Office of the State Archeologist, Texas Historical Commission, Austin.
1978 Archeology of Palo Duro Canyon. *Panhandle–Plains Historical Review* 51:35–57.
1991 Prehistoric Cultural Developments on the Texas High Plains. *Bulletin of the Texas Archeological Society* 60:1–55.

Hughes, J. T., H. C. Hood, and B. P. Newman
1978 *Archeological Testing in the Red Deer Creek Watershed in Gray, Roberts, and Hemphill Counties, Texas.* Archeological Research Laboratory, Killgore Research Center, West Texas State University, Canyon.

Ingold, T.
1983 The Significance of Storage in Hunting Societies. *Man* 18:553–571.

Jelinek, A. J.
1967 *A Prehistoric Sequence in the Middle Pecos Valley, New Mexico.* Anthropological Papers No. 31. Museum of Anthropology, University of Michigan, Ann Arbor.

Jelks, E. B.
1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas.* Archaeology Series No. 5. Department of Anthropology, The University of Texas at Austin.

Johnson, E. H.
1931 *The Natural Regions of Texas.* Bulletin No. 3113. University of Texas, Austin.

Johnson, L.
1994 *The Life and Times of Toyah-Culture Folk: The Buckhollow Encampment, Site 41KM16, Kimble County, Texas.* Office of the State Archeological Report 38. Texas Department of Transportation and Texas Historical Commission, Austin.

Jones, J. G.
1990 Assessment of Pollen Preservation and Macrobotanical Analysis. In *Phase II Investigations at Prehistoric and Rock Art Sites, Justiceburg Reservoir, Garza and Kent Counties, Texas*, by D. K. Boyd, J. T. Abbott, W. A. Bryan, C. M. Garvey, S. A. Tomka, and R. C. Fields, pp. 521–532. 2 Vols. Reports of Investigations No. 71. Prewitt and Associates, Inc., Austin.

Kirkpatrick, Z. M.
1992 *Wildflowers of the Western Plains: A Field Guide.* University of Texas Press, Austin.

Krieger, A. D.
1946 *Culture Complexes and Chronology in Northern Texas with Extension of Puebloan Datings to the Mississippi Valley.* Publication No. 4640. University of Texas at Austin.

1978 The Southern Limits of Central Plains Culture Complexes. In *Proceedings of the Fifth Plains Conference for Archeology*, assembled by J. L. Champe, pp. 98–99. Reprint of 1949 Laboratory of Anthropology Note Book No. 1. University of Nebraska, Lincoln.

Lea County Archeological Society
1971 *The Laguna Plata Site, L.C.A.S. C–10–C, LA–5148: A Preliminary Report.* Lea County Archeological Society, Hobbs, New Mexico.

LeBlanc, S. A. and M. E. Whalen (editors)
1980 *An Archeological Synthesis of South–Central and Southwestern New Mexico.* Office of Contract Archaeology, University of New Mexico, Albuquerque.

Lehmer, D. J.
1948 *The Jornada Branch of the Mogollon.* Social Science Bulletin 17. University of Arizona, Tucson.

Leslie, R. H.
1965 The Merchant Site: L.C.A.S. E–4. *Transactions of the First Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 23–29.

1978 Projectile Point Types and Sequence of the Eastern Jornada–Mogollon, Extreme Southeastern New Mexico. *Transactions of the 13th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 81–157.

1979 The Eastern Jornada Mogollon, Extreme Southeastern New Mexico (A Summary). In *Jornada Mogollon Archaeology: Proceedings of the First Jornada Conference*, edited by P. H. Beckett and R. N. Wiseman, pp. 179–199. New Mexico State University, Cultural Resources Management Division, Las Cruces.

LeVick, G. and L. LeVick
1966 The Case of the Aching Ulna or Would you Believe a Projectile in an Elbow? *Oklahoma Anthropological Society Newsletter* 14(9):9–10.

Lintz, C.
1982 An Overview of the Antelope Creek Focus. *Transactions of the 17th Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 37–56.

1984 The Plains Villagers: Antelope Creek. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 325–346. Academic Press, New York.

1986 *Architecture and Community Variability within the Antelope Creek Phase of the Texas Panhandle.* Studies in Oklahoma's Past No. 14. Oklahoma Archeological Survey, Norman.

Lintz, C., A. Treece, F. M. Oglesby, K. Kibler, P. O'Neill, W. N. Trierweiler, C. Frederick, J. M. Quigg, and A. J. Taylor
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas, Volume II: Test Excavations at Prehistoric Sites and Assessment of Rock Cairn Features.* Technical Report 346–II. Mariah Associates, Inc., Austin.

Lintz, C., W. N. Trierweiler, F. Oglesby, P. O'Neill, W. Doering, and M. McFaul
1991 *A Cultural Resource Survey at Mitchell Reservoir, Mitchell County, Texas*. Technical Report 433. Mariah Associates, Inc., Austin.

MacNeish, R. S.
1993 *Preliminary Investigations of the Archaic in the Region of Las Cruces, New Mexico*. Historic and Natural Resources Report No. 9. Cultural Resources Management Program, Directorate of Environment, United States Army Air Defense Artillery Center, Fort Bliss, Texas.

Mauldin, R.
1991 Agricultural Intensification in the Mogollon Highlands. In *Mogollon V*, edited by J. H. Kelley and P. H. Beckett, pp. 62–75. COAS Publishing and Research, Las Cruces, New Mexico.
1993 The Relationship between Groundstone and Agricultural Intensification in Western New Mexico. *Kiva* 58(3):317–330.

Miller, B.
1992 41HG66 Skeletal Analysis. In *Archeological Investigations at the Kent Creek Site (41HL66): Evidence of Mogollon Influence on the Southern Plains*, by J. B. Cruse, pp. 161–165. Publication No. 6. Panhandle Archeological Society, Amarillo.

Minnis, P. E.
1985 Domesticating People and Plants in the Greater Southwest. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 309–339. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Natural Heritage Policy Research Project
1978 *Preserving Texas' Natural Heritage*. Policy Research Project Report No. 31. The Natural Heritage Policy Research Project, Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin.

Nelson, B. A. and S. A. LeBlanc
1986 *Short–Term Sedentism in the American Southwest: The Mimbres Valley Salado*. University of New Mexico Press, Albuquerque.

Northern, M. J.
1979 Archaeological Investigations of the Montgomery Site, Floyd County, Texas. Master's thesis, Department of Anthropology, Texas Tech University, Lubbock.

Oklahoma Archeological Survey
1993 Radiocarbon Dates for RM–668. *Oklahoma Archeological Survey Newsletter* 12(3).

O'Laughlin, T. C.
1980 *The Keystone Dam Site and Other Archaic and Formative Sites in Northwest El Paso, Texas*. El Paso Centennial Museum Publications in Anthropology No. 8. The University of Texas at El Paso.
1993 The Long and Short of It: Jornada Pueblo Occupational History. Paper presented at the Jornada Mogollon Conference VIII, March 18–21, 1993, Tularosa, New Mexico.

Parker, W. B.
1984 *Notes Taken during the Expedition Commanded by Capt. R. B. Marcy, U.S.A., through Unexplored Texas, in the Summer of 1854*. Texas State Historical Association, Austin.

Pennington, C. W.
1963 *The Tarahumar of Mexico*. University of Utah Press, Salt Lake City.

Perttula, T. K.
1992 *"The Caddo Nation": Archaeological and Ethnohistoric Perspectives*. University of Texas Press, Austin.

Perttula, T. K. and J. E. Bruseth
1983 Early Caddoan Subsistence Strategies, Sabine River Basin, East Texas. *Plains Anthropologist* 28(99):9–21.

Quigg, J. M., C. Lintz, F. M. Oglesby, A. C. Earls, C. D. Frederick, W. N. Trierweiler, D. Owsley, and K. W. Kibler
1993 *Historic and Prehistoric Data Recovery at Palo Duro Reservoir, Hansford County, Texas*. Technical Report No. 485. Mariah Associates, Inc., Austin.

Quigg, J. M., C. Lintz, F. M. Oglesby, and A. C. Treese
1993 *The Testing Phase at Mitchell Reservoir, Mitchell County, Texas*. Technical Report No. 820. Mariah Associates, Inc., Austin.

Raisz, E.
1957 *Landforms of the United States*. Map, 6th revised edition, to accompany Atwood's "Physiographic Provinces of North America."

Ray, C. N.
1932 Archeological Research in Central West Texas. *Bulletin of the Texas Archeological and Paleontological Society* 4:63–70.
1933 Multiple Burials in Stone Cist Mounds of the Abilene Region. *Bulletin of the Texas Archeological and Paleontological Society* 3:14–24, and 32 (Plate 8).
1936 Some Unusual Cremated Burials Found near Colorado, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 8:9–16.

Ray, C. N. *(Continued)*
1941 The Various Types of the Clear Fork Gouge. *Bulletin of the Texas Archeological and Paleontological Society* 13:152–162.

1946 Two Buried Multiple Stone Cist Structures. *Bulletin of the Texas Archeological and Paleontological Society* 17:18–27.

Raymer, L. E.
1988 The Form and Function of Subterranean Food Storage Structures: A Cross–Cultural Study of the Conditions Affecting Pit Storage in the Ethnographic Records. Paper presented at the symposium "The Economics of Storage: Developing an Interpretive Framework for Archaeology" at the 53rd Annual Meeting of the Society for American Archaeology, April 29, 1988, Phoenix, Arizona.

Renfro, H. B.
1973 *Geological Highway Map of Texas*. United States Geological Highway Map Series, Map No. 7. American Association of Petroleum Geologists, Tulsa.

Riggs, A. D., Jr.
1965 LY–4: A Surface Site of the South Plains. *Bulletin of the South Plains Archaeological Society* 2:1–35. Floydada, Texas.

Robinson, D. G.
1992 Petrographic Analysis of Nonlocal Plainwares. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 1*, by D. K. Boyd, S. A. Tomka, C. B. Bousman, K. M. Gardner, and M. D. Freeman, pp. 221–227. Reports of Investigations No. 84. Prewitt and Associates, Inc., Austin.

1994 Petrographic Analysis of Plainwares from 41GR291. In *Data Recovery at Lake Alan Henry (Justiceburg Reservoir), Garza and Kent Counties, Texas: Phase III, Season 3*, by D. K. Boyd, S. A. Tomka, K. W. Kibler, and M. D. Freeman, pp. 356–361. Reports of Investigations No. 93. Prewitt and Associates, Inc., Austin.

Runyan, J. W.
1972 The Laguna Plata Site: LCAS–C10–C, LA 5148. *Transactions of the Seventh Regional Archaeological Symposium for Southeastern New Mexico and Western Texas*, pp. 101–114.

Salinas, M.
1990 *Indians of the Rio Grande Delta: Their Role in the History of Southern Texas and Northeastern Mexico*. University of Texas Press, Austin.

Saunders, R.
1983 *The Carrizozo Bridge Site: A Plains Woodland Site on the Oklahoma/New Mexico Border*. Papers in Highway Archaeology 7. Oklahoma Department of Transportation, Oklahoma City.

Schlanger, S. H.
1990 Artifact Assemblage Composition and Site Occupation Duration. In *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 103–121. Westview Press, Boulder, Colorado.

1991 On Manos, Metates, and the History of Site Occupations. *American Antiquity* 56(3):460–474.

Shafer, H.
1977 Late Prehistory of Central Texas. *Bulletin of the South Plains Archeological Society* 3:18–27.

Sommer, A. E.
1971 Big Spring Site. *Transactions of the Sixth Regional Archeological Symposium for Southeastern New Mexico and Western Texas*, pp. 111–122.

Sonnichsen, C. L.
1958 *The Mescalero Apaches*. University of Oklahoma Press, Norman.

Stuiver, M. and H. A. Polach
1977 Discussion: Reporting of ^{14}C Data. *Radiocarbon* 19:355–363.

Stuiver, M. and P. J. Reimer
1993 Extended ^{14}C Database and Revised CALIB 3.0 Age Calibration Program. *Radiocarbon* 35:215–230.

Thurmond, J. P.
1988a The 1988 Society Field School: The Beaver Dam Site, 34RM208, Roger Mills County. *Oklahoma Anthropological Society Newsletter* 36(4):2–5.

1988b An Update on Investigations at the Beaver Dam Site (34RM208), Roger Mills County. *Oklahoma Anthropological Society Newsletter* 36(6):3–9.

1988c Update on the 1988 Fall Dig at 34RM308. *Oklahoma Anthropological Society Newsletter* 36(8):3.

1991 Archeology of the Dempsey Divide: A Late Archaic/Woodland Hotspot on the Southern Plains. *Bulletin of the Oklahoma Anthropological Society* 39:103–157.

Treece, A. C., C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller
1993 *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas. Vol. III: Data Recovery Results from Non–Ceramic Sites*. Technical Report No. 346–III. Mariah Associates, Inc., Austin.

Tunnell, C. D.
1964 Two Burials from the Jim Arnold Site in Northwest Texas. *Bulletin of the Texas Archeological Society* 35:83–93.

Turner, E. S. and T. R. Hester
1985 *A Field Guide to Stone Artifacts of Texas Indians.* Texas Monthly Press, Austin.

Vehik, S. C.
1984 The Woodland Occupations. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 175–197. Academic Press, Orlando.

Vestal, P. A. and R. E. Schultes
1939 *The Economic Botany of the Kiowa Indians as it Relates to the History of the Tribe.* Botanical Museum, Harvard University, Cambridge, Massachusetts.

Ward, H. T.
1985 Social Implications of Storage and Disposal Patterns. In *Structure and Process in Southeastern Archaeology*, edited by R. S. Dickens and H. T. Ward, pp. 82–101. University of Alabama Press, University.

Watts, W. C.
1963 Distribution of Pottery in Surface Sites on the South Plains of Texas. *Bulletin of the South Plains Archeological Society* 1:1–25.

Wedel, W. R.
1975 Chalk Hollow: Culture Sequence and Chronology in the Texas Panhandle. *Actas del XLI Congreso Internacional de Americanistas* 1:271–278. Mexico, D.F.

Welch, J. R.
1991 From Horticulture to Agriculture in the Late Prehistory of the Grasshopper Region, Arizona. In *Mogollon V*, pp. 75–92. COAS Publishing, Las Cruces, New Mexico.

Whalen, M. E.
1977 *Settlement Patterns of the Eastern Hueco Bolson.* El Paso Centennial Museum Publications in Anthropology No. 6. The University of Texas at El Paso.

1980 The Pithouse Periods of South–Central New Mexico. In *An Archeological Synthesis of South–Central and Southwestern New Mexico*, edited by S. A. LeBlanc and M. E. Whalen, pp. 318–386. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Whalen, M. E. and P. A. Gilman
1990 Introduction: Transitions to Sedentism. In *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 71–75. Westview Press, Boulder, Colorado.

Willey, P. S.
1978 Human Skeletal Remains from the Deadman's Shelter Site. In *Archeology at Mackenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 198–204. Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Willey, P. S. and J. T. Hughes
1978a The County Line Site. In *Archeology at Mackenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 115–137. Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

1978b The Deadman's Shelter Site. In *Archeology at Mackenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 149–190. Archeological Survey Report No. 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Willey, P. S., B. R. Harrison, and J. T. Hughes
1978 The Blue Clay Site. In *Archeology at Mackenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 138–140. Archeological Survey Report No. 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Williams, J. L. and P. E. McAllister
1979 *New Mexico in Maps.* Technology Application Center, University of New Mexico, Albuquerque.

Wiseman, R. N.
1981 Further Investigations at the King Ranch Site, Chaves County, New Mexico. *The Artifact* 19(3 and 4):169–198.

1988 The Continuing Saga of the King Ranch Site (LA 26764): Update and Summaries of Findings. In *Fourth Jornada Mogollon Conference (Oct. 1985) Collected Papers*, edited by M. S. Duran and K. W. Laumbach, pp. 223–254. Human Systems Research, Inc., Tularosa, New Mexico.

Wiseman, R. N., D. V. Hill, and D. McIntosh
1994 The Llano Estacado Pottery Project. Paper presented at the 52nd Plains Conference and 65th annual meeting of the Texas Archeological Society, Lubbock, Texas.

Witte, A. H.
1955 A Double Indian Burial from Donley County, Texas. *Panhandle–Plains Historical Review* 28:82–86.

Woodbury, R. A., and E. B. W. Zubrow
1979 Agricultural Beginnings, 2000 B.C.–A.D. 500. In *Southwest*, edited by A. Ortiz, pp. 43–60. Handbook of North American Indians, Vol. 9. Smithsonian Institution Press, Washington, D.C.

Word, J. H.

1963 Floydada Country Club Site (41FL1). *Bulletin of the South Plains Archeological Society* 1:37–63.

1965 The Montgomery Site in Floyd County, Texas. *Bulletin of the South Plains Archeological Society* 2:55–102.

1991 The 1975 Field School of the Texas Archeological Society. *Bulletin of the Texas Archeological Society* 60:57–106.

Wulfkuhle, V. A.

1986 Investigations into the Prehistory of the Upper Clear Fork of the Brazos River, Fisher and Jones Counties, Texas. Master's thesis, Department of Anthropology, The University of Texas at Austin.

Archeology and Late Quaternary Environments of the Southern High Plains

Eileen Johnson and Vance T. Holliday

ABSTRACT

The Southern High Plains contains a rich record of Late Quaternary sedimentation and human occupation spanning the past 12,000 years. The stratigraphic and cultural records are best preserved in the three principal loci of Late Quaternary deposition: draws, dunes, and playa basins. The best-known multiple-occupation sites within good stratigraphic contexts are found in draws. This paper is a summary of the archeological and paleoenvironmental record of the Southern High Plains. A model for the cultural sequence (Paleoindian, Archaic, Ceramic, Protohistoric, and Historic) is based on the Lubbock Lake record, supported by data from other sites. The paleoenvironmental sequence is based on region-wide investigations of paleontology, paleobotany, sedimentology, pedology, and geomorphology. The record is one of changing climatic, environmental, and hydrological conditions, and the adjustments to those changes made by the peoples inhabiting the region. The climate changed from one with reduced seasonal contrasts in the Late Pleistocene, with increased effective precipitation, to a more seasonal climate in the Early Holocene, culminating in drought in the Middle Holocene. The modern continental climate was established in the Late Holocene. Some of the cultural subdivisions coincide with these changes and others do not. The cultural record spans at least the last 11,500 years and relects both the various aboriginal and European peoples who inhabited the region. The aboriginal record is primarily that of grasslands hunter-gatherers engaged in task-oriented economic pursuits and short-term residential activities. These activities came to an end as Europeans begin to use the region from the 1860s onward.

INTRODUCTION

The Southern High Plains of northwestern Texas and eastern New Mexico (Figure 1) contains a rich record of human occupation and sedimentation spanning the past 12,000 years. The sediments, along with soils and paleontological and paleobotanical remains contained within them, provide evidence of the environmental history of the region. Numerous prehistoric sites are located throughout the Southern High Plains, including some of the best-known Paleoindian sites in North America. Most archeological sites are single-occupation localities or surface occurrences. Several multiple-occupation sites with good stratigraphic context have been investigated to varying degrees. Early investigators (e.g., Cotter 1937; Howard 1935; Sellards 1952; Wendorf 1961; Wendorf and Hester 1975) focused on the stratigraphy, depositional environments, and paleoenvironments of deposits older than about 8000 B.P. (Paleoindian-age), although these sites generally also contained younger strata and cultural remains. These sites include: Lubbock Lake (Johnson 1987a), Clovis (Blackwater Draw Locality #1) (Hester 1972), Plainview (Sellards et al. 1947), Marks Beach (Honea 1980), and Lake Theo (Harrison and Killen 1978)

Among these sites that have long been of interest to archeologists, Lubbock Lake has undergone the most scrutiny with excavations throughout its lengthy Late Quaternary record, producing the most complete site-specific Late Quaternary archeological and environmental database in the region. Geoarcheological work over the past 20 years (Holliday 1985, 1993, 1995a; Holliday and Allen 1987) has produced a well-dated stratigraphic record covering the last 12,000 years. This stratigraphic record is complemented by detailed cultural and zooarcheological records for the same time period (Johnson 1987a, 1993, 1995a, 1995b; Johnson and Holliday 1989). The Lubbock Lake records form the database for modeling the regional culture history and its relationship to paleoenvironmental change, supported by data from other sites.

This paper reviews the results of investigations into the stratigraphy and cultural history of the

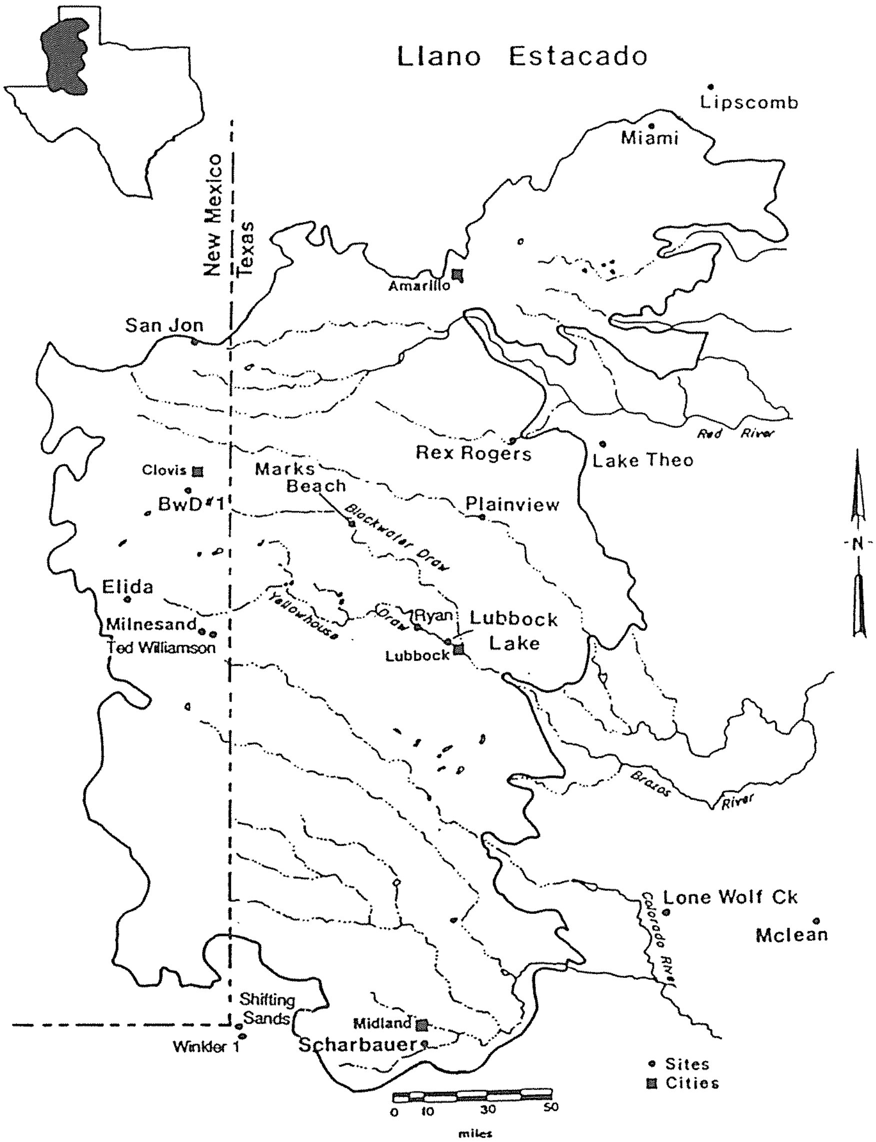

Figure 1. Map of the Southern High Plains with locations of selected Paleoindian sites and inset of Texas locating the Southern High Plains; note that BWD#1 is the Clovis site.

Southern High Plains, with supplementary data from other Southern Plains sites immediately adjacent to the region. The time period covered is the Late Quaternary, from the latest Pleistocene through the Holocene, and encompasses five major cultural periods. Paleontological and geoscientific research that began at Lubbock Lake has expanded to encompass the entire region (Holliday 1989b, 1995b, 1995c; Johnson 1986a, 1986b, 1989a, 1991, 1994; Johnson and Shipman 1986, 1993; Johnson et al. 1982, 1986, 1987). The Late Quaternary paleoenvironments, therefore, are reconstructed from a regional database with details from site-specific records.

REGIONAL SETTING

The Southern High Plains (or Llano Estacado) is an extensive plateau covering about 130,000 km^2 and bounded by escarpments on the east, north, and west. The southern portion of the High Plains surface grades into the Edwards Plateau (see Figure 1). The region has a virtually featureless, constructional surface formed by deposition of thick, widespread aeolian sediments (Blackwater Draw Formation) during the Pleistocene (Reeves 1976; Holliday 1989c, 1990). These sediments rest on aeolian and alluvial deposits of the Ogallala Formation (Miocene-Pliocene), and locally on Pliocene and Pleistocene lacustrine sediments (Reeves 1972; Hawley et al. 1976; Caran 1991).

Slight topographic relief on the High Plains surface is provided by small lake basins, dunes, and dry valleys (Reeves 1972; Wendorf 1975; Hawley et al. 1976; Holliday 1985a; Sabin and Holliday 1995). About 20,000 small (<5 km^2) depressions dot the landscape and contain seasonal lakes or "playas." About 40 larger (tens of km^2) basins, also called "playas" or "salinas," are interspersed throughout the region. The playa and salina basins contain the only available surface water on the Southern High Plains, although the water is seasonal and often brackish or saline. Lunettes (fringing dunes) often are found adjacent to the playas, and several large sand dune fields are present along the western Llano Estacado. The dry valleys or "draws" are northwest-southeast trending tributaries of rivers on the Rolling Plains to the east (see Figure 1). The Late Quaternary (post-Blackwater Draw Formation) stratigraphic record of the Southern High Plains, containing the in situ archeological record, is found in draws, playas, salinas, and dunes (Reeves 1972; Harbour 1975; Holliday 1985a, 1995b, 1995c).

The climate of the Southern High Plains is continental and semi-arid (classified as BScDw), a steppe with dry winters, mainly mesothermal years (mean temperature of the coldest month is 32-64° F) with occasional microthermal years (mean temperature of the coldest month is below 32° F) (Russell 1945). Relatively uniform gradients in precipitation and temperature occur across the region; precipitation generally increases from west to east, and temperature usually increases from northwest to southeast (Lotspeich and Everhart 1962; Carr 1967; Haragan 1983; Bomar 1983).

The historic vegetation of the Southern High Plains is a mixed-prairie grassland, and the dominant native plant community is short-grass (Blair 1950; Lotspeich and Everhart 1962). Trees are absent except along the escarpments and reentrant canyons. Native plant communities of the region occur in very few areas today, however, because most of the Southern High Plains is under cultivation.

The Southern High Plains has low, even environmental gradients, flat topography, and uniform regional geology. These topographic and geologic conditions prevailed throughout the Late Quaternary, suggesting that past environments were relatively uniform throughout the region and that geomorphic responses to climate were similar and synchronous. This situation, in turn, suggests that long distance geological and paleoenvironmental correlations can be made with some degree of confidence.

CULTURAL AND ENVIRONMENTAL CHRONOLOGY

Five general cultural periods are recognized for the Southern High Plains: Paleoindian (11,500-8500 B.P.); Archaic (8500-2000 B.P.); Ceramic (2000 B.P. to ca. A.D. 1450); Protohistoric (ca. A.D. 1450-1650); and Historic (ca. A.D. 1650-1940s). The Paleoindian period covers the transition from the latest Pleistocene to the earliest Holocene when now-extinct mammals were hunted by people. The Archaic, from the later Early Holocene into the Late Holocene, is characterized by evidence for systematic incorporation of plant use in the subsistence base. The Ceramic period, in the Late Holocene, is marked by the presence of both ceramic artifacts and arrowpoints. The Protohistoric period covers the time when Europeans were in the region, but their influence was not manifested in the aboriginal material culture nor in the archeological record. The Historic period is denoted by European material culture in the archeological record, and includes both aboriginal and Anglo-European occupations.

The timing of the three major environmental periods under discussion for the Southern High Plains is based on geological and geomorphological work of the junior author (Holliday 1985a, 1985c, 1989a, 1995b, 1995c). The latest Pleistocene and Early Holocene are presented as a combined period covering the time from 12,000 to 7500 B.P., while the Middle Holocene dates from 7500 to 4500 B.P., and the Late Holocene dates from post-4500 B.P. The boundary between the Early and Middle Holocene previously was set at 6500 B.P. (e.g., Johnson and Holliday 1993), based on the Lubbock Lake record. Regional stratigraphic and paleoenvironmental studies have revised the age of the boundary to 7500 B.P. (Holliday 1995c). The boundaries for some of the environmental subdivisions sometimes crosscut the cultural divisions. Environmental reconstructions for these periods are based on paleontological, sedimentological, pedological, and geomorphic data sets.

Pre-Clovis Period

The existence of a pre-Clovis period is a subject of intense debate (e.g., Dincauze 1984; Lynch 1990; Bryan 1978, 1986; Dillehay and Meltzer 1991), focusing on the issues of when people entered the New World and the type of archeological evidence considered acceptable for pre-Clovis occupations. This period generally is considered to date to the Late Wisconsinan, from around 25,000 to 11,500 B.P. (e.g., West 1983; Johnson 1991). Currently, cultural subdivisions are not recognized, as the few purported pre-Clovis sites come from widely disparate times and locations throughout the New World (West 1983).

Very little is known about the environment for the period 25,000 to 11,500 B.P. on the Southern High Plains (Johnson 1991). An equitable, humid, maritime-like climate occurred over the Southern Plains, with cool summers, mild winters, and abundant precipitation (Lundelius et al. 1983; Johnson 1993). Significant areas of open grassland environments existed on the Southern Plains, including parklands and savannas (Lundelius et al. 1983; Bryant 1977). Limited evidence from pollen and stable carbon isotopes suggest that during this time, the environment may have fluctuated between cool-moist and cool-dry conditions (Hall and Valastro 1995; Holliday 1995c).

Currently, only one site has materials that may date to this uncertain period. At Lubbock Lake (see Figure 1), two Late Pleistocene occupation levels occur, the younger of Clovis-age, and the older still undated. Geologic evidence, and the age of the younger cultural level, indicate an age of >11,100 B.P. (Holliday and Johnson 1984; Johnson and Holliday 1985). The bone bed contains the remains of mammoth, horse, camel, and bison. Cut lines occur on various elements from these species, and those on the bison remains were confirmed by scanning electron microscopy (SEM) analysis (Johnson and Shipman 1986; Johnson 1989). The remains are found on a gravel terrace above the Clovis-age stream bed, and could represent either early Clovis activities or an occupation from the pre-Clovis period. Additional work needs to focus on the depositional context of the materials, and dating, before any further claims of a pre-Clovis period occupation are made. Alexander (1978:21) suggests that "middle or early Pleistocene" artifacts were found at Lubbock Lake. However, this statement is based on a misinterpretation of the stratigraphy, as Holocene artifacts were mixed into much older Pleistocene lake beds.

Paleoindian Period

The Paleoindian period is subdivided on the basis of distinctive projectile point types (Wormington 1957; Wheat 1972; Frison 1991, 1993) representing cultures that consistently have tightly-clustered radiocarbon ages and discrete time periods. On the Southern Plains, the Paleoindian period is subdivided into the Clovis (11,500 to 11,000 B.P.), Folsom (10,800 to 10,300 B.P.), Plainview (ca. 10,000 B.P.), and Firstview (ca. 8600 B.P.) cultures.

The Late Pleistocene and Early Holocene sediments of most archeological significance are found in the draws that cross the region (see Figure 1). The draws developed during the Pleistocene, probably the result of repeated cutting and filling, but their origin and chronology are poorly known (Holliday 1995b, 1995c). The oldest dated alluvial sediments are 12,000 to 11,000 years old. During this time, bedded sand and gravel was deposited in most draws, indicative of competent streams flowing in the drainages (Holliday 1995b, 1995c). Water ceased to flow, and lacustrine deposition, in the form of diatomite and sapropelic mud, began abruptly about 11,000 B.P. in some reaches in a number of draws. Otherwise, the streams continued to flow until about 9500 B.P. (Holliday 1995b, 1995c).

During the Clovis period, an equitable, humid, maritime paleoclimate existed with a lower mean annual temperature than today; there also were cooler summers and warmer winters that lacked extended freezing conditions (Johnson 1986a, 1987c). Open grassland environments (mixed-grass prairie) existed on the uplands with parklands along the draws. Low gradient streams, with emergent vegetation and sedge beds along the banks, meandered through the draws. Mean annual temperature was about 10°-13° C (Johnson 1986a, 1987c) compared to 15° C today (Haragan 1983; Bomar 1983). A lowered summer temperature by at least 5.6° C existed with a winter temperature at or above 0° C (Johnson 1986a, 1987c). A winter rainfall pattern may have existed, coupled with cool, dry summers. These climatic conditions produced more effective moisture, lower evaporation rate, and greater humidity than today.

Three sites on the Southern High Plains (see Figure 1) have yielded evidence of Clovis-age occupation. At Blackwater Draw Locality #l (Hester 1972; Haynes 1995), the most extensive occupation studied was along the northern edge of the paleobasin, and involved at least five mammoth that represented individual kill or scavenging events (Saunders 1980). Remains from horse, camel, and bison recovered during excavations of the mammoth exhibited cut lines, dynamic impact features, and evidence of tool use (E. Hughes 1984; Johnson 1989a). Two worked sections of mammoth tusk also were recovered from the general area of the El Llano Dig #1 excavations (Saunders et al. 1990, 1991). Radiocarbon assays from carbonized plants in the sediments surrounding the mammoths yielded ages of 11,040, 11,170, and 11,630 B.P. (Hester 1972). Near the southern end of the South Pit, Cotter's (1937) excavation revealed two mammoth that had been scavenged by Clovis peoples (Saunders and Daeschler 1994). Jelinek's (1956) excavation in an area between the North and South pits yielded the partial remains of a mammoth and four bison that represented different events, most likely scavenging by people. Organic sediments taken from around the jacketed mammoth skull yielded an age of 10,780 B.P. (Johnson and Holliday 1995). Several Clovis points from this site were resharpened and reused as butchering tools (Johnson 1991).

At Miami (Sellards 1938), the remains of five mammoth (three adults and two juveniles) were found in sediments filling a playa-lake basin. While Saunders (1980:94) interpreted the site as a single kill event based on the age profile of the mammoth, Holliday et al. (1994) offered alternative interpretations, including scavenging by Clovis peoples. Marks on the ribs that appeared to be hack marks from butchering could not be confirmed by SEM analysis because of cortical surface erosion (Johnson and Shipman 1986). Long bones were not fractured (Johnson 1989a). Radiocarbon dates bracketed the Miami bone bed between 11,400 and 10,800 B.P. (Holliday et al. 1994). Clovis points from Miami were resharpened and used as butchering tools (Johnson 1991).

The Late Pleistocene occupation level at Lubbock Lake dates to 11,100 B.P. (Holliday et al. 1983). At least six species of megafauna were processed, with their remains exhibiting cut lines, helical fracture surfaces, dynamic loading points, and evidence of tool use (Johnson 1985, 1987b, 1995; Johnson and Holliday 1985; Johnson and Shipman 1986). Fractured mammoth limb elements were recovered associated with two large caliche boulders. Mid-diaphyseal impact was used to fracture the humerus and produce radial diaphyseal segments (Johnson 1985). Modified lithic tools were absent, although a Clovis point was recovered from the bone bed during dredging operations that uncovered the site. The point was resharpened and used as a butchering tool (Johnson 1991; Johnson and Holliday 1987).

Post-depositional disturbance to the bone bed had occurred, and bone orientation data (Kreutzer 1988) showed that bones were realigned; the stream velocity and competency data indicated, however, that neither the large caliche boulders nor the megafaunal limb elements could have been transported in by the stream (Kreutzer 1986; Johnson et al. 1987). Stream velocity and competency data were based on grain size analysis of sediment samples, and these demonstrated that the stream was competent to transport particles no larger than 2 cm (Kreutzer 1986). Kreutzer's (1986, 1988) analysis further demonstrated an orientation of bones by fluvial action, but did not demonstrate transport or, therefore, secondary context. Johnson (1995a), in a more detailed analysis of all in situ bones, demonstrated that the bone bed comprising the Clovis-age megafaunal processing station was in primary context, and that transport did not occur although the bones were realigned. Furthermore, discrete cultural activity areas still were discernible. Carnivore disturbance was minimal, as less than 3 percent of the total bone assemblage was affected by carnivore modification.

The Clovis-Folsom transition (ca. 11,000 B.P.) on the Southern High Plains was a time of significant climatic and environmental change that continued into Late Paleoindian times (Johnson 1986a, 1987c; Lundelius et al. 1983; Holliday, 1995b, 1995c). An accelerated warming trend, greater seasonality, increased annual temperature fluctuation, and wide-spread extinctions denote this transition. Higher mean annual temperatures and warmer summers prevailed over the preceding period. Winter temperatures were lower with sustained below-freezing periods. Minimum and maximum temperatures fluctuated near 21° C from highs greater than 32° C to lows below 0° C (Johnson 1986a, 1987c). These conditions reflect a less equitable climate than in the previous period, but one still more ameliorated than today. Perennial streams still existed in some reaches of the lower draws, but extensive freshwater, clear ponds with weedy growth, were in the valley axes in upper reaches. Water levels in these ponds fluctuated; the water was centimeters to meters deep or it was at or below the surface, exposing the floor of the draw. The mixed grasslands habitat became dominant with scattered deciduous trees on the draw slopes and around the ponds. Wet meadow grasses and sedge beds around the ponds graded into better-drained mixed grasslands along the valley floor. By 10,000 B.P., many of the streams ceased to flow and the ponds evolved into muddy marshes. On the uplands, playas and salinas continued to have seasonal, if not perennial, freshwater. Localized sand sheets formed in lowland settings, indicating a regional reduction in vegetative cover. This reduction most likely was the result of drying, reflecting the waning stages of pluvial conditions.

Four Folsom sites in good stratigraphic context are known for the region. At Blackwater Draw Locality #1 (Hester, 1972), a series of small herds of bison were killed and butchered around the ponded spring waters. Radiocarbon ages date these kills between 10,900-10,200 B.P. (Hester 1972; Haynes 1995). Just off the Southern High Plains to the northeast, Lipscomb (Barbour and Schultz 1941) and Lake Theo (Harrison and Killen 1978) appear to represent Folsom kills of larger herds of bison. At Lake Theo (Harrison and Killen 1978), at least 12 to 14 bison were killed and butchered. An apparent camping area was associated with the bison kill. Bone butchering tools were not recognized but expedient lithic flake tools were common. However, little else is known about Lake Theo.

Lipscomb (Hofman 1991; Hofman and Todd 1990; Hofman et al. 1989, 1991; Todd et al. 1990) appears to be a single-event, large-scale kill of at least 55 bison that took place in the late summer or fall. Of the skeletally mature animals, the sex ration is 3:1 females to males. Topographic setting still is unclear although the bone bed was adjacent to a 2 m-deep arroyo that existed at the time. Butchering of the carcasses appears limited, with many still fully articulated. Carnivore damage is limited and the bone bed appears to have been buried soon after the event. Some of the Folsom points have been reworked to extend their usefulness (Hofman 1992). Lipscomb now represents the largest single-event Folsom kill known for the Southern Plains.

At Lubbock Lake, Folsom occupations are represented by a series of bison kills around the marshy edges of ponds. Each kill was of a small cow-calf herd, and the animals were butchered on the spot using both expedient lithic and bone butchering tools (Johnson and Holliday 1987; Johnson 1987b). Bones from an individual carcass were stacked in small piles representing butchering units. Lithic tools were either retouched or utilized amorphous flakes. Production of the bone butchering tools took place in the kill area and the debris and tools were discarded at the locale when the tasks were finished (Johnson 1985). Folsom points were refashioned and also resharpened for use as butchering tools (Johnson and Holliday 1987). Based on one kill analyzed for seasonality data, kills took place in the late fall-early winter (Johnson 1987c). The Lubbock Lake Folsom occupation is radiocarbon dated between 10,800 to 10,300 B.P. (Holliday et al. 1983, 1985).

Four Plainview sites in good stratigraphic context are known for the region (see Figure 1). At the Plainview site (Sellards et al. 1947), the type locality, a thick bone bed was embedded in pond deposits in an abandoned stream channel in Running Water Draw. The bone bed represented at least two large-scale kill events that totaled over 100 bison. One event took place in the spring while the other was in the early fall (Johnson 1989a). The lithic tool kit consisted primarily of Plainview projectile points (refashioned into butchering knives) with a few amorphous flake tools (Knudson 1983); bone butchering tools were not recognized. Two radiocarbon assays on bone yielded ages of 10,200 B.P. and 9860 B.P. (Speer 1986). Testing at Lake Theo (Harrison and Killen 1978) yielded Plainview projectile points and other lithic tools and flakes in place stratigraphically above the Folsom occupation. Little else is known about the nature of occupation. A radiocarbon assay on soil humates yielded an age of 9950 B.P. (Johnson et al. 1982), while assays on bone yielded ages of 9360 B.P. and 8010 B.P. (Harrison and Killen 1978)

At Ryan's site (Johnson et al. 1987; Hartwell 1991, 1995; Hartwell et al. 1989), Plainview points, large bifaces, and large flakes were found within lacustrine deposits of a very small, extinct playa that overlooked Yellowhouse Draw. The morphology of the points ranged from pristine to reworked. The lineal distribution, and damage and breakage patterns (cf. Mallouf 1982), indicated plow-disturbed material that appears to have represented a cache.

The Plainview occupation at Lubbock Lake is characterized by the continuation of kills of small herds of bison around the marshy edges of ponds, the clustering or grouping of bones in distinct concentrations, and a change in weaponry design and the technology to produce the new design. The practice continued of resharpening and reusing the points as butchering tools. The lithic tool kit was complemented by a bone butchering tool kit made from the bison being processed in the locales. The Plainview occupation at the site is radiocarbon dated to 10,000 B.P. (Johnson and Holliday 1980).

Testing at Mark's Beach (Honea 1980) uncovered an apparent bison kill of Plainview age. Disarticulated remains from a bison were found in lacustrine deposits. Neither lithic nor bone tools were recovered, but a radiocarbon assay on bone yielded an age of 9920 B.P. (Honea, 1980), and a sample of soil humates was dated at ca. 9710 B.P. (Holliday 1995c).

By the time of the Firstview occupation of the Southern High Plains, the Early Holocene warming and drying trend was intensifying. Effective precipitation was decreasing with a shift away from the previously established rainfall pattern, and maximum summer temperatures were rising. Periodic summer droughts and disappearing surface-water resources denoted the end of the pluvial period and the beginning of the trend toward modern climatic conditions. Seasonality was more strongly expressed with greater seasonal temperature fluctuations, decreasing rainfall, and lowered humidity. A scrub-grasslands, transitional from a mixed-prairie to a desert-plains grasslands, dominated the draws while the uplands probably were a short-grass prairie. Alkaline marshes began to dominate the floors of the draws (Holliday 1995c). Locally, valley-axis wet meadows-freshwater marshlands with emergent vegetation and sedge beds were available, grading into better-drained valley floors and margins with mixed-grass prairie (Johnson 1986a, 1987c; Holliday 1995c). These hydrologic changes resulted from warming of water, and from a reduction in effective precipitation that decreased the discharge of springs and seeps (Holliday 1995c). Deposition of aeolian sediments in the draws, and as dunes on the uplands, increasingly became more common. Playas and salinas held seasonal water as well as locally accumulated aeolian sediment.

Three Firstview sites have been excavated in the region (see Figure 1). At Clovis (Hester 1972), Firstview occupations are from the carbonaceous silts (Unit E [Haynes 1975, 1995]), but the stratigraphic and geochronological situation of the material is not clear. Only a few radiocarbon ages are available from this unit, but at most, it spans the period from ca. 10,500 to 8500 B.P. (Haynes 1995). Little information is available on excavated activity areas within the carbonaceous silts. At least three bison kill/butchering locales were excavated, two in the lower part of the silts and one in the upper part (Hester 1972; Agogino et al. 1976), while a possible fourth locale is mentioned by Agogino and Rovner (1969).

At Station E along the northwestern edge of the South Pit, Evans (Sellards 1952) uncovered a large bone bed in the upper silts containing the remains of numerous bison in association with a suite of projectile points and amorphous lithic flake tools (Hester 1972). Sellards (1952) based his Portales Complex on this suite of projectile points. Bones were jumbled and the deposit may have been trampled. At least three episodes of surface weathering are evident on the elements, indicating more than one kill event (Johnson 1986b; Johnson and Holliday 1995). Radiocarbon assays on organic sediments taken from jacketed bone blocks yielded ages of 8970 B.P. (bone block #1) and 8690 B.P. (bone block #2) that did not overlap at two-sigma (Johnson and Holliday 1995). These dates fall within the age range for Firstview on the Southern High Plains (Johnson and Holliday 1981; Johnson 1987a), and indicate that the bone bed represents at least two Firstview occupational events. Wheat (1972) reexamined the projectile points and concluded that most were resharpened variants of the Firstview design.

San Jon (Roberts 1942), on the northwestern edge of the Southern High Plains (see Figure 1), was a stratified, multi-component site where cultural activities took place along the edge of a playa basin. The "San Jon" bone bed in Area II yielded a minimum of five bison, and articulated limb elements, particularly lower limbs, were common. Presumably, this bone bed represented a small-scale bison kill at the edge of the playa. The one projectile point recovered from the bone bed was the type specimen for the San Jon point (Roberts 1942), and its tip was reworked (Hill et al. 1995). Wheat (1972) subsumed the San Jon type into his Firstview type. Organic sediments from within the bone bed yielded an age of ca. 8360 B.P. (Hill et al. 1995).

At Lubbock Lake, Firstview peoples continued to hunt and butcher small herds of bison at the edge of the marshlands (Johnson and Holliday 1981). Bone concentrations and the stacking of elements continued. Bone fracturing was minimal and, therefore, bone tool manufacture and use was reduced and marrow processing was rare. The amorphous lithic flake tools were common, and Firstview points were resharpened and reused as butchering tools. The Firstview occupation at Lubbock Lake was radiocarbon dated to 8600 B.P. (Holliday et al. 1983, 1985).

Archaic Period

In the Early Archaic, during the latter part of the Early Holocene, available moisture and humidity levels continued to decrease, reflecting the intensification of the warming and drying trend, and more marked seasonality. By the end of the Early Holocene, hard-water, alkaline marshes, localized desiccation, and aeolian sedimentation characterized deposition in the draws (Holliday 1989b, 1995b, 1995c). Marshes that persisted in the valley axes were surrounded by a treeless mixed-grass prairie. Sedge beds and wet meadows were absent. On the uplands, aeolian sediments accumulated as sand dunes, in lunettes, and in playa basins as a result of reduced vegetation cover and wind deflation of the High Plains surface brought on by drought.

Little is known about the Early Archaic, and Lubbock Lake (Figure 2) is the only excavated site for this time period. The practice of hunting and butchering small herds of bison continued. A bone concentration representing several individual bison consisted of articulated to semiarticulated segments indicating butchering units. None of the elements were broken for marrow. Neither lithic nor bone butchering tools were recovered, although numerous resharpening flakes indicated the use of several lithic tools. Radiocarbon ages on soil humates date the Early Archaic activity to ca. 8000 B.P. (Johnson and Holliday 1989).

Although not excavated, an Early Archaic bison bone bed dated to ca. 7600 B.P. occurs stratigraphically above the Firstview bison bone bed at San Jon in Area II (Hill et al. 1995). The two projectile points recovered from the bone bed have not been identified as to type, however (Hill et al. 1995). This bone bed around the playa basin potentially represents the second known Early Archaic bison kill for the region.

By about 6000 B.P., the lakes and marshes in the draws had left significant accumulations of marl, but the dominant sediment across the region, in and out of the draws, was wind-blown material (Holliday 1989b, 1995b, 1995c). Aeolian sedimentation was episodic but widespread from 9000 until 5500 B.P., with most areas affected by 6500 B.P. Between 5500 and 4500 B.P., aeolian sedimentation occurred throughout the Southern High Plains. This aeolian sedimentation culminated in significant filling of draws, construction of sand dunes, local sedimentation in playa basins, and additions to lunettes throughout the region. This aeolian activity marked peak aridity in the Late Quaternary and the period between 6500 and 4500 B.P. is known as the Altithermal (Holliday 1989b).

The Altithermal coincides with the Middle Archaic period. Conditions were hot, dry, and dusty (Holliday 1989a; Johnson and Holliday 1986). The massive aeolian sedimentation that occurred indicates further reduction in vegetation cover probably due to increased temperatures and decreasing effective moisture in the form of lower effective precipitation. Dental abnormalities in bison at this time indicate poor range conditions due to excess grit on the vegetation. The presence of yellow-faced gophers denotes semiarid to arid conditions (Johnson 1987c; Johnson and Holliday 1986). Open, treeless grasslands covered the valleys and available surface water decreased greatly. Given the climatic conditions derived from geologic and faunal evidence, a desert-plains grasslands probably occurred on the Southern High Plains during the Middle Archaic.

Excavated Middle Archaic materials in good stratigraphic context are documented at five sites (see Figure 2). Three sites yielded evidence for the excavation of wells by prehistoric occupants in the Middle Holocene. At Blackwater Draw Locality #1 (Evans 1951; Green 1962), at least 19 wells are known. At Mustang Springs (Meltzer 1991; Meltzer and Collins 1987), dozens of wells were discovered. Excavations at Mark's Beach (Honea 1980) exposed a purported well. A hearth and associated Clear Fork gouge were recovered in Middle Archaic context from substratum 4A at 41LU26 (Bandy et al. 1981). Although this material was undated, substratum 4A at Lubbock Lake, less than 1 km upstream, dated from 5500 to 5000 B.P. (Johnson and Holliday 1986).

Despite the harsh conditions, relatively intensive occupation continued throughout this period at Lubbock Lake. At least 28 activity areas are known that include: camping events, bison kill/butchering locales, and a large oven probably used for vegetal processing (Johnson and Holliday 1986). The oven is a large oval basin filled with ash, and capped by a layer of burned caliche cobbles. A broken, worn sandstone metate was found in the rock covering. This feature was radiocarbon dated to ca. 4800 B.P. (Johnson and Holliday 1986).

Little deposition or erosion occurred during much of the Late Holocene and, as a result, the Middle Holocene sediments often are modified strongly by pedogensis. Some local deposition

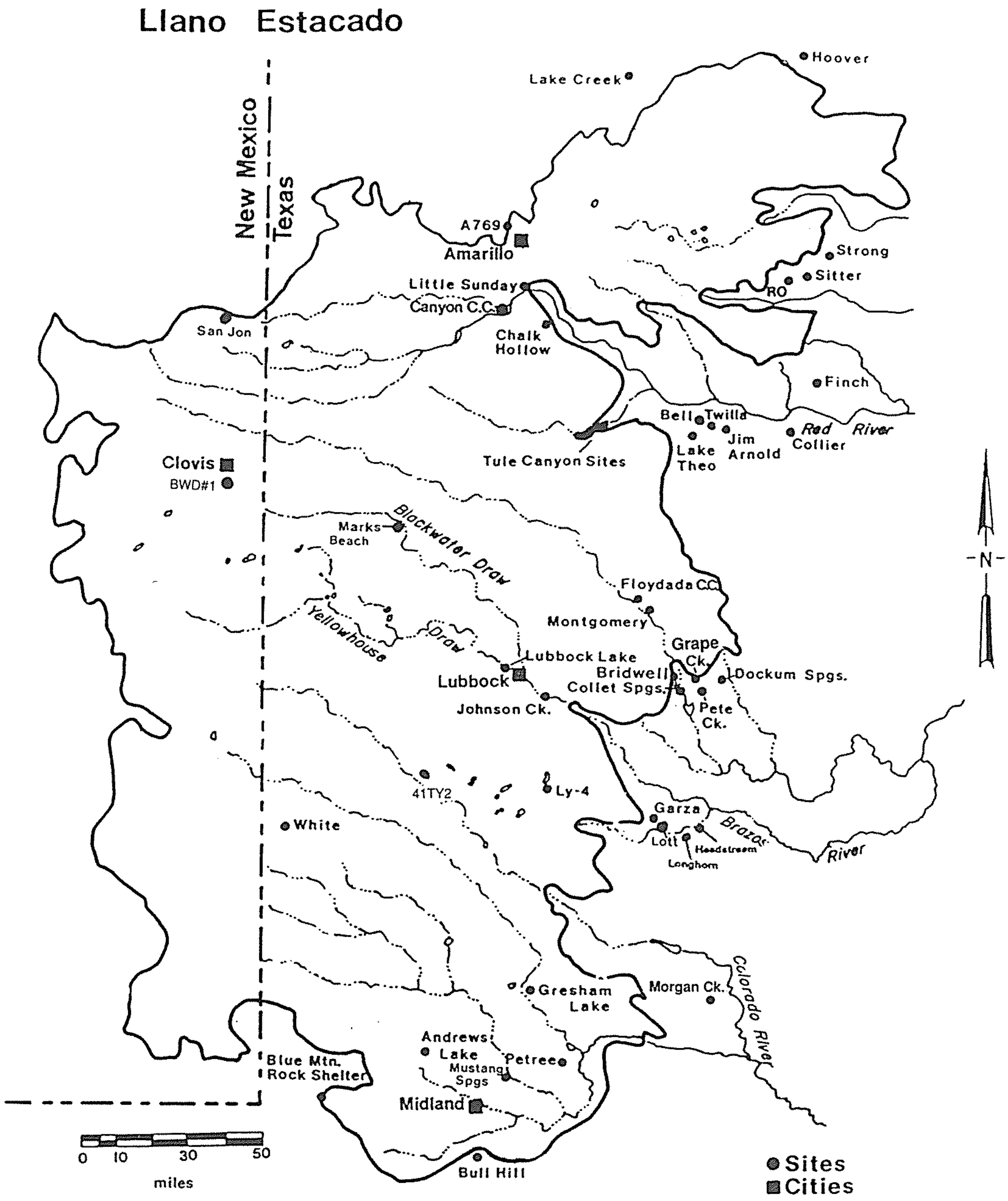

Figure 2. Map of the Southern High Plains with locations of selected Post-Paleoindian sites.

occurred within the last several thousand years. Late Holocene marsh sediments appear to be common along the floors of the draws (Holliday 1985b, 1995b, 1995c). The most recent period of aeolian sedimentation in the large dune fields and lunettes appear to be less than 2,000 years old (Holliday 1995b, 1995c; Haynes 1975, 1995). Localized, relatively short term drought is suggested by the varied occurrences of aeolian sediment.

By 4500 B.P., the climate began to ameliorate and return to cooler and more moist conditions that brought about landscape stability and environmental changes that generally have persisted into modern times. Sedimentation ceased, little wind erosion occurred, and a stable vegetation cover returned. Formation of the Lubbock Lake Soil at Lubbock Lake and similar soils at other localities (Holliday 1985b, 1990, 1995b, 1995c) occurred. This landscape stability heralded the establishment of essentially modern conditions and continental climate. Range conditions improved, and a mixed grass prairie replaced the probable desert-plains grasslands of the Middle Holocene, both in the draws and on the uplands. Localized marshlands returned to the valley axes with a resurgence of springs; occasional hardwood trees were found in the draws. On the uplands, playas and salinas held seasonal to year-round water (Holliday 1995b, 1995c). More extensive surface water was available, indicating more available and effective moisture.

Only three sites in the region have Late Archaic materials within good stratigraphic context (see Figure 2). The "lower midden zone" at Chalk Hollow (Wedel 1975) is composed of three occupations dating between ca. 3800-2200 B.P. (Lintz 1995). These deposits, with corner and side-notched Late Archaic points, represent camps for hunters pursuing bison herds (Lintz 1995).

At San Jon in Area III, Roberts (1942) excavated a Late Archaic bison kill, the only excavated bison kill site for this time period on the Southern High Plains. A minimum of seven bison were killed and butchered at the edge of the playa. Based on the bone bed distribution map (Hill et al. 1995:Figure 7), skulls and mandibles were common, some articulated limb and vertebral units occurred presumably representing butchering units, and bones or articulated units were disassociated from each carcass. Organic sediments from the substratum in which the bone bed occurs yielded an age of ca. 3600 B.P. (Hill et al. 1995). The two projectile points associated with the bone bed were not identified as to type (Hill et al. 1995).

At Lubbock Lake, the Late Archaic is represented by at least nine occupation surfaces found buried within the A-horizon of the Lubbock Lake Soil. These surfaces are denoted by scattered burned caliche (from disturbed hearths), broken lithic tools, and both diffuse and concentrated lithic flaking debris. These activities appear to represent camping events. Diagnostic artifacts have not been recovered with the occupation surfaces, but a Late Archaic age is based on stratigraphic position and radiocarbon ages associated with the stratigraphic unit (Holliday 1985a; Holliday et al. 1983, 1985). Because this A-horizon represents a stable land surface that existed well into the Ceramic period, Late Archaic and Ceramic-age materials may be mixed in the uppermost occupation surfaces. A Late Archaic hearth has been excavated at 41LU29 (Johnson 1989b), on the eastern rim of Yellowhouse Draw overlooking Lubbock Lake, and a Late Archaic-age cache was recovered from 41LU6 in Yellowhouse Draw less than 1 km upstream from Lubbock Lake (Buchanan 1995)

Archaic-age deposits have been investigated in the Justiceburg Reservoir (Lake Alan Henry) area on the Double Mountain Fork of the Brazos River, downstream from Lubbock Lake ca. 97 km. This area is located in the same drainage system as Lubbock Lake and is just off the Southern High Plains, southeast of Lubbock, on the Rolling Plains. Most sites are in geologically unstratified deposits (Boyd et al. 1989, 1990). Site types identified include campsites, rockshelters, bison processing stations or kill sites, and lithic procurement sites. At least six sites (41GR207, 41GR287, 41GR376, 41GR383, 41GR456, and 41KT49) have been identified as Archaic, and another six as Late Archaic in age (41GR471, 41KT33, 41KT34, 41KT52, 41KT53, and 41KT151) based on excavated features (primarily hearths), radiocarbon ages, and artifact types (Boyd et al. 1990).

Ceramic Period

Ameliorated conditions continued until about 2,000 years ago when a pattern of episodic drought began that continues today. This episodic pattern indicates minor departures towards some aridity through increased temperatures and decreased effective moisture. Regionally, the details of this episodic pattern are not clear. Although these droughts appear not to have been severe enough to alter the modern Southern Plains faunal communities, they are severe enough to cause vegetation denuding and surface erosion that led to deposition and alteration of the landscape (Holliday 1985a, 1990; Johnson 1987b).

However, a range change occurs with one mammalian community member that has been used as an environmental indicator. Between 1830-1240 B.P., the pine vole (*Microtus ochrogaster*) reestablishes itself on the northern portion of the Southern High Plains (Willey and Hughes 1978), reflecting the ameliorated, more mesic conditions that prevailed after 4500 B.P. during the Late Archaic and early Ceramic periods. After 1240 B.P., *Microtus ochrogaster* no longer ranged onto the Southern High Plains. The periodic droughts progressively are less severe, or of less duration, or both. Coincident aeolian activity in the dune fields record the same events (Holliday 1985b, 1995b, 1995c). Limited stable isotope data support drier conditions on the Southern High Plains within the last 1,000 years (Holliday 1995b, 1995c).

In upper reaches of the draws without spring activity during this time, slopewash and aeolian sedimentation occurred. But in the lower reaches, a spring-fed stream and wet meadow-marshland complex existed along valley axes for the past 1,000 years (Holliday 1985a, 1995b, 1995c). Hackberry, native walnut, and mesquite grew along the valley floor and slopes. The local environs were those of a mesquite savanna surrounding a riparian marshland complex (Johnson 1987c).

The earlier part of the Ceramic (ca. 2000 to 1000 B.P.) period appears to have been one of transition from traditional Archaic lifeways—denoted by the retention of Archaic point designs—to a newer lifeway signaled by the adoption of technological changes brought about with ceramics and the bow and arrow. Three sites in the region with good stratigraphic context have dart points or mixed dart and arrow point assemblages (see Figure 2). Camping features have been excavated at County Line, Blue Clay, and Deadman's Shelter (Hughes and Willey 1978). At Deadman's Shelter (Willey and Hughes 1978), dart and arrow points have been found in association with brownware pottery. Radiocarbon ages of ca. 1740 B.P. and 1830 B.P. are the earliest dates associated with arrowpoints and pottery in the region. Several bison kills (Twilla, Bell, Strong, Collier, Sitter, Finch, R.O., and Hoover sites) found just east of the Southern High Plains (see Figure 2) contain a variety of Late Archaic point designs with radiocarbon ages that averaged 1387 B.P. (D. Hughes 1977).

This 1,000 year span within the Ceramic period also is characterized by corner-notched Scallorn arrow points and coarse-tempered cordmarked pottery (Hughes and Willey 1978). Only a few Scallorn-associated sites are known and they are not well-dated. Chalk Hollow (Wedel 1975) has an upper component with Scallorn points and pottery (Lintz 1995), while Lake Creek (J. Hughes 1962) and Borger Bridge (Hughes and Willey 1978) are also considered to date from Scallorn times. At Lubbock Lake, this period of occupation is indicated by a hearth with associated camping debris that included a Scallorn point, modern bison remains, lithic tools and flakes, and bone beads (Kelley 1974). Downstream at 41GR291 (Justiceburg Reservoir or Lake Alan Henry), Deadman's and Scallorn points were found associated in a camp occupation (Boyd et al. 1990; see also Boyd, this volume).

The later Ceramic period (ca. 1000 to 500 B.P.) is characterized by a mixed assemblage of Puebloan trade pottery and Plains lithic tool types. The tradewares are dominated by Mogollon ceramics, representing the eastern variety of the Jornada branch of the Mogollon culture (see Perttula et al., this volume). Numerous sites are known from this time period but few occur in good stratigraphic context. Examples are such sites as Jim Arnold (Tunnell 1964), A769 (Harrison and Griffin 1973), Floydada Country Club (Word 1963, 1991), Montgomery (Word 1965), 41CB27 (Parker 1982), Pete Creek, Grape Creek, and Dockum Springs (Parsons 1967), 41TY2 (Pope 1991), the lower level at Slaton Dump (Booker and Campbell 1978), Petree (Riggs 1972), Gresham Lake (Breeding 1971), and Bull Hill (Shawn 1975).

At Lubbock Lake, game-animal (modern bison, pronghorn antelope, coyote, and wolf) processing stations are found in serial stratigraphic position. Although these stations lack ceramics, radiocarbon assays and stratigraphic position indicate this latter part of the Ceramic as the period of occupation (Johnson 1987b). At Justiceburg Reservoir (Lake Alan Henry), two late Ceramic campsites (41GR303 and 41GR393), four Ceramic-age campsites (41GR359, 41GR383, 41GR456, 41KT52), and one Ceramic-age rockshelter (41GR559) have been investigated (Boyd et al. 1990).

Protohistoric Period

Numerous Protohistoric sites are known in the region but again few occupations are in good stratigraphic context. At Lubbock Lake, numerous occupation levels attest to intense and repeated use of the area. These levels are characterized by Garza points, occur in serial stratigraphic sequence, and have associated radiocarbon ages of ca. 500 to 300 B.P. (Johnson et al. 1977; Holliday et al. 1983, 1985). Both living surfaces with associated hearths and large game-animal processing stations occur in these occupation levels.

Less than 1 km downstream from Lubbock Lake, Protohistoric Garza occupations within a geologically-stratified context have been excavated at 41LU26 and 41LU35 (Bandy et al. 1981). Wheat (1955) tested a Garza campsite on the uplands overlooking Yellowhouse Canyon in the vicinity of Buffalo Springs Lake. Further downstream at the Justiceburg Reservoir (Lake Alan Henry) area, Boyd et al. (1989, 1990) recorded and tested several Garza occupations, and excavated two sites (Longhorn and Headstream) spanning the Protohistoric and Historic periods that may be Garza occupation sites (Boyd et al. 1990, 1993; Boyd and Peck 1992). The Garza (Runkles 1964) and Lott (Runkles and Dorchester 1987) sites, in geologically-unstratified context, are located just off the Southern High Plains along tributaries of the Double Mountain Fork of the Brazos River.

Northeast of Lubbock Lake, in the Running Water Draw system, a Garza occupation within a stratified context was tested at the Floydada Country Club site (Word 1963, 1991) in Blanco Canyon near Floydada. Downstream about 5 km, Garza occupations mixed in unstratified contexts with earlier and later components also were tested at the Montgomery site (Word 1965) and 41CB27 (Parker 1982; Baugh 1992). Northward in lower Tule Canyon, Katz and Katz (1976) excavated a hearth at 41BI83 that dates to this time period, but it lacked diagnostic artifacts. Further north, J. Hughes (1971) tested a Garza occupation within a stratified context at the Canyon City Club Cave site along Palo Duro Creek at the outskirts of Canyon. West of Lubbock Lake just off the Southern High Plains, Speth and Parry (1978, 1980) excavated Garza sites (bison kill and camp sites) on the Mescalero Plains near Bottomless Lake.

Historic Period

Historic period sites in good stratigraphic context are extremely rare on the Southern High Plains. This period is marked by the appearance of European trade goods and modern horse remains. It is subdivided into aboriginal Historic and Anglo-Historic times. At Lubbock Lake, numerous aboriginal Historic occupation levels are characterized by Washita points. These levels occur in serial stratigraphic sequence, and have associated radiocarbon ages of ca. 300 to 150 B.P. (Holliday et al. 1983, 1985). Processing stations are similar to ones in the Protohistoric and Ceramic periods. They are distinctive, however, in the inclusion of modern horse as a game-animal.

Further downstream, aboriginal Historic sites have been tested at 41LU35 (Bandy et al. 1981), 41GR484, 41KT53, and 41KT69 (Boyd et al. 1990). Several historic rock art sites are present in the Justiceburg Reservoir (Lake Alan Henry) area (Boyd 1992; Boyd and Kibler 1993). Historic period glass trade beads from the 1700s have been recovered from 41CB27 (Parker 1982) in Blanco Canyon near Crosbyton, and the Headstream site (Boyd and Peck 1992; Peck et al. 1993) at Justiceburg Reservoir (Lake Alan Henry). To the north, two probable Comanche sites have been excavated at MacKenzie Reservoir (Hughes and Willey 1978) in Tule Canyon with distinctive hearths and post-1840 glass seed beads. At Lubbock Lake, a Comanche occupation is represented by several activity areas that have yielded glass seed beads (Ladkin 1993, 1995). The Codgell (Word and Fox 1975) and White (Suhm 1961) sites in Floyd and Yoakum counties also contained glass seed beads.

European occupation of the Southern High Plains began in the middle to late 1800s. The first Europeans were buffalo hunters and U.S. military units, followed by sheepherders (Pastores), traders, ranchers, and settlers. Few excavations of these sites have been conducted. A buffalo hunter's camp, occupied sometime between 1874 and 1879, was tested at Justiceburg Reservoir (Lake Alan Henry) (41GR528 [see Freeman and Boyd 1990]). The Pastores, Hispanic sheepherders from New Mexico, began moving into the Canadian River Valley in the early 1870s, and by the late 1870s, small settlements, such as at Tascosa, were being established in the valley (Archambeau 1946; Taylor 1980), with the southernmost settlement at Merrell-Taylor Village (Guffee 1976) on Quitaque Creek along the escarpment below Palo Duro Canyon. Test excavation and recording of rock corrals at the Ellis site (Lichti 1994; Hicks and Johnson in preparation) in Yellowhouse Canyon near Southland, and the Massie site (Word 1980; Lichti 1994) in Blanco Canyon near Floydada, document the transhumance use of the Southern High Plains by the Pastores. By the mid-1880s, the Pastores had left the region and returned to New Mexico (Rathjen 1973; Taylor 1980).

At the northern end of the Southern High Plains, excavations at Adobe Walls (Baker and Harrison 1986) along the Canadian River revealed a wide variety of European goods available to the area's occupants during the late 1860s to 1870s. Along Yellowhouse Draw in the east-central Southern High Plains, Singer Store was a trading post located at Lubbock Lake from 1881 to 1886 (Holden 1974). Testing produced artifacts (square nails, metal cans, and a ginger beer bottle) relating to this occupation, as well as artifacts attesting to buffalo hunting activity (heavy-caliber rifle shell casings) (Johnson 1987b). Archaeological exploration occurred at one of the XIT Ranch headquarters (Jackson 1976) near Hereford.

Just off the Southern High Plains in the Justiceburg Reservoir (Lake Alan Henry) area, testing of historic sites (Freeman and Boyd 1990) included that of a sheepherder's camp dating from the 1880s (41GR443), several dugouts occupied between the 1880s and 1900 (41GR474, 41GR263, 41GR392, and 41KT150), an 1880s to 1920s line camp (41KT84), several homesteads (41GR250, 41GR474, and 41GR443), ranch headquarters (41GR13), and a town building (41GR331).

Investigations at an Anglo-Historic dump in Lamb County documented two dumping periods at the site, one episode around 1915 and the other centered around 1935 (Hicks et al. 1994). These episodes corresponded with two periods of population increase for the city of Littlefield. At Lubbock Lake, Anglo-Historic dumps from the early 20th century were tested. Dumping episodes centered around 1940 and 1955, also corresponding to periods of population increase for the city of Lubbock (O'Brien 1995).

SUMMARY DISCUSSION

The Late Quaternary archeological and paleoenvironmental records of the Southern High Plains are well-preserved in the draws, dunes, and lake basins of the region. The fill in the draws historically is most-closely linked to the human history of the region as a result of the discovery of several renowned archeological sites in these settings. The draws also provide the most complete and sensitive regional environmental record so far available.

At the beginning of the Paleoindian occupation, the environment of the Southern High Plains, for the most part, was relatively cool and moist. The draws had perennial flowing water, and lake basins probably had permanent water. Haynes (1991) proposed a Clovis-age drought for the region based on stratigraphic data from the Clovis and Miami sites and argued that megafaunal extinctions at the end of the Pleistocene were linked to that drought. This hypothesis is not supported by paleobotanical, paleontological, or other stratigraphic data from the regional draws, dunes, or playas (Holliday 1995b, 1995c). The earliest evidence of warming and drying in the Late Quaternary is from the Folsom period (Holliday 1995c).

By Folsom times, hydrologic conditions changed. Less flowing water was available in the draws as spring discharge and runoff declined. Streams were replaced with ponds and marshes. Aeolian sedimentation appeared in the stratigraphic record by 10,000 B.P., and aeolian deposition in the draws, dunes, and playas became more widespread through the Early Holocene.

This deposition culminated in the Middle Holocene in significant filling of draws and construction of sand dunes. This aeolian activity likely marked peak aridity in the Late Quaternary in response to increased temperatures and lower effective precipitation relative to the preceding or following periods. By about 4,500 years ago, a change in climate toward more moist and cooler conditions, relative to the Middle Holocene, brought landscape stability and environmental changes that have more or less persisted to present times. This stability resulted in little Late Holocene sedimentation in the region.

This stratigraphic and paleoenvironmental scheme generally follows earlier reconstructions of the paleoecology of the Southern High Plains (e.g.

Wendorf 1961; Wendorf and Hester 1975) but differs considerably in detail. The various Late Pleistocene and Early Holocene climatic intervals proposed in earlier schemes are not identifiable in the stratigraphic record now emerging due to problems of dating, stratigraphic correlation, and pollen preservation in the work that led to the earlier schemes (Holliday 1987, 1995c).

The known archeological record for the Southern High Plains provides a lengthy and rich heritage for the region. People have lived on and used the Southern High Plains for at least 11,000 years, and perhaps for as long as people have been in the New World. Although varying through time in variety, quality, and plentitude, the environments of the Southern High Plains have provided ample natural resources for the various peoples inhabiting the region. This resource base is spread over large parameters of seasonality, space, and time, and the abundance or scarcity and sparcity of such resources as lithic materials, water, and wood on the Southern High Plains has influenced the adaptive responses to environment and environmental change as conditions went from pluvial, to xeric, to mesic. The relationship between environment and the people that occupied that environment, then, potentially could be well-defined in such settings.

High-quality lithic resources were a localized resource at best, represented by Alibates agate at the northern edge of the region along the Canadian River and Tecovas jasper at the eastern edge of the escarpment near Quitaque (e.g., Holliday and Welty 1981; Banks 1990). Ogallala Formation quartzites and cherts (generally of much poorer quality) were available along the escarpment and at localized outcrops within the draws (Holliday and Welty 1981). Due to this limited distribution, imported lithic resources, particularly from Central Texas (Edwards Formation chert), played a major role in the adaptive strategies utilized on the Southern High Plains.

Resource availability of wood and water closely mirrored the climatic changes of the region. Both commodities were available regionally, and were locally abundant during the Late Pleistocene and Early Holocene, but became much more scarce and further localized during the Middle Holocene (Johnson 1987c; Meltzer 1991; Holliday 1989, 1995b, 1995c). Surface waters in playas and draws increased again in the Late Holocene (Holliday 1995b, 1995c), with limited wood resources available only within the draws (Johnson 1987c). An episodic pattern of droughts for about the past 2,000 years (Holliday 1985, 1995b, 1995c) undoubtedly affected long-term adaptive strategies. Coupled with the drought pattern for at least the last 500 years was the steady influx of various groups of non-local peoples, from the Athabascans and Comanche to the Pastores and Anglo-Americans, and the eventual replacement of the indigenous people.

The long record of occupation of the Southern High Plains primarily was of hunter-gatherer peoples, presumably practicing a seasonal yearly round of activities. In general, Clovis peoples had a broad-spectrum, meat-related subsistence base where they were hunting and scavenging a wide-variety of game animals. With widespread extinctions, bison became the major game animal of post-Clovis peoples. Later Paleoindian peoples had a very narrow-spectrum, meat-related subsistence base, systematically cropping both small cow-calf herds as well as large mixed herds of bison. By the Middle Holocene, Archaic peoples had a mixed desert plant and meat-related subsistence base, and they were forced to rely on wells for water in the western and southern part of the Southern High Plains. A mixed plant and meat-related subsistence base continued throughout Late Holocene Ceramic through aboriginal Historic times, but with more mesic vegetation and abundant surface water (Johnson 1987c, 1991, 1994; Johnson and Holliday 1986; Meltzer 1991).

The occupation of the Southern High Plains through time by these hunter-gatherer peoples appears to be by small groups of people for both economic (hunting, plant processing, and tool production and rejuvenation) and short-term residential uses, with repeated use of the landscape as well as differential use of landscape features. Key aspects missing from the record are longterm home bases and quarries for lithic resources. Quarries must have existed along the outcroppings of Alibates and Tecovas but they have not been documented. Quarrying of outcrops of Ogalalla Formation materials has been documented on the Rolling Plains just off the eastern escarpment in the Brazos River drainage (Johnson 1994).

Various Late Holocene peoples along the Canadian River and associated drainageways, in particular the Antelope Creek peoples, practiced agriculture that modified or changed lifestyles and social organization. This lifeway was brief on the Southern High Plains, being practiced for much less than 1,000 years and apparently coming to an end in the A.D. 1400s as outsiders moved into the region. From then on into the 1800s, aboriginal occupation of the northern Southern High Plains was again by hunterer-gatherers.

By the 1860s, a quick succession of non-aboriginal peoples began using the Southern High Plains for economic purposes, and then settling the region. This intrusion brought to a close the aboriginal occupation of the region by the late 1870s. The use of land and other resources changed dramatically from the aboriginal patterns to patterns of the non-aboriginal peoples. The buffalo hunters decimated the bison herds while the Pastores and ranchers used the plains grasslands to pasture domestic stock (sheep, then cattle). The early settlers plowed the grasslands to raise domesticated crops. By the turn of the century, towns were being established on the uplands, away from the traditional aboriginal resource bases of the draws and playas.

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REFERENCES CITED

Agogino, G. A. and I. Rovner
1969 Preliminary Report of a Stratified Post-Folsom Sequence at Blackwater Draw Locality No. 1. *American Antiquity* 34:175-176.

Agogino, G. A., D. K. Patterson, and D. E. Patterson
1976 Blackwater Draw Locality No. 1, South Bank: Report for the Summer of 1974. *Plains Anthropologist* 21(73):213-224.

Alexander, H. L.
1978 The Legalistic Approach to Early Man Studies. In *Early Man in America from a Circum-Pacific Perspective*, edited by A. L. Bryan, pp. 20-22. Occasional Papers 1. University of Alberta, Department of Anthropology, Occasional Papers, Alberta, Canada.

Archambeau, E. R.
1946 Spanish Sheepmen on the Canadian at Old Tascosa. *Panhandle-Plains Historical Review* 19:72-96.

Baker, T. L. and B. R. Harrison
1986 *Adobe Walls. The History and Archeology of the 1874 Trading Post.* Texas A&M University Press, College Station.

Bandy, P., J. Montgomery, W. J. Mayer-Oakes, and R. O. Keslin
1981 *Archaeological Mitigation, Canyon Lakes Project, Lubbock, Texas.* Cultural Resources Institute, Department of Anthropology, Texas Tech University, Lubbock.

Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans-Mississippi South, the Southern High Plains and Adjacent Southwest.* Memoir 4. Oklahoma Anthropological Society, Oklahoma City .

Barbour, E. H. and C. B. Schultz
1941 The Lipscomb Bison Quarry, Lipscomb County, Texas. *Bulletin of the University of Nebraska State Museum* 2(7):67-68. Nebraska State Museum, University of Nebraska, Lincoln.

Baugh, T. G.
1992 The Bridwell Site: A Protohistoric Community in the Texas South Plains. In *Cultural Encounters and Episodic Droughts: The Protohistoric Period on the Southern Plains*, edited by E. Johnson, pp. 41-42. Lubbock Lake Landmark Quaternary Research Center Series 3. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Blair, W. F.
1950 The Biotic Provinces of Texas. *The Texas Journal of Science* 2:93-117.

Bomar, G.W.
1983 *Texas Weather.* University of Texas Press, Austin.

Booker, R. and J. Campbell
1978 An Excavation Report on Site 41LU6: Slaton Dump Site. *Bulletin of the South Plains Archeological Society* 4:19-37.

Boyd, D. K.
1992 Historic Native American Rock Art of Garza County, Texas. In *Cultural Encounters and Episodic Droughts: The Protohistoric Period on the Southern Plains*, edited by E. Johnson, pp. 69-90. Lubbock Lake Landmark Quaternary Research Center Series 3. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Boyd, D. K. and K. W. Kibler
1993 Rock Art Site Investigations, Monitoring and Survey, and Off-Site Geomorphological Investigations. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*, by D. K. Boyd, J. Peck, S. A. Tomka, and K. W. Kibler, pp. 237-240. Reports of Investigations 88. Prewitt and Associates, Inc., Austin.

Boyd, D. K. and J. Peck
1992 Protohistoric Site Investigations at Justiceburg Reservoir, Garza and Kent Counties, Texas. In *Cultural Encounters and Episodic Droughts: The Protohistoric Period on the Southern Plains*, edited by E. Johnson, pp. 43-68. Lubbock Lake Landmark Quaternary Research Center Series 3. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Boyd, D. K., M. D. Freeman, M. D. Blum, E. R. Prewitt, and M. Quigg
1989 *Justiceburg Reservoir, Garza and Kent Counties, Texas: Phase I Cultural Resources Investigations on the Double Mountain Fork of the Brazos River.* Reports of Investigations 66. 2 Vols. Prewitt and Associates, Inc., Austin,

Boyd, D. K., J. T. Abbott, W. A. Bryan, C. M. Garvey, S. A. Tomka, and R. C. Fields
1990 *Phase II Investigations at Prehistoric and Rock Art Sites, Justiceburg Reservoir, Garza and Kent Counties, Texas.* Reports of Investigations 71. 2 Vols. Prewitt and Associates, Inc., Austin.

Boyd, D. K., J. Peck, S. A. Tomka, and K. W. Kibler
1993 *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2.* Reports of Investigations 88. Prewitt and Associates, Inc., Austin,

Breeding, A.W.
1971 Gresham Lake Site: 41ML3. *Transactions of the Regional Archeological Symposium for Southeastern New Mexico and Western Texas* 6:1-8.

Bryan, A. L. (editor)
1978 *Early Man in America from a Circum-Pacific Perspective.* Occasional Papers 1. University of Alberta, Department of Anthropology, Edmonton, Alberta.
1986 *New Evidence for the Pleistocene Peopling of the Americas.* Center for the Study of Early Man, University of Maine, Orono.

Bryant, V. M. Jr.
1977 A 16,000 Year Pollen Record of Vegetational Change in Central Texas. *Palynology* 1:143-156.

Buchanan, B.
1995 Archaeological Background of Lubbock County. In *Archaeological Investigations at Reese Air Force Base and Terry County Auxilliary Airfied*, edited by E. Johnson. Lubbock Lake Landmark Quaternary Research Center Series 9. Museum of Texas Tech University, Lubbock Lake Landmark. In press.

Caran, S. C.
1991 Cenozoic Stratigraphy, Southern Great Plains Area. In *Quaternary Nonglacial Geology: Coterminous U.S.*, edited by R. B. Morrison, plate 5. Centennial Volume K-2. Geological Society of America, Boulder.

Carr, J. T.
1967 *The Climate and Physiography of Texas.* Report 53. Texas Water Development Board, Austin.

Cotter, J. L.
1937 The Occurrence of Flints and Extinct Animals in Pluvial Deposits near Clovis, New Mexico, part IV. Report on Excavation at the Gravel Pit, 1936. *Proceedings of the Philadelphia Academy of Natural Sciences* 90:2-16.

Dillehay, T. D. and D. J. Meltzer (editors)
1991 *The First Americans: Search and Research.* CRC Press, Inc., Boca Raton, Florida.

Dincauze, D. F.
1984 An Archaeo-Logical Evaluation of the Case for Pre-Clovis Occupations. *Advances in World Archaeology* 3:275-323. Academic Press, New York.

Evans, G. L.
1951 Prehistoric Wells in Eastern New Mexico. *American Antiquity* 17(1):1-9.

Freeman, M. D. and D. K. Boyd
1990 *Phase II Historical Investigations at Justiceburg Reservoir, Garza and Kent Counties, Texas.* Reports of Investigations 72. Prewitt and Associates, Inc., Austin.

Frison, G. C.
1991 The Goshen Paleoindian Complex: New Data for Paleoindian Research. In *Clovis Orgins and Adaptations*, edited by R. Bonnichsen and K. L. Turnmire, pp. 133-151. Center for the Study of the First Americans, University of Maine, Orono.
1993 The North American Paleoindian: A Wealth of New Data but Still Much to Learn. *Plains Anthropologist Memoir* 27:5-16.

Green, F. E.
1962 Additional Notes on Prehistoric Wells at the Clovis Site. *American Antiquity* 28(2):230-234.

Guffee, E.
1976 *Merrell-Taylor Village Site*. Llano Estacado Museum, Wayland Baptist College, Plainview.

Hall, S. A. and S. Valastro, Jr.
1995 Grassland Vegetation in the Southern Great Plains During the Last Glacial Maximum. *Quaternary Research* 44(2):237-245.

Haragan, D. R.
1983 *Blue Northers to Sea Breezes: Texas Weather and Climate*. Hendrick-Long Publishing Co., Dallas.

Harbour, J.
1975 General Stratigraphy. In *Late Pleistocene Environments of the Southern High Plains*, edited by F. Wendorf and J. J. Hester, pp. 33-55. Publication of the Ft. Burgwin Research Center 9. Southern Methodist University, Dallas.

Harrison, B. R. and B. T. Griffin
1973 An Infant Burial in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 44:61-68.

Harrison, B. R. and K. L. Killen
1978 *Lake Theo: A Stratified, Early Man Bison Butchering and Camp Site, Briscoe County, Texas*. Special Archeological Report 1. Panhandle-Plains Historical Museum, Canyon, Texas.

Hartwell, W. T.
1991 Ryan's Site: A Plow-Disturbed Plainview Cache on the Southern High Plains of Texas. Unpublished Master's thesis, Department of Anthropology, Texas Tech University, Lubbock.
1995 The Ryan's Site Cache: Comparisons to Plainview. *Plains Anthropologist* 40(152):165-184.

Hartwell, W. T., E. Johnson, V. T. Holliday, R. W. Ralph, and S. Lupton
1989 A Re-evaluation of Ryan's Site: A Disturbed Plainview Cache on the Southern High Plains of Texas. *Current Research in the Pleistocene* 6:14-15.

Hawley, J. W., G. O. Bachman, and K. Manley
1976 Quaternary Stratigraphy in the Basin and Range and Great Basin Provinces, New Mexico and Western Texas. In *Quaternary Stratigraphy of North America*, edited by W. C. Mahaney, pp. 235-274. Dowden, Hutchingson and Ross, Inc., Stroudsburg, Pennsylvania.

Haynes, C. V. Jr.
1975 Pleistocene and Recent Stratigraphy. In *Late Pleistocene Environments of the Southern High Plains*, edited by F. Wendorf and J. J. Hester, pp. 57-96. Publication of the Ft. Burgwin Research Center 9. Southern Methodist University, Dallas.

Haynes, C. V. Jr. *(Continued)*
1991 Geoarchaeological and Paleohydrological Evidence for a Clovis-age Drought in North America and its Bearing on Extinction. *Quaternary Research* 35:438-450.
1995 Geochronology of Paleoenvironmental Change, Clovis Type Site, Blackwater Draw, New Mexico. *Geoarchaeology*10:317-388.

Hester, J. J.
1972 *Blackwater Locality No. 1: A Stratified, Early Man Site in Eastern New Mexico*. Publication of the Ft. Burgwin Research Center 8. Southern Methodist University, Dallas.

Hicks, J. K. and E. Johnson
n.d. Pastores on the Southern High Plains. MS in preparation by the authors.

Hicks, J. K., M. Hamilton, W. Kinney Jr., K. Hicks, and T. Peach
1994 Analysis. In *Historic Anglo-European Occupation - An Archaeological Survey of the City of Littlefield Proposed Wastewater Treatment Plant, Lamb County, Texas*, edited by E. Johnson, pp. 33-58. Lubbock Lake Landmark Quaternary Research Center Series 7. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Hill, M. G., V. T. Holliday, and D. J. Stanford
1995 History of Investigations, Geoarchaeology, and Reexamination of the Extant Lithic and Faunal Collections from the San Jon Site, New Mexico. *Plains Anthropologist*, in press.

Hofman, J. L.
1991 New Light on the Lipscomb Bison Quarry. *Oklahoma Archeological Survey Newsletter* 11(3):2-4.
1992 Recognition and Interpretation of Folsom Technological Variability on the Southern Plains. In *Ice Age Hunters of the Rockies*, edited by D. J. Stanford and J. S. Day, pp. 193-224. University Press of Colorado, Niwot.

Hofman, J. L. and L. C. Todd
1990 The Lipscomb Bison Quarry: 50 Years of Research. *Transactions of the Regional Archeological Symposium for Southeastern New Mexico and Western Texas* 25:43-58.

Hofman, J. L., R. L. Brooks, J. S. Hays, D. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein
1989 *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Hofman, J. L., L. C. Todd, and M. B. Collins
1991 Identification of Central Texas Edwards Chert at the Folsom and Lindenmeier Sites. *Plains Anthropologist* 36(137):297-308.

Holden, W. C.
1974 Historical Background of the Lubbock Lake Site. In History and Prehistory of the Lubbock Lake Site, edited by C. C. Black. *The Museum Journal* 15:11-14. Museum of Texas Tech University, Lubbock.

Holliday, V. T.
1985a Archaeological Geology of the Lubbock Lake Site, Southern High Plains of Texas. *Geological Society of America Bulletin* 96:1483-1492.

1985b New Data on the Stratigraphy and Pedology of the Clovis and Plainview Sites, Southern High Plains. *Quaternary Research* 23:388-402.

1985c Holocene Soil-Geomorphological Relations in a Semi-arid Environment—The Southern High Plains of Texas. In *Soils and Quaternary Landscape Evolution*, edited by J. Boardmen, pp. 325-357. John Wiley and Sons, New York.

1986 Late Pleistocene Vegetation of the Southern High Plains: A Reappraisal. *Current Research in the Pleistocene* 3:53-54.

1987 Re-examination of Late-Pleistocene Boreal Forest Reconstructions for the Southern High Plains. *Quaternary Research* 28:238-244.

1989a Geoarchaeological Investigations at the Lubbock Lake Landmark, 1987 Season. In *1987 Fenceline Corridor Survey and Testing Program*, edited by E. Johnson, pp. 69-82. Lubbock Lake Landmark Quaternary Research Center Series 1. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

1989b Middle Holocene Drought on the Southern High Plains. *Quaternary Research* 31:74-82.

1989c The Blackwater Draw Formation (Quaternary): A 1.4-plus m.y. Record of Eolian Sedimentation and Soil Formation on the Southern High Plains. *Geological Society of America Bulletin* 101:1598-1607.

1990 Soils and Landscape Evolution of Eolian Plains: The Southern High Plains of Texas and New Mexico. In Soil and Landscape Evolution, edited by P. L. K. Knuepfer and L. D. McFadden. *Geomorphology* 3:489-515.

1993 Geoarchaeological Investigations at the Lubbock Lake Landmark, 1988 Season. In *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 1: The 1988 Work*, edited by E. Johnson, pp. 23-34. Lubbock Lake Landmark Quaternary Research Center Series 5. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Holliday, V.T. *(Continued)*
1995a Geoarchaeological Investigations at the Lubbock Lake Landmark, 1989 and 1990 Season. In *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 2: The 1989 and 1990 Work*, edited by E. Johnson, pp. 33-53. Lubbock Lake Landmark Quaternary Research Center Series 8. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock. In press.

1995b Late Quaternary Stratigraphy of the Southern High Plains. In *Ancient Peoples and Landscapes*, edited by E. Johnson, pp. 289-313. Museum of Texas Tech University, Lubbock.

1995c *Stratigraphy and Paleoenvironments of Late Quaternary Valley Fills on the Southern High Plains.* Memoir 186. Geological Society of America, Boulder. In press.

Holliday, V. T. and B.L. Allen
1987 Geology and Soils. In *Lubbock Lake: Late Quaternary Studies on the Southern High Plains*, edited by E. Johnson, pp. 14-21. Texas A&M University Press, College Station.

Holliday, V. T. and E. Johnson
1984 The Lubbock Lake 1983 Field Season. *Current Research in the Pleistocene* 1:11-13.

Holliday, V. T. and C. R. Welty
1981 Lithic Tool Resources of the Eastern Llano Estacado. *Bulletin of the Texas Archeological Society* 52:201-214.

Holliday, V. T., C. V. Haynes Jr., J. L. Hofman, and D. J. Meltzer
1994 Geoarchaeology and Geochronology of the Miami (Clovis) Site, Southern High Plains of Texas. *Quaternary Research* 41:234-244.

Holliday, V. T., E. Johnson, H. Haas, and R. Stuckenrath
1983 Radiocarbon Ages from the Lubbock Lake Site, 1950-1980: Framework for Cultural and Ecological Change on the Southern High Plains. *Plains Anthropologist* 28(101):165-182.

1985 Radiocarbon Ages from the Lubbock Lake Site: 1981-1984. *Plains Anthropologist* 30(110):277-291.

Honea, K.
1980 The Marks Beach Site, Stratified Paleoindian Site, Lamb County, Texas. *Bulletin of the Texas Archeological Society* 51:243-269.

Howard, E. B.
1935 Evidence of Early Man in North America. *The Museum Journal* 24:61-175. University of Pennsylvania Museum, Philadelphia.

Hughes, D. T.
1977 Analysis of Certain Prehistoric Bison Kills in the Texas Panhandle and Adjacent Areas. Unpublished Master's thesis, Department of Anthropology, University of Arkansas, Fayetteville.

Hughes, E.
1984 The Blackwater Draw Locality #1 Collection of the Museum, Texas Tech University: A Case Study in Conservation, Collection Management, and Data Reconstruction. Unpublished Master's thesis, Texas Tech University, Lubbock.

Hughes, J. T.
1962 Lake Creek: A Woodland Site in the Texas Panhandle. *Bulletin of the Texas Archeological Society* 32:65-84.

1971 The Canyon City Club Cave in the Panhandle of Texas. Unpublished report submitted to the Texas Historical Commission, Austin.

Hughes, J. T. and P. S. Willey (editors)
1978 *Archeology at MacKenzie Reservoir.* Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Jackson, M.
1976 Field notes on the excavation at XIT headquarters. On file at the Museum of Texas Tech University, Lubbock.

Jelinek, A. J.
1956 Field notes on the excavation in the brown sand wedge at the Clovis site. On file at the Vertebrate Paleontology Laboratory, Texas Memorial Museum, Austin.

Johnson, E.
1985 Current Developments in Bone Technology. In *Advances in Archaeological Method and Theory, Vol. 8*, edited by M. B. Schiffer, pp. 157-235. Academic Press, New York.

1986a Late Pleistocene and Early Holocene Vertebrates and Paleoenvironments on the Southern High Plains, U.S.A. *Géographie physique et Quaternaire* 40(3):249-261.

1986b The 1949 Bone Bed from the Carbonaceous Unit at Blackwater Draw Locality #1. *Current Research in the Pleistocene* 3:7-9.

1987a (Editor) *Lubbock Lake: Late Quaternary Studies on the Southern High Plains.* Texas A&M University Press, College Station.

1987b Cultural Activities and Interactions. In *Lubbock Lake: Late Quaternary Studies on the Southern High Plains*, edited by E. Johnson, pp. 120-158 Texas A&M University Press, College Station.

Johnson, E. *(Continued)*
1987c Paleoenvironmental Overview. In *Lubbock Lake: Late Quaternary Studies on the Southern High Plains*, edited by E. Johnson, pp. 90-99. Texas A&M University Press, College Station.

1989a Human Modified Bones from Early Southern Plains Sites. In *Bone Modification*, edited by R. Bonnichsen and M. H. Sorg, pp. 431-471. Center for the Study of the First Americans, University of Maine, Orono.

1989b (Editor) *1987 Fenceline Corridor Survey and Testing Program.* Lubbock Lake Landmark Quaternary Research Center Series 1. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

1991 Late Pleistocene Cultural Occupation on the Southern Plains. In *Clovis Origins and Adaptations*, edited by R. Bonnichsen and K. L. Turnmire, pp. 215-237. Center for the Study of the First Americans, Oregon State University, Corvalis.

1993 A Late Pleistocene Small Mammal Fauna from South Texas. *Current Research in the Pleistocene* 10:105-107.

1994 *Archaeological Survey Along the Mobil ESTE CO2 Pipeline Corridor from Denver City to Clairemont, Texas.* Lubbock Lake Landmark Quaternary Research Center Series 6. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

1995a Site Formation and Disturbance Processes at Lubbock Lake (Southern High Plains, U.S.A.) During the Terminal Pleistocene. In *Ancient Peoples and Landscapes*, edited by E. Johnson, pp. 315-340. Museum of Texas Tech University, Lubbock.

1995b (Editor) *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 2: The 1989 and 1990 Work.* Lubbock Lake Landmark Quaternary Research Center Series 8. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock. In press.

Johnson, E. and V. T. Holliday
1980 A Plainview Kill/Butchering Locale on the Llano Estacado - the Lubbock Lake Site. *Plains Anthropologist* 25(88):89-111.

1981 Late Paleoindian Activity at the Lubbock Lake Site. *Plains Anthropologist* 26(93):173-193.

1985 A Clovis-Age Megafaunal Processing Station at the Lubbock Lake Landmark. *Current Research in the Pleistocene* 2:17-19.

1986 The Archaic Record at Lubbock Lake. In Current Trends in Southern Plains Archaeology, edited by T. G. Baugh. *Plains Anthropologist Memoir* 22:7-54.

1987 Lubbock Lake Artifact Assemblages. In *Lubbock Lake: Late Quaternary Studies on the Southern High Plains*, edited by E. Johnson, pp. 100-119. Texas A&M University Press, College Station.

Johnson, E. and V. T. Holliday *(Continued)*

1989 Lubbock Lake: Late Quaternary Cultural and Environmental Change on the Southern High Plains, USA. *Journal of Quaternary Science* 4:145-165.

1993 Les Cultures Préhistoriques des Southern High Plains (USA) dans leurs Contextes Stratigraphique et Paléoclimatique. *L'Anthropologie* 97(4):651-673.

1995 Analysis of Paleoindian Features at the Clovis Site: New Data from Old Excavations. *Plains Anthropologist*, in press.

Johnson, E. and P. Shipman

1986 Scanning Electron Microscope Studies of Bone Modification. *Current Research in the Pleistocene* 3:47-48.

1993 Scanning Electron Microscope Analysis of Bone Modifications at Pendejo Cave, New Mexico. *Current Research in the Pleistocene* 10:72-75.

Johnson, E., V. T. Holliday, and L. A. Kreutzer

1987 Significance of Bone Orientation Data for the Clovis-age Bone Bed at the Lubbock Lake Landmark. *Current Research in the Pleistocene* 4:77-78.

Johnson, E., V. T. Holliday, and R. Neck

1982 Lake Theo: Late Quaternary Paleoenvironmental Data and New Plainview (Paleoindian) Date. *North American Archaeologist* 3(2):113-137.

Johnson, E., V. T. Holliday, M. J. Kaczor, and R. Stuckenrath

1977 The Garza Occupation at the Lubbock Lake Site. *Bulletin of the Texas Archeological Society* 48:83-109.

Johnson, E., V. T. Holliday, James Warnica, and Ted Williamson

1986 The Milnesand and Ted Williamson Paleoindian Sites, East-Central New Mexico. *Current Research in the Pleistocene* 3:9-11.

Johnson, E., V. T. Holliday, R. W. Ralph, R. Knudson, and S. Lupton

1987 Ryan's Site: A Plainview Occupation on the Southern High Plains of Texas. *Current Research in the Pleistocene* 4:17-18.

Katz, S. R. and P. R. Katz

1976 *Archeological Investigations in Lower Tule Canyon, Briscoe County, Texas.* Archeological Survey Report 16. Texas Historical Commission, Office of the State Archeologist, Austin.

Kelley, J. H.

1974 A Brief Resume of Artifacts Collected at the Lubbock Lake Site Prior to 1961. In History and Prehistory of the Lubbock Lake Site, edited by C. C. Black. *The Museum Journal* 15:43-78. Museum of Texas Tech University, Lubbock.

Knudson, R.

1983 *Organizational Variability in Late Paleo-Indian Assemblages.* Reports of Investigations 60. Laboratory of Anthropology, Washington State University, Pullman.

Kreutzer, L. A.

1986 Cultural vs. Natural Bone Deposition in Feature Area 2-1, Lubbock Lake Site. Unpublished Master's thesis, Department of Anthropology, University of Washington, Seattle.

1988 Megafaunal Butchering at Lubbock Lake, Texas: A Taphonomic Reanalysis. *Quaternary Research* 30(2):221-231.

Ladkin, N.

1993 Glass Seed Beads from the 1988 Excavations. In *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 1: The 1988 Work*, edited by E. Johnson, pp. 213-222. Lubbock Lake Landmark Quaternary Research Center Series 5. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

1995 Analysis of Ceramics and Glass Seed Beads. In Late *Holocene Investigations at the Lubbock Lake Landmark, Volume 2: The 1989 and 1990 Work*, edited by E. Johnson, pp. 313-330. Lubbock Lake Landmark Quaternary Research Center Series 8. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Lichti, S.

1994 Pastores Culture in the Southern Area of the Texas Llano Estacado. Report to the National Endowment for the Humanities Younger Scholars Program, Washington, D.C.

Lintz, C.

1995 Radiocarbon Dates from Chalk Hollow, A Stratified Site in the Texas Panhandle. Paper presented at the 53rd Annual Plains Anthropological Conference, Laramie, Wyoming.

Lotspeich, F. B. and M. E. Everhart

1962 Climate and Vegetation as Soil Forming Factors on the Llano Estacado. *Journal of Range Management* 15:134-141.

Lundelius, E. L. Jr., R. W. Graham, E. Anderson, J. Guilday, J. A. Holman, D. W. Steadman, and S. D. Webb

1983 Terrestrial Vertebrate Faunas. In *Late Quaternary Environments of the United States: The Late Pleistocene*, edited by S. C. Porter, pp. 311-354. University of Minnesota Press, Minneapolis.

Lynch, T. F.

1990 Glacial-Age Man in South America? A Critical Review. *American Antiquity* 55(1):12-36.

Mallouf, R. J.
1982 An Analysis of Plow-Damaged Chert Artifacts: The Brookeen Creek Cache (41HI86), Hill County, Texas. *Journal of Field Archaeology* 9(1):79-98.

Meltzer, D. J.
1991 Altithermal Archaeology and Paleoecology at Mustang Springs, on the Southern High Plains of Texas. *American Antiquity* 56:236-267.

Meltzer, D. J. and M. B. Collins
1987 Prehistoric Water Wells on the Southern High Plains: Clues to Altithermal Climate. *Journal of Field Archaeology* 14:9-28.

O'Brien, K.
1995 Historic and Modern Dumps at Lubbock Lake Landmark. In *Late Holocene Investigations at the Lubbock Lake Landmark, Volume 2: The 1989 and 1990 Work*, edited by E. Johnson, pp. 331-404. Lubbock Lake Landmark Quaternary Research Center Series 8. Museum of Texas Tech University, Lubbock Lake Landmark, Lubbock.

Parker, W.
1982 *Archeology at the Bridwell Site*. Crosby County Pioneer Memorial Museum and Crosby County Historical Commission, Crosbyton.

Parson, M. L.
1967 *Archeological Investigations in Crosby and Dickens Counties, Texas, During the Winter, 1966-1967*. Archeological Program Report 7. State Building Commission, Austin.

Peck, J., S. A. Tomka, and K. W. Kibler
1993 Investigations at 41KT51, the Headstream Site. In *Data Recovery at Justiceburg Reservoir (Lake Alan Henry), Garza and Kent Counties, Texas: Phase III, Season 2*, by D. K. Boyd, J. Peck, S. A. Tomka, and K. W. KIbler, pp. 35-86. Reports of Investigations 88. Prewitt and Associates, Inc., Austin.

Pope, L.
1991 The Hogue Site (41TY2). *Transactions of the Regional Archeological Symposium for Southeastern New Mexico and Western Texas* 27:3-4.

Rathjen, F. W.
1973 *The Texas Panhandle Frontier*. M. K. Brown Range Life Series 12. University of Texas Press, Austin.

Reeves, C. C. Jr.
1972 Tertiary-Quaternary Stratigraphy and Geomorphology of West Texas and southeastern New Mexico. In *Guidebook for East-Central New Mexico*, edited by V. Kelley and F. D. Trauger, pp. 108-117. New Mexico Geological Society, Albuquerque.
1976 *Caliche: Origin, Classification, Morphology and Uses*. Estacado Books, Lubbock.

Riggs, A. D. Jr.
1972 The Petree Site: SPAS-MT-30. *Transactions of the Regional Archeological Symposium for Southeastern New Mexico and Western Texas* 7:1-20.

Roberts, F. H.H.
1942 *Archaeological and Geological Investigations in the San Jon District, Eastern New Mexico*. Smithsonian Miscellaneous Collections 3:1-39. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Runkles, F. A.
1964 The Garza Site: A Neo-American Campsite Near Post, Texas. *Bulletin of the Texas Archeological Society* 35:101-115.

Runkles, F. A. and E.D. Dorchester
1987 The Lott Site: A Late Prehistoric Site in Garza County, Texas. *Bulletin of the Texas Archeological Society* 57:83-115.

Russell, R.
1945 Climates of Texas. *Annals of the Association of American Geographers* 35:37-52.

Sabin, T. J. and V. T. Holliday
1995 Playas and Lunettes on the Southern High Plains: Morphometric and Spatial Relationships. *Annals of the Association of American Geographers* 95:286-305.

Saunders, J. J.
1980 A Model for Man-Mammoth Relationships in Late Pleistocene North America. *Canadian Journal of Anthropology* 1(1):87-98.

Saunders, J. J. and E. B. Daeschler
1994 Descriptive Analyses and Taphonomical Observations of Culturally-Modified Mammoths Excavated at "The Gravel Pit," Near Clovis, New Mexico in 1936. *Proceedings of the Academy of Natural Sciences of Philadelphia* 145:1-28.

Saunders, J. J., G. A. Agogino, A. T. Bouldurian, and C. V. Haynes Jr.
1991 A Mammoth-Ivory Burnisher-Billet from the Clovis Level, Blackwater Locality No. 1, New Mexico. *Plains Anthropologist* 36(137):359-363.

Saunders, J. J., C. V. Haynes Jr., D. Stanford, and G. A. Agogino
1990 A Mammoth-Ivory Semifabricate from Blackwater Locality No. 1, New Mexico. *American Antiquity* 55(1):112-119.

Sellards, E. H.
1938 Artifacts Associated with Fossil Elephant. *Bulletin of the Geological Society of America* 49:999-1010.

Sellards, E. H. *(Continued)*
1952 *Early Man in America*. University of Texas Press, Austin.

Sellards, E. H., G. L. Evans, and G. E. Meade
1947 Fossil Bison and Associated Artifacts from Plainview, Texas. *Bulletin of the Geological Society of America* 58:927-954.

Shawn, R. A.
1975 The Bull Hill Site Excavation. *Transactions of the Regional Archeological Symposium for Southeastern New Mexico and Western Texas* 10:1-48.

Smith, G. I. and F. A. Street-Perrott
1983 Pluvial Lakes of the Western United States. In *Late-Quaternary Environments of the United States, Vol. 1: The Late Pleistocene*, edited by S. C. Porter, pp. 190-212. University of Minnesota Press, Minneapolis.

Speer, R.
1986 History of the Plainview Site. *Guidebook to the Archaeological Geology of Classic Paleoindian Sites on the Southern High Plains, Texas and New Mexico*, edited by V. T. Holliday, pp. 52-59. Department of Geography, Texas A&M University, College Station.

Speth, J. D. and W. J. Parry
1978 *Late Prehistoric Bison Procurement in Southeastern New Mexico: The 1977 Season at the Garnsey Site (LA-18399)*. Technical Reports 8. University of Michigan, Museum of Anthropology, Ann Arbor.

1980 *Late Prehistoric Bison Procurement in Southeastern New Mexico: The 1978 Season at the Garnsey Site (LA-18399)*. Technical Reports 12. University of Michigan, Museum of Anthropology, Ann Arbor.

Taylor, A. J.
1980 A Survey of New Mexican Pastores in the Texas Panhandle-Plains 1876-1886. Texas Historical Foundation, Austin.

Todd, L. C., J. L. Hofman, and C. B. Schultz
1990 Seasonality of the Scottsbluff and Lipscomb Bison Bonebeds: Implications for Modeling Paleoindian Subsistence. *American Antiquity* 55(4):813-827.

Tunnell, C. D.
1964 Two Burials from the Jim Arnold Site in Northwest Texas. *Bulletin of the Texas Archeological Society* 35:83-94.

Wedel, W. R.
1975 Chalk Hollow: Culture Sequence and Chronology in the Texas Panhandle. *Actas del XLI Congreso Internacional de Americanistas* 41:270-278.

Wendorf, F.
1961 *Paleoecology of the Llano Estacado*. Museum of New Mexico Press, Santa Fe.

Wendorf, F. and J. J. Hester (editors)
1975 *Late Pleistocene Environments of the Southern High Plains*. Publication of the Ft. Burgwin Research Center 9. Department of Anthropology, Southern Methodist University, Dallas.

West, F. H.
1983 The Antiquity of Man in America. In *Late-Quaternary Environments of the United States, Vol. 1: The Late Pleistocene*, edited by S. C. Porter, pp. 364-382. University of Minnesota Press, Minneapolis.

Wheat, J. B.
1955 Two Archeological Sites near Lubbock, Texas. *Panhandle-Plains Historical Review* 28:71-77.

1972 *The Olsen-Chubbuck Site. A Paleo-Indian Bison Kill*. Memoirs 26. Society for American Archaeology, Washington, D.C.

Willey, P. S. and J. T. Hughes
1978 The Deadman's Terrace Site. In *Archeology at MacKenzie Reservoir*, edited by J. T. Hughes and P. S. Willey, pp. 205-225. Archeological Survey Report 24. Office of the State Archeologist, Texas Historical Commission, Austin.

Word, J. H.
1963 Floydada Country Club Site 41FL1. *South Plains Archeological Society Bulletin* 1:37-63.

1965 The Montgomery Site in Floyd County, Texas. *South Plains Archeological Society Bulletin* 2:55-102.

1980 Who Were the Pastores? *Floyd County Historical Museum Newsletter* 1:1-2.

1991 The 1975 Field School of the Texas Archeological Society. *Bulletin of the Texas Archeological Society* 60:57-106.

Word, J. H. and A. Fox
1975 The Codgell Burial in Floyd County, Texas. *Bulletin of the Texas Archeological Society* 46:1-63.

Wormington, H. M.
1957 *Ancient Man in North America*. Popular Series 4. Denver Museum of Natural History, Denver.

The Lower Pecos River Region of Texas and Northern Mexico

Solveig A. Turpin

ABSTRACT

This paper focuses on major behavioral trends and changes in the prehistoric and historic archeological record of the Lower Pecos River region of Texas and northern Mexico. Of particular importance is the long record of hunter-gatherer adaptations in the region, marked by spectacular prehistoric rock art styles and a commonality in material culture dominated by well-preserved wood and plant artifacts from the dry rock shelters.

INTRODUCTION

The Lower Pecos region, the smallest of the defined cultural regions in Texas, encompasses an elliptical area that centers on the mouth of the Pecos River and extends perhaps 150 km north and south of the Rio Grande, from the vicinity of modern-day Sheffield to the Valle de la Babia in Coahuila, Mexico (Figure 1). The east-west axis roughly follows the Rio Grande from Del Rio-Ciudad Acuna to beyond the historically famous hamlet of Langtry.

Traditionally, the geographical boundaries of the region have been defined by the extent of the most distinctive of four prehistoric rock art styles, the Pecos River style, and by a commonality in material culture recovered from dry rock shelters, the latter partly a product of preservation. The concept of a Lower Pecos cultural area is in fact a construct based on the florescence of regionally specific characteristics, such as the distinctive Pecos River style pictographs and projectile points that bear local names—Langtry, Val Verde, and Pandale—between 5000 and 3000 years ago, during the Middle Archaic period. Before and after the Middle Archaic, the Lower Pecos shares many of its traits with adjacent regions, apparently affected by cultural influences radiating from Texas and northern Mexico. Thus, the trajectory of Lower Pecos cultural adaptations can be visualized as an ellipse whose apogee is the Middle Archaic period.

Typically, hunter-gatherer adaptations are strongly correlated to environmental factors, and the Lower Pecos is no exception. The climatic sequence has been reconstructed from fauna (Dibble and Lorrain 1968; Lundelius 1984); pollen (Bryant 1966, 1969; Story and Bryant 1966; Bryant and Shafer 1977); macroflora (Dering 1979); coprolites (Williams Dean 1978; Stock 1983); flood sequences (Patton and Dibble 1982); and ethnohistory (Turpin 1987a). The cool mesic Late Pleistocene savanna, capable of supporting herds of now-extinct megafauna, succumbed to increasing aridity some 9000 years ago. Semi-desert conditions prevailed, reaching their peak about 5000 years ago and relaxing around 3000 B.P. during a short but influential mesic interlude. A return to aridity was again broken late in prehistory or early history, until the fragile balance was tipped by the resurgence of the drying trend, and the introduction of domestic herd animals in the 1880s.

Topographically, the Lower Pecos region is flat to rolling rangeland dissected by entrenching tributaries to the three major rivers—the Devils, the Pecos, and the Rio Grande, their confluences now inundated by Amistad Reservoir. Although all were (and are) important sources of water, and by extension faunal and floral resources, the three differ in potability. The saline Pecos, originally called the Salado, the muddy Rio Grande, and the clear, spring-fed Devils, were undoubtedly the nucleus of prehistoric occupation but springs, seeps, and *tinajas* (potholes) permitted exploitation of upland and tributary resources that apparently waxed and waned in intensity depending upon climatic conditions. The poorly known southern half of the Lower Pecos region, between the Rio Grande and the Sierra del Carmen, is deficient in

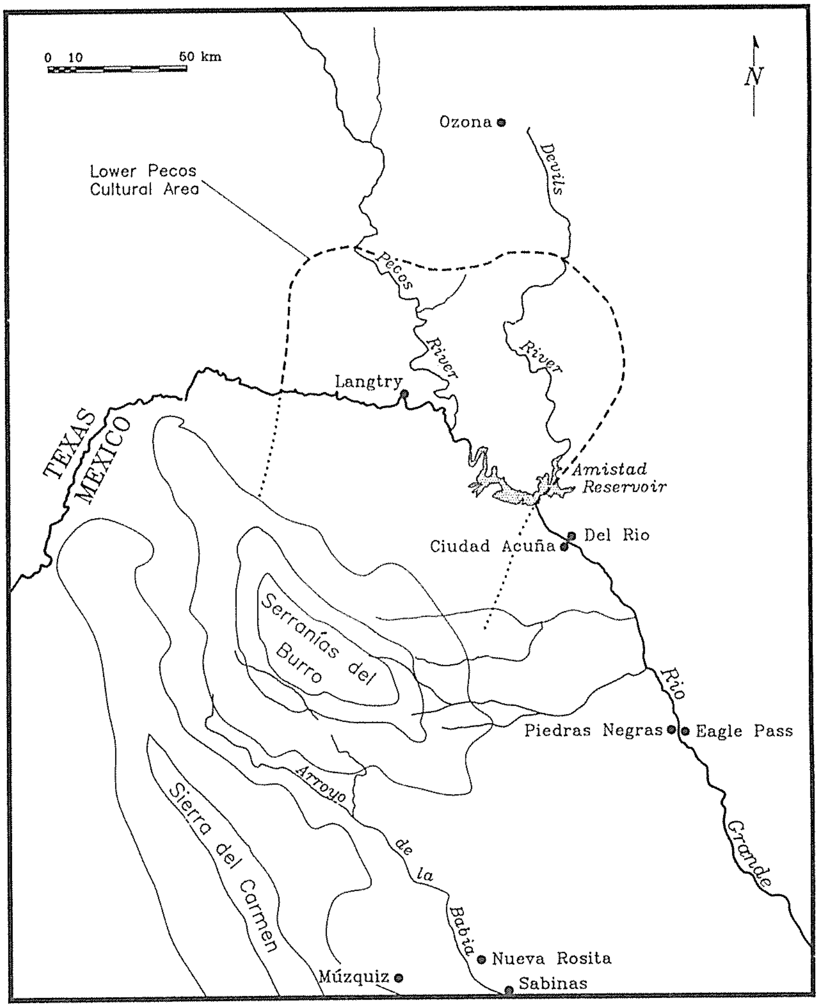


Figure 1. Map of the Lower Pecos cultural area with its southern limits undefined.

permanent water sources, forcing its inhabitants to develop a different adaptive strategy.

Geologic factors that influenced prehistoric occupation include the numerous rock shelters hollowed from the sheer limestone cliffs (Figure 2), the copious quantities of lithic raw material available as gravels or eroding chert beds, and the strictures imposed on accessibility between upland and riverine resources. The prehistoric settlement pattern reflects the high incidence of rock shelters on the Pecos River and the Rio Grande, and their lesser presence on the Devils River where huge open camps are found at the mouths of every tributary. Erosion, exacerbated by over-grazing and modern droughts, has reduced the soil cover in historic times; the end result is evident in the siltation of Amistad Reservoir. The modern flora and fauna are similarly a product of livestock husbandry, but the vegetational communities retain the basic components utilized during much of prehistory.

Archeological research in the Lower Pecos region can be divided into three eras: the antiquarian search for museum specimens that prevailed in the 1930s; the salvage program in anticipation of the construction of Amistad Reservoir (then Diablo Reservoir) between 1958 and 1969; and the current resurgence of individual and privately-funded research. The last 15 years have seen rock shelter excavations and broad area surveys, but the most recent trend is a phenomenal interest in the diverse body of Native American rock art preserved in the dry shelters and overhangs. The published and unpublished information generated by 60 years of research is so abundant that the reader is often directed to summary articles rather than primary sources, a lamentable practice that often leads to bibliographic drift, but one mandated by the number of citable resources.

Over 275 radiocarbon dates contribute to one of the most precise regional chronologies in Texas (Table 1), although several nomenclatures have been proposed (see Turpin 1991a). The one used to guide this overview was first proposed by Dibble (in Prewitt 1983) and later refined as more assays were generated. The traditional quadrapartite division into Paleoindian, Archaic, Late Prehistoric, and Historic periods is expanded into 11 subperiods (including one phase and one probable horizon) for the prehistoric era, leaving the historic period intact.

The culture history of the Lower Pecos is a microcosm of hunting and gathering societies

Figure 2. A typical rock shelter overlooking the Rio Grande (41VV656).

PALEOINDIAN PERIOD, AURORA SUBPERIOD, PRE-12000 B.P.

The first inhabitants of the Lower Pecos region apparently arrived on the banks of the Rio Grande sometime between 12,000 and 14,000 years ago, bearing a fully developed cultural system that centered on the procurement of big game. Scattered and burned horse, camel, bison, and bear bones in the small site of Cueva Quebrada are the first radiocarbon-dated evidence of Paleoindian occupation of the region (Lundelius 1984). Bone beds of equivalent age at Bonfire Shelter (Figure 3) undoubtedly represent the intermittent slaughter and butchering of elephant, camel, horse, and

throughout the world, alternating between an emphasis on a hunting economy to one dominated by gathering. The stamp of arid lands adaptation is seen in the material culture, technology, and the settlement patterns, which are aspects of prehistoric lifeways most influenced by environment and economics. The excellent preservation of normally perishable items, and the diverse and elaborate body of art, both mural and mobiliary, takes us beyond the mundane into the political, social, and religious spheres of hunter and gatherer lifeways.

Two competing models of prehistoric adaptation have been generated from two different perspectives on the material record. One school postulates a static Archaic continuum that endured for 9000 years (Kirkland and Newcomb 1967; Shafer 1976, 1981, 1986; Shafer and Bryant 1977); my perceptions are one of both abrupt and gradual changes within the parameters of hunter and gatherer society (Turpin 1990a). These diametrically opposed viewpoints are in part a function of research focus. The first is derived from the natural environment, and such material classes as food, fiber, coprolites, and stone tools, and can be theoretically described as an ecological, functional, or adaptive model. The latter perspective is conditioned by an emphasis on less tangible items and processes, including rock art, mortuary customs, and settlement patterns.

Table 1. Periods in the Chronology of the Lower Pecos Region

Period	Subperiod	Radiocarbon Years B.P.
Paleoindian		<12,000-9,800
	Aurora	14,500-11,900
	Bonfire	10,700-9,800
Late Paleoindian		9,400-9,000
	Oriente	9,400-8,800
Early Archaic		9,000-6,000
	Viejo	8,900-5,500
Middle Archaic		6,000-3,000
	Eagle Nest	5,500-4,100
	San Felipe	4,100-3,200
Late Archaic		3,000-1,000
	Cibola	3,150-2,300
	Flanders	2,300-?
	Blue Hills	2,300-1,300
Late Prehistoric		1,000-350
	Flecha	1,320-450
	Infierno	450-250
Historic		350-0

Figure 3. Excavation in the lowest bone beds at Bonfire Shelter (41VV218).

bison, but the absence of stone tools weakens the case (Bement 1986; Dibble and Lorrain 1968). Although the perspective afforded by these two sites is perforce limited, and perhaps biased, both are compatible with the widely held concept of Paleoindians as big game hunters exploiting the specialized environment of the terminal Pleistocene.

PALEOINDIAN PERIOD, BONFIRE SUBPERIOD (10,700 TO 9800 B.P.)

More definitive is the massive accumulation of now-extinct bison associated with Folsom and Plainview dart points in Bone Bed 2 at Bonfire Shelter (Dibble and Lorrain 1968). On at least three occasions, herds totalling an estimated 120 animals were driven over the cliff above the shelter, tumbling into the interior where they were butchered and processed. Radiocarbon dates confirm an age range centering on 10,000 B.P., concurrent with a mesic period that Bryant (1966) called the Medina stage. The flood sequence at Arenosa Shelter, near the mouth of the Pecos River, shows a series of fine-grained sedimentary layers indicative of a humid interlude predating 9500 B.P. (Patton and Dibble 1982).

Bone Bed 2 at Bonfire Shelter is the oldest known example of the jump technique of killing herd animals, and this presumably implies organizational skills consistent with coordinated group procurement strategies. More importantly, the big game hunting strategies and the characteristic projectile point styles incorporate the Lower Pecos into the Paleoindian sphere as it was expressed across North America just prior to the extinction of many of these species.

LATE PALEOINDIAN PERIOD, ORIENTE SUBPERIOD (9400 TO 8800 B.P.)

Although commonly called the Late Paleoindian period because of continuities in lithic technology, the Oriente period sees the first tentative beginnings of the Archaic adaptation that was to become the hallmark of the Lower Pecos region. Johnson (1964) first noticed the mixture of Archaic and Paleoindian cultural traits at Devils Mouth where the economy was not noticeably oriented towards big game hunting. Broad resource procurement was evidenced at Baker Cave in deposits of this age (Hester 1983), and the fiber industry was apparently well underway (Andrews and Adovasio 1980), at least in northern Mexico. These technological and economic shifts are appropriate responses to the onset of the long drying trend that Bryant (1966) called the Stockton Stage.

EARLY ARCHAIC PERIOD, VIEJO SUBPERIOD (8900 TO 5500 B.P.)

The Early Archaic period, or Viejo subperiod, as currently defined, is far too long and amorphous to be considered a meaningful cultural unit. Spanning some 3400 years, the period sees the entrenchment of many of the traits that sum to the Archaic tradition that defines the Lower Pecos region. The Viejo subperiod occupies the latter half of Bryant's (1966) Stockton Stage, the 5000-year long trend to aridity that presumably conditioned the adaptive strategies of Lower Pecos people. Localized phenomena, observed at Black Cave (Turpin 1982) and Seminole Sink (Turpin 1988), suggest intermittent periods of erosional intensity sometime prior to 6800 B.P., perhaps connected to the onset of the drying trend (Turpin 1991a:28).

During the Viejo subperiod, rock shelter habitation becomes the norm with sites such as Hinds Cave yielding evidence of segmented space; that is, the rock shelter has activity areas defined by interior burned rock middens, prickly pear floors, latrines, and perishable items (Lord 1984). Dietary information gained from coprolite analysis implies an extremely successful adaptation to an increasingly arid environment (Williams Dean 1978), presumably through a reliance on desert succulents. Brown (1991:118) has summarized the evidence for the introduction of sotol and agave (likely lecheguilla) into rock shelter deposits during the Early Archaic period.

These same plants are the basis of the Lower Pecos fiber industry and the source of raw materials for clothing, matting, basketry, sandals, and twine (Andrews and Adovasio 1980; McGregor 1992; Schuetz 1956, 1963). Commonalities with the northern Mexican fiber assemblages, and continuity over time, led Adovasio (Andrews and Adovasio 1980) to postulate a Coahuilan origin or affiliation.

The projectile points considered characteristic of this subperiod, although they bear localized names such as Baker and Bandy, are widespread throughout Central Texas where they are known as Uvalde and Martindale (Turner and Hester 1993). A number of other generic projectile point types, called by descriptive terms such as Early Barbed, Early Stemmed, and Early Corner-Notched, remain ambiguously defined.

The one mortuary site of this age that has been excavated (Turpin 1988) has cultural analogs in Coahuila and the karst regions of Texas. A skeletal population of 21 individuals recovered from a vertical shaft cave, Seminole Sink, suggested that the people experienced only temporary, perhaps seasonal, dietary stress and little trauma (Marks et al. 1988). However, dental pathologies were common and were accompanied by early tooth loss that probably resulted from a high intake of sugar and carbohydrates.

The mixture of young and old, male and female, in this one site, hints at an egalitarian society where all ages and both genders were accorded the same treatment after death. The broad distribution of this mortuary practice can be attributed to both the physical convenience afforded by a natural tomb, and the psychological value of returning the dead to the earth (Turpin 1988).

Little else is known about the social structure and world view of these Early Archaic people. Two forms of portable art that characterize the Archaic period as a whole may have their beginnings at this time: painted pebbles and unbaked or poorly fired clay figurines. Neither form of art is well-dated, but the painted pebbles have been stylistically sequenced and placed within an Archaic context that spans all the subdivisions (Parsons 1986; see also Mock 1987). These flat, smooth river rocks are systematically decorated with a limited number of motifs that often portray human attributes (Parsons 1986; Mock 1987). In fact, the pebble often reflects the organization of the human body with eyes in the upper, narrower end, and identifiable genitalia, usually female, in the lower, wider end. It has been suggested that the pebble served as a substitute for real people in curing and fertility rites or as personal, as opposed to public, ritual paraphenalia.

Clay figurines are less common but they too are miniature humans, with pronounced female sexual characteristics but headless (Shafer 1975; Chandler et al. 1994). They are even more poorly dated than the painted pebbles, in part due to their rarity and in part due to poor provenience. They are only included here because they, like the painted pebbles, are Archaic phenomena of ambiguous age.

THE MIDDLE ARCHAIC PERIOD, EAGLE NEST SUBPERIOD (5500 TO 4100 B.P.)

About 5500 B.P., the beginnings of an insularity that reaches its peak in the subsequent San Felipe subperiod are signalled by the appearance of Pandale projectile points, a distinctly beveled style with a limited regional distribution. This shift in lithic technology coincided with the culmination of Bryant's (1966) Stockton Stage in an extremely hot, dry interlude he called the Ozona Erosional after disconformities in strata at Arenosa Shelter (Dibble 1967) and the Devils Mouth site (Johnson 1964). At about the same time, Black Cave suffered another massive erosional event that flushed the deposits, exposing Pleistocene-age eboulis (Turpin 1982).

At Baker Cave, Brown (1991:123) observed a shift to the labor-intensive processing of lecheguilla, sotol, and yucca around 5000 B.P., resulting in

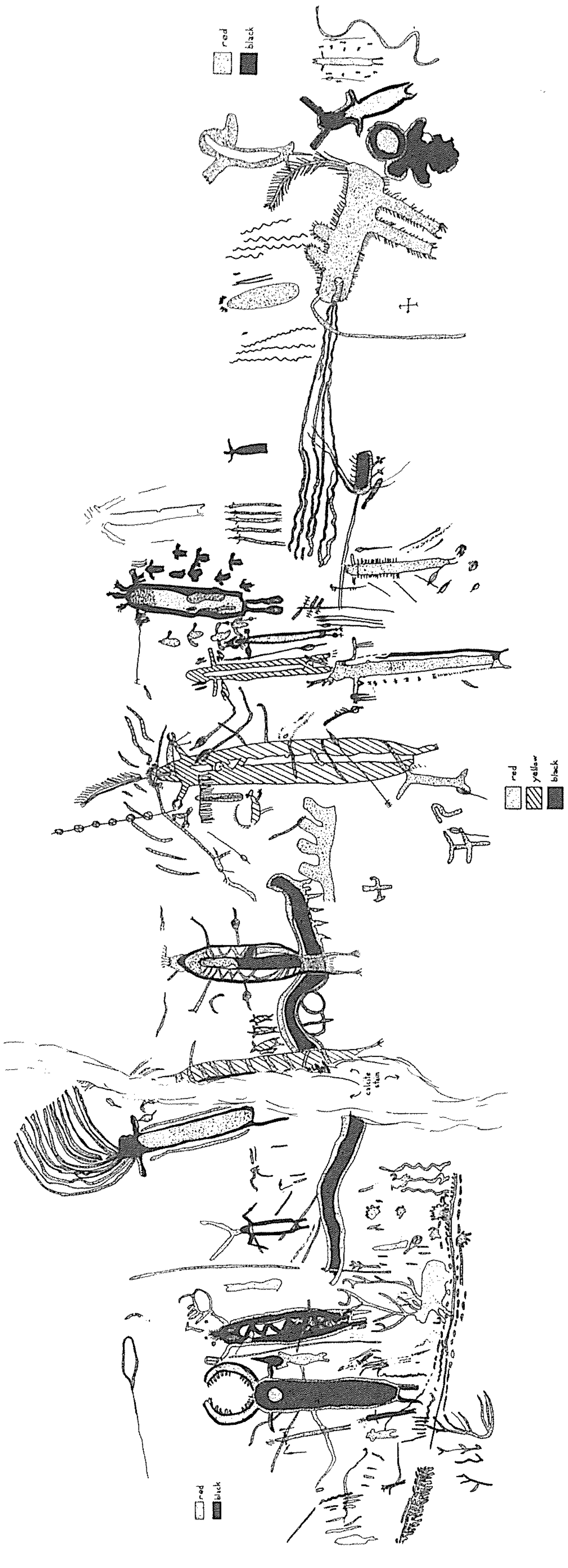


Figure 4. Pecos River style rock art. This panel (41VV1230) was recorded in 1990 during a survey along the Devils River, and recorded in pen and ink by David G. Robinson. Tallest shaman figure is approximately 1.25 meters tall.

what he called an *economy of scale*. Brown (1991:123) suggests that considerable energy was invested in food production as a least-risk response to environmental deterioration. Implied are increased diet breadth, group mobility, and community size.

MIDDLE ARCHAIC PERIOD, SAN FELIPE SUBPERIOD (4100 TO 3200 B.P.)

Signs of increasing regionalization during the San Felipe subperiod include the further refinement of local projectile point styles, such as Langtry, Val Verde, and Arenosa dart points, and the emergence of the first and most complex of four prehistoric pictograph styles, the Pecos River style (Figure 4). These monumental polychrome pictographs rank among the oldest, yet most elaborate, religious art forms in the New World (Kirkland and Newcomb 1967; Turpin 1994a, 1994b). The central characters are shamans, the religious practicioners of hunting and gathering societies throughout the world. Anthropomorphic figures with animal characteristics such as feathers, wings, claws, fur, and horns are equipped with atlatls, darts, fending sticks, and enigmatic pouches that hang from their elbows. The mountain lion, colloquially called panther, figures prominently in the Pecos River style bestiary, which also includes deer, birds, fish, and fantastic insects.

At least three primary tenets of shamanism are expressed in the art: the power of magical flight (Turpin 1994a); the ability to assume the form of an animal familiar (Turpin 1994b); and the concept of parallel supernatural and natural worlds accessible through a central axis (Turpin 1994a) or holes in the earth (Turpin 1992a, 1992b). The size, complexity, and accessibility of the paintings indicate they were produced by a group effort for public consumption; their consistency in theme and style demonstrates that a unified belief system prevailed over the entire Lower Pecos area as currently defined; and their redundancy evidences their role in ritual performances.

Regionalization and intensified ritual activity are an unlikely correlate to increased flooding of the Pecos River (Patton and Dibble 1982), an environmental phenomenon probably related to the denudation of the landscape during this hot, dry, climatic interval (Figure 5). Component counts (Marmaduke 1978) and relative frequencies of projectile point styles (Turpin 1990b) indicate two shifts in the settlement pattern: increases in population density along the rivers and in the number of upland sites presumably devoted to exploitation of food resources.

Such a conjunction of events can parsimoniously be explained as a result of people adapting their economic and social strategies to desertification of the natural environment. As upland water sources dwindled, the general population concentrated along the three major rivers, occupying rock shelters and open camps where their domestic debris accumulated rapidly. Desert succulents, the mainstay of the diet, may well have increased at the expense of grasses and trees, but the manner in which they were obtained changed from band foraging to task-oriented collecting. Small groups spread out across the landscape, gathering foodstuffs and returning them to the home base, thus proliferating upland work stations and temporary camps. The increase in population density, but not numbers of people, presented social challenges that

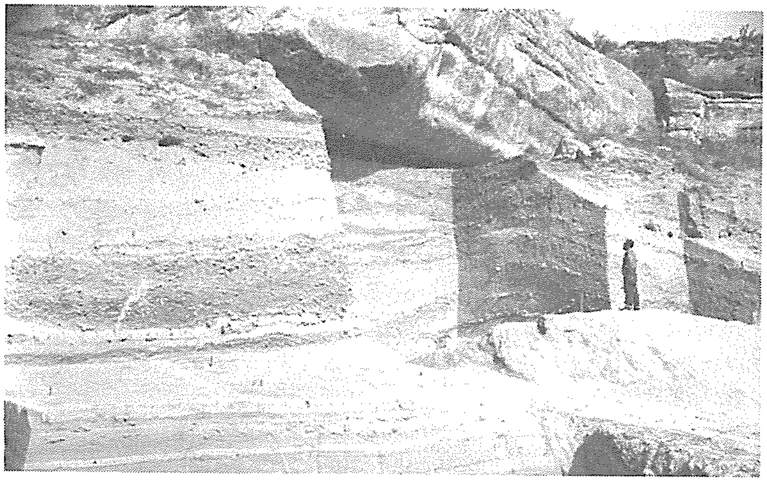


Figure 5. Intermittent flooding of the Pecos River left a detailed stratigraphic record at Arenosa Shelter (41VV99), excavated prior to Amistad Dam closure.

were met by the institution of ritual communication that was manifested in the rock art.

LATE ARCHAIC, CIBOLA SUBPERIOD (3150 TO 2300 B.P.)

The beginning of the Late Archaic period, aptly named the Cibola subperiod, is signalled by abrupt economic, technological, and site distribution changes that in turn coincide with an apparent break in the climatic trend toward aridity that transpired some 3000 years ago. The rapid spread of cultural traits that demonstrate spatial continuities meets Willey and Phillips' (1958) definition of a horizon. In Bryant's (1966) original climatic reconstruction, this interlude was called the Frio Interval to recognize the resurgence of pollen types typical of cooler, more mesic conditions. The faunal evidence from Bonfire Shelter is incontrovertible. The uppermost bone bed produced the estimated remains of approximately 800 modern bison, accompanied by broad-bladed dart points usually considered to be Central Texas types, and securely radiocarbon-dated to around 2600 years ago (Dibble and Lorrain 1968). Bison bones have also been recovered in lesser amounts at Eagle Cave, Castle Canyon, Arenosa Shelter, and Skyline Shelter in deposits of approximately the same age. A tentative shift in settlement patterning is suggested by the distribution of characteristic projectile point styles such as Marshall, Castroville, and Montell. Relative percentages decrease in large stratified rock shelters and increase at the Devils Mouth site, an open terrace camp, a trend that is consistent with expectations for an economic strategy that centered on mobile food sources.

Dibble (Dibble and Lorrain 1968) provided both environmental and cultural explanations for the evidence from Bonfire Shelter. In his model, cooler, wetter climatic conditions permitted the grasslands of the Great Plains to recolonize the Lower Pecos, bringing with them large herds of migratory game animals and their attendant hunters bearing their characteristic arms. Ethnographic sources of much later date describe coordinated winter bison hunts near the mouth of the Pecos and along the Devils River, so perhaps the in-migrations of the Late Archaic were seasonally scheduled events as well.

Based on the depiction of bison hunts and atlatls in the miniature Red Linear pictographs, I have tentatively correlated the paintings to the Late Archaic intrusion of the bison hunters (Turpin 1984, 1990c). Using a much smaller sample of pictographs, Newcomb (Kirkland and Newcomb 1967) also attributed them to the Archaic period, although Gebhard (1965) thought they were more recent (ca. A.D. 900 to A.D. 1400) and perhaps related to Kokopelli, the hump-backed flute player of the American Southwest. The one experimental radiocarbon assay, run on samples from one of the presumed bison painted at Cueva Quebrada, produced a date of 1280 B.P. (Ilger et al. 1994), placing it within the closing centuries of the Late

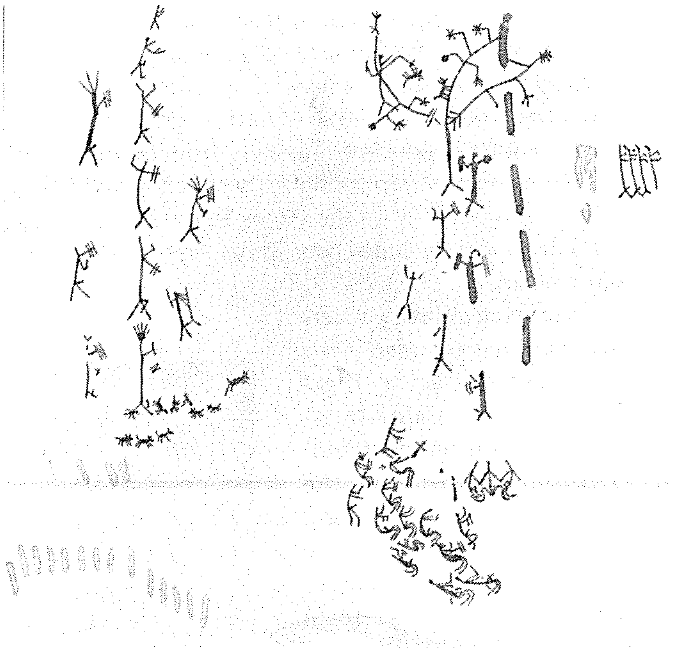


Figure 6. Forrest Kirkland's rendition of the Red Linear rock art type site (41VV201) in Seminole Canyon State Historical Park. Processions of headressed warriors are a key characteristic of this style. The group at lower right apparently depicts a ritual connected with childbirth, another common Red Linear rock art theme. Frost wedging has seriously damaged this panel, eliminating whole figures and their context. Figures average less than 10 cm tall (reproduced courtesy of the Texas Memorial Museum, University of Texas at Austin).

Archaic period but well beyond the end of the Cibola subperiod.

Other favored themes in this style are processions of headdressed warriors sometimes apparently involved in conflict with other males (Figure 6), and deer hunting scenes that incorporate geometric designs that may imply traps or nets. Several secluded sites are devoted to scenes of sexual intercourse, pregnancy, and birth, perhaps hinting that the paintings were part of puberty rites that prepared the initiates for adult life. The Red Linear artists were capable of endowing these tiny crude stick figures with animation and vivacity not found in any of the other Lower Pecos pictograph styles. This artistic skill and the consistency in theme, style, and minor details, displayed from the Devils River to the Rio Grande west of the Pecos, suggest that the conventions were developed in another medium, such as hide painting, and brought into the Lower Pecos in fully developed form. Whether that introduction coincided with the demonstrated movement of people off the Plains in Cibolo times remains hypothetical.

Although little research attention has been devoted to the issue, the changes in resource distribution and the influx of new people must have had a fragmenting effect on the resident population whether they coexisted, migrated, or were absorbed. When the grasslands retreated, the vacuum was filled by desert-adapted people, apparently with affiliations to northern Mexican groups.

THE LATE ARCHAIC PERIOD, FLANDERS SUBPERIOD (ca. 2300 B.P.)

The Flanders subperiod of the Late Archaic is the most elusive time period in the regional chronology. The hallmark of the period, the Shumla dart point style, has antecedents in Nuevo Leon and Coahuila where it is found in deposits dating from 3100 to 1850 years ago, reaching its peak popularity about 2300 B.P. (Turpin 1991a). The few dates available from rock shelter excavations north of the Rio Grande are ambiguous. Bryant (1966) recognized a return to aridity that he called the Juno Interval, so presumably the Flanders subperiod people were practicioners of the ancient exploitation strategies of Early and Middle Archaic development. There can be little doubt that people using Shumla dart points left a substantial material record in many sites, stratigraphically above the Cibola deposits, but the most prolific sites have been the most poorly excavated. A reasonable hypothesis is that northern Mexican people were able to expand into the Lower Pecos once environmental conditions stabilized to their liking. Little more can be said until excavations concentrate on deposits of this age.

LATE ARCHAIC PERIOD, BLUE HILLS SUBPERIOD (2300 TO 1300 B.P.)

Compared to the regional insularity of the Middle Archaic period and the distinctive spread of the Cibola horizon, the Blue Hills period is diffuse. The characteristic projectile points, primarily Ensor and Frio, are shared across broad expanses of Texas (see Prewitt, this volume). The fiber industry is somewhat elaborated by the appearance of more ornate painted mats as part of a mortuary complex that is dominated by bundled burials. Although some evidence suggests that bundled burials are a generalized Archaic trait, most of the datable examples are of Blue Hills age (Turpin et al. 1986). Flexed corpses, sometimes lashed into a fetal position, were wrapped in mats, and tied into a compact package that was then interred in dry rock shelter deposits. Ornaments and items of clothing are sometimes preserved and, on rare occasions, tissue, skin, hair, and flesh are naturally mummified (Huebner 1995). Contrary to expectations voiced by a number of anthropologists, infants were apparently accorded special treatment, their tiny bodies wrapped in rabbit skin robes, deer skins, and mats, and placed on grass beds, often with their broken cradle boards.

Based on a single experimental radiocarbon date (Ilger et al. 1994), it is possible that the Red Linear pictographs, described in a preceding section, are contemporaenous. A response to the cyclical return to aridity may be mirrored in yet another peak in the number of components (Marmaduke 1978) and projectile point frequencies (Turpin 1990a) attributable to this period. The number of upland sites bearing Late Archaic points coupled with an increase in the proportionate number of unifaces, usually considered as vegetal material processing tools, has led to speculation that there was an escalating reliance on desert plants. A higher recovery of fish bones and scales in some shelter deposits suggests exploitation of previously less important food sources, but at other sites, such as Skyline Shelter, riverine resources were always a significant component of the diet.

The terminal Late Archaic blended into the Late Prehistoric period with little evidence of severe disjunctions in the cultural trajectory. Dart points and arrow points coexist in strata dated to the transitional centuries, perhaps in part because these same upper deposits are generally the most disturbed.

LATE PREHISTORIC PERIOD, FLECHA SUBPERIOD (1320 TO 450 B.P.)

The Late Prehistoric period is marked by changes in artifact types, site types, settlement patterns, exploitation strategies, rock art styles, and mortuary customs. The temptation to credit these innovations to an influx of a singular people is dampened by the lack of stratified or well-dated single component sites that might coordinate or sequence these events.

Sometime between A.D. 600 and A.D. 900, the bow and arrow were adopted in the Lower Pecos region, signalling the advent of the Flecha subperiod (Turpin 1991a:Table 1.12). Unfortunately, the upper levels of most rock shelters are highly disturbed, so it is difficult to distinguish components based on arrow point styles, none of which are unique to the Lower Pecos region.

Although the Late Prehistoric people continued to take advantage of the natural shelter offered by caves and overhangs, they apparently began processing desert succulents in a manner that left a distinctive feature on open sites. Ring middens—crescentic accumulations of burned rock—consistently date to the Late Prehistoric period, although some caution is introduced by the mixture of projectile point styles on these open sites and the common sense recognition that charcoal is less likely to survive in older features. Brown (1991:127) suggests that pit-baking ovens were relocated, moving from rock shelters to open sites situated near stands of plants and firewood where a temporary surplus could be produced.

The technological and economic changes are accompanied by the introduction of foreign burial customs and fully developed art styles. Although interment in rock shelter deposits continues, the practice of bundling may have fallen into disuse over time (Turpin 1991a:35). Two exhumed mummies date to this period; the earlier, an adult male buried about 1150 years ago, was accorded the typical Archaic mortuary treatment: flexed, wrapped in mats, and tied into a package with a long human hair rope (Turpin et al. 1986). Analysis of the preserved intestinal contents showed that this individual had consumed a most eclectic diet during his last days. The more recent burial, a prepubescent child, was laid, flexed, in a rock shelter grave outlined by sotol stalks, cushioned by a grass and prickly pear bed, and covered with an antelope skin robe some 600 years ago. Huebner (1995) was able to demonstrate that the child suffered from severe malnutrition, verging on starvation. Yet a third rock shelter burial produced another innovation that can be relatively dated to the Late Prehistoric period: a threaded and twined bullrush mat, rolled like a carpet, was exhumed from a grave that contained the seated and flexed remains of two people. A similar mat was radiocarbon dated to 570 years ago, leading McGregor (1991) to consider this weaving technique to be a Late Prehistoric introduction to the Lower Pecos fiber industry.

A more drastic change in mortuary customs is evidenced by the appearance of cairn burials, piles of rocks usually built on high promontories or points overlooking the canyons. Only one such cairn has been excavated (Turpin 1982); it produced two dart points and two arrow points, mirroring the overlap of the two artifact forms so often seen in rock shelter deposits. The presumed recent age of these features is substantiated by their co-distribution with tipi rings, a house style clearly attributable to the Infierno phase (see below).

The latest mortuary practice documented by radiocarbon dates is cremation and disposal in a vertical shaft cave. The incinerated remains of an adult male were dropped down the shaft at Seminole Sink where they lay atop the talus cone for some 400 years (Turpin 1988). Technically, this event falls within the Infierno phase time frame, but there is no evidence to link the two beyond age.

The case for the migration of new people into the Lower Pecos is furthered by the appearance of two fully-developed pictograph styles—both shared with western and southern desert areas—and a different set of petroglyph motifs related to a series of sites that extend northwest across the

Eldorado Divide. All are dated to the Late Prehistoric period by stylistic criteria; one experimental radiocarbon date narrows the time frame of one style, the Red Monochrome, to about A.D. 800.

The Red Monochrome style (Figure 7) consists of frontally posed, static, life-size human figures and realistic animals, such as dogs, turkeys, catfish, deer, mountain lions, rabbits, and turtles, painted, as the name suggests, in red pigment (Turpin 1986a). A variation on the human figure is nicknamed "lizard man" for the bent knees and elbows. A most curious attribute is the common depiction of protuberances or "buns" on the side of the head. Single feather headdresses are common. Presumably female figures wear long skirts but the males are often naked with pronounced genitalia. Some are armed with bows; others are impaled by arrows, an emphasis on conflict that carries over into historic period pictographs that show clear antecedents in the Red Monochrome style (41VV205, Missionary Shelter [Turpin [1987b, 1989:Figure 18-5]).

The two largest panels in this style line the walls of low-lying shelters, above standing pools of water, leading Kirkland (Kirkland and Newcomb 1967) to name it the Flooded Shelter style. The larger inventory of smaller sites known to date shows a clear preference for isolated, often high, shallow overhangs with little or no cultural debris, as though the artists were avoiding the long-occupied shelters with their ornate Pecos River style paintings. Most of the Red Monochrome sites are near the mouth of the Pecos River, but some examples are found on the Devils River, as far north as the mouth of the Dry Devils.

Several Red Monochrome sites, including at least one painted in black pigment, have been defined in the Big Bend area. Lowrance (1982) attributed them to Jumano artists, citing ethnohistoric descriptions of clothing and hairstyles that could be artistically rendered as "buns." The Jumanos, and their allies, the Cibolos, were placed along the Rio Grande, from La Junta to south of modern-day Del Rio, by seventeenth century Spanish chroniclers, so Lowrance's (1982) hypothesis is not without merit.

Another intrusive art style, the Bold Line Geometrics, is less securely dated to the Late Prehistoric period because its abstract iconography provides few temporal clues (Turpin 1986b). Design motifs are variations on straight lines and blank spaces that are combined into nested zigzags, herringbones, cross-hatches, and blanket patterns (Figure 8a-b). In the latter, diamond-shaped cells are linked, forming a spider web design that uses blank space as a design element. Many of the geometric pictographs are associated in some way with water, painted surrounding seeps in the shelter walls or, in the case of Parida Cave, above interior springs. Again, most of the sites are found near the mouth of the Pecos River, with a few aberrant examples recorded on the Devils River and Red Bluff Creek. The Bold Line Geometrics are most clearly affiliated with the generic Desert Abstract styles of northern Mexico and the American Southwest, perhaps identifying one source of the intrusive traits of the Lower Pecos Late Prehistoric period.

Although petroglyphs are rare in the Lower Pecos, the largest and most famous site, Lewis

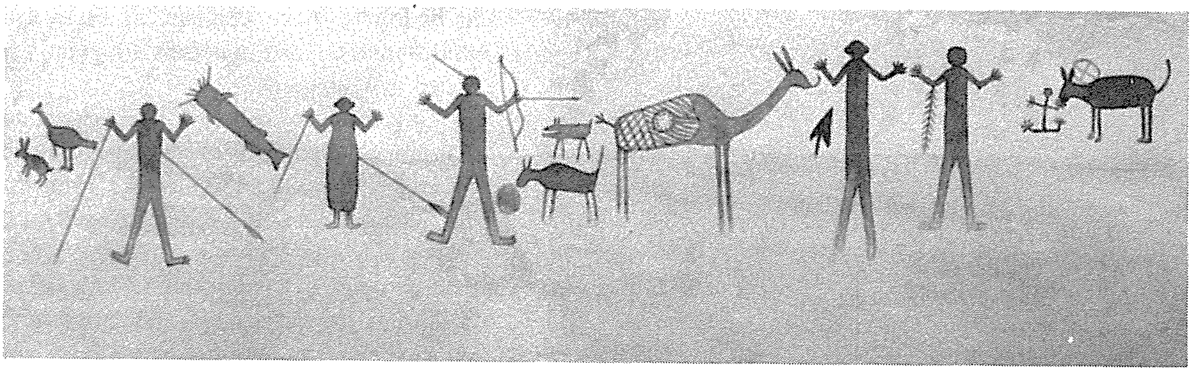
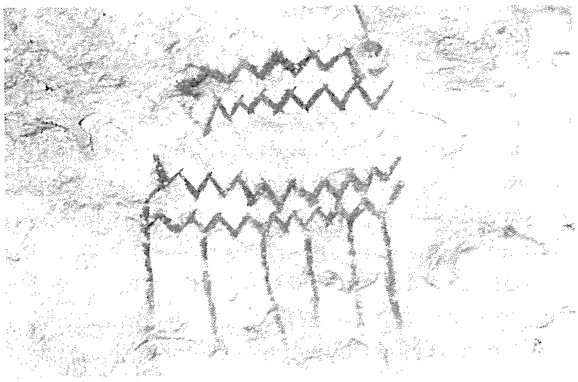


Figure 7. Forrest Kirkland's rendition of the Red Monochrome rock art type site (41VV78), which he called the Flooded Shelter style. Note bow and arrow, protuberances over the ears of two figures, and the realistic animals (reproduced courtesy of the Texas Memorial Museum, University of Texas at Austin).



A

B

Figure 8. Examples of the Bold Line Geometrics style pictographs: a, nested zigzag lines (41VV138); b, blanket pattern (41VV187). No scale.

Canyon (Figure 9), also shows an iconographic shift from curvilinear designs associated with free-floating atlatls to abstract geometrics (Turpin 1993), dominated by what Newcomb (Kirkland and Newcomb 1967) called the line-and-circle motif. Although difficult to date, one of the later petroglyphs appears to be an arrow point, suggesting a Flecha period age. A series of similar but smaller petroglyph sites are found north of Lewis Canyon, on the Eldorado Divide, but geometric petroglyphs are also one of the most common artistic expressions in northern Mexico.

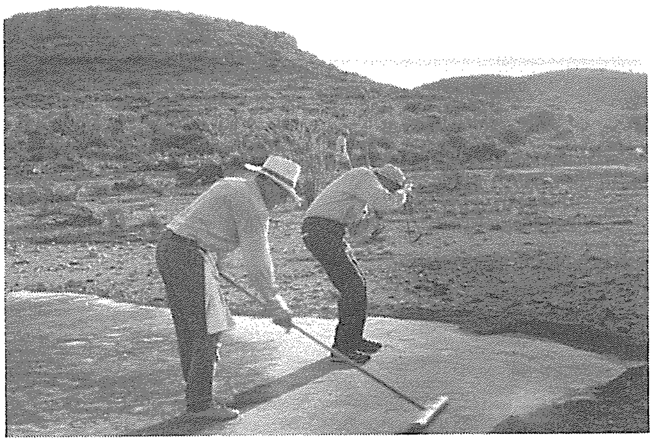


Figure 9. Texas Archeological Society volunteers clearing dirt, and recording buried petroglyphs at Lewis Canyon (41VV223).

LATE PREHISTORIC PERIOD, INFIERNO PHASE (ESTIMATED 450 TO 250 B.P.)

The Infierno phase inventory consists of less than a score of sites characterized by circles of paired stones that were presumably pole supports for brush or hide-covered structures (Figure 10), and by a tool kit that is dominated by four artifact types: small triangular stemmed arrow points, steeply beveled end scrapers, four-beveled knives, and plain ceramics. The type site, Infierno Camp, contains over 100 rings; the lesser sites have as few as one and as many as eight stone rings. In one locale, a single ring sits beside eight oblong cairns, presumably burial mounds. The Infierno people exhibited a distinct preference for high promontories, usually overlooking springs or semi-permanent water holes. These locations are usually reduced to bedrock so the chances of recovering stratified or datable materials are greatly reduced.

Only one tipi ring has been excavated (Turpin and Bement 1989), and it produced no materials suitable for radiocarbon dating. The site was selected because it overlooked an early Plains Indian rock art site that presumably dated to about 1700. Among the surface artifacts whose ages spanned the entire spectrum of Lower Pecos prehistory were a plainware sherd and a Guerrero arrow point, both indicative of protohistoric or early historic occupation. It is important

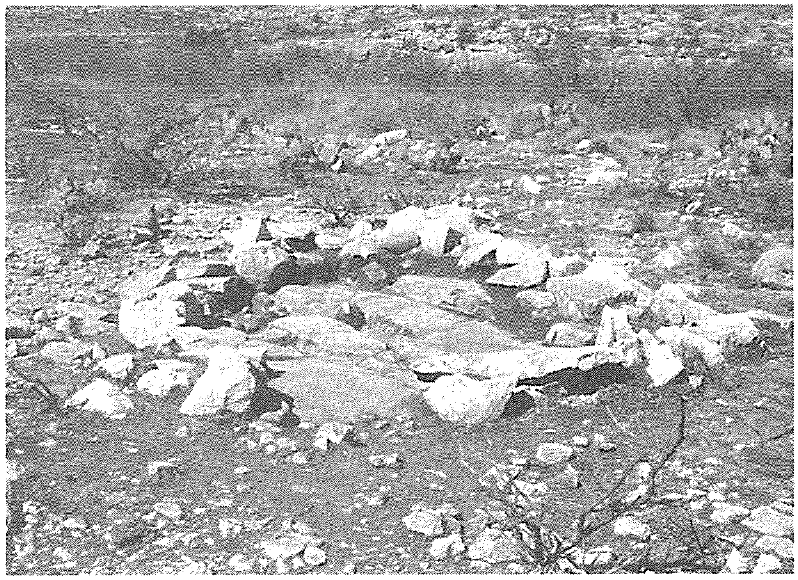


Figure 10. Excavated tipi ring at Live Oak Creek (41VV828). The diameter of the stone ring is approximately 2.5 meters.

to note that not one of the Infierno phase single component sites has yielded a single European-derived historic artifact.

The rare ceramic sherds collected from Infierno phase sites are poorly fired, calcite-tempered brownwares of uncertain origin. They most strongly resemble sherds of native pottery recorded at the Apache mission of San Lorenzo de la Santa Cruz, abandoned in 1771 (Tunnell and Newcomb 1969). A similar sherd was recovered from the Sotol site in Crockett County from a stratum that dated to the range between 460 and 340 years ago, the only radiocarbon date even remotely attributable to Infierno phase materials.

The Infierno people clearly came into the Lower Pecos region late in prehistory. Seventeenth century Spanish documents describe native northern Mexican people travelling en masse to the mouth of the Pecos River for annual bison hunts, perhaps recording a cyclical round that predates European contact. Ethnohistoric references to bison hunting in and around the region suggest that the Lower Pecos was again part of the great sea of grass that characterized the American frontier (Turpin 1987a), reverting to semi-desert only after the introduction of livestock in the late 1880s.

The Infierno phase is the only archeological unit in the Lower Pecos that meets Willey and Phillips' (1958) criteria for phases. It is spatially and temporally limited, and its tool kit and site features clearly distinguish it from generic Late Prehistoric assemblages.

HISTORIC PERIOD (350 B.P. TO PRESENT)

Technically, the historic period began in the Lower Pecos region in 1590 when Gaspar Castaño de Sosa, then Lt. Governor in Nuevo León, and a contingent of some 160 to 170 souls crossed the Rio Grande, somewhere near Ciudad Acuna, en route from Villa Almaden (Monclova) to the Pecos Pueblo (Hammond and Rey 1966; Schroeder and Matson 1965). Undoubtedly, however, the native people had already experienced the repercussions of the Spanish movement north, if only through the ripple effect as indigineous northern Mexican groups migrated to avoid slavery and disease (Hackett 1926, 1931; Steck 1932). Castaño, like the many Spaniards that followed, found little but hardship in the Lower Pecos region. Expeditions sent to explore the Rio Grande as a prelude to settlement and the establishment of viable trade routes brought back such discouraging reports (Bolton 1908; Castañeda 1938, 1946; Daniel 1955; Weddle 1968) that colonizing missions were abandoned, and forays across the river often became largely military manuevers in retaliation for raids on communities in Coahuila and Nueva Vizcaya (Bolton 1962; Weddle 1968).

The closest the Spanish ever came to establishing a physical presence in the Lower Pecos region was an abortive attempt to found a presidio, Sacramento, on the San Diego River, south of Ciudad Acuna, in 1737. Prior to its completion, the presidio was removed to the Santa Rosa valley, near modern-day Muzquiz. Returned to the San Diego site in 1773, the presidio, renamed Agua Verde, lasted only seven years before the troops were removed to San Fernando de Austria (Zaragoza) in 1780 (Moorhead 1975:226).

After their first experiences with the arid mountainous reaches of northern Mexico, including the

Lower Pecos region, the Spanish movement north bifurcated, heading east through the gateway mission of San Juan Bautista and west through La Junta, the confluence of the Mexican Conchos River and the Rio Grande. The vast intervening area became known as the *despoblado*, or unpopulated zone (Daniel 1955), despite the fact that it sheltered refugee and renegade native populations for three centuries. Spanish government and military reports provide an inventory of native people (Bolton 1908; Griffen 1969; Hackett 1926), and chronicle the immense changes that took place as population movements quickened and warfare intensified. In the late seventeenth century, the Jumanos and Cibolos are often mentioned as allies of the Spanish in the general area of the Lower Pecos. By 1729, indigenous people and intrusive northern Mexico groups alike were overrun by the Apaches, who were reportedly in complete control of the Rio Grande (Weddle 1968:200). Their supremacy was short-lived, for the Comanches and their allies, the Kiowas, came down out of the north, forcing the Apaches into political and military limbo in the mountains of northern Mexico. By the turn of the century, beset by revolution and engaged in wars on both continents, the Spanish empire was forced to abandon its frontier, leaving its colonial population undefended.

With the coming of Anglo-American sovereignty in the middle of the nineteenth century, linking east and west became a priority that depended upon the extermination of the erstwhile Plains Indians that controlled much of the Desert West. Mapping expeditions were followed by stage and mail routes; trade caravans; freighters; cattle drovers; and mineral exploration (Turpin 1989). Fort Clark was established in 1852, squarely athwart one of the well-traveled Comanche traces. In 1857, Camp Hudson was built to protect a ford of the Devils River that later came to be called Bakers Crossing for one of the early settlers. After a hiatus imposed by the Civil War, the U.S. military resumed its attempt to eradicate the Native American presence along the Rio Grande. Comanches and Kiowas annually rode south to raid the settled communities of northern Mexico, causing the Mexican government to complain bitterly to Washington. Kickapoos carried on their undeclared war against Texans from their secure base in the mountains near Santa Rosa (Musquiz) until 1874 when U.S. troops illegally raided their villages in a clear case of boundary transgression. Driven from the American side, renegade Apaches took refuge in the vast arid reaches of the Bolsón de Mapimí, south of the Big Bend, where they were pursued by Mexican troops as late as 1881.

The completion of the southern transcontinental railroad in 1882 opened the Lower Pecos to markets in the east and west. Small towns sprang up around depots at sites that later gave their names to projectile point styles: Langtry and Shumla. Pioneer stockmen with their herds of sheep and cattle colonized the marginal rangeland and forever changed the face of the countryside. The very fact that substantial herds of cattle found sufficient graze agrees with the ethnohistoric record of bison hunting in and south of the Lower Pecos, suggesting that the great sea of grass that characterized the American Frontier once again extended to and below the Rio Grande (Turpin 1987a). The modern environment is a product of historic land use exacerbated by natural phenomena, such as the famous droughts of the 1950s and the floods of 1954 and 1974.

HISTORIC PERIOD ARCHEOLOGY

The historic Native American period is represented archeologically by one rock shelter, reported in the 1940s (Kirkland 1942), a few scattered metal arrow points, and 16 rock art sites that incorporate Euro-American elements (Figure 11) or bear strong affinities to defined Plains Indian styles (Turpin 1989; Turpin and Davis 1993). Tipi rings found adjacent to some of the historic pictographs may represent the living sites of the artists, but proof awaits more temporally diagnostic artifacts and radiocarbon assays (Turpin and Bement 1989). An internal chronology signalled by theme, style, and iconographic details sequences the paintings and elucidates a trend from initial curiosity to bitter enmity (Turpin 1989). A change in site distributional patterns, shifting from deeply entrenched canyons to open areas near accessible water sources, can be attributed to the demands of horse husbandry. The overall scarcity of sites is the legacy of a period of social unrest wherein mobility often meant survival.

The historic Euro-American period has attracted little scholarly attention. The construction

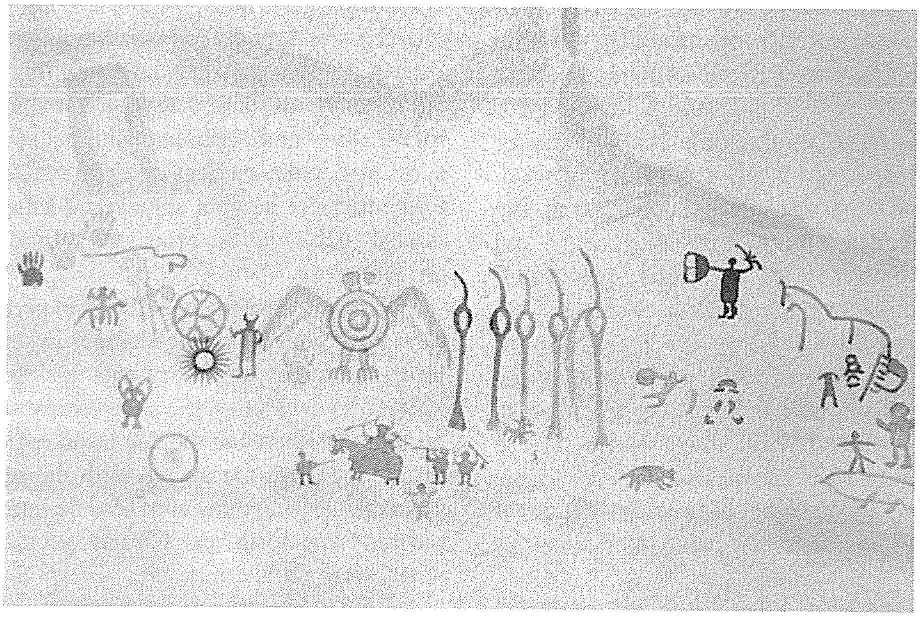


Figure 11. Kirkland's copy of historic pictographs at Meyers Springs in Terrell County (41TE9). Typical themes are the thunderbird, horned headressed figures, horses, and weapons. The group scene in the left center shows a horse in battle armor, placing it early in the historic period, before the development of the "finest light cavalry in the world," the mounted Plains warriors. The central rider is about 20 cm in length.

of the Southern Pacific Railroad left an archeological trail that includes abandoned tracks and tunnels, depots, graves, and work camps with domestic, commercial, and industrial features (Briggs 1974; Turpin 1995). The ranching era is poorly represented by site survey data that records rock shelter habitations (Turpin 1987c) and a few early ranch headquarters (Turpin 1990d).

SUMMARY

The cultural trajectory of Lower Pecos prehistory originates in stereotypic Paleoindian big game hunters who apparently entered the region some 12,000 to 14,000 years ago. Based on the two known sites of this age, the economy was oriented toward the procurement of megafauna such as elephant, camel, horse, and bison. The later Folsom and Plainview hunters had apparently perfected the jump technique of bison hunting, suggesting organizational skills consistent with group procurement strategies that center upon migratory herd animals.

The extinction of the large game herds and the onset of a trend toward aridity triggered a transition to Archaic lifeways about 9400 years ago. The people apparently exploited a broader resource base, developing a reliance on plant products, both as food and as raw material for the burgeoning fiber industry, while retaining established lithic traditions. The transition culminated in a robust adaptation that gives the outward but perhaps misleading impression of great stability for a period of some 4000 years. Rock shelters became the nucleus of the settlement pattern, showing differentiated activity areas of a domestic nature. Mortuary customs included disposal of the dead in convenient vertical shaft caves, regardless of age or gender.

Then, about 5500 years ago, the cultural system began a series of internal adjustments, presumably in response to an increasingly arid environment. The end result would be the consolidation of traits into the full-blown Archaic expression that defines the Lower Pecos as a distinct cultural entity. A model that parsimoniously explains this development was formulated by analogy to emerging complex societies documented ethnohistorically and archeologically in arid lands around the world.

In this model, changes in the distribution of essential resources, most prominently potable water, triggered responses in the settlement pattern and procurement strategies, leading to a disproportionate concentration of people along the major rivers. Aridity does not imply a shortage of food, especially if desert succulents increase at the expense of grasslands, but gathering and processing of thorny plant foods and small mammals requires specialized techniques and knowledge. The responsibility for food procurement, especially hunting and gathering in the uplands, would have been delegated to mobile task groups who operated from these bases on the rivers. Diversification broadened the diet to include labor intensive processing of a wider range of foodstuffs, activities that took place in open camps and rockshelters as well.

New methods of social control were mandated by the redistribution of human populations, who were in effect circumscribed by the availability of water. The inevitable tensions introduced by proximity elicited a restructing of society that was accompanied by the intensification of ritual that was, in turn, manifested by the florescence of publicly produced mural art. A common belief system, rooted in the principles of shamanism and expressed in cave paintings, held sway over the area that is now defined as the Lower Pecos cultural region. This is the apogee of the Lower Pecos cultural trajectory: the consolidation of an ethnic identity that trembled on the verge of societal complexity that was never achieved, possibly for lack of the ability to generate an adequate surplus, the necessary and sufficient condition for sedentism.

Sometime around 3000 years ago, the insular Lower Pecos cultural persona relaxed, perhaps disrupted by the advent of new people with a different economic strategy and social structure. A mesic interlude permitted the grasslands of the Great Plains to expand to the Rio Grande, drawing herds of bison and their attendant hunters. Even episodic, perhaps seasonal, influxes of people bearing a fully developed cultural system of their own must have had a perceptible effect on the resident population; at present it can only be discerned in settlement patterns, tool types, and possibly art styles.

The return to aridity and the retreat of the grasslands created a vacuum filled by desert-adapted people who came north across the Rio Grande from northern Mexico. Soon, the Lower Pecos found affinities with Central Texas, sharing in the generalized Late Archaic lithic assemblage while perfecting its fiber industry, retaining its characteristic burial customs, and keeping a balance between rockshelters and open campsite occupations. Measures of population density again rise, reaching and exceeding the heights achieved during the Middle Archaic peak, but the processes behind the increase are less clear.

The Late Prehistoric period experienced a cultural upheaval, including changes in settlement patterns, site types, mortuary customs, art styles, and artifact types. Pictograph styles show affinities with northern Mexico and the Big Bend region of Texas; lithic tool types are shared with the rest of Texas; and mortuary customs appear to be introduced from the north and northwest. Clearly, people, rather than ideas, were on the move.

Late in prehistory, one intrusive group is identified by a distinctive artifact assemblage, including small arrow points and ceramics, a preference for promontories with sweeping views, and residences that used paired stones as pole supports for a thatch or hide cover. The people of the Infierno phase may be precursors to ethnohistorically described bison hunters who again seasonally congregated at the mouth of the Pecos during yet another mesic interlude.

The Spanish found little of value in the Lower Pecos, isolating it as part of the great uninhabitable desert of their northern frontier, but native peoples found refuge in the rugged terrain. Indigenous groups were soon replaced by Apaches who, in turn, were driven south by the Comanches. Under American hegemony, a concerted effort to clear the way west resulted in the extirpation of native people by the time the second transcontinental railroad was completed in 1882.

The recent era has been largely dominated by an economy based on animal husbandry, illustrating one reason why a hunting and gathering lifeway was maintained over the millenia. The most modern methods can not wrest a surplus from the indominable landscape of the Lower Pecos region, the effects of a century of over-grazing have further reduced the productive capabilities of these marginal lands, and siltation is reclaiming Amistad Reservoir 50 years ahead of schedule. The economic hope of the region has turned to commercial wildlife exploitation and ecotourism— a return to hunting and gathering?

REFERENCES CITED

Andrews, R. L. and J. M. Adovasio
1980 *Perishable Industries from Hinds Cave, Val Verde County, Texas.* Ethnology Monographs 5. Department of Anthropology, University of Pittsburgh, Pittsburgh.

Bement, L. C.
1986 *Excavation of the Late Pleistocene Deposits of Bonfire Shelter, Val Verde County, Texas.* Archeology Series 1. Texas Archeological Survey, The University of Texas at Austin.

Bolton, H. E.
1908 *Spanish Exploration in the Southwest, 1542-1705.* Barnes and Noble, New York.
1962 *Texas in the Middle Eighteenth Century: Studies in Spanish Colonial History and Administration.* Russell and Russell, New York.

Briggs, A. K.
1974 The Archeology of 1882 Labor Camps on the Southern Pacific Railroad, Val Verde County, Texas. Master's thesis, Department of Anthropology, The University of Texas at Austin.

Brown, K. M.
1991 Prehistoric Economics of Bakers Cave: A Plan for Research. In *Papers on Lower Pecos Prehistory,* edited by S. A. Turpin, pp. 87-140. Studies in Archeology 8. Texas Archeological Research Laboratory, The University of Texas at Austin.

Bryant, V. M., Jr.
1966 Pollen Analysis: Its Environmental and Cultural Implications for the Amistad Reservoir Area. Master's thesis, Department of Anthropology, The University of Texas at Austin.
1969 Late Full-Glacial and Postglacial Pollen Analysis of Texas Sediments. Ph.D. dissertation, Department of Anthropology, The University of Texas at Austin.

Castañeda, C. E.
1938 *The Mission Era, The Missions at Work, 1731-1761.* Volume III of *Our Catholic Heritage in Texas, 1519-1936.* Von Boeckmann Jones, Austin.
1946 *The Mission Era, the Passing of the Missions, 1762-1782.* Volume IV of *Our Catholic Heritage in Texas, 1519-1936.* Von Boeckmann Jones, Austin.

Chandler, C. K., T. R. Hester, and H. J. Shafer
1994 New Data on Clay Figurines from the Lower Pecos Area, Texas. *Bulletin of the Texas Archeological Society* 65:347-353.

Daniel, J. M., Jr.
1955 The Advance of the Spanish Frontier and the Desploblado. Master's thesis, Department of History, The University of Texas at Austin.

Dering, J. P.
1979 Pollen and Plant Macrofossil Vegetation Records Recovered from Hinds Cave, Val Verde County, Texas. Master's thesis, Department of Anthropology, Texas A&M University, College Station.

Dibble, D. S.
1967 Excavations at Arenosa Shelter, 1965-66. MS on file, Texas Archeological Salvage Project, The University of Texas at Austin.

Dibble, D. S. and D. Lorrain
1968 *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas.* Miscellanous Papers 1. Texas Memorial Museum, The University of Texas at Austin.

Gebhard, D.
1965 Prehistoric Rock Paintings of the Seminole Canyon Area, Val Verde County, Texas. Submitted to the National Park Service by the University of California at Santa Barbara.

Griffen, W. B.
1969 *Culture Change and Shifting Populations in Central Northern Mexico.* Anthropological Papers 13. University of Arizona, Tucson.

Hackett, C. W. (editor)
1926 *Historical Documents Relating to New Mexico, Nueva Vizcaya, and Approaches Thereto in 1772.* 2 Vols. Carnegie Institute of Washington, Washington, D.C.
1931 *Pichardo's Treatise on the Limits of Louisiana and Texas,* Volume 1. University of Texas Press, Austin.

Hammond, G. P. and A. Rey (editors)
1966 *The Rediscovery of New Mexico, 1580-1594.* University of New Mexico Press, Albuquerque.

Hartnady, P. W.
1988 Premature Tooth Loss in the Archaic Trans-Pecos Region of South Texas. Master's thesis, Department of Anthropology, University of Arkansas, Fayetteville.

Hester, T. R.
1983 Late Paleo-Indian Occupations at Baker Cave, Southwestern Texas. *Bulletin of the Texas Archeological Society* 53:101-120.

Huebner, J.
1995 Stable Isotope Analysis of Bone and Soft Tissues from Four Mummies from the Eastern Chihuahua Desert of Texas. Paper presented at the II World Congress on Mummy Studies, Cartagena, Colombia.

Ilger, W. A., M. Hyman, and M. W. Rowe
1994 Radiocarbon Dates for a Red Linear Style Pictograph. *Bulletin of the Texas Archeological Society* 65:336-346.

Johnson, L.
1964 *The Devil's Mouth Site: A Stratified Campsite at Amistad Reservoir, Val Verde County, Texas.* Archeology Series 6. Department of Anthropology, The University of Texas at Austin.

Kirkland, F.
1942 Historic Materials from Fielder Canyon Cave. *Bulletin of the Texas Archeological and Paleontological Society* 14:16-71.

Kirkland, F. and W. W. Newcomb, Jr.
1967 *The Rock Art of Texas Indians.* University of Texas Press, Austin.

Lord, K. J.
1984 The Zooarcheology of Hinds Cave (41VV546). Ph.D. dissertation, Department of Anthropology, Texas A&M University, College Station.

Lowrance, M.
1982 Rock Art of Brewster County, Texas. *The Artifact* 20(1-4). El Paso Archeological Society, El Paso.

Lundelius, E.
1984 A Late Pleistocene Mammalian Fauna from Cueva Quebrada, Val Verde County, Texas. *Special Publication of the Carnegie Museum of Natural History* 8:456-481. Carnegie Museum of Natural History, Pittsburgh.

Marks, M. K., J. C. Rose, and E. L. Buie
1988 Bioarcheology of Seminole Sink. In *Seminole Sink: Excavation of a Vertical Shaft Tomb, Val Verde County, Texas*, compiled by S. A. Turpin. Memoir 22. *Plains Anthropologist* 33(122), Part 2:75-118.

Marmaduke, W. S.
1978 Prehistoric Culture in Trans-Pecos Texas: An Ecological Approach. Ph.D. dissertation, Department of Anthropology, The University of Texas at Austin.

McGregor, R.
1991 Threaded and Twined Matting: A Late Introduction to the Lower Pecos Region. In *Papers on Lower Pecos Prehistory*, edited by S. A. Turpin, pp. 141-148. Studies in Archeology 8. Texas Archeological Research Laboratory, The University of Texas at Austin.

1992 *Prehistoric Basketry of the Lower Pecos, Texas.* Monographs in World Archaeology 6. Prehistory Press, Madison, Wisconsin.

Mock, S. B.
1987 The Painted Pebbles of the Lower Pecos: A Study of Medium, Form and Content. Master's thesis, Department of Anthropology, The University of Texas at San Antonio.

Moorhead, M.
1975 *The Presidio, Bastion of the Spanish Borderlands.* University of Oklahoma Press, Norman.

Parsons, M.
1986 Painted Pebbles, Style and Chronology. In *Ancient Texans*, by H. J. Shafer, pp. 180-185. Texas Monthly Press, Austin.

Patton, P. and D. S. Dibble
1982 Archeologic and Geomorphic Evidence for the Paleohydrolic Record of the Pecos River in West Texas. *American Journal of Science* 282:97-121.

Prewitt, E. R.
1983 Remote Sensing of Archeological Remains in the Stockton Plateau Region of Texas: An Experiment in Site Recognition and Prediction. Master's thesis, Department of Anthropology, The University of Texas at Austin.

Schroeder, A. H. and D. S. Matson
1965 *A Colony on the Move: Gaspar Castano de Sosa's Journal 1590-1591.* School of American Research, Salt Lake City.

Schuetz, M. K.
1956 An Analysis of Val Verde County Cave Material. *Bulletin of the Texas Archeological Society* 27:129-160.

1963 An Analysis of Val Verde County Cave Material: Part III. *Bulletin of the Texas Archeological Society* 33:131-165.

Shafer, H. J.
1975 Clay Figurines from the Lower Pecos Region, Texas. *American Antiquity* 40(2):148-158.

1976 Defining the Archaic: An Example from the Lower Pecos Region, Texas. In *The Texas Archaic: A Symposium*, edited by T. R. Hester, pp. 1-9. Special Report 2. Center for Archaeological Research, The University of Texas at San Antonio.

1981 The Adaptive Technology of the Prehistoric Inhabitants of Southwest Texas. *Plains Anthropologist* 26(92):129-138.

1986 *Ancient Texans.* Texas Monthly Press, Austin.

Shafer, H. J. and V. M. Bryant, Jr.
1977 *Archeological and Botanical Studies at Hinds Cave, Val Verde County, Texas.* Special Series 1. Anthropological Laboratory, Texas A&M University, College Station.

Steck, F. B.
1932 Forerunners of Captain de Leon's Expedition to Texas, 1670-1675. *Southwestern Historical Quarterly* 36(1):1-28.

Stock, J.
1983 The Prehistoric Diet of Hinds Cave, Val Verde County, Texas. Master's thesis, Department of Anthropology, Texas A&M University, College Station.

Story, D. A. and V. M. Bryant, Jr.
1966 *A Preliminary Study of the Paleoecology of the Amistad Reservoir Area.* Report to the National Science Foundation by the University of Texas at Austin.

Tunnell, C. D. and W. W. Newcomb, Jr.
1969 *A Lipan Apache Mission, San Lorenzo de la Santa Cruz 1761-1777.* Bulletin 14. Texas Memorial Museum, The University of Texas at Austin.

Turner, E. S. and T. R. Hester
1993 *The Stone Artifacts of Texas Indians.* Second Edition. Gulf Publishing Company, Houston.

Turpin, S. A.
1982 *Seminole Canyon: The Art and the Archeology.* Research Report 83. Texas Archeological Survey, The University of Texas at Austin.

1984 The Red Linear Style Pictographs of the Lower Pecos River Region, Texas. *Plains Anthropologist* 29(105):181-198.

1986a Pictographs in the Red Monochrome Style in the Lower Pecos River Region. *Bulletin of the Texas Archeological Society* 55:123-144.

1986b Toward a Definition of a Pictograph Style: The Lower Pecos Bold Line Geometrics. *Plains Anthropologist* 31(112):153-161.

1987a Ethnohistoric Observations of Bison in the Lower Pecos River Region: Implications for Environmental Change. *Plains Anthropologist* 32(118):424-429.

1987b The Vanishing Rock Art of Texas Indians. *Heritage Magazine* 5(1):36-43. Texas Historical Foundation, Austin.

1987c Be It Ever So Humble: Rock Shelter Homes of Early Settlers. *Heritage Magazine* 5(3):22-23. Texas Historical Foundation, Austin.

1988 (compiler) *Seminole Sink: Excavations of a Vertical Shaft Tomb, Val Verde County, Texas.* Memoir 22. *Plains Anthropologist* 33(122), Part 2.

1989 The Iconography of Contact: Spanish Influences on the Rock Art of the Middle Rio Grande. In *Columbian Consequences, Volume 1: Archaeological and Historical Perspectives on the Spanish Borderlands West,* edited by D. H. Thomas, pp. 277-299. Smithsonian Institution Press, Washington, D.C.

Turpin, S. A. *(Continued)*
1990a Rock Art and Its Contribution to Hunter Gatherer Archaeology: A Case Study from the Lower Pecos River Region of Southwest Texas and Northern Mexico. *Journal of Field Archaeology* 17(3):263-281.

1990b Speculations on the Age and Origin of the Pecos River Style. *American Indian Rock Art* 16:99-122.

1990c New Perspectives on the Red Linear Style Pictographs of the Lower Pecos River Region. *Plains Anthropologist* 35(132):375-381.

1990d Taming the Devils Country. *Heritage Magazine* 8(2):16-19. Texas Historical Foundation, Austin.

1991a Time Out of Mind: The Radiocarbon Chronology of the Lower Pecos River Region. In *Papers on Lower Pecos Prehistory,* edited by S. A. Turpin, pp. 1-49. Studies in Archeology 8. Texas Archeological Research Laboratory, The University of Texas at Austin.

1991b Sin Nombre and El Fortin: Pecos River Style Pictographs in Northern Mexico. *Bulletin of the Texas Archeological Society* 60:267-281.

1992a More About Mortuary Practices in the Lower Pecos River Region of Southwest Texas. *Plains Anthropologist* 37(138):7-17.

1992b Sacred Holes in the Ritual Landscape of the Lower Pecos River Region. *Plains Anthropologist* 37(140):275-278.

1993 Hunting Camps and Hunting Magic: Petroglyphs of the Eldorado Divide, West Texas. *North American Archaeologist* 13(4):295-316.

1994a On a Wing and a Prayer: Flight Metaphors in Pecos River Pictographs. In *Shamanism and Rock Art in North America,* edited by S. A. Turpin, pp. 73-102. Special Publication 1. Rock Art Foundation, Inc., San Antonio.

1994b The Were-Cougar Theme in Pecos River Style Art and its Implications for Traditional Archeology. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research,* edited by D. S. Whitley and L. L. Loendorf, pp. 75-80. Monograph 36. Institute of Archaeology, University of California, Los Angeles.

1995 *41VV540: A Railroad Era Industrial Site in Val Verde County, Texas.* Cultural Resource Program Report 95-1. Texas Parks and Wildlife Department, Austin.

Turpin, S. A. and L. C. Bement
1989 The Live Oak Hole Complex: Plains Indian Art and Occupation in the Lower Pecos River Region. *Bulletin of the Texas Archeological Society* 59:65-82.

Turpin, S. A. and M. W. Davis
1993 The Devils River State Natural Area: The 1989 TAS Field School. *Bulletin of the Texas Archeological Society* 61:1-50.

Turpin, S. A., M. Henneberg, and D. K. Riskind
1986 Late Archaic Mortuary Practices in the Lower Pecos River Region, Texas. *Plains Anthropologist* 31(114):295-315.

Weddle, R. S.
1968 *San Juan Bautista: Gateway to Spanish Texas.* University of Texas Press, Austin.

Williams Dean, G.
1978 Ethnobotany and Cultural Ecology of Prehistoric Man in Southwest Texas. Ph.D. dissertation, Department of Anthropology, Texas A&M University, College Station.

Willey, G. R. and P. Phillips
1958 *Method and Theory in American Archaeology.* The University of Chicago Press, Chicago.

Zintgraff, J. W. and S. A. Turpin
1991 *Pecos River Rock Art.* McPherson Publishing Company, San Antonio.

COMMENTS

Many a Slip 'Twixt Cup and Lip: Correcting Perdiz Statistics from the Buckhollow Site Report

LeRoy Johnson

Just before the report on the Buckhollow site (Johnson 1994) went to press, the *t*-scores of Table 9 were reviewed and corrected—wrongly, as it turned out. The calculator which was used had definitely gone quite bonkers, and had outlived its usefulness. Regrettably, that fact was not discovered until after the "revised" table was published. It thus falls upon me to offer a proper and corrected table since copies of the Buckhollow site report have been disseminated far afield. The data of Table 9 are important, for they test the significance of differences between pairs of dimensional means for collections of Perdiz arrow points from three major archeological sites: Buckhollow, Las Haciendas, and Hinojosa.

Hopefully, the interested reader will review the new table below. The null hypothesis of no real difference between means is everywhere rejected (even when α is .06 or .07), except where an (X) appears in the table's right-hand margin. For the compared Perdiz points from Buckhollow and Las Haciendas, differences between means that are not considered significant are for variables H (mean maximum length) and I (mean maximum width). For H, the difference between means is only 1.4 mm, a small cipher, indeed. For I the difference is merely 0.8 mm. It is likely that the lack of significance in differences is real, and not due to the effects of undersampling (see totals in Johnson 1994:Table 8).

For the compared collections from Buckhollow and Hinojosa, all pairs of means for which tests were figured can be said to be significantly different. However, the means for variable J (mean maximum thickness), with a difference of 0.3 mm, give borderline results.

For the collections of Perdiz points from Las Haciendas and Hinojosa, pairs of means are significantly different except for variable J (mean maximum thickness) and variable K (mean stem width). Given the lack of sizeable differences in these cases (0.1 mm for both variables), it is unlikely that the lack of significance would be remedied much by increasing sample sizes.

In sum, it seems that Buckhollow and Las Haciendas Perdiz points may be virtually identical (as measured by the means) in terms of length and maximum width. It is also likely that Las Haciendas and Hinojosa Perdiz points share truly similar means for maxiumum thickness and stem width.

REFERENCES

Blalock, H. M., Jr,

1979 *Social Statistics*. 2nd Edition. McGraw-Hill Book Company, New York.

Johnson, L.

1994 *The Life and Times of Toyah-Culture Folk As Seen from the Buckhollow Encampment, Site 41KM16, of Kimble County, Texas*. Report 38. Office of the State Archeologist, Texas Historical Commission, Austin.

Revision of Table 9 (Johnson 1994:82).
Special Student's *t*-statistic (Blalock 1979:formula 13.5), Perdiz arrowheads (Buckhollow, Las Haciendas, and Hinojosa sites), for pairs of means for metric variables, including levels of significance (two-tailed test); (+) identifies larger mean of pair.

Difference Between Means	Variable	*t*-Score	Approx Degrees Freedom	Significance Level
	H. Mean Max. Length			
1.4 mm	Buckh. (+) vs. Las Hac.	.9307	30	.40 (X)
10.6 mm	Buckh. (+) vs. Hinoj.	2.4770	45	.02
9.2 mm	Las Hac. (+) vs. Hinoj.	7.6247	57	.001
	I. Mean Max. Width			
0.8 mm	Buckh. vs. Las Hac. (+)	-1.4242	105	.20 (X)
1.9 mm	Buckh. (+) vs. Hinoj.	2.7897	65	.01
2.7 mm	Las Hac. (+) vs. Hinoj.	4.0651	66	.001
	J. Mean Max. Thickness			
0.2 mm	Buckh. vs. Las Hac. (+)	-1.9425	82	.10 (α ca. .06)
0.3 mm	Buckh. vs. Hinoj. (+)	-1.8550	63	.10 (α ca. .07)
0.1 mm	Las Hac. vs. Hinoj. (+)	-.8445	37	.50 (X)
	K. Mean Stem Width			
0.6 mm	Buckh. (+) vs. Las Hac.	3.5494	77	.001
0.8 mm	Buckh. (+) vs. Hinoj.	2.2305	55	.05
0.1 mm	Las Hac. (+) vs. Hinoj.	.4549	36	.70 (X)
	L. Mean Stem Length			
2.7 mm	Buckh. vs. Las Hac. (+)	-5.6251	63	.001
2.5 mm	Buckh. (+) vs. Hinoj.	4.5036	75	.001
5.2 mm	Las Hac. (+) vs. Hinoj.	13.7885	64	.001
	O. Mean Weight			
0.3 g	Buckh. (+) vs. Las Hac.	2.0793	21	.05
0.5 g	Buckh. (+) vs. Hinoj.	3.6322	26	.01
0.2 g	Las Hac. (+) vs. Hinoj.	2.9869	64	.01

REVIEWS

Disease and Demography in the Americas, edited by John W. Verano and Douglas H. Ubelaker. Smithsonian Institution Press, Washington, D.C., 1992. x + 294 pp., figures and plates.

Reviewed by Maynard B. Cliff, Geo-Marine, Inc.

The papers in this volume were originally presented in 1989 at one of a series of scholarly symposia held as a prelude to the Seeds of Change exhibition at the National Museum of Natural History, Smithsonian Institution. The exhibition, a commemoration of the Columbus Quincentenary, was intended to examine "the processes of encounter and exchange set in motion by the Columbus voyages of discovery" (Herman Viola, volume Foreword). The symposium itself was entitled "Disease and Demography in the Americas, Changing Patterns Before and After 1492." The editors state in the introduction to this volume that the symposium was designed to stimulate discussion and communication among researchers in skeletal biology or paleopathology and demography since, as they put it:

> Much of the demographic literature depicts pre-European contact America as a "disease-free paradise," while the literature in physical anthropology and paleopathology regularly documents a variety of disease conditions in ancient America. Conversely, demographic reconstructions from ancient samples seem at odds with standard interpretations from ethnohistory and demography. What is fact and what is theory? (p. 1).

According to the editors, the symposium, and the papers in this volume that resulted from it, was designed to stimulate discussion between the different disciplines with the hope of clarifying the issues involved. If by this is meant a better understanding of the complexity and variability inherent in questions of Native American health and population demography, then these goals have been achieved. However, if one is looking for consensus of interpretation, or a reconciliation of competing views, it will not be found here, a fact which the editors readily admit (cf. Becker 1994). The first day of the symposium dealt with questions of precontact health conditions, while on the second day the symposium shifted to the important question of population size and related demographic issues. The organization of the symposium is loosely reflected in the organization of the book, with Part 1 dealing with "Disease before and after Contact" and Part 2 with "Population Size before and after Contact."

The papers in Part 1 are based largely on bioarcheological and paleopathological studies of Late Prehistoric and Early Historic skeletal populations from archeological contexts. As an introduction to these studies, Donald Ortner ("Skeletal Paleopathology: Probabilities, Possibilities, and Impossibilities") presents an overview of the nature of paleopathological studies, together with a discussion of their strengths and limitations. He points out that while skeletal remains can provide data on chronic bacterial disease conditions, acute diseases, such as the great epidemics of the post-contact period, leave at best nonspecific and indirect evidence in a skeletal sample. In particular, he notes that "viral diseases such as smallpox and measles had a particularly devastating effect on Native American populations subsequent to A.D. 1500 but there is no clear evidence of either disease in archeological skeletal samples" (p. 5). He does note, however, that new techniques for extracting human immunoglobulins and even viral DNA from archeological skeletal samples may change this situation in the near future.

The rest of the papers in this section include reviews of data from South America, southeastern North America, northeastern North America, the Midwest, the Great Plains, the Southwest, and California. As Arthur Aufderheide states in his summary to this section ("Summary on Disease before and after Contact"), all of these papers "clearly document the presence of malnutrition, anemia, and a variety of tuberculoid, treponematoid, and other infections as well as trauma and degenerative conditions" (p. 165) in the New World prior to the arrival of Europeans. Nevertheless, the data suggest that most Native Americans had developed a certain level of immunity to some of these infections, such as tuberculosis and treponematosis, with the result that they had become chronic illnesses or even childhood diseases (such as smallpox had become to the Europeans of this time). On this basis, it is clear that the "concept of a pristine, disease-free, pre-Columbian New World environment is no longer credible" (p. 165). However, the radical, and even catastrophic, nature of the change in Native American health conditions cannot be downplayed, even in regard to conditions which may have been chronic prior to the contact period (for example, the resurgence of tuberculosis among nineteenth century Native Americans on reservations is probably related to changes in disease environment, rather than the introduction of new strains).

Beyond this, however, the studies in Part 1 also highlight the great degree of variability in the health conditions of Native American populations prior to contact, and the differences in their response to the changes brought about by the Europeans during and after contact. In some areas, such as Andean South America, the Southeast, the Northeast, and the Plains, population morbidity (i.e., the rate of disease in a population) was increasing during the pre-Columbian period, presumably as a result of cultural changes, such as agricultural intensification and dietary shifts, increasing population, and increasing sedentism, with accompanying side effects. Conditions such as these would only have been made worse by the new, contact-related changes. Stodder and Martin ("Health and Disease in the Southwest before and after Contact") show that in other areas, such as the Southwest, isolated populations either postponed, or escaped entirely, the infectious epidemics suffered by their less fortunate neighbors. In his study of several contemporary populations, Milner ("Disease and Sociopolitical Systems in Late Prehistoric Illinois") shows that substantial differences in aboriginal health conditions enabled certain groups in the Midwest to cope with new infections better than others. Larsen and his colleagues ("Population Decline and Extinction in La Florida") document the rather rapid extinction of aboriginal social groups in the Southeast. Owsley's data ("Demography of Prehistoric and Early Historic Northern Plains Populations") for the Northern Plains indicates at least two waves of high mortality during the early contact period, with some groups (such as the Arikara) surviving to prosper, and succumbing to infectious disease and social disruption only later. In Aufderheide's words, all of these studies "clearly demonstrate the peril of extrapolating isolated observations of disease-related demographic changes to the population of an entire region or even a continent" (pp. 165-166).

The papers in Part 2 rely largely on ethnohistorical and historical data to examine the question of how and why Native American population sizes changed as a result of European contact. Ubelaker ("North American Indian Population Size: Changing Perspectives") opens this section with a review of previous attempts to estimate the aboriginal population of the New World prior to 1500, along with a discussion of the methodologies used by various researchers. In the summary to this section, Alfred W. Crosby ("Summary on Population Size before and after Contact") notes that such estimates have ranged from a low of 8.4 million for the total population of this hemisphere in 1492 (Kroeber 1939) to a high of 90-112 million (Dobyns 1983). Ubelaker observes that his own most recent estimate for North America, based on figures prepared for the *Handbook of North American Indians* (Sturtevant 1978-), more than doubles Kroeber's estimate but falls far short of Dobyns'.

Most of the rest of the papers in this part are "case studies" which focus on aspects of the demographic histories of specific areas, including: lowland South America, highland South America, the Caribbean, northern Mexico, southeastern North America, northeastern North America, the Great Plains, the Southwest, and the Northwest Coast of North America. Once again, as was found in the first set of papers, the view that emerges from all of these regional studies is that although Native American populations declined everywhere after contact (sometimes catasrophically), the details of decline differed enormously across space and through time. As Crosby puts it, "there is no doubt that the Euro- and Afro-Americans carried diseases deadly to Indians, but said diseases did not rain down uniformly and all at once on all the original peoples of the New World" (p. 278).

In the case of Amazonia, Meggers ("Prehistoric Population Density in the Amazon Basin") compares archeological and ethnohistorical data and concludes that early eyewitness estimates of high population density are unreliable, and that the post-contact population decline which occurred there (while severe) was less than has been previously suggested. In other areas, where the natural and cultural environment did allow large and dense pre-contact populations (such as Andean South America, the Southwest, and the Caribbean), post-contact losses were far more severe and catastrophic. The studies by Ubelaker, Snow ("Disease and Population Decline in the Northeast"), Trimble ("The 1832 Inoculation Program on the Missouri River"), and Thornton ("Depopulation in the Southeast after 1492") show that even within limited regions, population histories were not uniform.

Disease-waves and their accompanying demographic declines occurred unevenly, at different times to different groups, and affected groups differently. Boyd's ("Population Decline from Two Epidemics on the Northwest Coast") study of two epidemic cases on the Northwest Coast show this clearly. He contrasts the catastrophic Native American population decline (approximately 87 percent) in the Lower Columbia drainage due to the apparent presence of malaria after 1830, with the effect of the 1862-1863 smallpox epidemic on the Queen Charlotte Islands Haida (a nearly 60 percent decline). In the former case, he notes that "socially, after 1841, most Chinookan and Kalapuyan populations [of the Lower Columbia area] were approaching extinction as viable and ethnically distinct entities" (p. 251). In contrast, the Haida "regrouped and persisted in a few, fair-sized settlements" (p. 252), and have steadily recovered during the present century. Boyd concludes from these cases that the effect which a newly introduced disease may have on a "virgin population" (i.e., one not previously exposed to that infection and which has no immunity to it) is strongly related to the type of disease (whether its effects are deliberate and cumulative, or sudden and discrete), and to cultural practices (such as indigenous health care systems and the ability of social systems to readjust after severe perturbations).

In addition to the regional studies, Dobyns ("Native American Trade Centers as Contagious Foci") contributes a pan-regional overview of the potential role that trading centers played as foci for the introduction and spread of new infectious diseases. Drawing on examples from the Great Plains (the Mandan, Hidatsa, and Arikara), the Southwest (Pecos, the Northern Panya, and Pueblo de los Jumanos), the Southeast (the Eno and the Ocaneechi), and the Northeast (the Wenro, Neutral, and Huron), Dobyns argues that Native Americans who were involved in trade, or resident at such trading centers, were exposed to imported diseases earlier and probably suffered more severe effects from such diseases. The severity of these effects, Dobyns feels, is reflected in the fact that in all cases Native American "merchants abandoned hitherto prosperous trading centers a year or so after a final demoralizing epidemic disease episode" (p. 220).

Despite the lack of a single theoretical theme or viewpoint to this book, as well as the fact that a true consensus has yet to emerge regarding questions of disease and demography raised by these papers, the volume offers valuable insights to anyone interested in the problems of Native American disease and population decline. It is truly interdisciplinary in that the papers draw on data from archeology, paleopathology, ethnohistory, and history. Although the focus is generally on North America, it does provide some comparative data regarding the population history of South America, Mexico, and the Caribbean. All of the individual papers are relatively short and can be read or reread rapidly and, except for the introduction and summaries by Ubelaker, Verano, Aufderheide, and Crosby, each paper stands alone. In addition, each paper is accompanied by its own bibliography which allows the interested researcher to seek out other references on particular topics or areas without a great deal of effort. Likewise, the book has an eight page index which also increases its utility as a research tool. This volume will certainly stand as an important resource for both the interested lay-reader and the professional alike for a long time to come.

REFERENCES

Becker, M. J.
1994 Review of *Disease and Demography in the Americas*, edited by J. W. Verano and D. H. Ubelaker. *American Antiquity* 59(2):383-384.

Dobyns, H. F.
1983 *Their Number Became Thinned: Native American Population Dynamics in Eastern North America.* University of Tennessee Press, Knoxville.

Kroeber, A. L.
1939 *Cultural and Natural Areas of Native North America.* Publications in American Archaeology and Ethnology 38:1-242. University of California, Berkeley.

Sturtevant, W. C. (editor)
1978- *Handbook of North American Indians.* 20 Vols. Smithsonian Institution Press, Washington, D.C.

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