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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 history, prehistory and archeological theory. In line with the goals of the society, it encourages scientific collection, study and publication of archeological data.

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SYSTEMATIZED ETHNOHISTORY AND PREHISTORIC CULTURE SEQUENCES IN TEXAS*

T. N. CAMPBELL

ABSTRACT

Archeologists and ethnohistorians have certain limited objectives in common, one of which is arranging the evidence of past human populations in chronological order. Prehistoric archeologists construct models known as local or regional culture sequences and are interested in correlating, whenever possible, their latest prehistoric culture units with ethnic groups named and described by early Europeans in written records that have been analyzed by ethnohistorians. Archeologists sometimes feel handicapped because ethnohistorians do not always present their data in a systematized form that is readily available, intelligible, and practically useful to the archeologist. It now seems reasonable to advocate that ethnohistorians pay more attention to the needs of archeologists and prepare an areal series of ethnohistory handbooks that will summarize and synthesize what is known about every historic ethnic group, large or small, with emphasis on environmental data and ecological patterns and also on interaction with other peoples, both native and European. Such handbooks should not be presented in the usual authoritarian manner, but should evaluate evidence presented and identify residual problems.

No attempt is made here to present specific ethnohistoric data on any part of Texas or adjoining areas. This paper is essentially a brief critical appraisal of past and current ethnohistoric studies as aids to prehistoric archeology in the Texas area, accompanied by suggestions as to how these ethnohistoric studies may be made more pertinent and useful to archeologists.

Today many archeologists profess to be interested in ecological processes of the past, particularly those in which man is involved. These archeologists are very much aware that for any given sample of the earth's landscape it is essential to identify and describe specific human population units, determine the approximate boundaries of their environmental exploitation, and then arrange these man-land associations in chronological order. With much effort, and perhaps with a certain amount of good fortune, it is sometimes possible to achieve such an ordering for a relatively small section of

*This is a slightly modified version of a paper with the same title presented at the 74th Annual Meeting of the Texas Academy of Science, Nacogdoches, Texas, March 12, 1971.

the earth's surface. This achievement is commonly referred to as a local cultural sequence. Unfortunately, the human groups involved can rarely be defined with precision, and it is equally difficult to chart their former territorial ranges. However, these difficulties do not seem to deter archeologists, who are sustained by the hope that greater precision and refinement will eventually emerge from continued study and that this procedure may be extended to larger and larger portions of the earth's surface. It is generally believed that these sequences provide a realistic setting for study of the various processes that operate when groups of men develop sociocultural extensions that permit them to live acceptably in their chosen landscape arenas and maintain themselves through time.

How does the specialty known as ethnohistory relate to this limited objective of sequence recognition and the more distant objective of defining and explaining ecological processes? As I conceive it, ethnohistory is initially a set of operations that one performs on observational data recorded in written documents to achieve definition, description, and chronological ordering of specific man-land associations. It involves difficult feats of information retrieval, analysis of refractory and often incomplete data, and eventually involves cross-examination of the ordered data to arrive at interpretive and explanatory statements about the nature of interactions between groups of men and between these human groups and their respective natural environments.

Although prehistoric archeologists and ethnohistorians seem to have common objectives concerning relations between man and nature, it is unrealistic to ignore certain differences which tend to inhibit communication between them. Archeologists who develop cultural sequences are accustomed to dealing with residues of human behavior from which they must make inferences about actual behavior. Ethnohistorians, on the other hand, are accustomed to working with verbally recorded observations of human behavior and, despite various kinds of bias that enter written records, are somewhat closer to the phenomena being studied. Archeologists deal with evidence of apparently slow behavioral change over very long periods of time, whereas ethnohistorians are more or less boxed-in by a short span of time determined by availability of written documents, less than 500 years in the Texas area. Furthermore, ethnohistorians must consider behavioral changes in a context of massive and often rapid acculturation, evasive or enforced migration, and frequent ethnic extinctions connected with intense competition of European and aboriginal populations for living space and exploitable resources.

These disparities tend to reduce effective cooperation of prehistoric archeologists and ethnohistorians to a short span of time in any given area, namely, just before and shortly after the initial entry of Europeans. This is dictated by the archeologist's desire to link his late prehistoric groups with named native groups recorded by the earliest travelers and explorers before the native cultures began to be extensively modified and also before post-European population pressures induced habitat shifts. This focuses attention on the truly aboriginal groups of any given area, meaning those who were there before various kinds of chain reaction developed. The ethnohistorian may be inclined to rebel against this restriction, for it forces him to concentrate on his earliest and generally his least informative written documents. I regard this as a healthy situation because ethnohistorians, like many archeologists, are attracted to the richer bodies of data and tend to pass quickly over obscurities. If the ethnohistorian is to meet this specific challenge, he must put far more effort and analytical ingenuity into study of the earlier documents. For example, in central, southern, and western Texas the ethnohistorian finds himself faced by the complex problem of identifying, locating, and describing innumerable obscure Indian groups who were later swept away by multi-directional pressures from aggressive Apaches, Comanches, and Spaniards. In such areas it is small wonder that the archeologist is discouraged from making greater use of ethnohistoric data for the purpose of extending his prehistoric sequences into the historic period. As things now stand, in these areas the archeologist is faced by an apparently meaningless jumble of small ethnic groups, for which there is minimal information on geographic range, on linguistic affiliation, and on distinctive behavior patterns. Since he can find few satisfactory statements of what ethnic unit was where, when, and how related to other units, he cannot be expected to show much enthusiasm about tracing cultural continuities into the historic period. He might, however, force the ethnohistorian's hand by finding and excavating more settlements attributable to the Apache, Comanche, and Spanish invaders. Specialists who share an interest in certain problems tend to expect too much from each other, but mutual prodding often gets results and eventually leads to beneficial cooperation.

It is only fair to make clear that my views about the relationships of ethnohistory to prehistoric archeology have developed as the result of unorthodox behavior. As an archeologist with an interest in

Texas and adjacent areas, I have recently been doing a limited amount of ethnohistoric research. It now seems to me that archeologists who deal with late prehistoric and early historic materials tend to make minimal and often ineffective use of ethnohistoric data mainly because those data have not been presented in a form that can be quickly found and readily used. What archeologists really want is more systematically organized ethnohistoric information, and with more of it organized with archeological problems in mind. Perhaps one way to inject more archeological bias into ethnohistory is for more archeologists to try their hands at ethnohistoric research and see what emerges. The first objection that archeologists will voice is that the professional archeologist is likely to be no more than an amateur ethnohistorian at best, and this is a valid objection. I must admit that my experience thus far has not always been satisfying, mainly because my archeological training failed to prepare me for even the most elementary ethnohistoric research. But there is nothing inherently mysterious or difficult about ethnohistoric research, any more than there is about archeological research. I would say that any archeologist can do his own ethnohistoric research if he really wants to and is willing to devote enough time to it.

Some of my archeological colleagues and students have questioned the value of further ethnohistoric studies connected with Texas and adjoining areas in both the United States and Mexico, particularly for the early historic period. One question has to do with the scope of the search for ethnohistoric data. Have historians and cultural anthropologists found most of the extant documents that are pertinent? The answer to this is an emphatic *no*. Thus far the search has been confined largely to the massive and better known archival collections, principally those in the great document-storage centers of Spain, France, Mexico, and the United States. Archival materials in many provincial capitals and lesser administrative centers for both church and state have been only spottily searched, and relatively little attention has been paid to specialized institutional records, such as those of old families, Christian missions, early mining companies and landed estates that used Indian labor, and court records that pertain to land inheritance and sale, marriages, and various kinds of crime.

The same question is sometimes phrased in another way. Is it possible that the search thus far has revealed most of the basic information about former native populations and that further effort will be merely a minor, mopping-up operation? My limited experience thus far forces me to be cautious in trying to answer this question. For some Indian populations we will never find much information simply because they were never actually seen by any European who put something down on paper. These populations are known only through hearsay from other Indians. But for other groups that were frequently observed and recorded over a considerable span of time the possibility of data recovery increases in proportion to the number of recorded observations retrieved. It all boils down to the fact that we will never know just how much information exists until we search. The situation is not greatly different from that faced by an archeologist who begins an excavation program in a poorly known area. He will never know what can be learned until he has excavated. My stance here is that the ethnohistorian should continue his search until he is satisfied that he has exhausted the possibilites and appears to have reached a point of rapidly diminishing returns. To this I would add my impression that much of the ethnohistoric research thus far done in the greater Texas area has been a cream-skimming operation. The effort has gone primarily into finding documents with high data yield, and I suspect that a substantial number of these may have been found. But I also believe that there has been general neglect of low-yield documents, whose number is phenomenal. Here, I think, lies the greatest opportunity. It is in these low-yield documents that one often finds critical information on population size, seasonal range of hunting and gathering groups, migrations, intergroup economic cooperation or conflict, earliest introduction of European trade goods, and non-linguistic evidence of linguistic affiliation. This potential is what makes me insist that what we most need now is a painstaking, dragnet operation through the innumerable documents that have never been examined for isolated detail or have been passed over as insignificant. This of course is a major undertaking, but I see no reason for anyone to be overawed by its magnitude. Few archeologists seem to be overwhelmed by the amount of work that must be done before their major objectives are achieved.

An imposing mass of information has been assembled and published on various historic Indian peoples in Texas. Much of this can be labeled as ethnohistory in a broad sense, but the Texas area is incompletely covered and the smaller population units rarely receive adequate individual attention. One has only to inspect a few special studies, such as Gatschet (1891) on the Karankawans, Ruecking on the Coahuiltecans (1953, 1954a, 1954b, 1955a, 1955b), Sjoberg (1953a, 1953b) on the Lipan Apaches and Tonkawas, Newcomb and Field (1967) on the Wichita groups, and Swanton (1942) and Griffith (1954) on the Caddoans to appreciate the wide range of approaches to the data as well as the variety in structured presentations. Failure to focus attention on the smaller ethnic units through both time and space sometimes results in misunderstanding, as in the case of the Ervipiame, always identified as a Tonkawan group linguistically and culturally. However, it is easy to demonstrate by documents that the Ervipiame migrated shortly after 1700 from northeastern Coahuila and vicinity to east-central Texas and there became associated with Tonkawan groups. They seem to represent assimilation of a Coahuiltecan group in a new social setting.

The first serious attempt to present ethnohistoric information on all the known groups in Texas was connected with the preparation of the *Handbook of American Indians*, edited by F. W. Hodge and published between 1907 and 1910. Basically this is an encyclopedia, consisting of a series of summarizing essays, one for each known Indian group, arranged in alphabetic sequence by name. These essays were written by the best qualified individuals of the time, and the dominant contributor for the Texas area was an historian, H. E. Bolton, who had specialized in colonial Spanish Texas and had examined thousands of unpublished documents bearing on Indian populations. His brief essays cover hundreds of Texas groups, particularly those noted for relative obscurity.

The most notable deficiency of the *Handbook* is that it is inadequately structured for effective information retrieval. It is name structured and difficult to use unless you begin with a known Indian group name. It is not place or time structured in any convenient way, nor is it structured for categories of cultural information. For instance, if you want to find the names of all the Indian groups known to have lived in southern Texas during the 17th century, or if you want to determine which groups had rabbit drives, cultivated maize, or used peyote ceremonially, you must read or scan some 2,000 double-column pages. This inadequacy could have been minimized by including a detailed name and topic index, but what the *Handbook* needed most was a series of integrative essays. However, this early *Handbook* does grapple effectively with the problem of name variants, one of the fundamental issues in ethnohistory, and it presents useful bibliographies.

Later publications can sometimes be used to supplement the *Handbook*. Swanton's *The Indian Tribes of North America* (1952) is place structured, but its scope is so broad that any particular subarea receives only schematic treatment. More generalized syntheses, such as Newcomb's *The Indians of Texas* (1961), provide orientation and perspective, but are of little help on the smallest identifiable ethnic units.

What is needed today, and especially by archeologists, is a more ambitious and better organized handbook. For maximum usefulness all known ethnic groups, large or small, well-known or obscure, should receive individual essay treatment and be arranged in alphabetic order. Each essay should summarize what is presently known about the Indian group in question. For groups with a wealth of recorded observational detail, the essays will have to be compressed. The poorly known groups, however, should get special attention because of previous neglect. Each essay should be accompanied by an alphabetized list of all name variants and a bibliography that will guide the user to all the truly informative sources. I would insist that all ethnic name variants should be entered in alphabetic order along with the essays and that the name variants be linked with essays by cross reference. This is the only realistic approach, since the handbook user will always start with a name, which may or may not be readily recognizable as equivalent to a name which has been standardized by frequent usage in anthropological literature. Since some name variants are less demonstrable than others, the handbook user is entitled to know in each case how good the evidence for equivalence actually is. If earlier errors were made in name linkages, he is also entitled to know who made the errors and the probable reasons for error. Hence all name variants should be accompanied by specific bibliographic citations.

A properly systematized ethnohistoric handbook should have a section that would permit one to begin with a specific landscape unit, such as a general geographic area or a physiographic, biotic, or archeological province, or even some smaller subdivision of these, and readily find alphabetized lists of Indian groups associated with these units during various phases of the historic period. This should be designed to separate the apparent aboriginal groups from groups known to have immigrated from adjoining or more distant areas. There should also be a special section on Spanish missions that will identify Indian groups known to have been represented there, with dates of entry and departure, if known. The list might even be subdivided on the basis of the areas of population origin. For example, the surviving records of Mission San Antonio de Valero (the Alamo) of San Antonio indicate that individuals and families from over 100 Indian groups were represented there at some time or other. No one has yet systematized this long list in any meaningful way.

Another section should be devoted to the earliest European explorers and the Indian groups they encountered and reported by name. Much more critical work needs to be done on the delineation of routes because the correct placement of many Indian populations depends upon the maximum precision in route determination. Thus far too many routes have been traced with too little first-hand knowledge of the terrain traversed and without making full use of ecological data. Hence some of the older route studies now seem naive or even ludicrous. Recent studies that have led to greater precision include Krieger's (1961) review of the route of Cabeza de Vaca across southern Texas and northern Mexico, Schroeder's (1962) revision of the routes followed by Coronado and Oñate across the southern High Plains, and Williams's (1962) remarkable paper on the route of Dominguez de Mendoza from El Paso eastward into the Edwards Plateau region of central Texas. The last, the study by Williams, has radically altered Bolton's (1916: 313-343) widely accepted earlier interpretation by on-the-spot observation of landmarks and unique ecological niches mentioned in Mendoza's itinerary. As a consequence of this route correction, it is now possible to identify a considerable number of Indian groups who ranged over a large part of the Edwards Plateau before being displaced by southward movement of the Apaches. At last the archeologist can begin to find the answer to an old question: just who were the aborigines of the Edwards Plateau?

For the archeologist a good ethnohistoric handbook should pay more attention to European observations of the natural environment, particularly those that indicate environmental changes during the past 400 years. My modest foray into the document jungle has forced me to realize that some documents are rich in observational detail and give important cues to both archeologists and cultural anthropologists. I suspect that we can learn as much about the environment and its changes as we can learn about the distribution of native groups and their behavior. An opportunity is being neglected when ethnohistorians continue to ignore basic environmental information that is available for collation, analysis and ecological interpretation. The richest sources, of course, are the records of earlier travelers, which are far more numerous than the publications by historians have led us to believe. Some European travelers were remarkably close observers of the landscape and sometimes took the trouble to record much detail on vegetation patterns and animal distributions. Occasionally they actually described specific ecological niches, and few failed to note vegetation dominants in areas traversed. Since weather limited early travel, European travelers often recorded excessive rainfall, massive floods, hurricanes, tornadoes and sometimes even commented on erosion and deposition in stream valleys. I believe that by segregating certain kinds of information and noting changes recorded through time we can better document gradual changes in soils and vegetative cover, such as, for instance, the early spread of thorny brush vegetation in southern Texas and northeastern Mexico. It may also be possible to document shifts in migratory animal distribution, such as the variable southern margin of the bison range during winter. It may also be possible to document changes that affected the irregularly distributed resources of special interest to man — surface water (springs, ponds, lakes), firewood, grass, salt, flint and other siliceous stones, and minerals used for pigment.

This is probably enough to provide some idea of the potential of systematized ethnohistoric data. In conclusion, I would like to comment on areas that are notably weak in ethnohistoric data. Certain parts of Texas are poorly known because Europeans rarely went there prior to 1800. This is particularly true of numerous small areas in which archeologists become interested. As an example we may cite the area around the mouth of the Pecos River, where so much archeological research has been done during the past decade. When you search the documents, published or unpublished, you find practically nothing about early Europeans actually encountering natives in this area, which had no resources that attracted Europeans and did not lie on routes to places of special interest. This does not mean, however, that we can never learn anything about the earliest historic inhabitants of the area. The approach here must be indirect, that is, one must search the records of the nearest Spanish settlements for information recorded by travelers who skirted the lower Pecos area or who talked with Indians who had been there or otherwise had some knowledge of the area. In this case, one learns that missionaries based in Coahuila traveled northward in the 1670's, crossed the Rio Grande, and penetrated the southwestern part of the Edwards Plateau just east of the Pecos (Bolton 1916: 283-309; Figueroa Torres 1963). These missionaries identified a considerable number of hunting and gathering groups whose seasonal range must at times have included the lower Pecos area. Similarly, records at Parral in Chihuahua reveal several lists of Indian groups reported as ranging north of the Rio Grande or along the Rio Grande from present Presidio, Texas, to the mouth of the Pecos. One document of 1693 (Griffen 1969: 93-94) clearly points to the lower Pecos area as the winter-season, bison-hunting range of a considerable number of named groups who at other times of the year ranged both sides of the Rio Grande upstream from the mouth of the Pecos River. As a result of this indirect approach, it is possible to say something specific about the attractiveness of the lower Pecos at certain times of the year. It also tells us something about distances which hunting and gathering peoples traveled to get at especially abundant food resources. Thus by careful analysis it is possible to identify a substantial number of native groups who with high probability exploited the lower Pecos area.

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TOWARD A GENERALIZED MODEL OF HUNTING AND GATHERING SOCIETIES

PARKER NUNLEY

ABSTRACT

Although much is ethnographically known about various hunting and gathering societies, all these groups had been affected to some degree by food producing groups at the time they were reported. Archeology remains the only viable source of data to test theories of the culture and society of hunting and gathering peoples before contact with food producing societies. The present paper represents an attempt to formulate generalizations, stated in the form of expectations, about hunting and gathering groups. The generalizations are inductively derived from ethnographic data and are limited to some of those areas amenable to verification by archeological investigation.

The utility of studies such as the present one lies, in part, in the possibility that they will contribute further to the limited data on variations in hunting and gathering cultures through time and through a wide variety of environments. Although our generalizations are by necessity limited ones, we agree with DeVore when he writes that he is unwilling " . . . to abandon the search for generalizations that seem to apply to most hunter-gatherers most of the time" (DeVore 1968:339). The lack of complete data should not discourage the formulation of careful generalizations, but should encourage caution in the use of such generalizations. The generalizations presented here depend heavily on the work of Birdsell (1958) and Steward (1936, 1938). Unlike Birdsell's and Steward's work however, the present work purposely excludes none of those societies which depend on a hunting and gathering subsistence base. Birdsell excluded societies such as the acorn gatherers of California, tribes in the Northwest coastal area and the Coastal Eskimo on the basis that they had access to "richer sources of energy" that would "influence density, population structure, and social and political organization in such a way that the generalizations derived from the more stringent economies no longer apply" (Birdsell 1958:189). Steward, on the other hand, was primarily interested in primitive bands and excluded from consideration those hunting and gathering groups with more complex social organization.

It now seems that exclusion of such groups artificially limits the extent of variation possible among groups with a hunting and gathering subsistence base (Freeman 1968). Dependence on the "classic cases" such as Netsilik Eskimos, the Arunta, and the !Kung Bushmen may be misleading as Lee and DeVore point out:

> . . . within a given region the 'classic cases' may, in fact, be precisely the opposite: namely, the most isolated peoples who managed to avoid contact until the arrival of the ethnographers. In order to understand hunters better it may be more profitable to consider the few hunters in rich environments, since it is likely that these peoples will be more representative of the ecological conditions under which man evolved than are the dramatic and unusual cases that illustrate extreme environmental pressure (Lee and DeVore 1968:5).

Since it is beyond the scope of this paper to derive a detailed ethnology of societies with a hunting and gathering subsistence base, the following discussion is limited to generalizations directly useful to archeological verification. Topics covered include: Territoriality, Settlement Pattern, Subsistence, and Social Organization.

TERRITORIALITY

It is by now apparent that all known hunting and gathering groups have some sort of territorial concept. These concepts range from a simple sense of a vague "life space" in which no territorial rights are asserted, as among the Eastern Hadza (Woodburn 1968) and the Western Shoshoni (Steward 1938) to specific land and water use rights as among the Indians of the Northwest coast (Suttles 1968) and the Ainu (Watanabe 1968).

Stanner (1965) described territoriality among certain groups in Australia. Although he was specifically referring to territory among Australian Aborigines, he introduced three terms into the anthropological literature that have much wider usage that he gave them:

> The pattern of aboriginal territoriality should be looked at from an ecological point of view. The evidence allows us to say that each territorial group was associated with both an *estate* and a *range*. The distinction is crucial. The estate was the traditionally recognized locus ("country", "home", "ground", "dreaming place") of some kind of patrilineal descent-group forming the core or nucleus of the territorial group. It seems to have been a more or less continuous stretch. The range was the tract or orbit over which the group, including its nucleus and adherents, or-

> dinarily hunted and foraged to maintain life. The range normally included the estate . . . Estate and range together may be said to have constituted a *domain*, which was an ecological life-space . . . In good habitats range and estate might be virtually co-extensive . . . At another extreme . . . an estate for practical purposes of life might amount to only places on a track (Stanner 1965:2).

If we discount the reference to a "patrilineal descent group" as the foundation of the territorial group, Stanner's terms are applicable to all hunting and gathering groups.

In all cases there exists some form of "boundary" dividing a group's domain from surrounding territories. Sometimes, as in the case of the Eastern Hadza and Western Shoshoni, the boundaries are similar to a "cline" in genetics in that interacting groups blend into one another rather smoothly. As Woodburn describes the concept among the Eastern Hadza: " . . . all four regions resemble each other in having no clear-cut boundary. To draw boundaries would be quite artificial; the regions grade into each other" (Woodburn 1968:104). Steward (1938) reports a similar lack of clear-cut boundaries among the Western Shoshoni.

Other groups have very specific boundaries to their territory, however. Among the Bushmen, for example,

> . . . each group of them has a very specific territory which that group alone may use, and they respect their boundaries rigidly. Each group also knows its own territory very well; although it may be several hundred square miles in area (Thomas 1958: 10).

Woodburn makes another important point about territoriality among the Hadza: "Each of these areas contains sufficient sources of food and water to maintain its inhabitants throughout the year and many people, especially the elderly, restrict their nomadic movements for years at a stretch largely to a single one of these four areas" (Woodburn 1968:104).

If we consider this in more general aspects, Woodburn's statement is applicable to all extractive groups. That is, all domains must supply the minimum needs of food and water in order that the population may survive. Therefore, the more scarce these necessities are in a given area, the larger must be the domain of a given human population. Contrariwise, the more abundant these resources, the smaller the domain necessary for a given population.

In a study designed to test this apparent relationship, Birdsell

(1953) assumed that mean annual rainfall is a reasonable correlate with the amount of food and water available to extractive cultures in Australia. Further assuming a tribal constant of five hundred individuals, he analyzed the relationship between rainfall and tribal area. After reducing his initial sample of 409 tribes to a basic series of 123 tribes on the " . . . grounds that either ecological factors distorted the basic relationship between size of tribal area and population density, or cultural variables produced undue deviations in the size of the tribal population as compared to the assumed constant of 500 persons per tribe . . . " (Birdsell 1953:181), he was able to conclude that " . . . there exists a very high degree of association between the size of the tribal area in the basic series and the mean annual rainfall occurring within its territory" (Birdsell 1953:183). If Birdsell's assumption that rainfall is a reliable indicator of ecological viability is valid, his conclusions support the generalization that the size of the domain of a group is inversely related to the amount of available food and water. Birdsell elsewhere points out that:

> . . . the qualitative descriptions in the literature strongly suggest that other populations at comparable levels of culture show densities also primarily determined by environmental variables . . . For each local group of populations the fuller array of environmental factors must be analyzed . . . the ability of each human group to utilize these sources of energy will vary with their extractive efficiency as determined by their technology (Birdsell 1953:192).

SETTLEMENT PATTERN

We are here concerned with the distribution of hunting and gathering groups within their domain. Murdock's classification of settlement patterns is used to facilitate reference to his *Ethnographic Atlas* (Murdock 1967) and Coult and Habenstein's *Cross-Tabulations* (1965).

Generally speaking, it has been widely held that the nomadic band is the typical settlement pattern associated with hunting and gathering groups. There is now good reason to question this belief. Part of the new skepticism arises from the realization that our ethnographic evidence is likely to be strongly biased in terms of marginal hunters and gatherers. This bias must be taken into account when generalizing about hunting and gathering groups.

Another area of skepticism centers about the question of whether one should separate hunting and gathering groups from fishing groups, and/or groups with storage facilities as Birdsell (1958) has done. This division of extractive groups seems to be particularly questionable in view of the high degree of association between hunting and gathering and fishing in groups with an extractive subsistence base. In the present paper all groups without food production are considered to be hunting and gathering groups.

With this broader definition of hunting and gathering groups, there is a fairly wide range of settlement patterns that occur. Coult and Habenstein (1965:318) show, for example, that out of 101 societies with an extractive subsistence base, thirty-three have fully migratory bands; forty-four are semi-nomadic/semi-sedentary; one is composed of a cluster of hamlets; and twenty-three are compact villages. They show no hunting and gathering groups with either compound settlements or neighborhoods of homesteads.

In terms of specific groups, settlement pattern among hunters and gatherers ranges from the permanent year-round residence of the Ainu (Watanabe 1968) and the semi-sedentary long houses of the Nootka (Drucker 1951) through the semi-nomadic bands of the !Kung and Gikwe (Thomas 1959), the Walbiri (Meggitt 1962) and the Eastern Hadza (Woodburn 1968).

Although the range of settlement patterns for known extractive societies is broad, the actual association between hunting and gathering and sedentary settlement patterns is a strong positive association between a hunting and gathering subsistence base and semi-nomadic settlement patterns. These associations are presented by Coult and Habenstein (1965:318) and are summarized in Table 1.

TABLE 1

ASSOCIATION BETWEEN SETTLEMENT PATTERN AND MODE OF SUBSISTENCE

Settlement Pattern	Mode of Subsistence		
	Extractive	Pastoralism	Plant Domestication
Bands	+ +	+ +	--
Semi-Nomadic	+	+	-
Permanent-Semi-Permanent	--	+	+ +

Note: Strength of association: strong positive, + +; positive, +; not significant, 0; negative, -; strong negative, --. (After Coult and Habenstein 1965:318)

If distinction is made between modes of subsistence within a general extractive subsistence economy, an interesting pattern emerges. As there is greater reliance on what may be termed a "water economy" — fishing, shellfishing, and taking large water animals — there is a tendency toward sedentary settlement patterns. Conversely, as the importance of a "water economy" decreases, there is a marked tendency toward nomadic settlement pattern. This tendency is suggested by comparison of Tables 2 and 3.

TABLE 2

ASSOCIATION BETWEEN SETTLEMENT PATTERN AND FISHING

Settlement Pattern	Mode of Subsistence: Fishing		
	Dominant	Co-dominant	Unimportant or Absent
Bands	0	0	+
Semi-Nomadic	+	0	-
Permanent-Semi-Permanent	0	0	--

Note: Strength of association: strong positive, + +; positive, +; not significant, 0; negative, -; strong negative, --. (After Coult and Habenstein 1965:207)

TABLE 3

ASSOCIATION BETWEEN SETTLEMENT PATTERN AND HUNTING AND GATHERING

Settlement Pattern	Mode of Subsistence: Hunting and Gathering		
	Dominant	Co-dominant	Unimportant or Absent
Bands	+ +	0	--
Semi-Nomadic	+ +	+ +	--
Semi-Permanent	--	-	+ +

Note: Strength of association: strong positive, + +; positive, +; not significant, 0; negative, -; strong negative, --. (After Coult and Habenstein 1965:254)

If we consider hunting and fishing as independent variables in extractive societies, the positive association between fishing societies and increasingly sedentary settlement patterns is quite clear. Table 4 illustrates the direction and strength of this association. Data for this table were derived from Murdock (1967) and include all those exclusively extractive cultures from America north of Mexico.

TABLE 4

FREQUENCY OF VARIOUS SETTLEMENT PATTERNS WITH REGARD TO SUBSISTENCE BASE

Subsistence Mode		Settlement Pattern: Bands	Semi-Nomadic	Transhumanic Semi-Sedentary	Permanent Village
Hunting Dominant	f	13	48	4	1
n = 66	%	20	73	6	2
Hunting and Fishing Co-dominant	f	0	9	5	2
n = 16	%	0	56	31	13
Fishing Dominant	f	2	30	20	16
n = 68	%	3	44	30	24

In Table 4 dominant means that the subsistence mode in question was scored higher than its alternative. Thus, if hunting were rated 4 and fishing 3 for a given society, that society would be tallied among those with a dominantly hunting subsistence base. It should be noted that the two societies with a dominant fishing base and band settlement pattern, the Satudene and the Karankawa, are both classed as only 10 percent more dependent on fishing than hunting and are therefore not as far from the predicted pattern as their extreme position would seem to indicate.

Similarly, the single hunting-based society occupying a permanent village, the Nomlaki, is a borderline case. This group is shown to be dominantly a food collecting society (56 to 35 percent) and fishing (6 to 15 percent). Still, this group must be included to satisfy the criteria of classification outlined above.

Chi-square was used to test the hypothesis that there is no significant difference between the observed and the chance expected frequency settlement of pattern among societies with dominant hunting subsistence as compared with societies with dominant fishing subsistence. The result was a x^2 value of 39.00 with 3 d.f. The null hypothesis that there is no significant difference between the observed distribution and that expected by chance was therefore rejected at better than the .001 level of confidence.

Although this distribution did not likely occur by chance, other factors such as biased sampling, faulty data, improper weighting of the classificatory criteria, etc., may account for some of the observed variation. The point is, although the relationship between increasing dependence on fishing and increasingly sedentary settlement patterns has not been proved, it remains a viable generalization.

SUBSISTENCE

There is a long-held myth about hunting and gathering societies that is only recently being corrected (cf. Binford 1968). It says, in effect, that hunting and gathering societies are conservative because the individuals in such societites have no leisure time to develop "higher" culture. This lack of leisure is thought to be especially restrictive in "marginal" areas since

> . . . this type of habitat limits and narrows the cultural patterns that are possible, once one method of survival has been worked out, the possibility that another and strikingly different mode of existence will be developed is remote. The people in such a culture are constantly busy supplying minimum needs; they cannot hazard the experiment of trying to find a new way of life. And in difficult habitats, such as the semideserts of south Texas, external influences which might stimulate culture change are apt to be minimal (Newcomb 1961:32).

In this passage the author makes two assertions which no longer seem to be justified. As regards the first, concerning cultural conservatism in marginal areas, it has been shown that one of the most striking cultural innovations yet, the domestication of plants and animals, transpired repeatedly and independently in just such areas as Newcomb's Western Gulf culture area (*cf.* Ucko and Dimbleby 1969). Furthermore, among the earliest and most spectacular of the "hydraulic" civilizations were some located on exotic streams similar to the Rio Grande. Rather than seeking an environmental reason for the apparent cultural conservatism in southwestern Texas, one should perhaps look for explanation within the cultural compulsives of the societies themselves or within the dynamics of population pressures as suggested by Binford (1968).

As regards the assertion that the rigors of life in a hunting and gathering society are such that the constituents "cannot hazard the experiment of trying a new way of life," quite the opposite is now widely documented from a number of widely different hunter-gatherer groups (Lee and DeVore 1968; Meggit 1962; Thomas 1959).

The consensus now seems to be that hunting and gathering groups tend, as a rule, to be among the most leisured human societies the world has known.

> By and large, the productivity of labor in hunting-gathering societies must be very low because of such limited technology. For this reason one might suppose that hunting and gathering activities must be nearly unremitting. It has frequently been assumed, in fact, that the hunting and gathering bands are restricted to a low level of cultural development simply because the people lack the leisure to refine or "build" their culture.
>
> But self-evident though this judgment may seem, it is nevertheless false. For reasons having to do with the very simplicity of the technology and the lack of control over the environment, many hunting-gathering peoples are quite literally the most leisured peoples in the world (Service 1962:12-13).

An alternative to Newcomb's hypothesis suggested by current data on hunting and gathering societies could be similar to Caldwell's (1958) "maximum forest efficiency." That is, rather than the development of "another and strikingly different mode of existence" being a remote possibility, just the opposite is true. One is then faced with the problem of explaining cultural conservatism in some other terms. It could be that change was impeded in such areas simply because the changes available were not as functionally adaptive as those cultural elements they would displace.

The point here is that societies with an extractive subsistence base ordinarily maintain a "surplus" of food within their domain. Surplus as used here refers to the fact that hunters and gatherers typically maintain themselves considerably below the maximum short term carrying capacity of their domain. Such maximum carrying capacity is, of course, a function of extractive technology and available resources. The general nature of this relationship was pointed out by Steward:

> The type of sociopolitical groups in the Basin-Plateau area was conditioned to a definable extent by human ecology. Rainfall, soils, topography, and climate determined the nature, quantity, and distribution of plant and animal species which were required for food. The hunting and gathering devices and transportation facilities known in the area allowed only a certain quantity of these to be procured and consequently limited the general population density. The subsistence habits required in each region largely determined the size, nature, and permanency

of population aggregates. These, in turn, predetermined many, though not all, features of social structures and political control (Steward 1938:256-257).

Murdock (1967:46) describes the subsistence base of a given society in terms of five major types of subsistence activity: gathering of wild plants and small land fauna; hunting, including trapping and fowling; fishing, including shellfishing and the pursuit of large aquatic animals; animal husbandry; and agriculture. Of these five, only the first three are of interest here.

An inspection of the description of 105 extractive societies from America north of Mexico (Murdock 1967:102-111) reveals the relative frequencies of occurrence of gathering, hunting, and fishing among them. After deleting twelve Plains Indian societies which were all dominated by a horse and buffalo economy and therefore felt to be special cases, the subsistence base of the remaining 138 societies is shown in Table 5.

TABLE 5

ASSOCIATION OF SUBSISTENCE TYPES

Important Subsistence Types	Dominant Subsistence Types			
	Gathering	Hunting	Fishing	Total
Gathering	--	9	19	28
Hunting	28	--	35	63
Fishing	3	13	--	16
Hunting and Gathering	--	--	8	8
Hunting and Fishing	12	--	--	12
Gathering and Fishing	--	4	--	4
Totals	43	26	62	131

Notes: 4 societies have Hunting and Fishing co-dominant; 2 societies have Gathering and Fishing co-dominant; 1 society has Hunting and Gathering co-dominant; 123 societies have all three types; 8 societies have Hunting and Gathering only; 7 societies have Hunting and Fishing only; 0 societies have Fishing and Gathering only.

In terms of Murdock's typology, several things clearly stand out. One of the most interesting of these is the fact that the term "hunting and gathering" is misleading when applied to general extractive societies. Hunting and gathering societies, that is, societies that depend either exclusively or mostly on hunting and gathering activities comprise only 33 percent of the total sample (46 of 138), while societies that depend chiefly on hunting and fishing comprise 44 percent (61 of 138) of the sample. Even if the Plains Indians were not excluded, the percentage of hunters and fishers would still be greater than the percentage of hunters and gatherers. A more accurate term to describe non-food producing societies would simply be the word "extractive". This assertion is supported by the observation that almost all of the societies in the sample (123 of 138) availed themselves of all three subsistence modes. Of the remaining fifteen, eight societies depended on hunting and fishing only, while none depended on gathering and fishing only. Of these extreme cases, most occur in a severe environment such as the Arctic in which one of the three modes of subsistence is ordinarily unavailable. In general it may be said that if the ecology of a domain permits, all three modes — gathering, hunting and fishing — will be used by an extractive society.

Fishing appears as the dominant subsistence activity in about sixty-two societies of the sample, gathering is dominant in forty-three societies, and hunting in only twenty-six. If we consider the total number of societies in which an activity is of considerable importance (dominant, co-dominant, and important), hunting emerges as the most frequent activity, fishing second most frequent, with gathering third. These figures suggest that, although gathering is present in most extractive societies, it is the least preferred of the three modes of subsistence. This idea is borne out by field observations:

> Very little of the vegetable food is eaten with much enthusiasm. But the advantage of vegetable food over meat (or honey), and the basic reason why it constitutes the bulk of the diet of the Hadza, is that it can be obtained quickly and, above all, predictably (Woodburn 1968:52-53).
>
> . . . gathering of vegetable foods is fully as important a factor in diet as is hunting. Although hunting is a more prestigious activity, gathering strategies play a large part in determining the band's daily and seasonal movement. Even in the direction of their all-male spear hunt, the Ik take the distribution of vegetable foods into consideration and women are called on for advice (Turnbull 1968:135).

In short, it would seem that gathering serves as the economic backbone for extractive societies and is increasingly relied upon where other means fail. Conversely, gathering is avoided when possible. The position gathering activities hold in extractive societies is no doubt one of the variables that operates to keep such a society near the long-term maximum carrying capacity of its domain while operating well below the maximum short term capacity. Gathering seems to be considered a way to supply supplementary foods even though, in fact, it may be the principle economic base of an extractive society.

On the other hand, hunting and fishing tend to be seen as the most important food producing activities even though they, in fact, account for only a fraction of the food required by a society. Furthermore, fishing will tend to displace hunting in importance when the environment allows equal access to both subsistence modes.

SOCIAL ORGANIZATION

Heeding Harris's (1968) warning to archeologists, this section is not concerned with those aspects of social organization that are commonly lumped under the rubric of kinship. Rather, the interest here is focused on the units into which hunting and gathering groups are segmented, the kind and intensity of interaction that takes place between and in those units, and the manner in which they are integrated with one another.

Three different orders or social units are found in hunting and gathering societies. Two of these, the nuclear family and the local community, are so clearly found in extractive societies that Murdock has been led to comment:

> Looking back on the 27 hunting societies covered in my conference paper, I come to the conclusion (leaving aside the Australian ones for the moment) that there is a surprisingly narrow range of variation in hunting and gathering cultures with regard to social organization. The two universal human social groupings — nuclear family and local community — stand out clearly in all the hunter-gatherer societies (Murdock 1968:335).

In addition to these two universal social units, it now appears that a third basic unit is common to extractive societies. This unit, which has been noted in studies of hunting and gathering groups throughout the world (Birdsell 1958:195; 1968:232), is today properly termed the *dialectal* tribe instead of the previously used *dialectic* tribe.

Since the nuclear family is conceded to be the basic social unit among hunters and gatherers, just as it is among all other known societies, it will not be further discussed here. Instead, attention is focused upon the local group and the dialectal tribe.

The local community is a social unit defined by Murdock (1949:79) as composed of individuals who interact with one another on a day-to-day basis. The community among hunters and gatherers is typically in the form of a band or, in Cooper's (1946) term, a "local group". It is territorially based and usually, but not always, composed primarily of affinally and consanguineously related persons.

In terms of interaction patterns, the local community is the chief social unit of cooperative interaction among the families in a society. It is this unit which is the most flexible, which expands in size when ecological conditions demand or permit, and shrinks again with further change in the ecology of the area.

> This was the worst season of the year for the people. Before this, during the winter, the large extended band . . . was separated into little family groups that were scattered through the veld, living at little waterholes that did not keep their water all year long. During the dry season the water in these waterholes vanished, causing the small family bands to gather at the last sure waterhole of the area (Thomas 1959:148).

The local community is held together primarily by a combination of kinship, cooperation, compatibility and friendship. There is typically no political force or informal rule that maintains such a community. Even so, forms of integration range from the political hierarchy of the chiefdoms of the Northwest coastal groups (Drucker 1965) to the simple primary associations of the Shoshoni (Steward 1938). The degree of political authority exercised within the local community seems to be minimal while kinship remains the major integrative force.

As described by Birdsell (1958:195), the dialectal tribe is the unit that most nearly fits the minimal definition of society. It is self-sufficient in all aspects and forms a territorially identified and defined cultural pattern of interaction as well as a Mendelian population. In short, the dialectal tribe can be defined as a collection of interacting groups of nuclear families and/or communities, sharing a linguistic dialect and forming a territory-specific cultural and genetic unit. The characteristics of specific dialectal tribes have been described by Cooper (1946), Woodburn (1968), Meggitt (1962) and Thomas (1959).

Cooper, for example, notes that the Yahgan divided themselves into five regional dialect groups and that "Marriages with mates from far distant localities, especially outside one's own of the five dialectic *(sic)* groups, were disliked and infrequent" (Cooper 1946:92). At the same time, however, marriage with blood relatives was taboo. Thus, an individual ordinarily sought a mate outside his local group, since most individuals in such a community were likely to be blood relatives, yet married within the dialectal tribe.

The dialectal tribe is not a tribe in the sense used by Service (1962). Rather, the concept of tribe as used here refers to a more informal concept of relationships than Service had in mind. The dialectal tribe is a collection of bands, of communities, that are integrated by sharing a common language dialect, a common domain, and a common *Weltanschauung* or collective consciousness. Such a dialectal tribe may incorporate well delineated forms of social differentiation, as among the Indians of the Northwest Coast, it may approach an egalitarian society as among the Eastern Hadza, the Bushmen, or the Yahgan, or it may be a combination of these with a higher number of achieved status positions as among the Plains Indians.

The significant characteristic concerning the dialectal tribe is that it appears in some form in all these kinds of societies with a hunting and gathering subsistence base. Societies with other types of subsistence may or may not have such a social unit. Among hunting and gathering groups, the dialectal tribe is thus the maximum social unit in terms of interaction patterns.

The size of the dialectal tribe seems to vary about a central tendency of approximately five hundred individuals (Birdsell 1953; 1958; 1968). This figure represents an empirically observed value derived from data on native Australians, Shoshoni, and Andamanese (Birdsell 1968) as well as the Eastern Hadza (Woodburn 1968), !Kung Bushmen (Thomas 1959), and Yahgan (Cooper 1946). The dialectal tribe may comprise the entire society as among the Eastern Hadza (Woodburn 1968), or it may be only a subdivision of a larger political unit. As the number of local groups within a dialectal tribe increases, there is a marked increase in cultural homogeneity between the units (Birdsell 1958).

Interaction between dialectal groups is described as relatively infrequent, although normally tranquil:

> Social relations within and between the dialectic and local groups appear to have been normally irenic, but violence and bloodshed were not infrequent . . . The *Yahgan* resented and

> avenged exploitive trespass upon their tribal territory . . . So, too, did members of any one of the five dialectic groups, of any one of the numerous local groups, by nonmembers (Cooper 1946:95).

Much of the interaction as does take place between dialectal tribes can be seen as a matter of cooperative sharing in emergencies:

> Members of one dialectic or local group could, however, exploit the territory of other groups to secure food in grave shortage, to feast on a stranded whale, and to gather firestones and suitable canoe bark which were found only in certain parts of the *Yahgan* territory (Cooper 1946:95).

The following quotation from Meggitt summarizes these three social units very well:

> From the point of view of the individual, the group at its greatest was the community that comprised all his country and included most of his closer relatives. At its least, the group was his family of procreation or orientation. Between these extremes, the unit might perhaps be termed a horde, but it was one whose personnel were recruited on a number of different bases that varied from one occasion to the next. These might reflect consanguineal links, affinal ties, bonds of ritual friendship or obligation, the pull of temperamental compatibility — or combinations of all of them (Meggitt 1962:51).

SUMMARY

It is recognized that this brief overview of ethnographic data cannot provide the basis for a definitive theory of the behavior of hunting-gathering groups. Instead, the purpose here is to provide a theoretical, abstract model in terms of which archeological and ethnographic data may be ordered and explained. The model is to be considered a flexible one, subject to change as the data and problems warrant. It is in this sense merely another conceptual tool and can only be judged by its usefulness.

Such a model, by its very nature, is stark and, perhaps, vague in its generality. It lacks the explicit detail that comes with the extraction of particular relationships from their context and in this sense is typological in nature. It is a mistake, too often made, to apply such a general model to particular situations without due allowance for the intricate contextual nuances that must be taken into account in the particular.

Another caution in using such a model is that it not be allowed to become the reality it was originally designed to represent. It must be remembered that a model is merely a rather simple abstraction which, in its better forms, more or less accurately represents a theoretical, complex reality. Thus, the following model, presented in the form of a series of statements, is to be considered to be a partial, problem-oriented list of expectations concerning extractive societies.

1. Extractive societies occupy a definite territory which is known to group members and which is defended in varying degrees against transgression by out-groups. The territory of such a group is often bounded by geographically distinct features such as broad plains, different watersheds, soil changes, etc.

2. This territory may be considered in terms of:

(a) An *estate*— the "home ground" of a group or an individual;

(b) A *range* — the tract over which a group ordinarily conducts its activity;

(c) A *domain* — the area containing both the estate and the range; the ecological life-space of a group.

3. The domain must supply the minimum needs of food and water to maintain the group on both a long-term and short-term basis. Therefore, if population size and extractive technology are held constant, there is an inverse relationship between availability of food and water and size of domain. Correspondingly, areas with little available food and water have relatively low population densities, while areas with an abundance of food and water tend to be relatively densely populated.

4. Extractive societies tend to establish an equilibrium between population density and available resources. The point of this equilibrium normally lies near the maximum long-range carrying capacity of a given domain, but is well below the typical short-term carrying capacity. This results in considerable amount of leisure time for hunting and gathering populations.

5. Extractive societies maintain themselves at an equilibrium with their environment in part by exploiting the resources of their domain in a preferential manner. Although hunting, fishing, and gathering activities are all employed when possible, hunting and fishing are preferred over gathering. Gathering activities normally provide the bulk of foodstuffs in hunting and gathering societies even though such activities are not preferred.

6. The settlement pattern of extractive societies range from small, fully nomadic bands to relatively large, sedentary villages. There is a direct relationship between sedentary settlement patterns and water economy, so that as an extractive society relies to a greater extent on a water economy, it grows increasingly sedentary. On the other hand, extractive societies with little or no reliance on fishing are typically highly nomadic.

7. The nuclear family, the local community, and the dialectal tribe are social units that are typically found in extractive societies.

8. The nuclear family is the basic unit of social organization in extractive societies, just as it is in societies with other forms of subsistence. It is similarly the primary source of enculturation, identification and reference. Patterns of interaction are intense and prolonged. The nuclear family is the only one of these three forms of social organization that is wholly exogamous.

9. The local community is the major social unit in terms of interaction patterns among families in a society. It ranges in form from ill-defined, temporary local bands to well defined long-lived, relatively permanent groups. It is territorially based, and its cultural patterns can be expected to differ significantly from similar territorially based groups.

The local community is composed of one or more families and is usually, though not always, exogamous. Interaction within the community is an intense, daily affair. Hence, the local community is second only to the family as an instrument of enculturation and provides the first opportunity to the individual for peer group and other extra-familial sanctions. The culture of the local group is typically quite distinctive, particularly in the more sedentary societies in which flux of movement in and out of the local community is at a minimum.

10. The dialectal tribe is a totally self-sustaining social unit. It is territorially based and is composed of a number of local communities. Interaction is largely within the tribe. This, plus the fact that the tribe is endogamous, leads to the development and maintenance of a distinctive cultural pattern.

11. The dialectal tribe is ordinarily a relatively long-lived sociocultural unit. Its duration should far exceed the time span of any of its constituent members or communities.

12. There is a marked increase in cultural homogeneity within a tribe as the number of local groups within the tribe increases. In relatively favorable regimes, therefore, one could expect dialectal tribes to be more culturally homogeneous than in relatively un-

favorable regimes.

13. Interaction of groups centrally located in the tribal domain is more likely to be confined to intertribal contacts than interaction of groups located near tribal boundaries. Therefore, centralized groups are more likely to be culturally conservative in relation to outlying groups. By the same token, and following the old culture area concept, centralized groups are more likely than outlying groups to interact with all other groups in the tribe.

14. Dialectal tribes vary greatly in size of population, but there is a marked central tendency toward approximately five hundred as the most frequently occurring size.

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PREHISTORIC OCCUPATION AT THE HOLDSWORTH AND STEWART SITES ON THE RIO GRANDE PLAIN OF TEXAS

THOMAS ROY HESTER AND T. C. HILL, JR.
WITH APPENDICES BY JOHN HOLDSWORTH AND DELBERT GILBOW

ABSTRACT

Archeological investigations were carried out in early 1971 at two prehistoric occupational sites in Zavala County on the Rio Grande Plain of Texas. The test excavations at these sites were designed to help solve specific problems in the local prehistory. Cultural debris attributable to Archaic and Late Prehistoric occupations were recovered. At Holdsworth, an abundance of Late Prehistoric materials (including bone-tempered ceramics) overlay ill-defined Archaic components. At the Stewart Site, only Archaic materials were found. Analysis of the faunal remains from Late Prehistoric deposits at Holdsworth indicates an emphasis on rodents in the subsistence system.

INTRODUCTION

In the past few years, there has been increased activity by both professional and amateur archeologists on the Rio Grande Plain of southern Texas (a summary of recent investigations has been published by Hester and Hill 1971a). One area which has received particular emphasis has been the counties of Dimmit and Zavala (Nunley and Hester 1966; Hill and Hester 1971). In the summer of 1970, Hester initiated a long-range study of prehistoric settlement and subsistence systems in the area. The first phase of this research, which included a site-testing program, was carried out at Chaparrosa Ranch, northwestern Zavala County. A preliminary report on these investigations has been prepared (Hester 1970), but a final summary must await completion of several special studies and the analysis of the large body of data obtained during the work.

In early 1971, Hill carried out the testing and surface sampling of sites in both the eastern and western parts of Zavala County. Two major sites, Holdsworth and Stewart, were investigated. Although Hill's work contributed to the settlement-subsistence research mentioned above, the major objective of test excavations at these two sites was an attempt to provide new data apposite to the solving of a specific set of problems. First of all, it was hoped that information on culture sequence could be acquired, since problem-oriented research in the Rio Grande Plain region remains hampered by the lack of a firm chronology. In addition, these hoped-for chronological data could be used to supplement those obtained in Hester's work at Chaparrosa Ranch. A second problem involved the temporal position of the local bone-tempered ceramics (Hester 1968; Hester and Parker 1970; Hester and Hill 1971b). The Holdsworth Site had yielded such pottery from the surface and from erosional faces, and the site seemed an ideal spot to test our hypothesis that these ceramics date from late prehistoric times (i.e., that they are not attributable to historic groups which operated in the area). Thirdly, the work was oriented toward the collection of faunal remains to be utilized in the study of subsistence activities and the seasonality of site occupation. Erosion in some areas of the Holdsworth Site had indicated that a variety of animal bones were preserved. Therefore, all deposits excavated at that site were passed through 1/16 inch mesh to permit a high recovery of faunal remains. These screening procedures also allowed for the recovery of all lithic debris, the analysis of which will be important to our understanding of the stone-working technologies in this area (Hester 1971e).

ETHNOGRAPHICAL AND ENVIRONMENTAL NOTES

The Zavala County area was occupied at the time of historic contact by small groups of hunters and gatherers known collectively as Coahuiltecans. Descriptions of their lifeway have been widely published (e.g., Ruecking 1953; Krieger 1956; Newcomb 1961), and the distribution of various groups in the area has been recorded by Ruecking (1955) and Campbell (ms.). More recently, Nunley (1971) has cast doubt on our knowledge of the Coahuiltecans. He believes that our reconstructions have been generalized quite haphazardly from widely scattered, and very meager, ethnographic data. It is his contention that all of the varied groups in this region cannot be lumped under the rubric "Coahuiltecan". While we do not wish to discuss the pros or cons of Nunley's arguments, we do believe that there are broad aspects of the aboriginal lifeway which can be abstracted from the extant ethnographic data, and we use some of these in our concluding section.

The environmental characteristics of the semiarid brushlands known as the Rio Grande Plain have also been given broad treatment in the literature (Kroeber, 1939; Inglis 1964; Gould 1969; Hill and Hester 1971). The region originally supported a grassland or savannah type climax vegetation. Historic settlement and exploitation of the area led to ecological alterations which brought about the current brushland conditions (Gould 1969: 12). The native fauna are representative of the Tamaulipan Biotic Province (Blair 1950). We will present more precise descriptions of the vegetation and fauna in our discussions of the microenvironments recognized in the vicinity of the two sites.

THE HOLDSWORTH SITE

This site (designated as 41 ZV 14) is located on the Holdsworth Ranch in southeastern Zavala County (Fig. 1). It is situated on the east bank of the west fork of Tortugas Creek, a major tributary of the Nueces River. The creek (including both the eastern and western branches) is characterized by a dendritic drainage pattern.

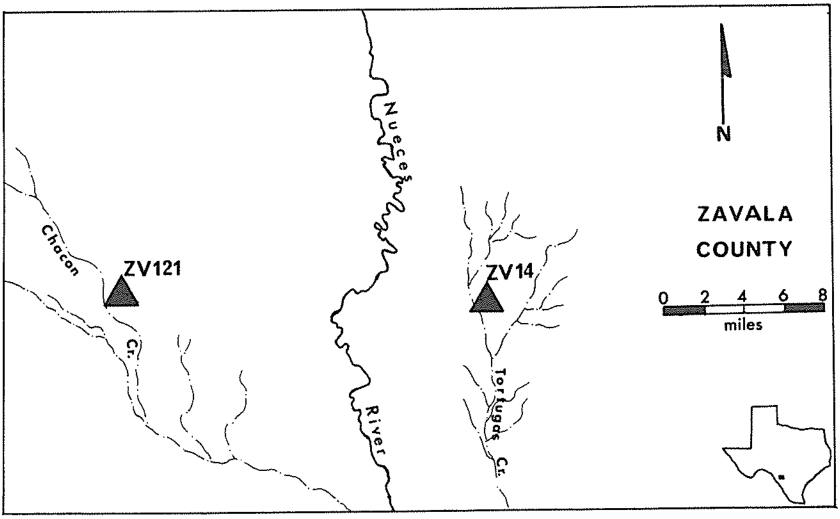

FIGURE 1. The Locations of Sites 41 ZV 14 (Holdsworth) and 41 ZV 121 (Stewart) in Zavala County, Texas. Inset shows location of the county within the state.

The Holdsworth Site lies in a low area between the main channel of the west fork and a former course of that stream (Fig. 2). It is thickly vegetated (the heavy cover has made an accurate estimate of site size impossible) and is subject to periodic flooding. Three microenvironments can be discerned in the vicinity of the site (Fig. 2). The first, within which the site is located, can be termed the **channel** microenvironment. It includes the channel of the west fork

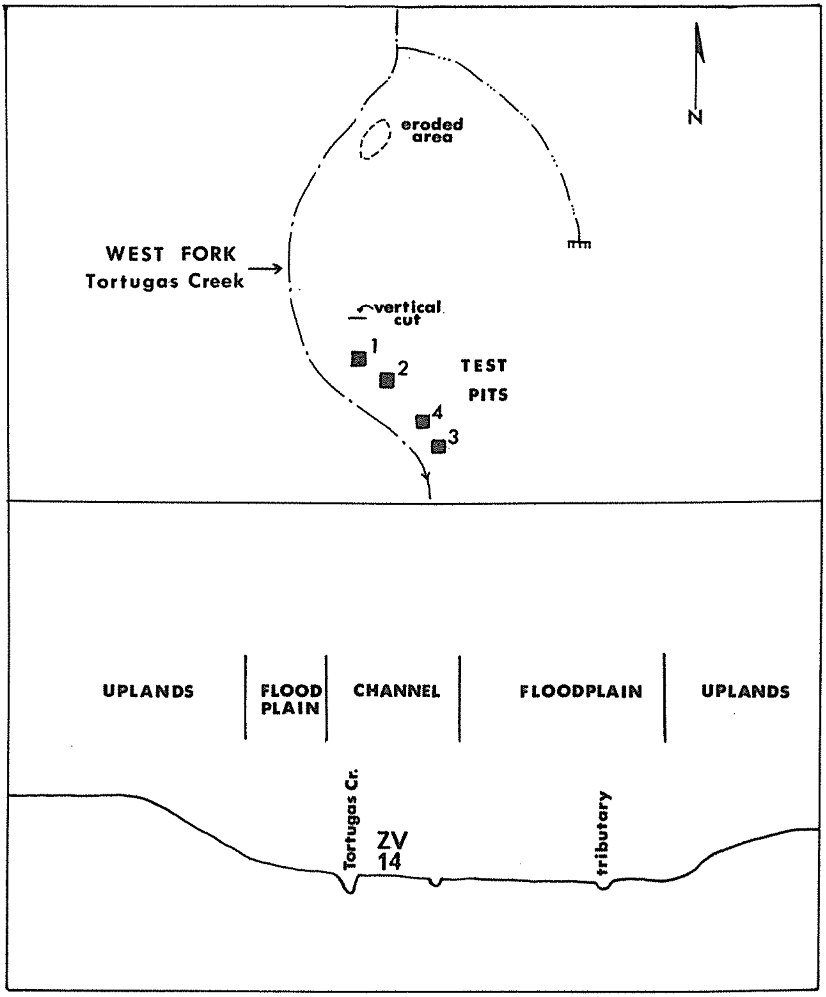

FIGURE 2. The Holdsworth Site, 41 ZV 14. Upper, sketch map (not to scale) showing location of test pits; Lower, schematic profile (looking North) of Tortugas Creek stream valley, showing location of 41 ZV 14 and extent of microenvironments.

(and its former channels paralleling the present stream course); there is heavy vegetation along the borders of the stream. A **floodplain** or "flats" microenvironment is also present. On the east side of the site it extends for some 500 yards; scattered thorny brush and much prickly pear (*Opuntia*) occur. This part of the floodplain is cut by a small tributary of the west fork. On the west side of the creek, the floodplain is narrow, only 30 to 50 yards in width. Several sites have been recorded in the eastern part of the floodplain microenvironment; most appear to be occupation sites spanning the time range from Late Paleo-Indian to Late Prehistoric.

The floodplain is flanked by hilly **uplands**, beginning 200 yards from the creek on the west and 1/2 mile on the east. The fringes of the uplands include ancient terrace remnants capped by lag gravels. Evidence of aboriginal use of the uplands zone is found in the form of chipping stations, small temporary camps and isolated hearths, and a few large occupation sites. One such large campsite is 41 ZV 27 (Holdsworth Highlands Site), about one mile east of 41 ZV 14. It covers approximately 20 acres on a hillslope. There are numerous intact hearths and large quantities of lithic debris. Commonly found are heavy chopping and scraping tools, "Clear Fork" gouges, and Paleo-Indian and Archaic (primarily Early Archaic) projectile point types (e.g., *Clovis, Angostura, Bulverde, Tortugas,* "Early Barbed").

Additional data on the flora and fauna of these three microenvironments (channel, floodplain, and uplands) is found in Appendix I.

The Holdsworth Site (41 ZV 14) was originally recorded in early 1969. Surface collections were made at that time by Hill. One eroded area in the northwestern section of the site yielded both Archaic and Late Prehistoric artifacts (*Frio* and *Tortugas* dart points, *Perdiz* and *Scallorn* arrow points, light and heavy scraping tools, and Leon Plain potsherds). A few animal bones had also been exposed, including those of whitetail deer, bison (?), cottontail rabbit, and alligator (?). Mussel shells were observed and a cutting or scraping tool made from a marine shell (*Macrocallista nimbosa* Solander) was found (see Hester 1971a:87).

In August 1970, the authors visited the site briefly and made a vertical cut in the face of an erosional gully near the center of the site (Fig. 2). The cut extended eight inches below the surface and revealed a dark brown to gray midden deposit containing scattered burned rocks, lumps of baked clay, snail shells, and an abundance of wood charcoal. Since this particular spot had previously yielded a Leon Plain potsherd, we felt that the midden was attributable to a

Late Prehistoric occupation. A charcoal sample was collected and submitted to the radiocarbon dating laboratory at the University of California at Los Angeles.*

The nature of the site suggested to us that extensive buried deposits were present and were a potential source of answers to the problems outlined earlier in this paper. Excavations were carried out by Hill during the period of January through April, 1971.

EXCAVATION PROCEDURES AND STRATIGRAPHY

Four test pits were dug at the Holdsworth Site (Fig. 2). Their horizontal dimensions were: Test 1, 3 x 4 feet; Test 2 and Test 4, 5 x 5 feet, and Test 3, 4 x 6 feet. In the excavation of Tests 1, 2 and 4, vertical control was established according to natural stratigraphic units. Zone 1 (surface to 10 inches below surface) is a dark, humus-stained alluvium containing occupational debris attributable to the Late Prehistoric period. In addition to artifactual material, the zone contains scattered hearthstones (mostly sandstone, but with chert and quartzite represented), baked clay nodules (Hester 1971b), gastropods (*Bulimulus* sp. including *B. dealbatus* and *B. schiedeanus*, *Polygyra texasiana*, and *Helisoma trivolis*), mussel shell fragments (*Unio* sp.), animal bones and wood charcoal. Zone 2 begins at 10 inches and continues to a depth which varies between 20 and 26 inches. The soil is lighter in color and contains clay, which increases toward the bottom of the zone. There is a marked increase in the frequency of *Bulimulus* shells with *Polygyra* and *Helisoma* also represented; other debris includes mussel shell fragments, hearthstones, baked clay nodules, animal bones and small amounts of charcoal. Zone 3, a sterile basal clay, blocky in texture and orange-yellow in color, extends to an unknown depth.

In recording artifact proveniences (Table 1), it was possible to divide Zones 1 and 2 into equal upper and lower units in Test 1; in Test 4, Zone 1 is similarly divided.

Test 3 represents the partial exploration of an intrasite feature. During work at the site, Hill noted an ill-defined, ash-stained area 20 to 25 yards south of Test 2. A 4 x 6 foot unit was excavated in which the upper one foot of deposit contained a variety of debris, including Late Prehistoric projectile points, bits of mussel shell, *Bulimulus* shells, hearthstones and baked clay nodules. The deposit

*The sample was not analyzed until after completion of this manuscript and was found to be "not older than 300 years" (ca. A.D. 1650; Rainer Berger, personal communication). The sample is from upper Zone 1 and probably represents protohistoric occupation at the site.

correlates quite well with Zone 1 except for an abundance of ash and a quantity of woody materials (twigs, limbs, etc., some of which are up to 6 inches in diameter) occurring near the bottom of the zone. We find it difficult to explain the presence of these wooden remains. Perhaps they could be attributed to rather recent burning and collapse of a large tree at the spot as some of the wood is burned, other charred, and some apparently unburned. We discount the recent nature of the wooden remains since they appear to be sealed by the Late Prehistoric midden. We have also wondered if the accumulation of wood might be flood-deposited drift; such a deposition would have had to occur during or prior to the last Late Prehistoric occupations. A third possibility is that the materials represent a burned packrat nest, structures found abundantly in the channel microenvironment today. However, Hill has recently taken apart a number of modern packrat nests and finds that the components differ from the remains excavated in Test 3. A fourth, and even more remote, possibility is that the materials are the partially-burned remnants of a flimsy aboriginal *jacal*-type structure, such as documented for the Coahuiltecans by Ruecking (1953: 484). We are not satisfied by any of these four explanations; fortunately, some of this ash-stained area remains intact and can be investigated further.

At a depth of one foot in Test 3, a hard clay surface was reached which revealed charcoal stains when scraped. Lying on (or just beneath) the surface were two *Ensor* projectile points, a few scattered hearthstones, and fragmentary faunal remains. Although the full horizontal extent of this feature is unknown, we believe that it may be a living surface (a hut floor or hearth area?) dating from *Ensor* times. It does not appear to be related to the wood accumulation previously discussed.

The soils at the site (the characteristics of which were described earlier) appear to be representative of the Maverick-Montell-Catarina series (Pederson and McEntire 1966). The Montell and Catarina components are clays and are of particular significance because they are vertisols (Jack Stevens — Soil Conservation Service soil scientist at Uvalde — and Wayne Hamilton — former SCS agent — personal communication; for a distribution map of vertisols on the Rio Grande Plains, see Duffield 1970). Vertisols are dynamic in nature and can cause the displacement of archeological materials within the soils (Duffield 1970).

MATERIAL CULTURE

The artifacts from the Holdsworth Site are described here; provenience data are given in Tables 1 and 2. Projectile point typology follows that of Suhm, Krieger and Jelks (1954) and Suhm and Jelks (1962). All measurements given are in millimeters and weights in grams. The following abbreviations are employed: L, length; W, maximum width; T, maximum thickness; SL, stem length; SW, stem width; and WT, weight. Measurements of fragmentary specimens are enclosed in parentheses.

The format in which the descriptions are presented varies somewhat from that used in most archeological studies in the Texas area. We have grouped the artifact categories under three broad functional headings (modified from Winters 1969) as we believe that these enable us to present a better view of the aboriginal tool kit. (1) **Hunting Tools/Weapons:** equipment used in the procurement of game, to which we can attribute the projectile points; (2) **Processing and Fabricating Tools:** general utility implements used to process raw materials and to fabricate other types of equipment; (3) **Domestic Equipment:** household equipment such as ceramic vessels used for the preparing, storing and serving of foodstuffs. Of course some of the items classed as Processing and Fabricating Tools could be included here, but we see no way to eliminate this overlap without changing our classification to one based on the sexual division of labor (*i.e.*, associating specific tool forms with either males or females).

The residue from the manufacture of chipped stone items in the tool kit is described under the heading of Tool Manufacturing Debris.

HUNTING TOOLS / WEAPONS

Projectile Points

Here we have used more or less standard criteria in separating arrow and dart points. Such distinctions are usually based on the size, technology, and weight of the points. Arrow points are small and thin and made on light flakes, while dart points are larger, thicker and made either on biface preforms or on large flakes. Fenenga (1953:322) has suggested that points exceeding 3.5 grams in weight were used with the dart and atlatl and those of less than 3.5 grams were used with the bow and arrow. The projectile point groups at Holdsworth clearly show such a bimodal distribution.

However, a number of so-called "dart points" have been found in direct association with arrow points at several sites on the Rio Grande Plain (Hill and Hester 1971; Hester 1970). As the provenience chart in Table 1 shows, two of the "dart points" (both quite small) at Holdsworth occurred in Late Prehistoric contexts, though admittedly this may be due to mixing as a result of the dynamic soils present at the site. Still, we feel that the data allow us to propose two hypotheses regarding the presence of "dart points" in the Late Prehistoric of the Rio Grande Plain: (1) the atlatl survived quite late in the area and was used along with the bow and arrow. The bow and arrow must have totally replaced it prior to historic contact, as early Spanish accounts make no mention of the atlatl's use in the region (Ruecking 1955). The retention of the atlatl might have been due to factors other than cultural conservatism; for example, in the Valley of Mexico, aborigines of the Colonial period used the bow and arrow to hunt deer, while the dart and atlatl were retained to hunt waterfowl and to spear fish (Michels 1971:226). (2) it is also equally feasible that with the advent of the bow and arrow in the region, small dart points were used along with the new arrow point forms to tip arrow shafts. Greer (1968:190) has suggested that the *Ensor* type of Trans-Pecos Texas may have functioned as an arrow point. The possibility of a functional overlap between "dart" and "arrow" points in southeastern Texas has been suggested by Aten (1967:17).

Arrow Points (Fig. 3,a-f)

Six arrow points were found in test excavations. Four are examples of the *Perdiz* type and are made from gray, tan, cream, and translucent cream cherts. Two additional arrow points are corner-notched and can be typed as *Scallorn*; they are fashioned from dull brown and cream cherts. The lateral edges of one *Scallorn* specimen are serrated.

Dimensions of arrow points are:

TYPE	L	W	T	SL	SW	WT.	FIG.
Perdiz	29	25	4.5	8	9	2.9	3,a
Perdiz	34	15	3	11	6	1.3	3,b
Perdiz	34	15	2.5	10	4.5	1.2	3,c
Perdiz	32	21	3	13	8	2.0	3,d
Scallorn	(20)	13.5	3	4	11	(1.2)	3,e
Scallorn	(36)	14	2	*	*	(1.9)	3,f

Dart Points (Fig. 3,g-l)

One of the six dart points found at the Holdsworth Site is similar to the *Pedernales* type, a large, stemmed form common in central Texas (Suhm, Krieger and Jelks 1954). It is of brown chert, crudely chipped, and has been burned. Another dart point has a rectangular stem and is made of translucent brown chert. There is also an unstemmed lanceolate dart point fragment (the tip is missing) made of translucent gray chert.

Three of the dart points have broad side notches and can be included in the *Ensor* type. Two of the specimens were found on the hard clay surface uncovered during the excavation of Test 3 and both of these points are fashioned from gray chert; the third specimen is made of cream chert.

Dimensions of dart points are:

TYPE	L	W	T	SL	SW	WT.	FIG.
Pedernales	67	27	7	17	21	12.0	3,g
Rectangular Stemmed	38	18	5	11	12	4.2	3,h
Lanceolate	(33)	20	5	-	-	(4.0)	3,i
Ensor	(27)	20	7	-	-	(4.8)	3,j
Ensor	39	21	7	-	-	6.0	3,k
Ensor	(40)	24	7	-	-	(6.5)	3,l

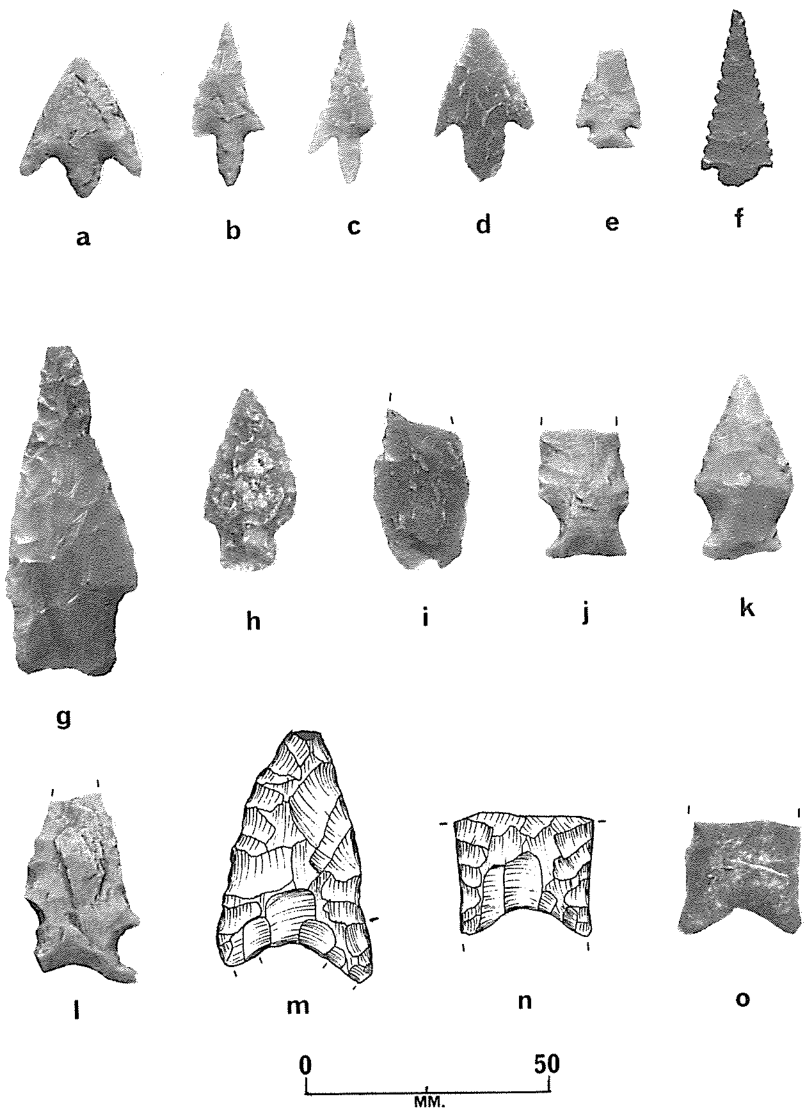

FIGURE 3. *Artifacts of Chipped Stone from the Holdsworth Site, 41 ZV 14.* a-d, ***Perdiz***; e, f, ***Scallorn***; g, ***Pedernales***; h, rectangular stemmed; i, lanceolate; j-l, ***Ensor*** (j, k, from Test 3); m, n, projectile points from deep gullies, east-central part of site (n, ***Plainview***); o, ***Plainview*** point from 41 ZV 7.

PROCESSING AND FABRICATING TOOLS

Bifaced Cobbles (Fig. 4,a-b)

Two cobbles with brown cortex (derived from terrace exposures in the site vicinity) have been bifaced at one end. One (Fig. 4,b) is a large rectangular specimen, 90 mm. long, 47 mm. wide, and 46 mm. thick weighing 282.0 grams. The other specimen (Fig. 4,a) is an oblong cobble 79 mm. long, 56 mm. wide and 48 mm. thick weighing 193.5 grams. The bifacial flake removals have created a rough cutting or chopping edge. On the oblong specimen, this edge has a broad cylindrical band of very heavy dulling. Witthoft (1955:20) has suggested that such use-wear could result from abrasion caused by rubbing it against another stone. Perhaps this tool was used to process plant fibers, skins, or some other thin material which was resting on a hard backing, such as a flat stone anvil.

End Scrapers (Fig. 4,c-e)

One specimen (Fig. 4,c) is made on a blade of translucent cream chert. The blade has a simple prepared (or single facet) striking platform and a salient bulb of percussion (a bulbar scar is present). A convex scraping edge has been formed at the distal end of the blade; edge angle is 60°. There is no observable evidence of wear on the working edge.

A second end scraper (Fig. 4,d) is made on a cortex flake of gray chert. The scraping edge is crudely chipped along the distal end of the flake, and there is irregular trimming along one lateral edge. The scraping edge forms an angle varying from 55°-60°; use-wear in the form of nibbling and crushing is present.

The third specimen (Fig. 4,e) can be best termed an "end-side" scraper, as one of the lateral edges (as well as the distal end) shows careful trimming. Edge angles on the distal edge range from 40°-80°, while on the trimmed lateral edge, the angle is 50°. The specimen is fragmentary and made of light gray chert.

Dimensions of end-scrapers are:

L	W	T	WT.	Fig.
50	23	8	8.7	4,c
(37)	37	8	-	4,d
43	30	10	12.0	4,e

Although distinctive use-wear is absent from all three specimens, the edge angle data indicate that they could have been used for a variety of tasks, including hide-working, plant processing, or heavy cutting. (Wilmsen 1968:156-157).

Notches (Fig. 4,f,g)

One specimen is a flake fragment with a notch 11 mm. in length chipped into one edge. The edge of the notch shows crushing resulting from use. The second specimen is a fragment of a blade with a notch (12 mm. long) crudely chipped into one edge. Dimensions are: L,(43),(30); W, 26,24; T, 13,4,5. Both could have served as implements for shaving or smoothing the surface of cylindrical wooden shafts.

Graver (Fig. 4,h)

This is a small flake fragment with a carefully chipped graver beak. No evidence of use was observed under microscopic examination. Length of the graver beak is 2 mm. Other dimensions are: L, (16), W, 25; T, 2.

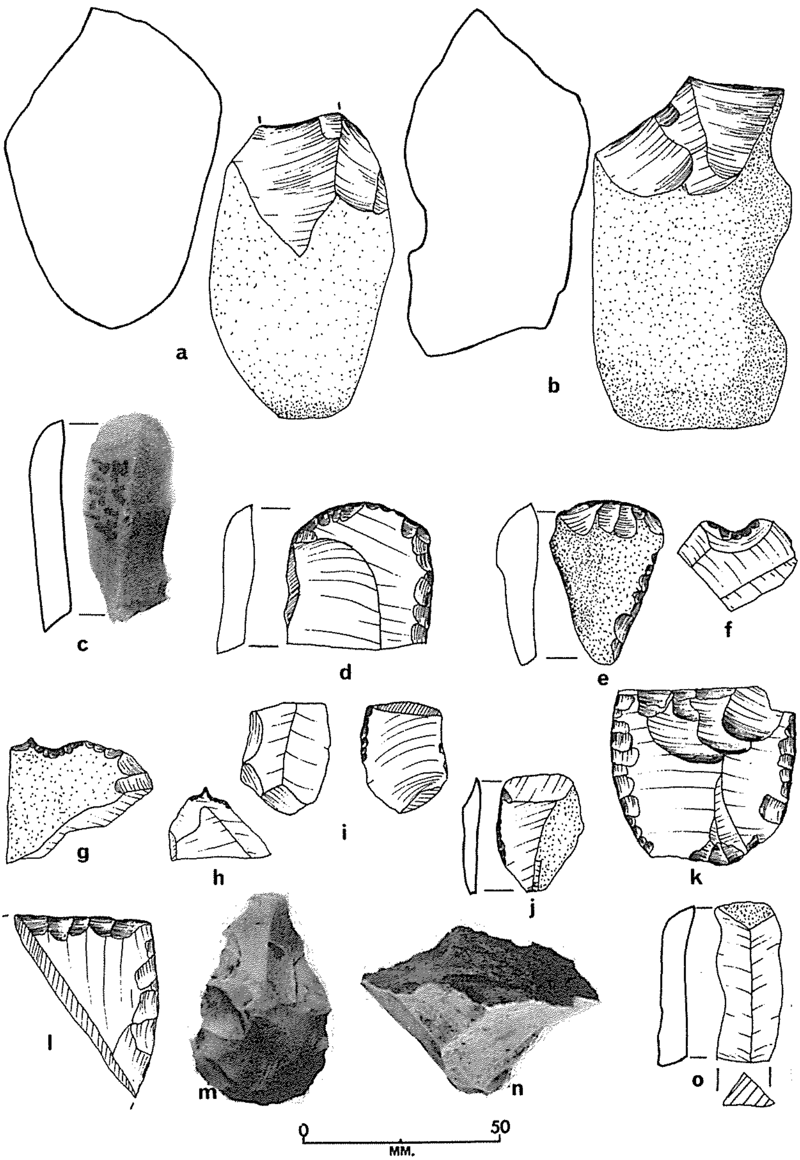

FIGURE 4. Artifacts of Chipped Stone from the Holdsworth Site, 41 ZV 14. a, b, bifaceted cobbles; c-e, end scrapers; f, g, notches; h, graver; i, j, laterally-trimmed flakes; k, uniface fragment; l, beveled biface fragment; m, preform; n, polyhedral core; o, blade.

Laterally-trimmed Flakes (Fig. 4,i,j)

Two specimens are secondary cortex flakes trimmed along one edge. The other two examples include a flake fragment with trimming on one edge, and an interior flake with trimming on the ventral surface of one edge. These artifacts probably were used for casual cutting or scraping activities. Dimensions are: L, 49,30,(27),(23); W,28,22, 20,35; T,6.4, 6.8.

Mano (not illustrated)

The specimen is a fragment of a bifaceted limestone mano.

Hammerstones (Fig. 5,a-e)

Three examples are made from purple quartzite pebbles, a favorite material of prehistoric flint-knappers in this area (Hester 1971e). Two are rounded and the third is oblong. Two are battered at one end and the other at both ends.

Another rounded hammerstone is made of a dense sandstone and the fifth specimen is made of a silicified limestone; both show battering at one end. The primary function of these tools was probably the fabrication of chipped stone implements.

The dimensions are:

L	W	T	WT.	FIG.
40	36	17	34.8	5,a
39	19	15	16.0	5,b
31	26	24	26.5	5,c
(61)	50	34	(158.4).	5,d
35	31	27	39.9	5,e

Fragmentary Tools (Fig. 4,l)

Tools broken during use include both bifacial and unifacial forms. Bifaces include: (a) 3 medial fragments; (b) fragment of a beveled-edge biface (possibly a knife); (c) two burned fragments. Fragmentary unifacial specimens are: (a) a possible scraper fragment; (b) medial fragment of a double edge side-scraper; (c) a uniface (scraper?) edge apparently detached by an "overshot" flake (*cf.* Shiner 1969:227); (d) a large scraper fragment on which the break has been used as a striking platform for the removal of several small flakes.

DOMESTIC EQUIPMENT

Potsherd (not illustrated)

The specimen is a body sherd of a bone-tempered vessel. The material is a fine, compact paste with many tiny bone fragments (some are up to 1 mm. in size). The exterior surface is smudged. The light pink interior retains smoothing striations. Wall thickness is 6 mm.

This sherd is characteristic of bone-tempered plainware (Leon Plain) found at numerous surface sites in southern Texas (Hester 1968; Hester and Parker 1970; Hester and Hill 1971b). However, this is the first specimen to be found in an excavated context.

TOOL MANUFACTURING DEBRIS

The excavations at Holdsworth yielded a quantity of lithic materials and debris attributable to various stages in the tool manufacturing process. These include preforms (tools under manufacture), cores, and various kinds of flakes.

Preforms (Fig. 4,m)

Five are crudely bifaced flakes which probably represent an initial stage in the bifacing of tools. Another specimen is a subtriangular dart point or knife preform (L,54; W,34; T,17; WT 25.8), and the sixth specimen is a preform medial section.

Cores (Fig. 4,n)

Two cores are intact. One is a semi-conical polyhedral flake core with one part of its striking platform cortex-covered and the remainder faceted. The platform forms angles of 75°-80° with the sides. Height of the core is 38 mm., maximum platform width is 60 mm., minimum width is 38 mm. and weight is 59.3 grams. The other core is a rounded chert nodule from which flakes have been bifacially detached using one edge of the nodule as a striking platform. L, 70; W, 69, T, 56; WT, 290.7.

One exhausted core was found and there are four core fragments. Three of the core fragments have simple prepared platforms (*i.e.*, single flake platforms), and the fourth a multifaceted platform.

Flakes

All flakes from each test pit were collected and analyzed. The flakes have been sorted into several categories which reflect the technological processes carried out in tool manufacture. The definitions for each category are based largely on the work of H. J. Shafer, (1969) and subsequent modifications by Hester (1971c), Hill and Hester (1971) and Skinner (1971). *Primary cortex flakes* have the dorsal surface covered with cortex; they represent the initial decortication of a core. *Secondary cortex flakes* retain some cortex on the dorsal surface, representing further shaping of a core. *Interior flakes* have no cortex on the dorsal surface, indicating their removal from the interior of a core. *Biface thinning flakes* ("lipped" flakes) result from the soft hammer technique of biface reduction (Epstein 1964:164). They have lenticular multifaceted platforms which overhang on the ventral surface. Occasional dulling of platform edges was observed on the Holdsworth sample; such abrasion may result from platform preparation or perhaps from the resharpening of a dulled biface edge (a knife edge). *Flake fragments* (the "chips" of Skinner 1971:159) are pieces which lack the striking platform and bulb of percussion. Twenty percent of such fragments from the Holdsworth site are burned.

A study of the platform types of all flakes suggest that cores with various types of platform preparation were present in the chipped stone industry. Some cores were developed from nodules with a flat striking surface (natural platform). Flakes detached from such cores have *cortex* -covered striking platforms. As indicated by studies at the Chaparrosa Ranch (Hester 1970), one popular type of core in the area was formed by the halving of a cobble and use of the resultant broad fracture surface as a striking platform. Thus, flakes detached from such surfaces will have a *single-facet* platform. Sometimes these cores underwent extensive platform modification in the form of faceting (Hester 1970); flakes removed from these cores often have *multifaceted* platforms, although flakes with single-facet platforms could also be removed. One specialized type of multifaceted platform is termed a *convergent* plat-

	Test 1				Test 2		Test 3		Test 4		TOTALS
	Zone 1		Zone 2		Zone 1	Zone 2	Zone 1	Zone 2	Zone 1		
	U	L	U	L					U	L	
Arrow points:											
Perdiz	1	—	—	—	—	—	2	—	1	—	4
Scallorn	—	—	—	—	1	—	1	—	—	—	2
Dart points:											
Pedernales	—	—	1	—	—	—	—	—	—	—	1
Rec. stemmed	—	—	—	—	1	—	—	—	—	—	1
Lanceolate	—	—	—	—	—	—	1	—	—	—	1
Ensor	—	—	—	—	1	—	—	2	—	—	3
Bifaced cobbles	—	—	—	—	—	—	—	—	2	—	2
End scrapers	1	—	—	—	—	—	2	—	—	—	3
Notches	—	—	—	—	1	—	1	—	—	—	2
Gravers	—	—	—	—	—	—	1	—	—	—	1
Trimmed flakes	1	—	—	—	1	—	1	—	—	1	4
Mano	—	—	—	—	—	1	—	—	—	—	1
Hammer-stones	1	—	—	—	—	—	1	—	2	1	5
Frag. tools:											
Bifaces	—	1	—	—	1	1	—	—	—	—	3
Unifaces	—	—	—	1	3	—	—	—	—	—	3
Potsherd	—	—	—	—	—	—	—	—	1	—	1
Preforms	2	—	—	—	—	1	1	—	2	1	7
Cores:											
Polyhedral	—	—	—	—	—	—	1	—	—	—	1
Bifacial	—	—	—	—	—	1	—	—	—	—	1
Exhausted	—	—	1	—	—	—	—	—	—	—	1
Fragmen-tary	1	—	—	—	1	1	1	—	—	—	4
Totals	7	1	2	1	10	5	13	2	8	3	52

Table 1. *Provenience of Artifacts from the Holdsworth Site.* U=upper half of zone; L= lower half.

form. Striking platforms on these flakes are formed by convergent planes (Hester 1971c:106). *Crushed* or *shattered* platforms were also observed. Figure 8 lists frequencies of flake striking platform types at the Holdsworth Site.

Bulbs of percussion observed on primary and secondary cortex flakes, and on most interior flakes, indicate their removal by hard hammer percussors. Diffuse bulbs noted on biface thinning flakes suggest the use of softer-than-stone billets, perhaps of wood or bone.

Raw materials were obtained in cobble form from terrace exposures near the site. A variety of multicolored fine and coarse-grained cherts are represented in the flake debris. Several flakes have the vitreous luster attributable to thermal alteration (Crabtree and Butler 1964; Purdy and Brooks 1971).

Ranges in flake size are indicated below:

	L	W	T
Primary Cortex	11-40	13-39	7-17
Secondary Cortex	8-65	9-50	2-20
Interior	7-55	10-45	1.5-16
Biface Thinning	8-40	6-37	1-8

	Test 1				Test 2		Test 3		Test 4		
	Zone 1		Zone 2		Zone 1	Zone 2	Zone 1	Zone 2[1]	Zone 1		TOTALS
	U	L	U	L					U	L	
Primary	2	—	—	—	1	—	4	—		2	9
Secondary	10	9	—	7	21	20	34	—	16	18	135
Interior	19	18	1	4	48	21	57	—	19	32	219
Biface thinning	7	7	12	3	19	38	12	—	7	11	116
Fragments	30	55	44	10	173	116	140	—	56	147	771
Uniface resharpen	—	—	—	—	1	1	—	—	—	—	2
Overshot	—	—	—	—	—	1	—	—	—	—	1
Blades	—	—	—	—	—	1	—	—	—	—	1
Chunks	—	2	—	—	—	1	—	—	—	—	3
"Potlids"	2	3	—	—	—	—	—	—	—	—	5
TOTALS	70	94	57	24	263	199	247	—	98	210	1262

Table 2. *Provenience of Flakes, Blades, Chunks and "Potlids" at the Holdsworth Site.* U = upper half of zone; L = lower half.

[1] no flake sample available for Test 3, Zone 2.

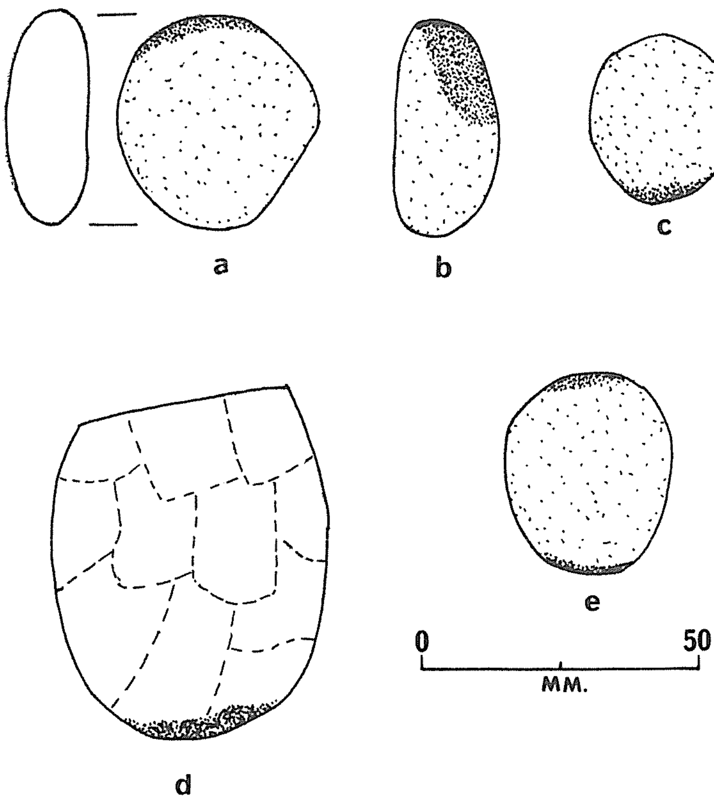

FIGURE 5. Hammerstones from the Holdsworth Site, 41 ZV 14. Battered areas indicated by stippling.

Miscellaneous Flakes and Chunks (Fig. 4,o)

Two flakes result from unifacial resharpening techniques (Shafer 1970). Both have multifaceted platforms with one edge dulled (this was the scraper edge being rejuvenated). L, 7,9; W9,11; T, 1.5, 2. There is also a single "overshot" flake (Shiner 1969:227) which is a fragment. Although several blade-like flakes are included in the flake categories, only one true blade was found. It is 41 mm. long, 17 mm. wide and has a triangular cross section 8 mm. in thickness. The platform is triangular and single-faceted with a patch of cortex at the distal end. Five "potlids" were noted; these are circular plano-convex pieces which are the product of the intense thermal fracture of a chipped stone specimen.

Three specimens are classed as chunks; two are burned. Deacon (1969:155) defines chunks as ". . . larger artifact waste predominantly of non-flake origin and graded on a size basis as greater than 10 mm. in maximum dimension."

THE STEWART SITE

The Stewart Site (41 ZV 121) is located in western Zavala County (Fig. 6) on the west side of the main channel of Chacon Creek. Occupational debris is buried in a natural levee (alluvial knoll) paralleling the creek; on the surface, debris is scattered for 30 yards north to south, varying from 10 to 15 yards in width. Three major ecological subdivisions can be recognized; many of their characteristics have been previously listed by Hill and Hester (1971: 52-53) in their report on the Honeymoon Site (41 ZV 34) located downstream from the Stewart Site. There is a **channel** microenvironment, including the intermittent Chacon Creek and a narrow band of vegetation (primarily live oaks and some brushy plants) paralleling the creek. The **floodplain** microenvironment is thickly vegetated with mesquite, prickly pear, and associated thorn brush. Soils are of the Uvalde-Montell series (Agricultural Extension Service 1965), and consist of dark grayish calcareous loams 10 to 20 inches thick, overlying either pale brown calcareous clay loam (Uvalde) or gray compact dense clay with $CaCO_3$ concretions (Montell). To the east of the site, the floodplain extends for approximately one mile until it reaches a line of gravel ridges and hills. This **upland** formation is composed of eroded remnants of ancient terrace systems; soils are gravelly loams overlying deposits of caliche. Waterworn chert or igneous gravels are exposed on the surface (Pederson and McEntire 1966); the surface often takes on a "desert pavement" appearance. Climax vegetation includes a variety of native grasses, guajillo, ceniza, black-brush, prickly pear, and mesquite. To the west of the Stewart Site, the floodplain is about one-half mile in width and is cut by a dendritic system of overflow channels of Chacon Creek. These channels have deep spots ("holes") which can retain water even during periods of sustained droughts (as observed by Hill during a severe year-long drought in 1970-1971). A small natural lake has been formed in one of these channels, *ca.* 100 to 150 yards east of the site. The western floodplain is bordered by broad sandy uplands, covered with native grasses and scattered thorny brush.

Though there has been no detailed study of the modern fauna in the site vicinity, we suspect that the composition of the faunal assemblage differs little from that recorded for the Holdsworth Site environs (see Appendix I).

The initial survey of the site by Hill led to the collection of several dart points and dart point fragments, indicative of Archaic occupations. These include a specimen with an expanding stem (Fig. 7,f) and a fragment with a bifurcated stem (Fig. 7,i). Two other

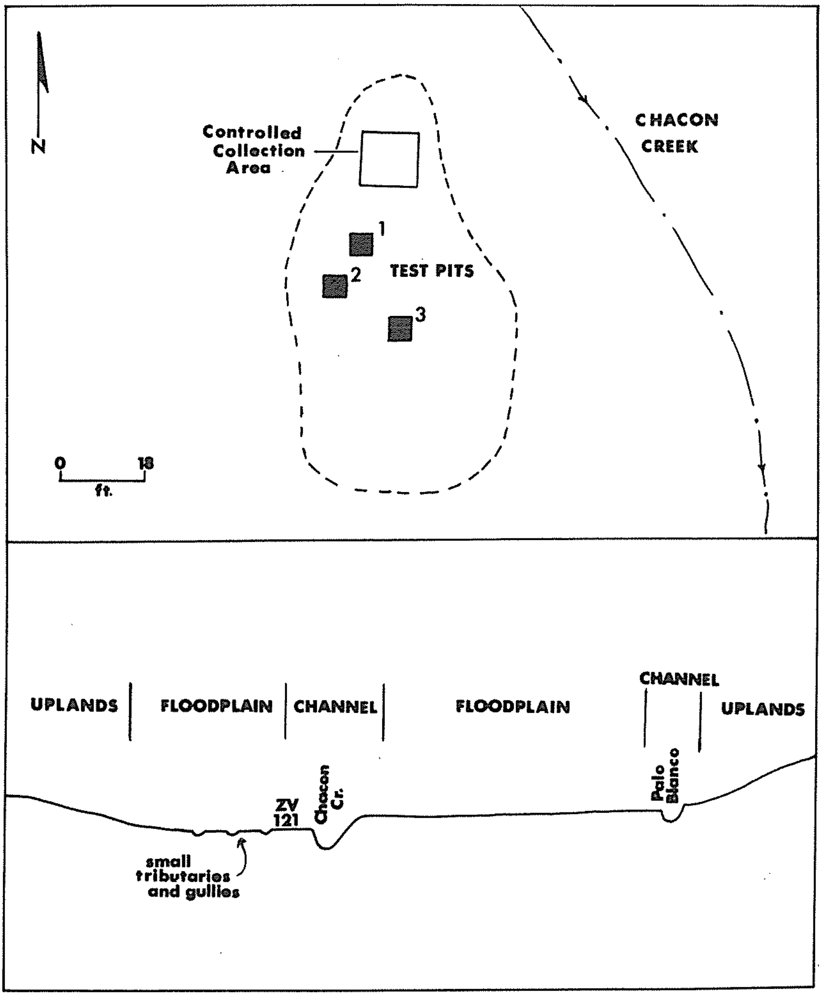

FIGURE 6. The Stewart Site, 41 ZV 121. Upper, sketch (scale indicated) of site, with test pits and surface collection unit shown (dashed line indicates horizontal extent of cultural debris); Lower, schematic profile (looking North) showing position of 41 ZV 121 and extent of microenvironments.

stemmed point fragments, two distal fragments, and a lanceolate binace basal fragment were also collected. Further inspection of the site indicated that buried deposits were present. Excavations were carried out by Hill in January and February 1971, to secure information on the presumed Archaic occupation of the site.

EXCAVATION PROCEDURES AND STRATIGRAPHY

Three test pits (all 5-foot squares) were dug at the Stewart Site, again according to stratigraphic units. Zone 1 extends from the surface to a depth of approximately one foot. It is a very soft, light brown soil, containing artifacts, hearthstones, *Bulimulus* shells, and bits of mussel shell. Zone 2 begins at a depth of one foot, but its total vertical extent is not known. It is a very hard, fine-grained, gray-brown soil (with an abundance of clayey materials). Only the upper six inches contain occupational debris. At a depth of 15 inches in Test 3, a concentration of burned rocks was found. Among the stones was a side-notched projectile point (Fig. 7,c). The nature of the concentration is unknown.

The soils appear to correspond to the Uvalde-Montell series (Agricultural Extension Service 1965).

CONTROLLED SURFACE SAMPLE

A concentration of lithic debris was observed on the site surface (Fig. 6). A 12 x 12 foot square encompassing the concentration was laid out. All lithic debris was collected and has been analyzed. Approximately 90 percent of all debris came from the northeast quadrant of the unit where a cluster of flakes was observed in an oval area 2 to 3 feet in diameter. In the southwest quadrant of the unit, a concentration of burned rocks (perhaps remnants of a hearth) was noted; as these were being removed, a *Shumla* projectile point (Fig. 7,a) was found.

MATERIAL CULTURE

Terminology, abbreviations, and measurements used in the description of the material culture from the Holdsworth Site are also employed here.

HUNTING TOOLS / WEAPONS

Dart Points (Fig. 7,a-c)

One specimen is a basal fragment with large side notches and a concave base. It is made of tan chert and was found among hearthstones in Test 3. The other two dart points were recovered from the controlled collecting area. One of these is made of gray chert, with corner notches, a concave base, and reworked distal tip. It is quite reminiscent of "Early Corner Notched, Variety 2" excavated by Hester (1971c) at the La Jita Site. The second specimen is a very carefully chipped point with basal notches and heavy barbs made of gray-pink chert. We feel that it can be included in the *Shumla* type. The dimensions of these specimens are:

TYPE	L	W	T	SL	SW	WT	FIG
Shumla	52	32	5	10	12	6.6	7,a
Corner-notched	27	28	6	10	(23)	(4.2)	7,b
Side-notched	(36)	30	6	-	-	(7.0)	7,c

PROCESSING AND FABRICATING TOOLS

Scraper (Fig. 7,j)

The specimen is a partially-bifaced pebble with a well-defined scraping edge chipped along one lateral edge. The edge angle is 65°. L, 52; W, 51; T, 22; WT, 49.5.

Notch (Fig. 7,k)

A small intact flake has been notched on one edge. The notch is 9 mm. in length. L, 29; W, 30; T, 8; WT, 7.5.

Fragmentary Tools (Fig. 7,d)

Five specimens are bifaces. Two are medial sections of thinned bifaces (knives or perhaps dart points), two others are end fragments, and one is an edge fragment. One uniface is represented and is apparently a section of a scraper edge.

TOOL MANUFACTURING DEBRIS

Preforms, cores and flakes were collected from the Stewart Site and have been sorted according to the criteria used in the analysis of the Holdsworth Site debris.

Preforms (not illustrated)

Both specimens are fragmentary. One is a section of roughly bifaced petrified wood, and the second is a fragment of a crudely-shaped biface.

Cores (Fig. 7,l)

There are three exhausted cores in the collection. Two of these are ovate remnants of bifacially-flaked cores, and the third is an ovate-piece which may have seen secondary use as a scraper or chopper. L, 71, 50, 53; W, 51, 48, 44; T, 21, 20, 27. Three additional specimens in this category are core fragments; one of these has been burned.

Chunks (not illustrated)

Four pieces of chert of non-flake origin are classified as chunks.

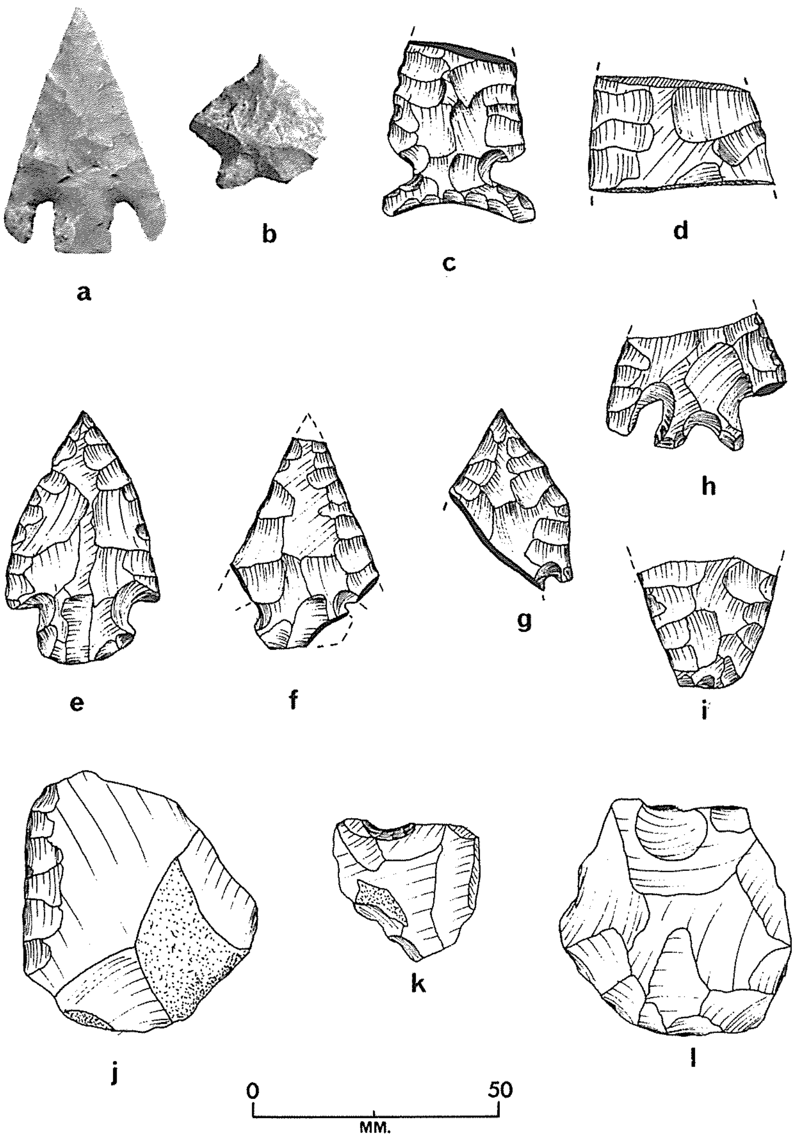

*FIGURE 7. Artifacts of Chipped Stone from the Stewart Site. a, **Shumla**; b, corner-notched; c, side-notched; d, medial fragment; e-i, points and fragments from surface random; j, scraper; k, notch; l, exhausted core.*

Flakes (not illustrated)

The flake debris was sorted in the same manner as that from the Holdsworth Site; frequencies and provenience data are given in Table 4. All of the flake platform types described for Holdsworth, except the convergent type, occur in the Stewart sample (Fig. 8). Dulling of the striking platform occurred among a small percentage of the excavated biface thinning flakes. However, among those from the controlled collecting unit, 35% have dulled platforms.

Raw materials recognized in the flake analysis include fine- and coarse-grained cherts of various colors, and small amounts of petrified wood and basalt. The major source was no doubt the gravel-capped ridges bordering the eastern floodplain.

The ranges in flake size are given below. Those for primary cortex flakes should probably be discounted because of the very small sample of that flake type, several of which are fragmentary.

	L	W	T
Primary cortex	?-17	18-26	3-7
Secondary cortex	18-65	12-48	2-15
Interior	11-55	10-30	1.5-8
Biface thinning	11-30	14-23	2-4

	Test 1 Zone 1	Test 2 Zone 1	Test 3 Zone 1	Test 3 Zone 2	12 x 12 surface	Totals
Dart points:						
Side-notched	—	—	—	1	—	1
Corner-notched	—	—	—	—	1	1
Shumla	—	—	—	—	1	1
Scraper	—	—	—	—	1	1
Notch	—	—	—	—	1	1
Frag. tools:						
Bifaces	3	2	—	—	—	5
Unifaces	—	—	—	—	1	1
Preforms	—	—	—	—	2	2
Cores:						
Exhausted	1	2	—	—	—	3
Fragments	—	1	—	—	2	3
Totals	4	5	0	1	9	19

Table 3. *Provenience of Artifacts from the Stewart Site.*

	Test 1 Zone 1	Test 2 Zone 1	Test 3 Zone 1	Test 3 Zone 2[1]	12 x 12 surface	Totals
Primary cortex	3	—	3	—	—	6
Secondary cortex	13	5	7	—	19	44
Interior	15	8	9	—	39	71
Biface thinning	45	8	7	—	100	160
Flake fragments	190	41	40	—	242	513
Chunks	3	—	—	—	1	4
Totals	269	62	66	—	401	798

Table 4. *Provenience of Flakes and Chunks at the Stewart Site.*

[1] no flakes were recovered from this partially-excavated zone.

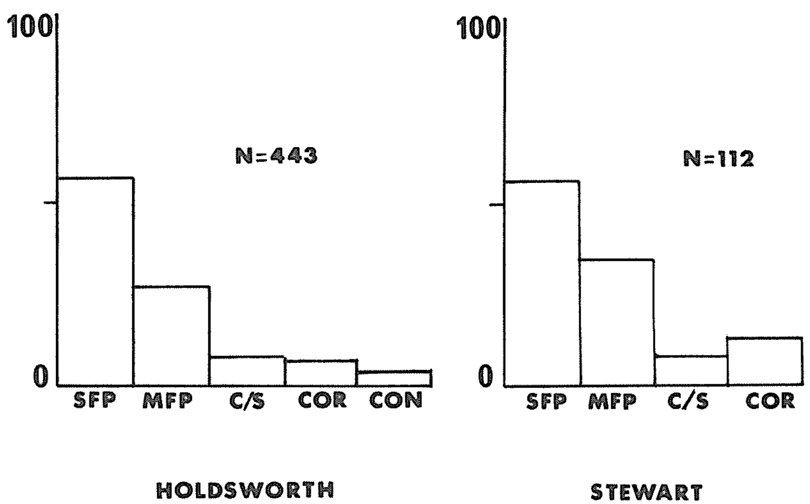

FIGURE 8. Frequencies (by percent) of Flake Striking Platform Types at the Holdsworth and Stewart Sites. SFP, single faceted platform; MFP, multifaceted platform; C/S, crushed or shattered; COR, cortex; CON, convergent.

DISCUSSION AND INTERPRETATION

We have thus far described the archeological investigations at the Holdsworth and Stewart sites and the cultural remains obtained as a result of the work.

One of our stated goals for excavation at the two sites was to secure information on the local culture history. At the Holdsworth Site, the stratigraphic data indicate the presence of Archaic occupational remains, although the nature and extent of this occupation cannot be presently defined. Zone 2, in which the Archaic materials occur, contained a *Pedernales* dart point, two *Ensor* points, a biface, a uniface, a mano, a bifacial preform, and two cores. Further investigation of this zone is required. We would like to point out at this juncture that even earlier occupational debris may be present within the site area. For example, recent erosion in the east-central part of the site has cut gullies of varying depth. The deepest of these (ca. two feet) has yielded a fragmentary *Plainview golondrina* point (Fig. 3,n) and possibly associated materials including flakes, tool fragments, and a triangular point with dulled lateral edges (Fig. 3, m). Just downstream from Holdsworth at Site 41 ZV 7, other *Plainview golondrina* specimens have been collected (an example is illustrated in Fig. 3,o). All of these presumed early points (cf. Johnson 1964: 96; Sorrow 1968: 19) are basal fragments. Since they show no evidence of stream-rolling or other artificial modes of transport, we can assume that they represent fragments discarded at a campsite when hunting equipment was being refurbished (Wendorf and Hester 1962:164). Therefore, it is our hypothesis that occupational components of this early period will eventually be recognized on the Tortugas Creek floodplain.

The most extensive cultural remains at Holdsworth are found in Zone 1 and are attributable to the Late Prehistoric period of southern Texas (Hester and Parker 1970; Hester 1971d). Represented in the remains are small projectile points (including some examples which others might classify as "dart points"), a variety of tools made on flakes (end scrapers, notches, gravers, laterally trimmed pieces), ceramics, and tool manufacturing residue in large quantities. Both *Perdiz* and *Scallorn* point styles are present; we could not separate them stratigraphically, although this may be due to both the limited nature of the excavations and the small sample of points recovered. In general terms, these late remains are comparable to the Late Prehistoric manifestations of the central Texas sequence (Shafer 1971). Although isolated Late Prehistoric components have been recognized previously in southern Texas (Hill and Hester

1971), we did not have the knowledge of associated tool types and lithic technological data provided by the Holdsworth sample.

Although the Stewart Site occupies a quite similar environmental position, it is contrasted with the Holdsworth Site by the presence of meager remains. There is absolutely no evidence of a Late Prehistoric occupation at the site. All projectile points recovered from the site appear to represent the Archaic period. The corner and side notched examples are not, based on our present data, temporally diagnostic. On the other hand, one specimen is typologically *Shumla*, and dated to the Middle Archaic period in the Trans-Pecos (Johnson 1964). Other materials include a scraper, a notch, a uniface, several bifaces, and tool manufacturing debris. We are provided here with an example of an apparently uncontaminated Archaic occupation site, a rarity thus far in Rio Grande Plain archeology. The variety of triangular dart points considered so typical of the Archaic of this region are absent. This is not surprising since stemmed and notched points are known to dominate the Archaic in the northern portion of the Rio Grande Plain (Nunley and Hester 1966: 251). If the Stewart Site is typical of buried Archaic deposits in this area, then much excavation will be required in order to define the sequence within this period.

A second problem investigated in our work was the temporal position of the local bone-tempered plainware ceramics. It has been suggested elsewhere (Hester and Hill 1971b) that these ceramics date to the Late Prehistoric period; this postulate was based largely on similarities between the local ceramics and those of Late Prehistoric central Texas. Excavations at Holdsworth revealed a single sherd in Zone 1, in loose association with a *Perdiz* arrow point. While this evidence is far from conclusive, it does add support to the postulate that the bone-tempered ware is a part of the local Late Prehistoric cultural inventory.

We were also concerned in our investigations with the recovery of faunal remains to aid in subsistence-settlement studies. A considerable amount of faunal material (relative to the small area excavated) was collected at Holdsworth, primarily through the use of fine-mesh screens. Had we used the standard 1/4" mesh, the bulk of the bones would have been lost. Appendix II by D. Gilbow contains a brief description of the faunal materials. Lack of research funds has thus far prevented a more rigorous analysis.

All animal bones were found in Zone 1 of the Holdsworth Site. It is unfortunate that Zone 2 at Holdsworth, and the Archaic deposits at Stewart, did not yield a faunal sample. At Holdsworth, the lack of

Archaic faunal remains may be due largely to our limited exposure of Zone 2; at Stewart, the absence of faunal remains is attributed to poor preservation.

The faunal list for the Holdsworth Site reveals the presence of several species whose habitats today are the channel and floodplain microenvironments. These include the desert cottontail *(Sylvilagus)*, cotton rat *(Sigmodon)* and plains pack rat or wood rat *(Neotoma)*. Jackrabbit *(Lepus)* and whitetail deer *(Odocoileus)* are species which adapt to a wide range of environmental situations and could be expected to occur in any of the three defined microenvironments. It might have been possible to kill deer during the time they watered in the channel zone (Tortugas Creek). The tortoise (*Gopherus sp.*) can also be found in a variety of environments. It is therefore apparent that the local Late Prehistoric inhabitants could have been exploiting all microenvironments, or just as easily, taking all animal foods from a single zone. It is clear that all three microenvironments are close and easily accessible, thus lending themselves to exploitative patterns which could cross cut all environmental zones (cf. Flannery 1968). While deer may have constituted the bulk of the meat diet (see Appendix II), there seems also to have been an emphasis at this site on rodents. Local aboriginal groups were known to include these small mammals in their subsistence (Ruecking 1953:485). It remains to be seen if we shall be able to link such preferences to seasonal hunting patterns as Flannery (1968) has done in Mexico.

One other aspect of the subsistence evidence at Holdsworth and Stewart is the shell remains. Both mussels and land snails are present at these sites. Mussels, of course, were obtained from the channel microenvironment; snails could be gathered from any of the microenvironments. Some of the snails could be introduced to the sites through natural means (cf. Holdsworth 1969:202 for an interesting example), although we consider most of them to represent food items (Krieger 1956; Clark 1969). Snail species found in the archeological deposits are identical to those occurring in the area today.

We have no way of accurately assessing the importance of plant foods in the local subsistence, although we feel that it was considerable. As evidenced in Appendix I, there are a wide variety of potential vegetal foods available in the Holdsworth Site area, particularly in the channel microenvironment and on the floodplain. The ethnographic record for this area indicates the significance of plant foods in the aboriginal economy (Ruecking 1953: 489). We suspect that the exploitation of plant foods was the dominant concern in the prehistoric subsistence system. Plant foods are a reliable food source and data reported by Lee (1968:33) indicate that they can be collected with little expenditure of effort. The !Kung Bushmen of the Kalahari Desert use vegetal foods for 60-80% of their diet, the collection of which involves two to three days of work per woman per week (Lee 1968:33). Our best archeological evidence in this area for the processing of plant foods is the mano and metate. Of course, other food processing or gathering equipment, such as digging sticks, may not be preserved. For example, wooden pestles and mortars are thought to have been used in the region (Beals 1932), perhaps similar to the set reported by Collins and Hester (1968).

Future interpretations of local subsistence-settlement activities will have to rely almost wholly on the archeological record, as there are scanty data for comparative models in the ethnographic literature (cf. Nunley 1971). Much more light will be shed on subsistence in Zavala County when funds are secured for the analysis of a sizable faunal sample (from several sites) only recently acquired. Unless preserved faunal materials can be found in Archaic deposits, we will have to confine our empirical studies of subsistence to the Late Prehistoric period.

The flint-working technology at the two sites has been previously discussed in the descriptive portion of this paper. The tool-making industry appears to be based largely on the use of prepared cores from which flakes intended for modification were removed. The use of flakes for tool manufacture is especially evident in Late Prehistoric times. The source of raw materials was an obvious one: the gravel-capped ancient terraces which flank the Tortugas and Chacon stream valleys. There are few primary cortex flakes at either site, suggesting that the initial decortication of cores occurred at terrace workshops (Hester 1971e). The occurrence of high percentages of thinning flakes in Zone 2 of Test 2 at Holdsworth and Zone 1 of Test 1 at Stewart may indicate areas where biface thinning activities were carried out. Such a chipping locus was observed on the surface at the Stewart Site. The presence of uniface resharpening flakes at Holdsworth indicates a tool rejuvenation technique (cf. Shafer 1970).

Both sites have a full array of hunting, processing and fabricating tools, and quantities of debris resulting from tool manufacture. It is safe to assume that both are occupation sites and were the centers of the various exploitative and procurement systems needed to maintain daily life. Data from the regional ethnography, and that extrapolated from ethnographies of other hunter-gatherer groups (cf. Nunley 1971), indicate that the local groups on the Rio Grande Plain roamed over a broad territory, camping at preferred sites for a few weeks at a time. Such a pattern would account for the presence of large occupation sites with widely dispersed debris found in the area (Hester, White and White 1969: 163). The relationship among such sites, or between these sites, and those with other functions (workshops, foraging camps, etc.) can be best studied through the examination of the archeological remains within a broad, well-defined research area. Such work is being carried on by Hester at Chaparrosa Ranch (Hester 1970). In addition, we need more data on culture sequence in this area, ideally with corresponding faunal materials. Hill is continuing this avenue of research in the Tortugas Creek and Chacon Creek drainages. Skinner (1971:257) has recently suggested that it is now time for the emphasis in central Texas archeology to shift from chronology to studies of subsistence and settlement. This is in line with the most recent advances in American archaeology (Binford 1968; Struever 1971; Gumerman 1971). While we are concerned with settlement and subsistence, it is obvious that such data will mean little unless it can be fitted into a chronological framework. We have made much progress now in defining the Late Prehistoric period on the Rio Grande Plain, but much work remains to be done before the Archaic and even earlier cultural manifestations can be defined.

In closing, we would like to offer our observations on the effect of vertisols at the Holdsworth Site. Although these dynamic soils have the potential to vertically displace buried archeological materials, we are unable to see any direct evidence of this happening at the site. It is most likely that a larger artifact sample is required in order to accurately evaluate the actions of vertisols. Duffield (1970) has published a map which shows vertisols quite widely distributed in the northwest part of the Rio Grande Plain. However, it appears that these soils are somewhat more restricted than Duffield's map indicates (Wayne Hamilton, personal communication). Archeologists working in this region should consult local soil conservation service technicians regarding the identification and interpretation of the soils in their research areas.

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Appendix I

A STUDY OF MODERN FLORA AND FAUNA IN THE VICINITY OF THE HOLDSWORTH SITE (41 ZV 14)

JOHN HOLDSWORTH

INTRODUCTION

A notable feature of Zavala County is its almost equal division by the 100th meridian. By coincidence, this coordinate marks very closely the eastward extent of the Great Plains, and therefore has the effect of dividing of the United States into the east and west life zones biologists generally recognize. While in Texas, the plains are interrupted by the Balcones Fault, whose eroded face now constitutes the Texas Hill Country. The Rio Grande Embayment or Plains commence immediately below the fault zone, and though some 1500 feet less in elevation, are essentially a continuation of the steppe, or semiarid grassland, making up the higher plains areas. The result is a considerable mixing of eastern and western species of plants and animals. Climatological records also show alternating periods of humid, subtropical conditions bringing about a more subtile exchange of species typical of the two climates.

There is, in addition, an overlapping of a number of species from the tropics, sometimes persistent at other times casual, and still others are more or less closely related to exotic forms. This mixing from several directions creates in the area an altogether unusual association of species (Blair 1950).

VEGETATIONAL PATTERNS

Effects of the coming of the Europeans have, of course, been radical, the most immediate and conspicuous being the overgrazing of the prairies. Even in 1777-78, Fr. Juan Agustín Morfi noted that the vast herds of mustangs had depleted the range adjacent to the waterings (Castañeda 1935). With later settlement, this was continued by cattle herds until certain species of grass were exterminated. Further, the lush growth of grass, which periodically burned off, suppressed brush and tree seedlings. The thorn brush chaparral has in this century spread from scattered thickets and mottes, mainly along the watercourses, (see Fig. 9), until the former grassland has been replaced in part by something resembling a desert scrub condition (Gould 1969).

During historic times, Tortugas Creek has been an intermittent stream, but there is some evidence it once had, in the vicinity of Site 41 ZV 14, a few seep springs that maintained a permanent waterhole. A ledge of sandstone extending into the creek is of the type associated with such springs elsewhere in south Texas. The earlier Spanish travelers reported such a waterhole at a campsite supposedly nearby (Inglis 1964:82). Large oaks of great age adjacent to the creek may also support this theory.

Liveoaks of all sizes are found around the waterholes, along with ash *(Fraxinus berlandieriana)*, button bush *(Cephalanthus occidentalis)*, cedar elm *(Ulmus crassifolia)* and occasionally the mescal bean or frijolillo (*Sophora secundiflora*), whose seeds were used by the Comanches as an emetic, "wild china" or soapberry (*Sapindus drummondii*) and willow (*Salix* sp.). Until recent years the small pepper called "chili piquin" (*Capsicum baccatum*) was plentiful in a few places. In overflows, small ponds and "hog wallows" a coarse, tall grass called giant sacaton often forms a thick growth.

The cat-tail (*Typha*), now occurring in stock ponds nearby, may have grown in these waterholes in earlier times. Water lilies were known in a pond about a mile distant. The roots of these plants could have been utilized as food.

In areas subject to overflow, where the soil is heavy and compact,

FIGURE 9. The Holdsworth Site, 41 ZV 14. View is of central part of site, looking to the southwest. Note large trees and heavy vegetation on right, paralleling Tortugas Creek. All excavation units were in background, to right and left of standing figure.

the retama (*Parkinsonia aculeata*) may be dominant. The bean-like seeds of this small, slender tree related to the palo verde are said to be edible. Broomweed (*Xanthocephalum*) occurs commonly in badly eroded ground, as in washes along the creek.

Widespread in both the bottoms (channel and floodplain) and uplands, the Mexican persimmon, mesquite and cat's claw were probably other sources of food to the early inhabitants. Seed pods of mesquite (*Prosopis glandulosa*) are still used in Mexico to prepare a nutritious paste known as *mezquitamal* containing about 30% glucose (cf. Ruecking 1953:487). *Acacia greggi*, the long-flowered cat's claw, produces seed used by the Pimas and Papagos to make *pinole*. The other species of Acacia, the round-flowered cat's claw (*A. roemeriana*), huisachilla (*A. tortuosa*), huajillo (*A. berlandieri*) and blackbrush (*A. amentacea*) would likely have been similarly useful. The last two species listed here are usually found at their best on the uplands.

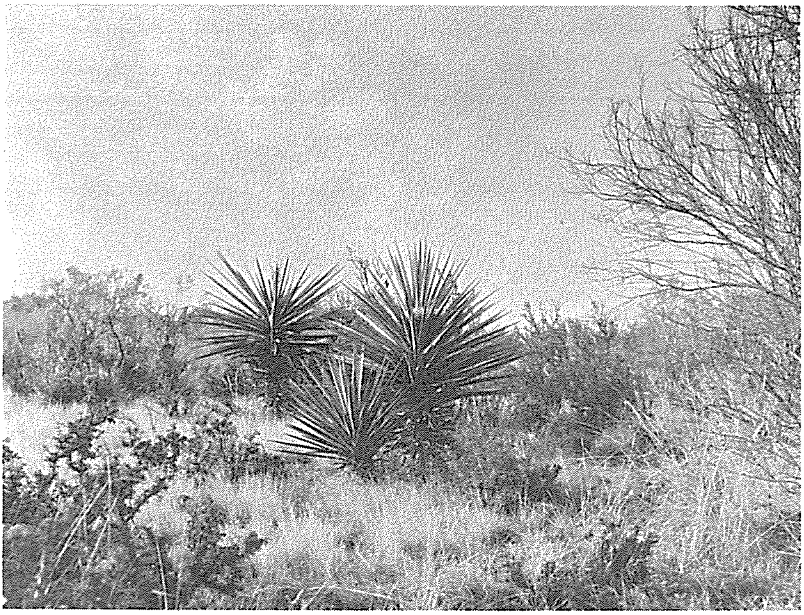

FIGURE 10. Typical Vegetation at the Holdsworth Site, 41 ZV 14.

Also very common, the granjeno *(Celtis pallida)* and various species of buckthorn — most importantly the brasil and the squawbush — of the genus *Condalia* produce quantities of small, edible, sweet berries. On the uplands west of the creek in a more alkaline soil, the ceniza *(Leucophyllum texanum)* is abundant, and here also the creosote bush *(Larrea)* grows sparingly. Both shrubs were thought to have medicinal value, and the creosote bush, here at approximately its eastward limit, yielded a scale insect that was made into a strong cement.

The extensive floodplain on the eastern side of the creek produces a number of cacti, principally the prickly pear *(Opuntia lindheimeri)*, the tasajillo *(O. leptocaulis)* and the petaya *(Echinocereus enneacanthus)*. The fruits of all these are held in rather high regard. Two species of *Echino-cactus* and the pincushion cactus *(Mammillaria)* are also known in the area.

The guayacan *(Porliera angustifolia)*, a lignum-vita, is plentiful throughout this area and particularly on the floodplain where there may also be found a scattering of all-thorns. The leaves of this curious shrub are reduced to scales and their function taken over by tough, green thorns and stems. The woods of these two are extremely hard. Another common shrub is thought to be "red berry" *(Schaefferia cuneifolia)*, whose small, numerous berries are edible. Bee- or white-brush *(Lippia lyciodes)* grows sparingly here but in some areas forms dense thickets. On sandy soils to the north a few hundred yards, the lantana *(Lantana horrida)*, supposedly poisonous, may be found. Here, too, is the hog plum *(Colubrina texensis)*. The value of the black nutlets, if any, is not known, but, according to local folklore, the bark was supposed to have some medicinal property. The lighter soils are also favored by the two species of *Ephedra*, one a climbing plant, the other a low, spreading shrub. They are the sole representatives of the conifers in this area and are known to live to a considerable age, possibly two centuries or more.

Though not seen in the immediate area, the coma *(Bumelia lyciodes)* is common on the sandy uplands and gravelly terraces to the east. This small tree of the Sapodilla family, resembling a scrubby liveoak, produces a pea-sized berry with a sweet, rubbery juice. In earlier times, children of Mexican extraction made chewing gum from the berries, evidence of kinship with the tropical Sapodilla which yields *chicle*.

Several plants with tuberous roots occur in the site area. These include the "flame flower" *(Talinum lineare)* which is small and inconspicuous above ground but has a large, edible tuber; the "four o'clock" *(Mirabilis)* and the wild balsam *(Ibervillea)* both have tuberous roots but it is not known if they are edible. The small wild onion *(Allium)* is also thought to be present.

Other interesting plants of the general area are the leatherweed, or "sangre de drago" *(Jatropha spathulata)*, the chewing of the roots of which was supposed to help gum disorders, the spanish dagger *(Yucca treculeana*; see Fig. 10 for a view of *Yucca* sp. on the site), provider of fiber as well as an edible flower and fruit, and the maguey *(Agave americana)*, whose various products are well known (Castetter, Bell and Grove 1938).

From a sparse growth of buffalo grass (Buchlöe) over the floodplain, the grass cover on the uplands improves to include various bunch grasses (Trichloris, pink pappus grass, windmill grass, etc.), curley mesquite *(Hilaria)*, three-awn grass (*Aristida*), hairy grama (*Bouteloua*), burr grass (*Cenchrus*) and others.

FAUNA

Land snails are common in the area, thriving particularly where the soil is strongly alkaline. In the larger waterholes, the mussel of the genus *Unio* may survive by estivation through periods of drouth. Crayfish are found in backwaters and tributaries not reached by fish.

About 4 miles downstream, a permanent lake (Woodward Lake) of some size formed a reservoir of fish, which migrated upstream to the site area during freshets lasting a week or two. Principal among them were the catfishes, the black bass, sunfish (*Lepomis*), gar (*Lepisosteus*) and the buffalo (*Ictiobus*). Bullfrogs (*Rana catesbiana*) and leopard frogs (*R. pipiens*) are plentiful, as are common and Fowler toads (*Bufo* sp.).

It is probable that a few alligators also occurred in the creek at one time, as they have been reported even in recent years along the Nueces River drainage. A variety of water turtles are still known. The snapper and soft shell must be considered very rare but the slider (*Pseudemys*) and mud turtle (*Kinosternum*) are numerous. On land the gopher tortoise (*Gopherus berlandieri*) is plentiful, and the western box turtle (*Terrapene ornata*) is seen at odd intervals. The best known lizards, all small, are the horned lizard (*Phrynosoma cornutum*), the spiny swift (*Sceloporus*) and the racerunner (*Cnemidophorus*). Best known of the larger snakes are the coachwhip (*Masticophis*), the indigo snake (*Drymarchon corais*), which may reach 8 feet in length, the bull snake (*Pituophis melanoleucus*), measuring as much as 7 feet, the water snake (*Natrix*), and the western diamondback rattlesnake (*Crotalus atrox*).

Any number of migratory waterfowl may be seen at some time in the area (cf. Leopold 1959). Woodward Lake, mentioned above, was considered in pioneer days to be an outstanding duck-shooting location. Coots and gallinules are seen there today, along with a variety of surface-feeding ducks, great blue herons, green herons and other waders and shore birds. In the early days of Anglo settlement, the upland plover and curlew were favorite game birds, though now they are not often seen. The once familiar wood stork (*Mycteria americana*) no longer visits the area.

As the character of the land changed (from grassland to brushland), it became less suitable for the bobwhite quail, while the scaled quail (*Callipela squamata*), a bird of the typical southwestern scrub, found itself better adapted to this region. Although the turkey does not thrive as a rule in this type of country, the liveoak bottoms (channel microenvironment) provide ample quantities of mast and other forage to support a fair number of the birds. The Aguayo Expedition of 1722 reported many turkeys, "peacocks" (apparently strutting gobblers), quail and rabbits on Tortugas Creek (Inglis 1964: 82). Other game birds include the mourning dove (*Zenaidura*) and the white-winged dove (*Zenaida*), although the latter is now quite rare. Meadowlarks are numerous in fall and winter.

Several hawks are known in the area, but only Harris's hawk (*Parabuteo unicinctus*), the red-tailed hawk (*Buteo jamaicensis*) and Swainson's hawk (*B. swainsoni*) are seen regularly. The golden eagle and Audubon's caracara (*C. cheriway*) are rare visitors. The two species of vulture, the great horned owl and the barn owl are all common. The burrowing owl (*Speotyto*), another victim of changing conditions, is rarely seen nowadays. The barred owl (*Strix varia*) may be heard occasionally in the more heavily wooded bottoms. The roadrunner, a terrestrial cuckoo, maintains a reasonable population.

During the early Anglo-Hispanic settlement of the region, the nine-banded armadillo was a standard food item, and the fact this is no longer the case (along with the reduction of predators), probably accounts for its very noticeable increase in the last half century. Raccoons are also, for similar reasons, now very common along the creek. Skunks and badgers represent the weasel family, with infrequent reports of the long-tailed weasel (*Mustela frenata*). Also present is the Mexican opposum (*D. marsupialis*). The gray fox is sighted occasionally and characteristically keeps to the wooded strips of the channel microenvironment. The coyote persists in some numbers, depending on the energy devoted to predator control in this general area.

Up to about fifty years ago, the jaguar was known to wander across the border at rare intervals and enter the Tortugas country, while the ocelot and margay cat (and even bear) were seen somewhat more often. The mountain lion has been reported more recently, keeping to the wooded bottoms and sometimes crossing from one stream to the other. It was never considered more than a transient, however. The only native wild cat considered an established resident is the bobcat, which is rather common.

Hoofed mammals now known in the area include only the white-tailed deer (*Odocoileus texanus*) and the white-collared peccary (*Pecari angulatus*), another displaced exotic, which the early settlers found very numerous. Whether the bison occurred here in recent centuries is conjectural. The early Spaniards reported them at no great distance, one sighting actually being made within the county (Inglis 1964:89), if it is possible to judge with any particular time. Later explorers did not see them, and they were certainly gone by the time of the first settlers. It appears, then, that the bison was never common here in historical times. Probably the same conclusion may be reached for the pronghorn antelope (Inglis 1964:89).

Rodents are numerous along Tortugas Creek, especially in the channel microenvironment. Although the Mexican ground squirrel (*Citellus mexicanus*) is the only species of gopher, and the fox squirrel is rare, the southern plains wood rat (*Neotoma micropus*), a robust animal measuring about 14 inches over all, is very plentiful, several "houses" often visible at once in bushes or cacti. The kangaroo rat (*Dipodomys*) leaves its curious footprints in the sand, though seldom seen itself. Three species of small mice have been reported, and the remains of the larger hispid pocket mouse (*Perognathus hispidus*) has been found in the nests of hawks. The cotton rat (*Sigmodon hispidus*) occurs in certain moist localities in the channel microenvironment.

Two species of cottontail (*Sylvilagus*) are present along the Tortugas channel and on the floodplain. The hardy black-tailed jackrabbit (*Lepus californicus*) is ever-present, though seeming to go through irregular population cycles not necessarily related to the food supply. It ranges through all microenvironments.

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Appendix II

PRELIMINARY IDENTIFICATION OF FAUNAL REMAINS FROM THE HOLDSWORTH SITE (41 ZV 14)

DELBERT GILBOW

A preliminary study of a collection of faunal materials from the Holdsworth Site (41 ZV 14) is presented here. A total of 334 pieces were examined, 242 of which are unidentifiable (see Table 1). The use of fine-mesh screens in the excavations permitted a high recovery of small faunal materials. Preservation of the remains is excellent, although most exhibit fracturing and charring/burning attributable to the use of the represented animals as food items.

Identification and distribution of faunal remains are given in Table 1. Since interpretations have already been presented in the main paper, I would just like to register my opinion that most of the unidentifiable bones represent the whitetail deer. Most of these fragments are thick splinters, indicating that deer bones at the site were comminuted to obtain marrow. If this assumption is granted, it is apparent that the major meat source for the prehistoric occupations was deer. The small mammals probably served as supplements to the meat diet unless, of course, the various species represent seasonal preferences.

Identification of the faunal remains was facilitated through the use of comparative collections of the Museum of Vertebrate Zoology and those of the Archaeological Research Facility, Berkeley.

EXCAVATION UNIT	SPECIES	NO. BONES	NO. OF INDIVIDUALS (estimated)
TEST 1			
Zone 1	Tortoise (*Gopherus* sp.)	5	1
	Unidentifiable	11	
TEST 2			
Zone 1	*Sylvilagus (auduboni?)* cottontail	2	1
	Sigmodon hispidus cotton rat	1	1
	Unidentifiable	39	
TEST 3			
Zone 1	*Odocoileus texanus* whitetail deer	2	1
	Sigmodon hispidus cotton rat	19	9
	Neotoma micropus plains pack rat	21	10
	Tortoise (*Gopherus* sp)	1	1
TEST 4			
Zone 1	*Sylvilagus (auduboni?)* cottontail	16	4
	Lepus californicus jack rabbit	1	1
	Sigmodon hispidus cotton rat	3	2
	Neotoma micropus plains pack rat	5	3
	Odocoileus texanus whitetail deer	1	1
	Tortoise (*Gopherus* sp.)	15	2
	Unidentifiable	192	

Table 1. *Faunal Remains from the Holdsworth Site (41 ZV 14).*

THE DEVIL'S HOLLOW SITE, A STRATIFIED ARCHAIC CAMPSITE IN CENTRAL TEXAS

MICHAEL B. COLLINS

ABSTRACT

The Devil's Hollow Site, excavated by the W.P.A. in 1939, contained a small sample of projectile points and other artifacts of Early, Middle and Late Archaic forms; these were stratified (respectively) below, in, and above a small burned rock midden. The midden is of the general category, "ring midden," and may have contained an earth oven not previously reported at this time horizon. The dart points occurred in morphological groups that have important implications for Central Texas dart point typology. Unfortunately, the site does not shed light on the nature of burned rock midden accumulation, however, as a possible earth oven, it raises the question of communal cooking by a sizable group. The hypothesis is put forward that seasonal coalescence of hunting-gathering bands may have accompanied intensive but brief food-collecting activities.

INTRODUCTION

The Devil's Hollow Site is a small buried midden of burned rock excavated under sponsorship of the Works Projects Administration through the agency of The University of Texas from November 3 to 16, 1939. Field supervision was by George R. Fox. The collection and Fox's excellent documentation are housed at the Texas Archeological Research Laboratory, The University of Texas at Austin. The site was originally designated CT-67 and now bears the number 41 TV 38. Devil's Hollow is now flooded by Lake Travis.

Data recovered by Fox indicate three important facts about the site: (1) cultural material at the site is stratified; (2) the midden can be placed in the Early Middle Archaic Period of the current Central Texas Chronology; and (3) the midden possibly contained a large, centrally-located, ash-filled cooking pit similar to that occurring in "mescal pits" (see Greer 1965; 1967). Also, the projectile points as a group have important typological implications.

FIELD METHODS

A crew of approximately eight unskilled laborers was employed to excavate the Devil's Hollow Site. It is clear from Fox's notes that the object of this excavation was to expose the midden, recover the artifacts from it, and nothing more. Fill above and below the midden was removed with picks and shovels and thrown, without

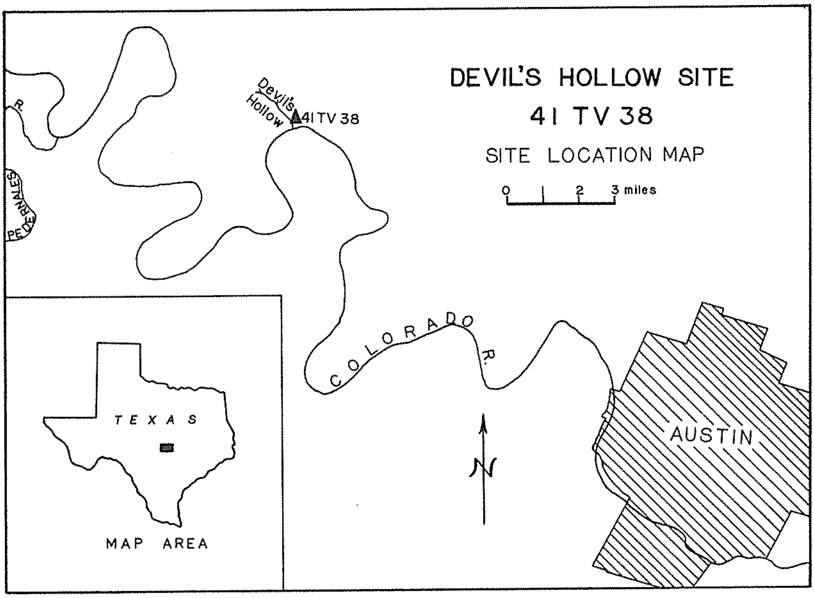

FIGURE 1. Devil's Hollow Site, site location map.

screening, into the creek bottom. Evidently, trowels and brushes were employed in excavating the midden, but is likely that picks and shovels also were used. The midden fill was not screened. In other words, specimens collected or counted were those noticed by the workmen. Profiles, maps, and photographs were made in quantity and are of high quality.

THE SITE

Devil's Hollow is a deep, narrow canyon tributary to the Colorado River. The canyon averages a few hundred yards wide and heads less than 3 miles northwest of its junction with the Colorado; this junction is in northwestern Travis County approximately 16 miles northwest of Austin, Texas (Fig. 1). The intermittent Devil's Hollow Creek has entrenched into colluvial deposits at the base of the steeply sloping walls of the Hollow and has deposited limited amounts of alluvium along its margins (Fig. 2).

The Devil's Hollow midden was seen eroding from the left bank of the creek approximately one-fourth of a mile above the Colorado River. Roughly its southwestern half had been eroded away and the resulting exposure was a northwest-southeast profile through the center of the midden (Fig. 3, Profile I).

Exposed in the cut bank were, from the base upward, a stratum of red clay at least 5 feet in thickness, the midden, a deposit of weathered limestone colluvium ("gravel" in Fox's notes) averaging 4 feet in thickness, and a dark-colored topsoil layer approximately 2 feet in thickness (Fig. 4). The surfaces of each of these strata dipped downstream and toward the cut bank (that is, to the southeast). As soil samples were not available for examination and the site is no longer accessible, Fox's stratigraphic descriptions must suffice; his notes (pp. 9, 18-19) include the following:

(1) *RED CLAY: red, sandy clay with a thin layer of occupational debris near the top; otherwise, it contains no gravel, shell, or stones.*

(2) *MIDDEN:* described below.

(3) *"GRAVEL": yellow gravel laid in successive layers, some layers of stone separate strata of gravel; present were limited amounts of cultural debris and many mussel shells.*

(4) *TOPSOIL: dark-colored humus soil, archeologically sterile.*

To judge from profiles and photographs, the contact between the red clay and the "gravel" involves some interbedding, perhaps resulting from downslope movements. Similarly, a small lens of midden deposit is buried in the red clay (Fig. 3, Profile II)

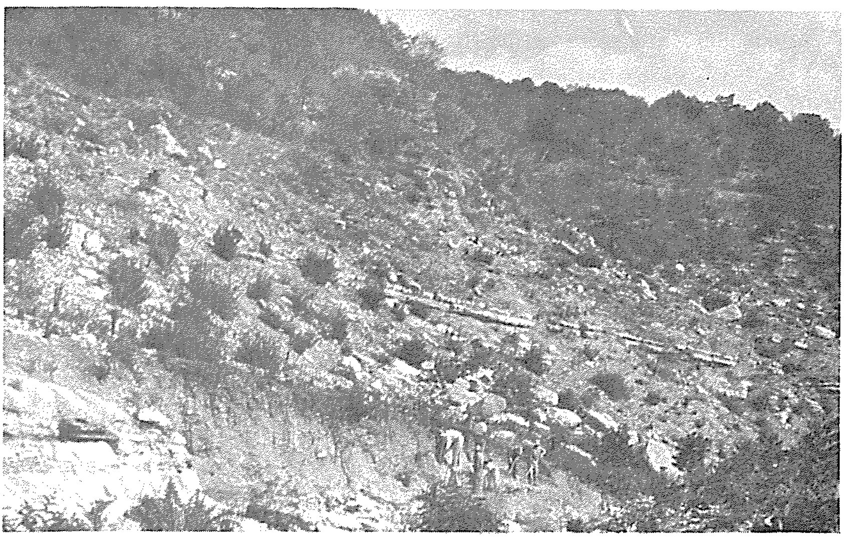

FIGURE 2. General view of the Devil's Hollow Site during excavation; the view is toward the southeast and shows the steeply sloping wall of the Hollow.

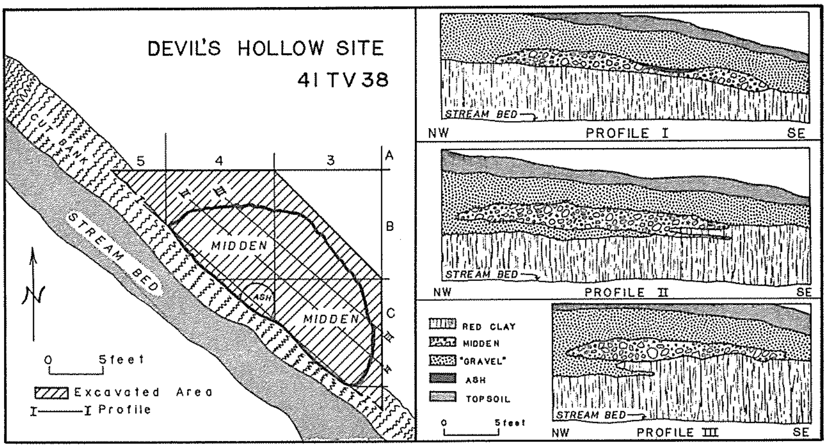

FIGURE 3. Devil's Hollow Site, plan map of the excavations and profiles I, II, and III.

suggesting either periodic deposition of midden debris with intervening accumulation of red clay or some form of mixing.

The midden was 26 feet in northwest-southeast diameter and 9 feet of its northeast-southwest diameter remained. Its upper surface (Fig. 5) sloped slightly from upstream to downstream (northwest to southeast) and included a shallow, ash-filled depression near the center of the original eroded profile. This depression was approximately 8 feet in diameter and about 1.0 foot in depth. The center of the depression contained a nearly rock-free ash deposit 1.2 feet in diameter and 0.3 of a foot in thickness. As can be seen in Fox's photograph (Fig. 4) there are virtually no rocks in the profile below this central depression, a strong indication that the rock-free center of the midden extended down to the red clay. This condition would suggest the presence of an earth oven (perhaps similar to, but shallower than, those characteristic of the "mescal pit") rather than a surface hearth from which fire-cracked rock had been thrown into a circular heap ("midden circle"); unfortunately this can only be a suggestion as no other observations were recorded or data collected to refute or corroborate the photographic hint.

The intact ashy deposit in the central depression precludes the possibility that some form of post-depositional disturbance caused the depression in the center of this midden.

The midden surrounding the central depression was composed principally of angular fragments of burned limestone rock and contained considerable ash as well as a large number of freshwater mussel shells.

Fox notes that the mussel shells were scattered throughout the midden but that some tended to occur in concentrations. One concentration of more than 100 shells was 1.4 feet east of the ash-filled pit and consisted of a "pile" of 0.4 of a foot thick (diameter not recorded). Another such concentration occurred in Square B-4. Mammalian remains included only a few small charred scraps of long bone (deer?) and a fragmentary innominate (deer).

In summary, although this was clearly a ring midden, too few details are recorded to determine the precise configuration of the central depression, and it is impossible to assign the feature to either the "midden circle" or "mescal pit" categories as they are defined by Greer (1965, 1967).

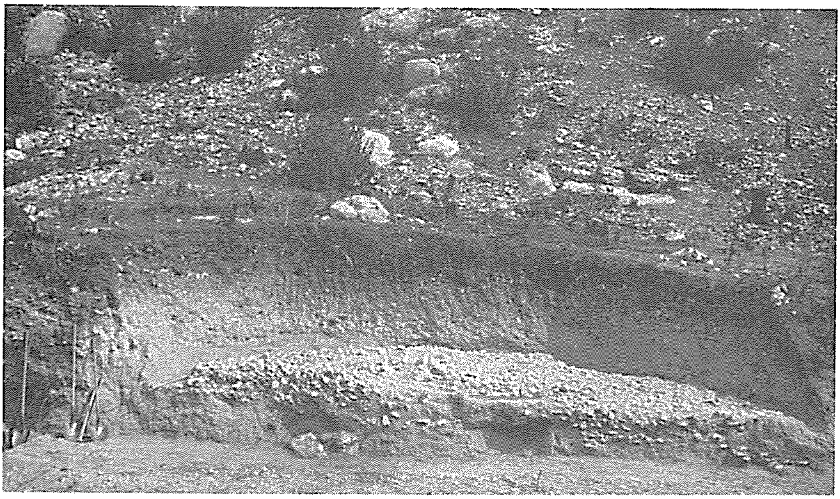

FIGURE 4. Devil's Hollow midden exposed. Note the stratigraphy as exposed in excavation walls, the depressed center of the ring midden surface, and the absence of rocks in the profile below the central depression.

FIGURE 5. Detail of upper surface of the Devil's Hollow Midden. The rock-free depression is to the right, and the ring midden configuration of the burned rocks is clearly visible.

Excavations were not extended more than a few feet beyond the margins of the midden (Fig. 3) so data are lacking on the nature of the site adjacent to this feature. Artifacts were found in the upper portion of the red clay, in the midden, and in the "gravel" above the midden. These materials, particularly the projectile points, provided additional data toward the refinement of the local chronology.

THE ARTIFACTS

Sixty-eight implements, all of stone, are described below; an additional 262 flakes are tabulated by vertical provenience, but these were evidently discarded at the time of excavation. Dart point data have been presented in more detail than those of the other artifact classes. The projectile points are designated by specimen numbers in the plates, in the descriptions, in the tabulations of metric data, and in Table I. For the remaining artifact classes, individual data are not presented, and provenience is reported by classes and by vertical provenience only (Table II). Measurements of chipped stone artifacts are reported in millimeters; of ground stone artifacts, in centimeters. An asterisk (*) denotes an estimated measurement.

CHIPPED STONE

Dart Points

Bulverde-like I (7 specimens, Fig. 6). Blades are triangular with slightly convex edges; shoulders are prominent and lack barbs (except specimen 3 with one barb); four (6,9,7, and 3) exhibit slight asymmetry; stems are parallel-sided or expand very slightly; bases of 6 and 9 are straight and bases of 11, 7, 12, 14, and 3 are slightly concave; the stem of 11 is wedge-shaped in longitudinal section. Stems average one-third of total length. Specimens are thin, bifacially-flaked, and exhibit marginal retouching; specimen 12 has longitudinal, bifacial thinning flakes extending up from the base. All are of opaque flint in gray and gray-tan colors. These projectile points occupy a morphological position between the defined types *Bulverde* and *Pedernales* (Suhm and Jelks 1962:169,235).

specimen number	6	9	11	7	12	14	3
maximum length	61	62	58*	72*	--	59	52
maximum width	32	27	28	28	28	30	31
thickness	6.5	7	7	7	7	7	7
stem length	17	17	17	15	15	20	14
stem width	18	17	20	16	16	16	17

Bulverde-like II (2 specimens, Fig. 6). These two specimens exhibit long triangular blades with slightly convex edges; shoulders are prominent but only one tends to be barbed; stems expand very slightly and bases are slightly convex. Both are completely bifacially thinned with bifacial marginal retouching; stems do not show wedge-shaped longitudinal section. One specimen is slightly beveled to the right along stem edges. The specimens occupy a morphological position between the defined types *Bulverde* and *Nolan* as defined by Suhm and Jelks (1962: 169,225) but lack the distinctive wedged stem of the former and strongly beveled stem of the latter.

specimen number	10	16
maximum length	62	72
maximum width	27	33
thickness	7	7.2
stem length	14	18
stem width	18	19

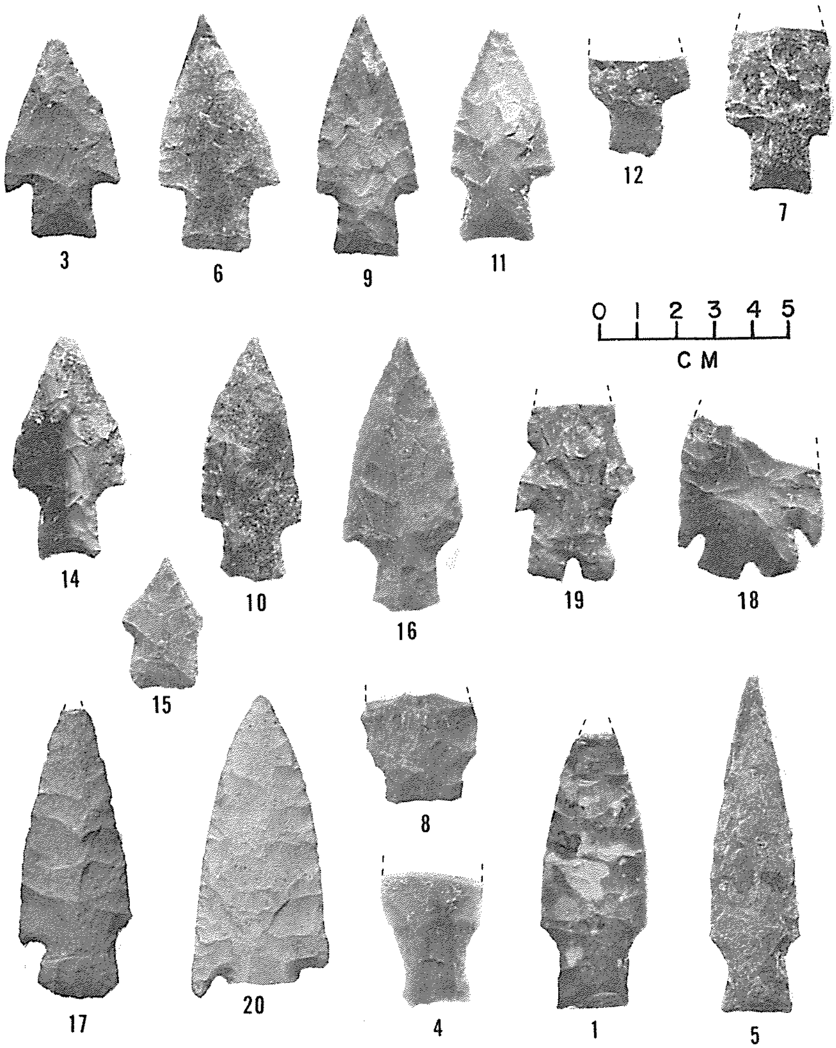

FIGURE 6. Devil's Hollow Site, dart points. 3,6,7,9,11,12, and 14, *Bulverde*-like I; 10 and 16, *Bulverde*-like II; 15, *Bulverde?*; 18 and 19, *Montell*; 1 and 4, *Nolan*; 5, *Travis*; 8,17, and 20, miscellaneous.

Bulverde ? (1 specimen, Fig. 6). This small, resharpened dart point exhibits a short, triangular blade, prominent shoulders lacking barbs, and a parallel-sided stem with very slightly concave base. It is bifacially flaked with bifacial marginal retouching; base is not as strongly wedge-shaped in longitudinal section as most *Bulverde* specimens.

specimen number	15
maximum length	35
maximum width	21
thickness	7
stem length	15
stem width	18

Montell (2 specimens, Fig. 6). Each is fragmentary; however, the distinctive basal notch is present. Blades appear to include one broad, thin example and one thin specimen with moderately narrow blade; shoulders are prominent and barbed; stem edges expand slightly; bases are convex with deep central notches. Materials are gray-tan, opaque flint. Each is thinned with broad, shallow thinning flakes and exhibits bifacial marginal retouching.

specimen number:	19	18
maximum length	--	--
maximum width	35*	39
thickness	5	6
stem length	18	13
stem width	24	27

Nolan (2 specimens, Fig. 6). Blade of more complete specimen is long, triangular, with edges slightly convex; shoulders of both are moderate and rounded; stems are approximately parallel-sided, bases straight; stem of specimen 1 moderately beveled to right, of specimen 4, steeply beveled to the right. One is of tan translucent, the other of gray translucent, flint. Each is evenly bifacially thinned and exhibits bifacial marginal retouching. Specimen 4 has two basal thinning flake scars on one face resulting in a somewhat thinner base than that of specimen 1.

specimen number	1	4
maximum length	80*	--
maximum width	28	27*
thickness	8	8
stem length	19	19
stem width	20	19

Travis (1 specimen, Fig. 6). Blade is long and triangular with very slightly convex edges; shoulders moderate and not barbed; stem expands slightly, and base is straight. Made of flint and exhibits bifacial thinning and marginal retouching.

specimen number:	5
maximum length	90
maximum width	24
thickness	8
stem length	20
stem width	19

Miscellaneous stemmed dart points (3 specimens, Fig. 6). Specimen 17 is a large point with triangular blade; blade edges nearly straight, shoulders prominent and slightly barbed, stem edges expanding and base convex. It is bifacially flaked and exhibits bifacial marginal retouching. Specimen 20 is also large with slightly convex blade edges and prominent shoulders with one strong and one slight barb; stem is missing. It is bifacially thinned and marginally retouched. Specimen 8 is a basal fragment of a thick, stemmed dart point; the stem is short and broad; shoulders and blade are broken away.

specimen number:	17	20	8
maximum length	77*	--	--
maximum width	30	36	--
thickness	11	9	8
stem length	15	--	11
stem width	22	--	21

Other Bifaces

Large, thinned bifaces (3 specimens, Fig. 7). These are convex-edged, bifacially thinned implements exhibiting marginal retouching; the base of the one complete lanceolate specimen (Fig. 7a) is cortex, and the basal fragment (Fig. 7c) exhibits a chipped convex base. Length of complete specimen, 107 mm; widths are 48, 40, and 45 mm.; thicknesses, 15, 9, and 12 mm.

Fragmentary bifaces (10 specimens). These include 3 probable projectile point tips, 6 fragments of small, thin, bifacially-flake "knives" and 1 thick bifacial fragment.

Thick, crude bifaces (9 specimens, Fig. 7). These are large, thick crudely-flaked bifaces with very limited trimming of edges; roughly lanceolate in outline to irregular, the more irregular items are probably cores whereas the more regular ones may be either implements or unfinished implements (preforms).

Miscellaneous Chipped Stone

Scrapers (4 specimens, Figs. 7 and 8). Three specimens are convex-edged side scrapers, one is an irregular flake with edge-trimming on two intersecting edges. One of the convex-edged specimens exhibits very heavy wear along a portion of the scraping edge; this section of the scraper edge also exhibits bifacial chipping, apparently resulting from the heavy use (Fig. 7f).

Flakes (268 specimens). Flakes were not systematically saved by Fox; however, they were counted and their vertical distribution is summarized in Table II. The 6 flakes which were kept include 2 initial cortex flakes, 2 secondary cortex flakes, and 2 interior flakes.

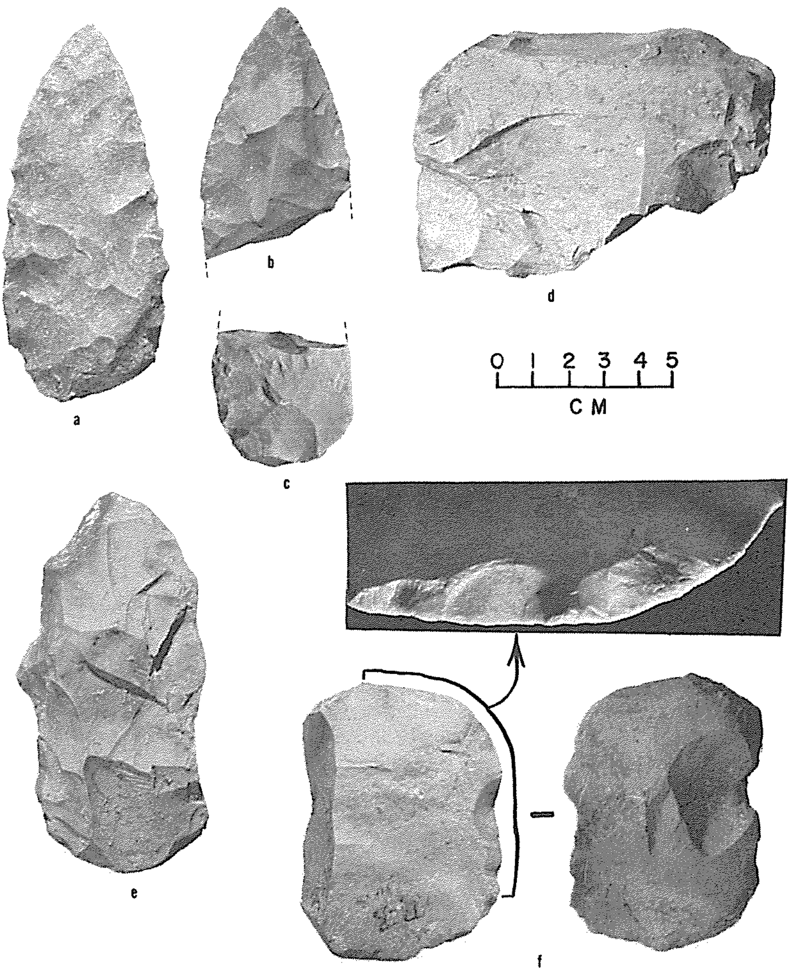

FIGURE 7. Devil's Hollow Site, chipped stone artifacts. a-c, large thinned bifaces; d-e, thick, crude bifaces; f, scraper with enlarged view of heavily worn edge.

Choppers (3 specimens, Fig. 8). One is a large quartzite cobble with flakes removed from both faces along two-thirds of its circumference; the remaining third exhibits cortex. Opposite the cortex, approximately one-half of the chipped edge is heavily battered (Fig. 8b). One smaller specimen (Fig. 8d) is a cortex-covered cobble with flakes removed bifacially from one end. The other is similar but was made on a large flake.

GROUND STONE

Manos

Bifacial manos (9 specimens, Fig. 8). Of these 9 specimens, 8 are fragmentary. Materials include fine-grained pink granite (5), dense limestone (1), sandstone (2), and quartzite (1). Grinding surfaces vary: four specimens exhibit 2 convex facets; one exhibits two flat facets; and four exhibit 1 flat and 1 convex facets. Thickness ranges from 3.5 to 5.5 and averages 4.5 cm. The one complete specimen is oval and measures 11.5 x 7.5 x 4 cm.

Unifacial manos (3 specimens, Fig. 8). This group includes a circular sandstone mano with a flat facet (10 x 9.2 x 4.8 cm.); a small ovoid mano of pink granite with a small, oval flat facet (8 x 7.5 x 4.5 cm.); and a small oval quartzite mano with a small, round flat facet (8 x 7.5 x 5 cm.).

Mano fragments (3 specimens). These are two sandstone and one pink granite fragments exhibiting one or two grinding surfaces; none is sufficiently complete to indicate its original form.

Surface Collection

In addition to the specimens described above, several items of surface provenience occur in the Devil's Hollow Site collections; according to Fox's notes, this surface collection was made over an area of several acres and probably has little relevance to the excavated material. The surface finds include basal fragments of one *Montell*, one *Travis*, one *Pedernales*, and 2 unidentified stemmed dart points plus a triangular dart point ("Taylor Thin-Base") and a small convex-based biface. Also present in the surface material are a quartzite unifacial mano, a quartzite hammerstone, 14 cores or thick bifacial implements, a large burin spall, and 5 utilized flakes.

TABLE I. Devil's Hollow Site, dart point distributions by specimen numbers.

	horizontal units			
vertical units	B-3	B-4	C-3	N
topsoil	-	-	-	0
gravel	17	18	19, 20	4
midden	9	11, 10	12, 14, 15, 16	7
red clay	1, 3	4	5, 6, 7, 8	7
N	4	4	10	18

specimen numbers
Bulverde-like I: 3,6,7,9,11,12,14
Bulverde-like II: 10,16
Bulverde?: 15
Montell: 18,19
Nolan: 1,4
Travis: 5
Miscellaneous: 8, 17, 20

SUMMARY

	Bulverde	*Nolan*	*Travis*	*Montell*
topsoil				
gravel	-	-	-	2
midden	7	-	-	-
red clay	3	2	1	-

TABLE II. Devil's Hollow Site, vertical distribution of chipped and ground stone artifacts other than projectile points.

	RED CLAY	MIDDEN	GRAVEL	UNCERTAIN	TOTALS
CHIPPED STONE					
large thin bifaces	2	-	1	-	3
fragmentary bifaces	1	5	3	1	10
thick, crude bifaces	1	7	1	-	9
scrapers	1	2	1	-	4
flakes	69	164	35	-	268
choppers	1	2	-	-	3
GROUND STONE					
bifacial manos	1	2	6	-	9
unifacial manos	-	3	-	-	3
mano fragments	1	2	-	-	3
TOTALS	77	187	47	1	312

SYNTHESIS

Although better controls and documentation prevailed in the excavation of this site than in many of its contemporary excavations, three basic kinds of information are lacking: descriptions of the natural strata are inadequate; no excavations were conducted outside of the midden area; and many items (e.g. chipping debris) were not saved. A sample of mussel shells was saved. And, apparently the few existing mammalian faunal specimens represent all that were found. Of course, it would not be realistic to expect in 1939 the application of certain procedures which are today considered fairly routine (e.g., collection of charcoal; systematic collection of flakes; collection of soil and pollen samples; more refined provenience controls, etc.) and Fox cannot be criticized for these deficiencies. However, it is impossible to evaluate the prevailing ecological conditions during the various periods of occupation or even to determine the depositional environment (e.g., it is not known if the "red clay" is water lain or if the term, "gravels," refers to actual gravels or to colluvium as the photographs would suggest). Similarly, with excavations restricted to the midden proper, nothing specific can be

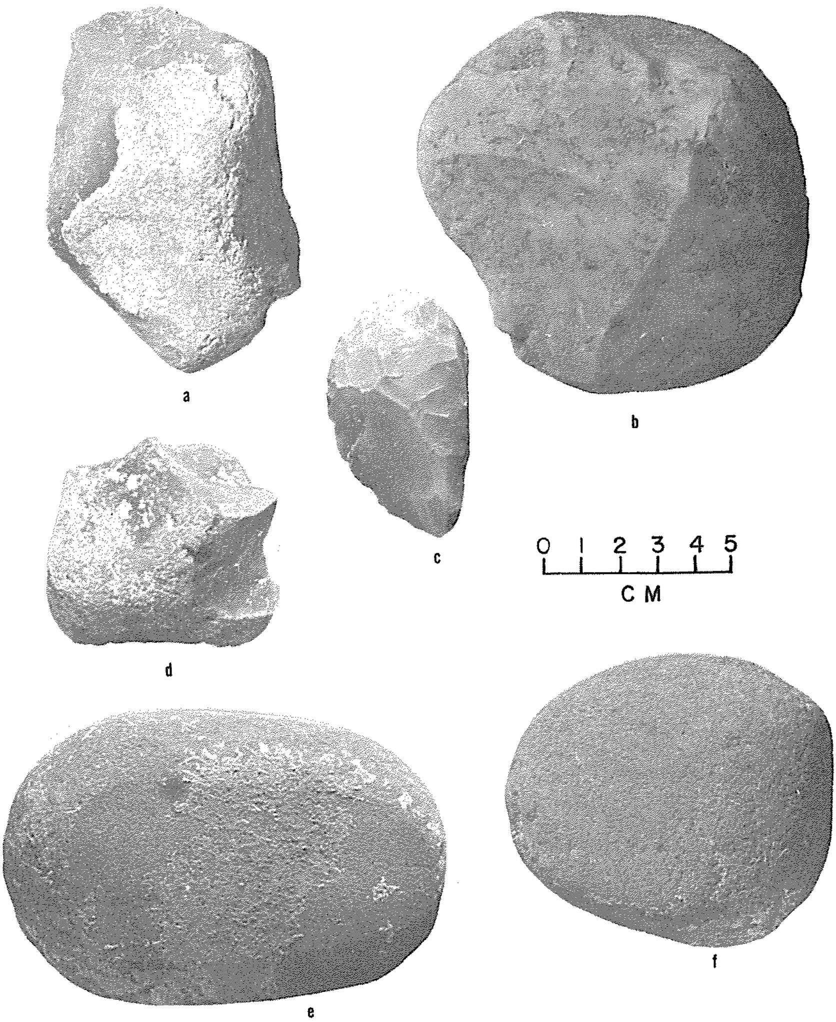

FIGURE 8. Devil's Hollow Site, chipped and ground stone artifacts. a, scraper; b, large quartzite chopper; c, convex-edged side-scraper; d, small chopper; e, bifacial mano; f, unifacial mano.

said of the remainder of the site and no progress is made toward understanding burned rock middens in terms of their relationship to associated cultural activities. Stone-chipping technology must be inferred from the more-or-less finished specimens collected, and the nature and amount of chipping conducted at the site remains obscure.

On the other hand, the diagnostic specimens were recovered in a stratigraphic relationship consistent with that from other sites in Central Texas (Table I). In the red clay beneath the midden were found projectile point types *Nolan*, *Travis*, and *Bulverde*-like I as well as one miscellaneous form. These give an age indication estimated at 3500 to 2000 B.C. and are assigned to the Early Archaic (Sorrow *et al.* 1967:141-144; Johnson *et al.* 1962:118-124). The midden contained Early Middle Archaic specimens — types *Bulverde*-like I and II and one possible *Bulverde* — probably dates from about 2000 B.C. (Sorrow *et al.* 1967; Johnson *et al.* 1962). Although there is certainly a considerable temporal overlap among types *Travis*, *Nolan* and *Bulverde* (Sorrow *et al.* 1967; Shafer 1963; Weir 1967), there is reason to believe that *Bulverde* may not have achieved popularity as early as did *Travis* and *Nolan* and may have survived longer (Johnson *et al.* 1962) which is perhaps the case at Devil's Hollow Site (Table I). Ring midden dates from elsewhere range from about 600 B.C. to A.D. 1500 (Greer 1968), considerably later than the evident dates for Devil's Hollow.

Above the midden are found Early Late Archaic *Montell* points which seem to date between 900 and 400 B.C. (Sorrow 1968:46-47). Other than the projectile points and manos, the relative vertical distributions of artifact classes at Devil's Hollow appear random, although most classes show an increase in frequency within the midden. Manos show a trend of increasing numbers through time with bifacial forms becoming the most abundant implement in the gravel stratum. Incidentally, as no metates were found at the site, it is not entirely clear what the functions of manos may have been. One is tempted to suggest that the trend of increasing manos may be evidence of increased reliance on the gathering (and processing) of plant foods. However, in the absence of metates it seems best not to rule out the possibility that manos served in some capacity other than plant-food grinding — hide working, for example.

The collection of dart points from Devil's Hollow midden is small; however, the *Bulverde* specimens, particularly *Bulverde*-like I and *Bulverde*-like II, form a very homogeneous group. The degree of homogeneity may indicate a short interval of manufacture, although this can only be speculation. Aside from their homogeneity, these points are interesting in light of their morphological position between types *Bulverde* and *Pedernales* as well as an apparently intermediate stratigraphic position. The Devil's Hollow *Bulverde* points persist later in time than types *Travis* and *Nolan*, a condition not found in Stillhouse Hollow Reservoir (Sorrow *et al.* 1967) or at the Youngsport Site (Shafer 1963). At most stratified sites in Central Texas, later *Pedernales* points replace earlier *Bulverde*, *Travis* and *Nolan* points. Perhaps at Devil's Hollow an incipient stage of *Pedernales* development is isolated in the midden deposits.

In general, then, the Devil's Hollow Site contained evidence of occupations from the Early Archaic to the Early Late Archaic and tends either to confirm the slightly later peak of *Bulverde* popularity seen at the Wunderlich and Oblate sites in Canyon Reservoir (Johnson *et al.* 1962) or to evidence an incipient stage in *Pedernales* development.

Technological and subsistence data are meager. The fairly large number of flakes in each of the three strata indicates that at least some flint work was done at the site. This may be further indicated by some of the artifacts here referred to as "thick, crude bifaces" (e.g. Fig. 7e) which appear to be early stages in bifacial thinning and by certain of the "large, thinned bifaces" (e.g. Fig. 7b) which appear to be unfinished bifacial implements. The granite manos and quartzite chopper indicate direct or indirect acquisition of materials from the Colorado River gravels or the Llano Uplift region whereas the varietites of flint are probably all obtainable on the Edwards Plateau. Lack of floral and adequate terrestrial faunal remains preclude evaluation of these aspects of the subsistence base. Mussel shells were present in the following numbers: red clay-620; midden-1176; gravel-749. These figures indicate a continuing exploitation of Colorado River resources throughout the occupations of the site as well as corroborate the artifactual indication that the greatest amount of cultural activity transpired at the site during the period of midden accumulation. An inquiry into the possible nature of that cultural activity is presented below.

Perhaps the most important single aspect of the Devil's Hollow Site is the possible presence of an earth oven. Had it been more clearly documented, the large central depression in the upper surface of the midden might have been an important feature to be considered, not only in the technological repertoire of the Early Middle Archaic peoples of Central Texas, but as an indicator of moderate social complexity. Earth ovens require an expenditure of labor and are efficient only for quantities of food consistent with fairly large social groups. However, the depression is not certainly an earth oven, and the presence of such features at this early time horizon must await confirmation at other sites.

Burned Rock Middens and Cultural Activity

Burned rock middens have been investigated for more than fifty years in Central Texas (Pearce 1919), yet very little progress has been made toward understanding their place in the total range of activities conducted at the sites in which they occur nor has it been determined how they fit into the annual cycle of the cultures of which they were a part.

Thus far, concern mainly has been with the content of burned rock middens, their temporal position, and their taxonomic significance to the Midwestern system. However, the following suggestions have been made concerning the activities which brought about these distinct concentrations of midden debris:

(1) most authors agree that a range of activities is involved but that repeated use of stone in fireplace preparation is of major importance (Kelley and Campbell 1942; Johnson *et al.* 1962; Weir 1967).

(2) the feeling that activity was concentrated on and very near the midden area is implicit or explicit in most discussions of burned rock middens (Suhm 1959; Jelks 1951; Weir 1967; Johnson *et al.* 1962; Kelley and Campbell 1942)

(3) it is suggested by some that burned rock middens are central to a larger spread of activity areas (Sorrow 1969: 1, 46-51) or that they are the result of deliberate removal of debris from an area of habitation to a central point of disposal (Sorrow 1969; Hester 1970:247; Sorrow and Hester personal communications).

The suggestions presented in number 3 above are based in part upon investigations not yet published; however, each is inferred from convincing evidence at different sites. My purpose in this discussion is to suggest that certain technological and social consequences of seasonality must also be considered in evaluating these proposals. This is deemed necessary in light of the widespread opinion implied or explicitly stated in most discussion of burned rock middens, that such middens are the result of activities (perhaps intermittently) of small social groups over long periods of time.

The archeological cultures of the Central Texas Archaic are generally thought of as resulting from the activities of small nomadic groups subsisting by hunting and gathering (cf. Suhm 1960:73). This inference is warranted by the evidence; however, it requires a qualification. Ethnographic evidence suggests that with very few — mostly maritime — exceptions, reliance upon wild flora and faunal resources in temperate regions dictates that the exploitative groups must be small and nomadic *with the exception of certain seasonal congregations into larger units.* It has not been invalid to interpret the archeological evidence from the Central Texas Archaic (which actually persists until at least A.D. 1250 and the first consumption, though perhaps not production, of agricultural products) as indicating reliance upon hunting and gathering. Nor has it been invalid to further infer that this involved small, nomadic groups. However, it is possible that it has been an oversight to assume that *only* small units existed and, therefore, that the accumulation of a sufficient volume of material to be called a burned rock midden indicates the elapse of considerable time.

Is it not possible that in the Central Texas Archaic small nomadic groups did prevail through most of the year but coalesced annually or seasonally? Ethnographically this pattern is not uncommon; for example, the hunting-and-gathering Washo of California and Nevada (d'Azevedo 1963) and the Southern Paiute of Utah and Arizona (Kelly 1964; Steward 1934) are known to have assembled in large groups in the early fall, but to have operated as small, dispersed bands during the remainder of the year. Similarly, the Coahuiltecans of southwestern Texas and northeastern Mexico congregated into large bands during the harvest of prickly pear tuna in late summer (Newcomb 1961). This pattern of activity could result in the accumulation of a midden the size of that at Devil's Hollow in a short period of time.

If we assume for the moment that half of the Devil's Hollow midden had eroded away at the time that Fox excavated it, we may get an idea of its total size by doubling Fox's counts for various kinds of debris. The resultant estimated quantities for the entire midden are as follows: 38,906 burned rock, 136 stone implements, and 2352 mussel shells (burned rock and mussel shell counts from Fox's notes). I can think of no basis for calculating rates of accumulation for burned rock and implements for various group sizes, however, food remains and estimated rates of consumption allow some very gross calculations of elapsed time of accumulation. These calculations rest upon a number of assumptions, none of which is demonstrably valid, and the results can be taken only as possibilities whose sole purpose is to provide a point of departure for further discussion. The first assumption is that Fox collected and counted accurately all of the mussel shells in the midden. The second assumption is that all cooking activities of the entire group (of whatever size) transpired at the communal midden. The third assumption is that no significant quantities of mussel shell were discarded outside of the midden area. None of these assumptions regarding the sample can be verified. Further assumptions are necessary concerning the nature of human consumption of river mussels; the variables here are not subject to specific verification for the prehistoric Devil's Hollow inhabitants, but reasonable ranges of estimate within human limits can be verified in a general way. Without detailed data on the identification and food value of the mussels from the Devil's Hollow midden, estimates through food-value figures and human requirements are not possible (see Ascher 1959, for an example of this method using marine mollusks), nor would this be warranted given the nature of the sampling.

Fox's count of 2352 single valves suggests the figure of approximately 1200 bivalve mollusks for the midden. Employing the relationship, *No. mussels/person/day X No. persons X No. days - 1200 mussels,* the following table may be constructed (see Figure 9 for a graph of these relationships):

No. mussels/ person/day (arbitrary estimates)	No. persons	No. days	= 1200 mussels
5	6	40	
5	10	24	
5	25	9.5	
5	60	4	
5	100	2.5	
20	6	10	
20	10	6	
20	25	2.5	
20	60	1	

Reading from the graph (Figure 9), a given number of people eating five mussels per person per day or twenty mussels per person each day will require a certain number of days to accumulate the 1200 or so mussels represented by the Devil's Hollow remains. The estimates possible from these figures range from six people

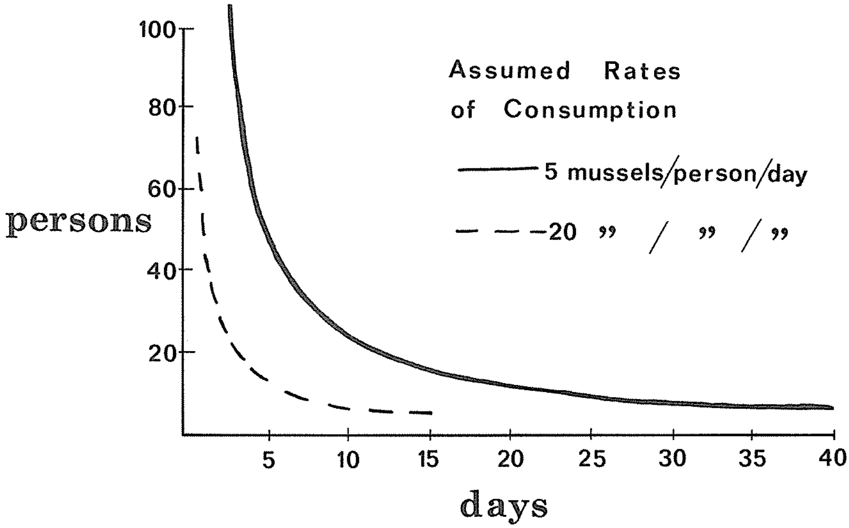

FIGURE 9. Graph of estimated lengths of occupation, Devil's Hollow Site, as functions of assumed rates of mussel consumption and population size. Arbitrarily, limits of no fewer than six nor no more than 100 persons are graphed as these seem to be effective minimums and maximums among known hunter-gatherers. Similarly, fewer than five or more than 20/mussels/person/day are arbitrarily assumed to be unlikely.

requiring 40 days to consume 1200 mussels to 100 people requiring 2 or 3 days at the rate of five mussels per person per day. Eating 20 mussels per day per person, 6 people could accomplish the task in 10 days or 60 people in one day.

In short, even as minimum figures, these data indicate that the amount of debris comprising this midden could have accumulated in a matter of days or weeks, especially if a communal earth oven were constructed where a fairly high number of stones were heated in the preparation of one "meal."

The alternative to a large number of people for a short period of time would be a small number of people for a long period of time. Burned rock middens, in the latter case, then would result from the prolonged, and probably intermittent, use of the same place for small cooking fires (cf. Kelley and Campbell 1942). This is clearly the case at many Central Texas burned rock middens; for example, the Williams Site (Suhm 1959) was evidently repeatedly used for a number of centuries.

The evidence now available suggest that certain middens, *as well as certain deposits within middens,* may result from the brief activity of a large group whereas other middens may have accumulated slowly as a result of repeated occupation at the same locus by small groups. An hypothesis worthy of testing would be that two seasons in the annual cycle are represented by these two distinct kinds of midden deposit. Support for the hypothesis would come from significant differences in the maturational stages or seasonal assemblages of faunal and (if preserved) floral remains, including pollens. In this connection, the very few bits of deer bone (probably from one individual) found in the Devil's Hollow midden would be consistent with the suggestion that the site was occupied briefly, perhaps during a season of heavy plant-food or river mussel exploitation when deer were killed only opportunistically.

Artifactual evidence provides a far weaker source of inference; however, sites such as Midden B at the Wunderlich Site (Johnson *et al.* 1962), Midden G at the Greenhaw site (Weir 1967), and the midden at Devil's Hollow show moderate to extreme homogeneity in dart point forms. The extreme homogeneity of the Devil's Hollow specimens 3,6,9,11,12,7, and 14 and their close similarity to specimens 10,16, and even 15, may be evidence that a short interval is represented. This is to say, individuals enculturated in the same group would be more likely to produce a homogeneous array of projectile points than individuals experiencing separate learning environments (Hemmings 1970, has put forward a similar interpretation regarding the high degree of homogeneity among Clovis points from the San Pedro Valley in southeastern Arizona). Less marked than, but similar to, the degree of homogeneity at Devil's Hollow is the homogeneity of the 11 *Nolan* points from Greenhaw Midden G which were found with 18 other points of types *Langtry, Castroville, Marshall, Pedernales, Travis, Zorra* and unclassified forms (Weir, 1967). *Pedernales* points account for almost 40% of the dart points from the Wunderlich Midden B whereas the remaining 60% is composed of 22 different forms (Johnson *et al.* 1962). On the other hand, Greenhaw Midden C, Wunderlich Midden A and numerous other sites contain very heterogeneous collections of dart point forms and probably represent extended and repeated periods of occupation; but it is possible, particularly in the light of the spatial segregation sometimes recognized in dart point forms within the heterogeneous middens (cf. Jelks 1951), that these repeated activities at least occasionally were by large groups for short periods of time.

In summary, data from the Devil's Hollow Site form the basis for three proposals amenable to testing in future investigations of burned rock midden sites in the Central Texas Archaic. First, in order to test the suggestion that earth ovens may be present, careful scrutiny of the midden configuration needs to be made. Second, two suggestions concerning the significance of typology, especially of projectile points, are made: perhaps recognition of homogeneous artifact forms will lead to further refinement of the local chronology; also, the tenuous position has been taken that marked homogeneity of projectile points indicates an abbreviated interval of manufacture within a single social unit. Third, to test the proposal that social groups of large size may be responsible for at least some middens, a number of specific kinds of information are to be sought. In the vicinity of the midden, the presence of reduplicative and contemporaneous clusters of remains indicative of separate households would offer one positive test for large group occupancy. Biological evidence should be sought and analyzed for seasonality. Means for estimating population size from food remains might be developed as well as an appreciation for the food potential of the Central Texas flora and fauna under various environmental conditions, in different seasons, and under various extractive technologies.

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PREHISTORIC SOCIAL BOUNDARIES: AN ARCHEOLOGICAL MODEL AND TEST

J. NED WOODALL

ABSTRACT

Using a series of late prehistoric Caddoan sites along the Neches River of Texas, an attempt is made to detect the location of ancient social boundaries. The model assumes that there is less social interaction between autonomous sociopolitical groups than within such groups. Thus measurements of intersite ceramic variability through space will reveal a disproportionate increase when such a boundary is crossed. The use of Pearson product-moment statistic *r*, comparing geographic distance with ceramic variability, suggests the presence of a boundary in the area under study. This boundary probably marks the division between two tribes of the Caddoan Hasinai confederacy.

INTRODUCTION

The definition of prehistoric sociocultural units comparable to those of the ethnographer has been a difficult task for the archeologist. Recent studies by Hill (1967), Longacre (1964), Deetz (1965) and others have focused on one aspect of this problem, pointing out archeological evidence for particular post-marital residence patterns and the detection of kin groups, most notably extended matrilocal families. This paper suggests a method for defining a more inclusive sociopolitical unit, the tribe, through the analysis of artifact attributes, their variation and distribution. More precisely, I have attempted to determine the location of those emic boundaries to social intercourse that allow the anthropologist to distinguish the more or less distinct social and cultural units commonly referred to as "tribes" (Service 1971).

The area under investigation lies in the upper Neches River basin of northeast Texas, part of the much larger Caddoan region. The Neches flows through territory occupied, in the seventeenth and eighteenth centuries, by the historic Hasinai confederacy, a loose political and religious union composed of ten tribes (Swanton 1942:7-16). The late prehistoric occupation is marked by numerous sites grouped into the Titus and Frankston foci of the Fulton Aspect. It is with these sites — believed to date between A.D. 1200-1500 — that this analysis is concerned.

In 1957 construction of a small dam on the Neches to create Lake Palestine prompted an archeological survey of the area (Johnson

1961). Data obtained from this reconnaissance was used to determine if in the territory covered by the survey, measuring approximately 25 km. north-south and 10 km. east-west, there was to be found the patterning of artifact attributes which satisfies the archeological model of tribal boundaries.

FORMULATION OF THE MODEL

In dealing with a tribal organization, such distinguishing or defining measures as the extent of pan-tribal sodalities (e.g., clans or age-grade societies) or linguistic differences cannot be detected with present archeological methods. The use of endogamy as a defining criterion for a social unit appears to be more useful from the standpoint of the archeologist, however. The Deetz and Longacre studies already mentioned have demonstrated the possibility of finding residence and, inferentially, marriage patterns revealed in the archeological record, and further expansion of this sort of analysis is the basis of the present approach. For the purpose of delineating the social limits of a particular tribe I shall use *the smallest endogamous group present in an area.* The geographical size of the area would vary with the economic system of the tribes present; it would be much larger for the highly mobile Plains Indian than for the largely sedentary eastern horticulturalists such as the Caddo. Also, our criterion of endogamy will hold only for societies at the tribal level of sociopolitical integration.

To find the smallest endogamous unit in a band society would lead to the inclusion of numerous groups having little or no political commonality; also in a stratified society such as a chiefdom, the smallest endogamous unit may be a class of individuals within the society. Hence the definition proposed here is not designed to reveal the presence or absence of tribal level society. Other means for this are available, e.g., the presence of ascribed status in the archeological record (Binford 1962). What I am offering is a definition which will allow the archeologist to divide a continuum of artifact types and sites into meaningful social units when he already is relatively certain he is dealing with tribal societies. In the absence of any contrary evidence in the archeological record, and with the positive indications supplied by the historical record, I believe this assumption can be made for the late prehistoric Caddo in the Neches basin. Once the archeologist working in the Caddoan area moves back into the period of large-scale mound construction, mass burials suggestive of retainer sacrifice, and sites on the size scale of

George C. Davis or Spiro, then he will find it necessary to demonstrate that he is dealing with a particular level of sociocultural integration and alter his model accordingly.

To determine more precisely what to expect of a social group such as a tribe in regard to its archeological evidence, consider some of the implications of a matrilocal tribal society with a dispersed settlement pattern. First of all, if women are the potters, and a girl is taught the craft by her female relatives, the archeologist would expect village microtraditions to develop. The presence of several generations of potters would produce an intellectual inbreeding of design motifs, vessel shapes and possibly other attributes which work to distinguish wares of a particular lineage in comparison with others. This phenômenon has been demonstrated for the Southwest (Longacre 1964: Hill 1967).

In the case of small hamlets, Caddo males would be likely to marry outside their own village of orientation in order to keep the incest taboo. If the men learn flint-knapping from male relatives in their youth, then any microtraditions in stone thus produced would be expected to have a more dispersed pattern than those of the women. Hence the smallest areal distribution of male-created microtraditions would coincide with tribal boundaries, assuming that the tribe represents a random breeding population, i.e., that any male was likely to be selected as a mate as any other male. Unfortunately, stone tools and flakes are exceedingly rare in the collections used in the following analysis, but this part of the model can be expected to have an expanded application once sufficient amounts of these materials are systematically collected.

Although a single tribe can be expected to embrace several ceramic microtraditions (the number being a factor of the number of matrilineages present), the tribe as a whole will also circumscribe a number of ceramic modes which, when plotted on a distribution map, should conform to the social (i.e., endogamous) boundaries. This is predicated on the assumption that the tribes comprising the confederacy were formed in a situation of relative isolation, either cultural or geographical, and that there was, and remained, more interaction on a social basis within the tribe than between tribes. Longacre (1964:157-8) has suggested a corrèlation between levels of ceramic analysis (type-variety-lineage style) and levels of sociopolitical interaction (tribe-village-lineage). Hill (1966:21) has inferred that social distance between residential areas within a single site may be suggested by the "tightness" of clustering of stylistic traits in each of the areas. That there is a clear-cut relationship between attribute combinations and social units in the Caddoan area is yet to be demonstrated; students in the area have long been warned, wisely I believe, against attributing any social reality to the McKern taxonomic units which are composed almost entirely of pottery types. On the other hand, in at least one situation it has been demonstrated that "social demography and social organization are reflected in the material cultural system" (Longacre 1964:158). Indeed, the anthropologist who believes that patterned behavior must manifest itself in a patterning of the results of that behavior (the artifacts), and that a particular behavior pattern is largely controlled by socially contracted norms, cannot avoid the implication that such a social unit as a tribe will leave a record of its distinctiveness in the archeological record. This is true provided the norms are sufficiently diverse from tribe to tribe so as to produce a discernible artifact variation. From Spanish and French sources, which state that there were religious and linguistic differences within the Hasinai confederacy, this can be assumed.

For a cogent and objective analysis of microtraditions, both within and between sites, certain statistical methods will be necessary. Since this analysis is designed to detect social units larger than the minimum residence groups (the family), between-site comparisons will be of initial concern.

The first step requires a sherd-by-sherd examination during which a table of the smallest analytical units, the modes (after Rouse 1965:92), will be composed. This table lists every mode present, the sites at which it is found, and its percentile representation at that site as well as its frequency.

Once the relative frequency (i.e., percentages) of each mode in a site is known, all sites can be compared using the Robinson-Brainerd seriation technique (Robinson 1951). It must be understood that while this technique was originally devised for chronological ordering of deposits, actually it simply measures the degree of similarity between artifact assemblages. Whether the measured differences are due to time, "social distance," or some other factor, such as functional variation, must be determined another way. In this instance all variation is assumed to be due to social distance, since the sites are believed to be contemporaneous as judged by their resident ceramic types.

Now, what sort of sociocultural implications can be derived from the above measurements? If we are operating on the assumption of differential social interaction within a confederacy, i.e., that there is more interaction within a tribe than between tribes, then it follows that if pottery design is at least a crude index to this interaction, we can expect less radical shift in the computed coefficient of similarity between sites of a single tribe than between sites formed by populations of two different tribes. The degree of this variation is dependent on innumerable factors, among them geographical distance, linguistic similarities, common cultural traditions, etc. All

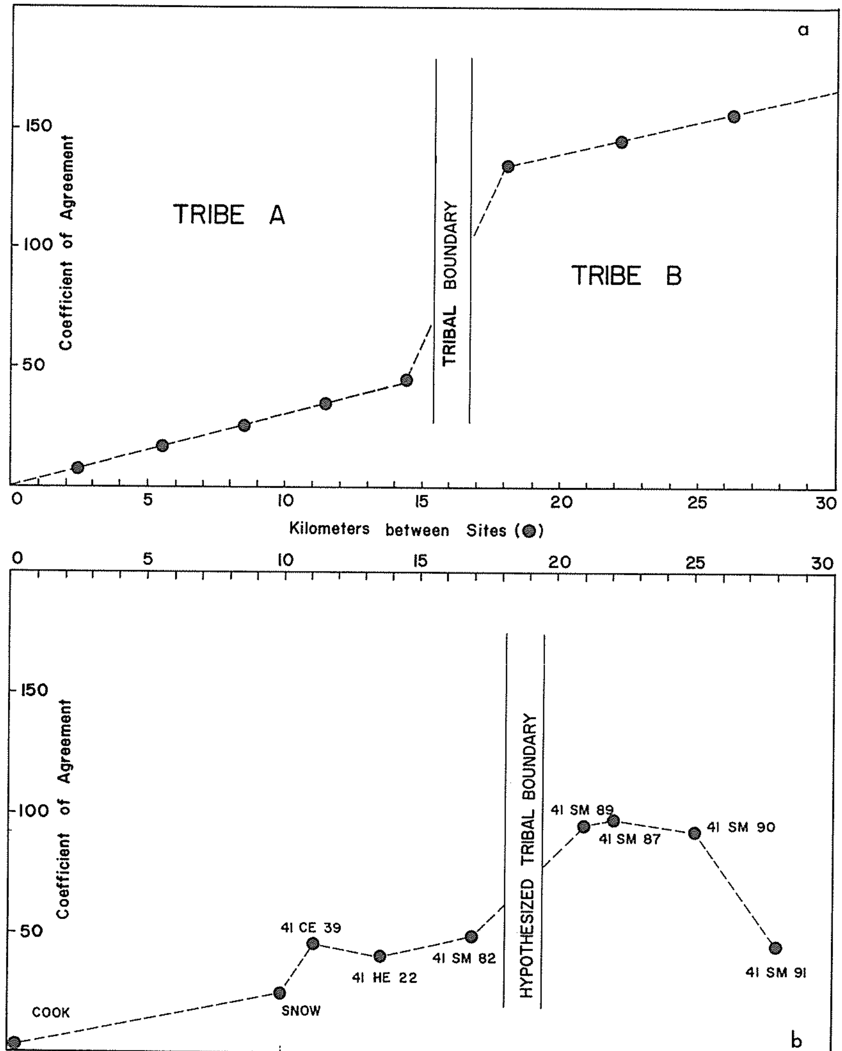

FIGURE 1. a, Graphic Model of Ceramic Variability as a Function of Distance and a Cultural Boundary. b, Ceramic Variability Between Lake Prehistoric Caddoan Sites on the Neches River.

of these factors, however, are assumed to operate to a lesser extent within a tribe than between tribes, thereby accounting for the assumption above, i.e., that there is less variation within a tribe than between two tribes. (Fig. 1).

Moving now to the particular sites used (Fig. 2), seven were chosen from the 40-odd found by Johnson's survey of Lake Palestine (Johnson 1961).

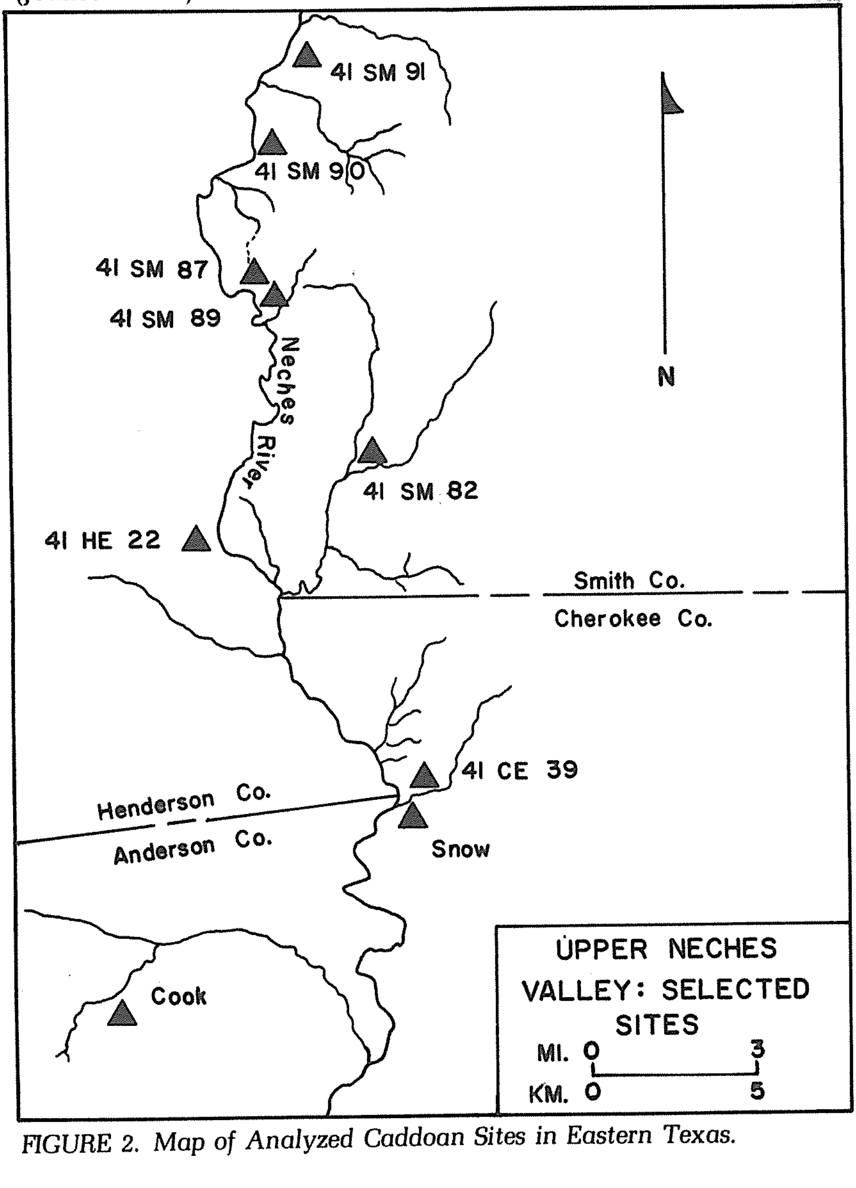

FIGURE 2. Map of Analyzed Caddoan Sites in Eastern Texas.

In addition, two sites found by the WPA crews in the 1930's in this same area were included (Cook and Snow sites). Each site collection displayed at least 100 occurrences of the selected ceramic modes. The first part of the analysis was concerned with the method of decoration, i.e., is there a discernible, significant variation in the method of decoration within the area? In fact this analysis was intended to act as a pilot project which would suggest the feasibility or possibility of success of a more detailed study. Toward this end 22 modes of ceramic decoration method were listed, these being chosen by shuffling through all the sherds heaped together with no regard at that point to individual site location. The 22 modes found occurring within the combined samples are as follows:

1. Wide-line engraving
2. Narrow-line engraving
3. Excising
4. Narrow-line incising
5. Medium-line incising
6. Wide-line incising
7. Incising over brushing
8. Direct punctation by small tool
9. Direct punctation by large tool
10. Oblique punctation by small tool
11. Oblique punctation by large tool
12. Mode 8 over brushing
13. Mode 9 over brushing
14. Mode 10 over brushing
15. Mode 11 over brushing
16. One-way brushing
17. Criss-cross brushing
18. Pinching
19. Applique
20. Ridging
21. Banding
22. Incising, overhanging lines

The qualifiers *small, medium,* and *large* or *narrow* and *wide* are not as subjective as they might appear. The narrow lines found on incised sherds are deep slits, probably made with a flint flake. Often these lines have been re-closed at spots as the potter manipulated the still-wet vessel. The medium lines are those most commonly found; apparently they were formed by dragging a small twig through the wet clay, as often there is a brushed effect within the line probably caused by fraying wood. The wide incised lines are comparable in breadth to the "trailing" found on certain Caddoan types. Little difficulty was experienced separating the incised sherds into three categories. The same can be said for the punctated sherds; in this case "large" refers to the tool used for punctation and includes those larger than the diameter of an ordinary lead pencil. Again there was little difficulty, most of the punctations being decisively larger or smaller than the total number of modes from that site. The sites used, and the mode totals, are as follows:

41 SM 91 (191)
41 SM 90 (375)
41 SM 89 (135)
41 SM 87 (101)
41 HE 22 (217)
41 CE 39 (122)
J. W. Snow (375)
Mrs. J. M. Cook (290)
41 SM 82 (103)

Following the previously described steps, the resultant coefficients of agreement were arranged in an ordered matrix as shown in Table 1. If one examines the above order, and then checks the site distribution map (Fig. 2), he will find an apparent coincidence of site association. More precisely, the ordering of the sites by similarities in the method of decoration and by geographical distance is shown in Table 2.

TABLE 1

COEFFICIENT AGREEMENT MATRIX, NECHES RIVER SITES

	SNOW	COOK	CE39	SM91	HE22	SM82	SM89	SM87	SM90
Snow	200								
Cook	174	200							
CE39	146	155	200						
SM91	135*	154	163	200					
HE22	138	159	148	163	200				
SM82	131	150	164	175	177	200			
SM89	90	106	123	129	138	145	200		
SM87	86	104	123	125	137	143	179	200	
SM90	93	108	117	123	132	144	157	168	200

*Negatively signed differences are underlined.

TABLE 2

ORDERING OF NECHES RIVER SITES

By artifact similarity	By geographical location (North to South)
41 SM 90	41 SM 91
41 SM 87	41 SM 90
41 SM 89	41 SM 87
41 SM 82	41 SM 89
41 HE 22	41 SM 82
41 SM 91	41 HE 22
41 CE 39	41 CE 39
J. M. Cook	J. W. Snow
J. W. Snow	J. M. Cook

If we consider the foregoing arrangement of sites as an ordinal scale in which each column ranks the sites — the first by artifact similarity and the other by distance from an imaginary point lying south of the Cook Site — the correlation between the two can be measured by Kendall's *tau*. This is a statistical measure of the degree to which pairs in the proper order exceed in number those in the reverse order (Blalock 1960:321). Assigning the values 1, 2, 3, etc. respectively, to sites, proceeding from the southern to the northernmost, i.e., from Cook (Rank 1) to SM 91 (Rank 9), the following computation of tau results:

$$\text{tau} = \frac{S}{1/2N\ (N-1)}$$

where S is a measure of differences in order occurring between the two arrangements, and N is the number of cases. In this instance *tau* is calculated as .67. A null hypothesis of independence between the two rankings can be tested by

$$Z = \frac{S}{\sqrt{1/18\ N\ (N-1)\ (2N+5)}} \quad \text{or } Z = 2.5,$$

significant at the .01 level.

The closeness of the two arrangements tends to verify the earlier assumption that the detected variation would be due to social distance rather than time. If time were the main factor underlying the variation, then there would be no explanation for the horizontal seriation other than an unequal rate of diffusion, unlikely within such a small area. Rather one would expect similar sites from both the northern and southern ends of the area, and also dissimilar sites at either end — in other words, the distribution of similar sites would be geographically random. Even more interesting than the relative positioning of the sites in a rank-order scale is the correlation between geographical distance intervening between every possible site pair and their shared coefficient of agreement. The Kendall's *tau* test above shows only that a positive relationship exists between these two values; the degree of correlation can be indexed by another statistic, the Pearson product-moment correlation coefficient *r*.

In order to prevent a negative correlation, the coefficient of agreement will be converted so as to yield smaller numbers as the similarity between sites increases; this is done by simply subtracting each of the indices in Table 1 from 200. Geographical distance will be measured in airline kilometers between each of the compared sites. The raw data of the calculations are shown in Table 3. The computed correlation coefficient *r* of .43 suggests a rather strong relationship between geographical distance and ceramic decoration methods. The *r*, converted to the F statistic for the analysis of variance test yields the quantity 7.72, easily significant to the .01 level. That is, less than one trial out of 100 would yield by chance alone such a correlation between distance and changes in decoration method, with no real correlation existing in the universe, i.e., among all the late prehistoric sites now or ever present in the area. If the aberrant Site 41 SM 91 is disregarded, the correlation arises to an amazing .75, significant at the .001 level of significance.

In the preceding discussion I have equated social distance with geographical distance, seemingly legitimate if we conceive of interacting social groups such as tribes to be spatially segregated from similarly conceived units. Thus one would expect a correlation between social interaction (already assumed to be reflected in artifact similarities) and geographical distance, but one would not expect this correlation ever to be perfect. The reason can be explained by the following example: imagine two segregated tribes making quite different pottery but living in contiguous areas, each occupying 40 square kilometers of a territory, say, 4 km. wide and 20 km. long. There would occur a positive correlation between distance and artifact similarity since one group lives in the southern half and the other in the northern half of the territory. The correlation would become very weak, however, in regard to those specific sites occurring near the mutual boundary, since these would be quite close geographically but different in regard to ceramics. Assuming we had an equal number of sites on either side of the boundary and the sites within each of the two tribal territories were randomly distributed we would not expect a correlation approaching 1.0. Given such a case, the archeologist would re-examine his data, especially the ordered matrix, to see if any sites seemed to cluster — i.e., whether there occurs a radical shift in the coefficients of agreement that might indicate a social boundary had been crossed. At this stage of analyzing the Neches River sites there is an intimation of such a cluster, namely sites SM 89, SM 87, and SM 90. These three have coefficients of agreement of 157, 168, and 179; the next most similar site, HE 22, is some 19 units below 157. There is then a shift of some 19 units, while within this group of three sites, and within the remaining group of six (Snow, Cook, CE 39, SM 82,

TABLE 3

CALCULATION OF r FOR DISTANCE VS. ARTIFACT SIMILARITY

Sites	Km. between sites (X)	X^2	200-Coefficient of agreement (Y)	Y^2
Snow-Cook	10	100	26	676
Snow-CE 39	1	1	54	2916
Snow-SM 91	22	484	65	4225
Snow-HE 22	10	100	62	3844
Snow-SM 82	10.3	106.1	69	4761
Snow-SM 89	15.5	240.25	110	12100
Snow-SM 87	16.2	262.44	114	12996
Snow-SM 90	20	400	117	13689
CE 39-Cook	11	121	45	2025
CE 39-SM 91	21	441	37	1369
CE 39-SM 82	9.2	84.64	36	1296
CE 39-HE 22	9.5	90.25	52	2704
CE 39-SM 89	14.5	210.25	77	5929
CE 39-SM 87	15.5	240.25	77	5929
CE 39-SM 90	19	361	83	6889
SM 91-Cook	27.5	756.25	46	2116
SM 91-SM 82	11.7	136.89	25	625
SM 91-HE 22	14.3	204.49	37	1369
SM 91-SM 89	7	49	71	5041
SM 91-SM 87	6.4	40.96	75	5625
SM 91-SM 90	2.6	6.76	77	5929
HE 22-Cook	13.5	182.25	41	1681
HE 22-SM 82	5.3	28.09	23	529
HE 22-SM 89	7.3	53.29	62	3844
HE 22-SM 87	8	64	63	3969
HE 22-SM 90	11.5	132.25	68	4624
SM 89-Cook	20.7	428.49	94	8836
SM 89-SM 82	5.5	30.25	55	3025
SM 89-SM 87	1	1	21	441
SM 89-SM 90	4.5	20.25	43	1849
SM 87-Cook	21.5	462.25	96	9216
SM 87-SM 82	6.2	38.44	57	3249
SM 87-SM 90	3.5	12.25	32	1024
SM 90-Cook	25	625	92	8464
SM 90-SM 82	9.5	90.25	56	3136
SM 82-Cook	17	289	50	2500

Sum X = 434.2   Sum X^2 = 6893.59   Sum Y = 2208   Sum Y^2 = 158440

N = 36   Sum XY = 29302.7   r = .43

SM 91, and HE 22), there is a smoother continuum of change in decoration methods from site to site.

It has been assumed that the higher degree of social interaction taking place within a tribe would result in greater artifact similarities. Social interaction is abetted by tribal endogamy, with intra-tribal artifact variation occurring among women's products because of matrilocal microtraditions. If one takes then a synchronic view of a region encompassing two or more sedentary tribes, beginning at a site farthest removed from the common boundary between the two and moving toward it, one will expect change in the artifacts increasing as does distance from the original site (due at least in part to the matrilocal microtraditions). In crossing the boundary, however, there will be a disproportionate increase in the continuum of change as measured by the coefficient of agreement. After the boundary is crossed, the continuum will decrease its slope, our concern being entirely with sites of the second tribe. This model can be expressed diagrammatically as Figure 1a. For a graphic presentation of this continuum of change among the sites involved in the present study, see Figure 1b and compare the actual with the ideal.

TESTING THE MODEL: ANALYSIS OF DESIGN MOTIF

Because of the small size of the average individual potsherd it was seldom possible to see a complete design motif or even a whole element of that motif. In one sense this may have had a beneficial influence on the study; it forced attention to miniscule variations which may have been a result of unconscious adherence on the part of the potter to modes of decoration learned early in her career. These are presumably inviolate to change despite widespread diffusion of total design motifs and methods which comprise the archeologists' types of Caddoan ceramics. Longacre, for a similar reason, isolated certain design elements which he hoped would be "nonconsciously selected based upon learning patterns within the social frame" (1964:163).

Of course it was not known initially which, if any, of the observed variations would be significant for the purpose at hand, i.e., delimiting the range and extent of social interaction. Consequently the sherds were classified several times, each time with a different criterion as the basis for the categories. Most of these classifications ended with a random distribution — the resultant categories coincided not at all with a geographical affinity of the contributing sites, or the specimens from several sites would be about equally divided between the groups. However, there were a few classifications that did yield a set of categories, the components of which were segregated geographically as well as stylistically. As will be pointed out in the following pages, the separation was largely in agreement with that discovered in the analysis of modes of decoration method. Each time the distribution of a particular design element was analyzed, the contributing sites were re-arranged and gerrymandered in order to get the highest possible chi-square. In every case it was found that the most marked variation coincided with the findings of the analysis of method of decoration, i.e., northern sites (SM 90, 87, and 89) vs. southern (HE 22, SM 82, CE 39, Snow, Cook). Site SM 91 consistently was more similar in design elements to the northern sites and was included with them in the chi-square tables.

STRAIGHT PARALLEL LINES

An example of the classification based on mode of design element involved sherds marked solely with straight parallel lines. There are 63 such specimens, some engraved and some incised, some "sloppy" and some neatly executed, and of a variety of thicknesses. A separation of these on the basis of the space between the lines was found to be most fruitful, however. Sherds which were decorated with straight parallel lines spaced less than 6.0 mm. apart were separated from those with more widely spaced lines; in the case of sets of such lines it was the intervening space within the set

TABLE 4

DISTRIBUTION OF STRAIGHT PARALLEL LINES

	Widely spaced	Narrowly spaced	Totals
Northern Sites	o: 23 e: 16.8	o: 10 e: 16.2	33
Southern Sites	o: 9 e: 15.2	o: 21 e: 14.8	30
Totals	32	31	63

Chi-square = 9.8 Degrees of freedom = 1

rather than between sets that was the determinant. Of course any two sherds which appeared to be of the same vessel were counted as one. The resulting groups were tested for statistical significance by chi-square as shown in Table 4. The computed chi-square is significant at the .01 level — we would expect such a distribution of stylistic traits in question to occur by chance only once in every hundred times the samples were drawn.

HACHURING

A prominent, easily recognized design is the use of sets of parallel lines intersecting and crossing, creating a hachured or diamonds effect. Twenty-eight such sherds were present, and it was clear even when the initial classification was in progress that this design was over-represented in the northern sites. Again, both engraved and incised specimens were used, but are lumped together in the chi-square test (Table 5). The computed chi-square of 5.2 is significant at the .05 level.

TABLE 5

DISTRIBUTION OF HACHURING

	Hachuring	No hachuring	Totals
Northern Sites	o: 20 e: 14.2	o: 155 e: 160.8	175
Southern Sites	o: 8 e: 13.8	o: 161 e: 155.2	169
Totals	28	316	344

Chi-square = 5.2 Degrees of freedom = 1

FILLED AREAS

There are 36 sherds in the collection exhibiting zones of short straight or curved lines circumscribed by either two parallel lines (resulting in a ladder-like element) or two converging lines (the filled triangle). Separating these specimens into ladder-like or triangular elements gave the following contingency table (Table 6). The computed chi-square value of 6.4 is significant at the .02 level.

TABLE 6

THE DISTRIBUTION OF FILLED LADDERS AND TRIANGLES

	Filled ladders	Filled triangles	Totals
Northern Sites	o: 8 e: 4.7	o: 11 e: 14.3	19
Southern Sites	o: 1 e: 4.3	o: 16 e: 12.7	17
Totals	9	27	36

Chi-square = 6.4 Degrees of freedom = 1

CONCENTRIC LINES

Twenty sherds show gently curving concentric lines spaced at various widths and occasionally intersecting a second set of similar lines. Within the category no significant differences between sites could be detected, but the occurrence of the design element was predominantly in the southern sites. If chi-square is calculated using as the categories sherds with concentric lines and sherds without such lines (as was done for hachured sherds), the results are as shown in Table 7. The chi-square is significant at the .10 level.

TABLE 7

DISTRIBUTION OF CONCENTRIC LINES

	With lines	Without lines	Totals
Northern Sites	o: 5 e: 9.1	o: 170 e: 165.9	175
Southern Sites	o: 15 e: 10.9	o: 195 e: 199.1	210
Totals	20	365	385

Chi-square = 3.5 Degrees of freedom = 1

SMOOTHING AND POLISHING

The separation of those sherds categorized as highly smoothed or polished provides one of the most marked difference between the northern and southern sites. The terms *highly smoothed* (low burnish) and *polished* (high burnish) are relative ones, relative only to the remainder of sherds in the sample at hand. All except one, a punctated-incised specimen, are decorated by engraving. When examined under a magnifying glass, all the sherds revealed small pits or depressions with a matte finish; these are spots unreached by the polishing stone, and indicate that the sheen thus imparted was not a natural result of using certain clays (Shepard 1954:122). Small sherds did not always present such evidence, but were included in the sample under the assumption that the evidence was missing due to vagaries of breakage.

Making the analysis of this category less convincing than it might be is the fact that sherds from two of the southern sites, Cook and Snow, may have been buried until their recovery by the WPA field crew — the notes fail to clear this detail. If they were buried it is not known how this will affect the preservation of the surface finish. Because the high percentage of lustrous sherds at these two sites might be due to differential preservation, two chi-square tests were conducted, the first using the Cook and Snow artifacts, the second excluding them. The results are shown in Tables 8 and 9. The chi-square of Table 8 is significant at the .01 level. Now excluding the two sites Cook and Snow, the contingency table appears as shown in Table 9. The value of chi-square is significant at the .33 level.

TABLE 8

DISTRIBUTION OF LUSTROUS SHERDS, WITH COOK AND SNOW SITES INCLUDED

	Lustrous	Non-lustrous	Totals
Northern Sites	o: 13 e: 20.9	o: 162 e: 154.1	175
Southern Sites	o: 28 e: 20.1	o: 140 e: 147.9	168
Totals	41	302	343

Chi-square = 6.9 Degrees of freedom = 1

TABLE 9

DISTRIBUTION OF LUSTROUS SHERDS, WITH
COOK AND SNOW SITES EXCLUDED

	Lustrous	Non-lustrous	Totals
Northern Sites	o: 13 e: 15.2	o: 162 e: 159.8	175
Southern Sites	o: 12 e: 9.8	o: 101 e: 103.2	113
Totals	25	263	288

Chi-square = 89 Degrees of freedom = 1

OTHER DECORATION MODES

A few of those modes of decoration which did not prove to have a significantly distinct variation in their geographical distribution should be mentioned. Using three such modes involving punctation, three nonexclusive categories were set up and tested by chi-square: free punctation, linear punctation, and zoned punctation. None of these had a restricted occurrence, nor did the combination of any two or all three categories. In fact this was not wholly unexpected and served in one way to bolster the suggestion that differences found significant in previous chi-square tests were products of social distance. To explain, the use of punctation — particularly zoned punctation — is generally conceded to be more typical of early Caddoan sites (Gibson Aspect) than late sites. Such types as *Weches Fingernail Impressed, Pennington Punctated-Incised,* and *Crockett Curvilinear Incised* all exhibit zoned punctation, and are considered indicative of the earlier part of the Caddoan time span. If the punctated sherds in the present sample — or even some few of them — belong to an earlier time period than that of the remaining decorated sherds, one would not expect a distribution of microtraditions congruent with the later wares.

Other modes investigated but deemed random in their distribution include ticked lines, excised pendant triangles, and random incisions or "slashes". In all three of these at least part of the difficulty is likely a result of the small sample size; as one's categories of microtraditions become more detailed, the size of each diminishes proportionally. Hence an extremely large initial sample would be required before any statistically viable conclusions could be reached regarding the occurrence of, say, "large excised pendant triangles." The absence of such a large sample was one of the liabilities of this study, and hopefully will be borne in mind in future reservoir survey work.

Site 41 SM 91

In the analysis of modes of decoration method it will be recalled that SM 91 allied itself with the southern group of sites, even though it lies on the northern edge of the area surveyed. On the other hand, in regard to design modes it agreed nicely with the northern sites, and attempts to include it among the southern group only reduced the resultant chi-square values. A study of percentages of decoration methods from each site reveals that SM 91 acquires its similarity to the southern group by its high percentage of brushed sherds and low percentages of medium line incised and narrow-line engraving. Although one source of explanation would be an inter-group marriage (and violation of the uxorilocal residence rules), this does not account for the adoption of the "northern" design elements. In other words, if SM 91 is different in the one regard, it should be different in both. The deviation of SM 91 from the regularities found among the other sites explains the sharp downturn of the line marking degree of artifact change in Figure 1b. The most convenient explanation is, of course, sampling error, but in light of the relatively large size of the SM 91 collection (191 specimens), it was retained. Such anomalies can operate only as a stimulus and guide for further research.

CONCLUSIONS

In the previous pages I have implied, and now make explicit, a belief that at least two distinct social groups were present in the area of Blackburn Crossing Reservoir. The nature of these groups cannot, at this stage of research, be determined. According to the various journals and other documents pertaining to early contact with the Caddo, the groups which were most distinct to the Europeans were the tribe and the confederacy. Certainly the two groups detected archeologically are not confederacies, but they may be tribes. They may also be extended matrilocal kin groups — either would yield the patterning of pottery modes described, although the latter should be included within a larger aggregate, the tribe, the boundaries of which might come to light with a more widespread survey and analysis in the region involved. Until more detailed analyses designed to reveal prehistoric social groups have been conducted on numerous sites throughout the Caddoan area, it is impossible to evaluate a single such analysis. Simply, one knows, or strongly suspects, that the two groups of sites were different, but until a more complete pattern of such differences is revealed, the isolated instance cannot be evaluated in terms of the usual ethnographic units such as kin group or tribe. While it appears that the area chosen for study includes a boundary of some sort, the size and range of the two groups on either side remains unknown. This is unfortunate because size — i.e., geographical extent — alone would provide a clue as to the nature of the social group. Judging by the occurrence of the southern series of sites, occupying an area at least 20 km. in length, a single extended kin group seems much less likely than a tribe.

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PREHISTORIC SETTLEMENT OF THE UPPER NECHES RIVER

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ABSTRACT

During archeological survey in 1969 and 1970, 98 sites were located along the upper Neches River in the area of Lake Palestine Reservoir. A small number of these are middle Archaic sites, interpreted as intermittently used hunting sites. Eighty-five sites have Caddoan ceramics. One site cluster west of the river has Alto Focus pottery and is probably a small village or hamlet belonging to the early Caddoan occupation of the upper Neches. Remaining sites have Frankston Focus ceramics and include a number of settlements interpreted as permanent hamlet or village localities. These are predominantly associated with streamside locations near relatively fertile soils; the site situation described for the Hasinai, who occupied the upper Neches historically. Other Caddoan sites are suggested as equivalents of seasonally-occupied localities in the Hasinai settlement system.

Excavation is proposed to further test the settlement models suggested for Archaic and Caddoan occupations, and the implications for social interaction that derive from these models.

INTRODUCTION

This report focuses on patterns of site distribution in the upper Neches River. Emphasis is placed on the structure and relationships of late prehistoric Caddo communities. Preliminary attempts will be made to formulate models to account for these settlement patterns from which hypotheses can be derived for testing in excavation.

If the results of two surveys, the present one and an earlier one by Johnson (1961) are reliable, the upper Neches River was inhabited primarily by Caddo peoples. Little Archaic material has been found and nothing earlier than "middle Archaic" is reported from the reservoir area.

The Caddo occupation of the reservoir area may have been relatively brief; it belongs primarily in the period of the Fulton Aspect. This relatively brief occupation (perhaps A.D. 1100-1600) is represented by a large number of small sites; a total of 122 have been recorded in both surveys.

A general shift in settlement pattern typifies the Fulton Aspect (Newell and Krieger 1949:194). This is a general dispersion of population into small villages with loss of impressive mounds and status burials of an earlier period (Gibson Aspect) which imply nuclear centers of social control through ranked chieftains and subordinates. It is the primary purpose of this report to provide a background for systematic consideration of this trend, to describe the archeological universe of the Upper Neches, and to isolate environmental, technological, economic and social variables which give insight into elements of village life by which this state of Caddo development can be characterized and compared with earlier settlements. The procedure followed is reflected in the organization of the report follows these steps:

1. Determination of environmental resources, considered as an ecological system relative to human occupation. This includes: (1) association of natural resources with specific areas or zones within the river drainage, (2) seasonal periods of maximum yield, and (3) natural limitations such as climatic and soil productivity, which affect their usefulness to man. This should result in a statement of the environment as a set (or cyclical series of sets) of boundary conditions which comprise fluctuating resources.

2. Abstracting from local and general ethnographic and archeological data the technological sequences, task group composition, residence units, and social group composition which may be reflected in physical remains.

3. Analysis and presentation of site data from the survey, with reference to the models and derive the problems to be solved by excavation of specific sites within the reservoir. The aim of this procedure is to excavate sites not just because few sites of a particular period have been dug, and it is intuitively felt that more are necessary, but because excavation will provide understanding of cultural adaptation, adjustment, and development.

SURVEY CONDITIONS AND TECHNIQUE

The survey was carried out primarily during July and August of 1969 with additional recording during March, July, and August of 1970. This season has limitations since during the summer in east Texas there is heavy plant cover which tends to obscure sites; it also includes the driest and hottest part of the year. Consequently, the sites were seen when conditions of flooding and water flow could not be related directly to site distribution. However, the summer has one distinct advantage in permitting observation of usable plant resources in full leaf, though many nuts and fruits do not ripen

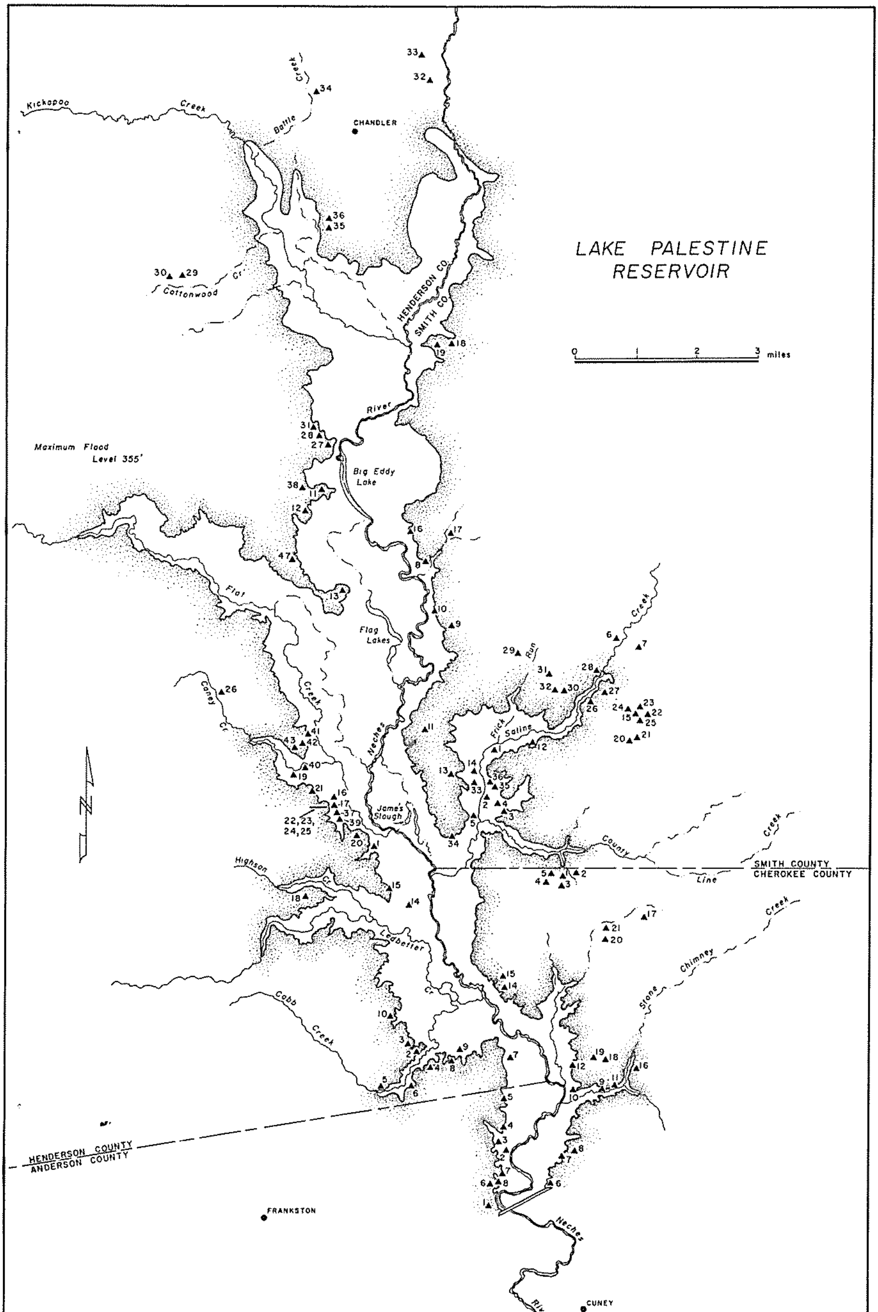


FIGURE 1. Lake Palestine Reservoir.

before fall.

The survey included both the proposed lake limits. the surrounding cleared zone following the 355 foot contour, and areas immediately outside the reservoir. A considerable amount of reservoir-connected construction and development threatens archeological sites adjacent to the reservoir.

The survey was of an exploratory type, conducted primarily to inventory a maximum number of sites in a limited time. Total collection of surface artifacts was attempted at most sites; in many, the surface artifacts were so few that limited controlled sampling would have resulted in a very small collection. Most sites were collected as a single unit, though sub-divisions were made in sites having obvious and discrete concentrations of artifacts correlating with physical features of the site. Site dimensions were determined by stepping off the site, or estimating the length and width of the area marked by surface artifacts or the obviously limited landform with which it was associated.

ENVIRONMENT

Descriptions of environmental features from the perspective of human economy and settlement are presented here, focusing on: (1) distribution of geological and biotic resources, (2) seasonal cycles in the endemic biotic community, (3) contrastive elements of topography, soils, and stream patterns, and (4) climatic fluctuation. These elements form a series of environmental domains which comprise resources and adaptive problems for indigenous human populations. By deriving those problems in the perspective of present environment and ethnographic and prehistoric data, models can be developed which enable predictions of environmental associations with specific cultural activities and settlements. These should be reflected by survey and excavation data.

Components of the environment vary in spatial discreetness and seasonal effect. However, at any given season at a particular location, certain economic activities and human task groups are more likely to have been found than others, and these groups may be expected to be represented by a certain class of artifacts. The intent of this chapter is to abstract components of the natural environment with which we would expect particular human activities to be associated.

The Lake Palestine enlargement includes the portion of the Upper

Neches River between the towns of Cuney and Chandler, a distance of slightly more than 17 airline miles. The enlargement, which will ris to 345 feet msl., encompasses the river bottoms and slopes and the lower drainages of the major tributary streams (Saline, Kickapoo, Flat, and Ledbetter creeks). Variation in geology and topography of the Neches valley are factors underlying localized resources which effect human settlement. The following discussion describes landforms, minerals, and soils and their usable resources.

TOPOGRAPHY AND GEOLOGY

The Neches River is a mature sluggish stream, meandering over a floodplain with a maximum width of two miles, between rolling convoluted uplands. The river is fed by a dendritic system of tributary streams, some of which have developed their own broad floodplains. This portion of the Neches flows across the Cenozoic Gulf Coast Geosyncline, a thick succession of continental and marine sediments with a low east-south-eastward dip (Sellards, Adkins, and Plummer 1932:519-277). Consequently, the gentle dip slope of the western uplands, deriving from the Queen City Formation, contrasts with the abrupt eastern escarpment slopes rising 60-80 feet above the river, and the river tends to hug the eastern uplands. These eastern uplands are formed from the Neches member of the Mount Selman Formation which is capped by erosion-resistant ferruginous beds (Mowery and Oakes 1959; Barnes 1964). These outcrop as boulder fields and ledges and provide quarries of sandstone of the same type used in tools found at archeological sites. Topography in the east is more rugged than in the west, with tributary streams forming relatively deep V-shaped valleys; in stream valleys erosional remnants and terraces form a random terrace structure.

Four Eocene formations — Sparta, Weches, Queen City, and Recklaw — form the basic geologic resources of the upland soils adjacent to the Neches floodplain. The steep east terraces of the river and some remnants west of the river are formed primarily of Weches glauconitic sandstone and shale, upon which rests Sparta sand (Mowery and Oakes 1959:45-47; Barnes 1964). Included in the Weches Formation are limonitic and sideritic iron ore and hard brown ferruginous sandstone which appears to have been a common resource for stone tools. The gentler slopes and terrace west of the river are formed from Queen City micaceous sands, which include occasional ironstone concretions and ledges, and ferruginous ledges and rubble (Barnes 1964). Other than the Brooks Salt Dome in Saline Creek, which has been tapped in historic times by salt factories and is capped by Cretaceous layers of limestone, chalk, marl, shale, and sand, there are no novel localized resources. Surrounding geologic surface deposits are primarily sands and shales within a radius of 30 to 80 miles.

Pleistocene terrace remnants, represented by exposures of sands, silts, and gravel-bearing clays, are present on the west margins of the floodplain, but in most cases they merge with the gentle upland slopes and are topographically non-distinctive (Mowery and Oakes 1959:47). They are apparently the only local source of cryptocrystalline material suitable for chipped stone tools. These deposits include pebbles and cobbles of flint, quartzite, and petrified wood similar to some materials represented by debris and tools found at archeological sites.

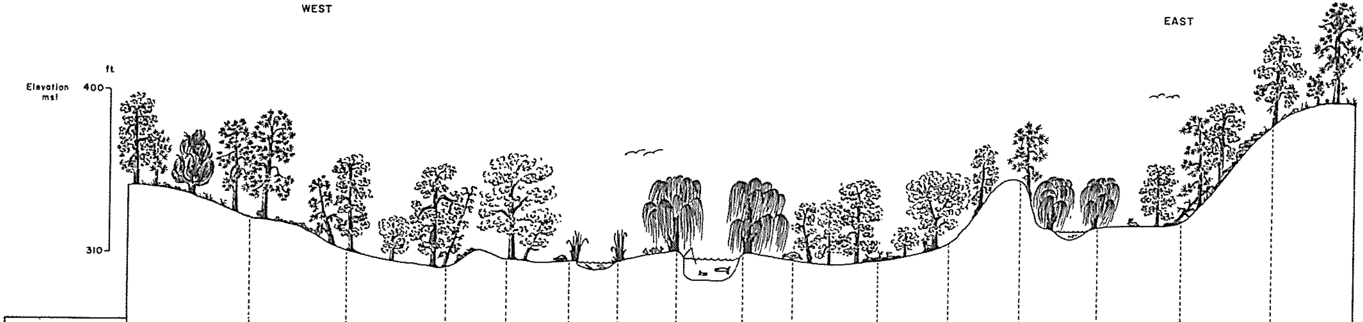
The floodplain has little relief, with subtle levees and shallow backswamps. Occasional low erosional remnants, capped by sandy soils similar to those of the uplands, rise above the bottomland floor. These and the marginal slopes of the floodplains are the only bottomland locations where archeological sites were found. The erosional remnants are least subject to seasonal flooding which occurs in April and May. In some locations, this flooding briefly extends aquatic fauna to the upland borders.

The meandering river channel varies from 50 to 100 feet in width. At one point, it forms a small lake 200 feet long and 1-1/4 mile wide (Big Eddy) which is heavily fished today by pole and trotline. Old meanders (Flag Lake, James Slough) and shallow floodplain basins are filled by spring floods; during late July and August these sloughs dry up, stranding large numbers of fish.

SOILS

The soils of the upper Neches drainage are of four basic types: (1) sandy and clayey soils of the floodplains; (2) sandy and clayey soils of the redlands; (3) soils with compact subsoils; and (4) sandy soils with friable subsoils (Mowery and Oakes 1959:7).

Floodplain deposits — recent alluvium — include some fertile soils but are not considered practical for present day farming since they are frequently overflowed and poorly drained. Redland soils, restricted to a few terraces on the eastern uplands, are the most fertile soils in the area; these are the areas having the most potential for



PHYSIOGRAPHIC UNIT	1 UPLAND	2 LOW TERRACE	3 FLOODPLAIN BORDER	4 EROSIONAL REMNANT	5 FLOOD-PLAIN	6 SLOUGH	7 LEVEE	8 NECHES RIVER	7 LEVEE	9 BACKWATER	3 FLOODPLAIN BORDER	10 SLOPE	11 TRIBUTARY STREAM	12 STREAMSIDE FLAT	10 SLOPE	13 UPLAND
SOIL TYPE	Brown to light brown sands, sandy loams	Silty clay, terrace gravel.	Alluvial clay loams; light brown sands on Border and Erosional Remnants.									Red and brown sandy loams, brown sandy loams.				
SOIL FERTILITY	Low to moderate	Low	Moderate									Low to moderate	Moderate			
OVERSTORY	Oak○ Post, White, Red, Black-jack, Pin, Sandjack. Shagbark Hickory○ Black Walnut○ Shortleaf Pine, Loblolly Pine. Bois d'Arc.			American Elm, Winged Elm. Sweetgum. Oak○ Post, Pin, Water. Bois d'Arc.			See units 4,5	Banks: Willow Oak, Boxelder, Black Willow, River Birch,▲ Red Mulberry	See units 4,5	Water Hickory, Water Oak, Pin Oak.	See units 2,4	Sweetgum, Giant Reed See units 1,2	See unit 8	See units 1,2		
UNDERSTORY AND CLEARINGS	Wild Plum▲ Bullnettle○ Chinquapin○ Persimmon○ Huckleberry○ Sassafras, French Mulberry○ Eastern Red Cedar, Flowering Dogwood, Wax Myrtle, Rosinweed.			Black-Haw○ Red-Haw, Redbud, Blackgum, Dwarf Palmetto, Holly, Yaupon, Hackberry○ Giant Reed.		Reed, Marsh Grass.	See units 4,5		See units 4,5	Persimmon Ironwood○	See units 2,4	See units 1,2	See unit 8	See units 1,2		
FAUNA	Deer□ Fox, Squirrel□ Raccoon□ Opossum□ Cottontail Rabbit□ Upland Birds□ Turkey*		Deer□ Gray Squirrel□ Raccoon□ Opossum□ Swamp Rabbit□ Turkey*			Smaller fish, Turtles, Crayfish, Snakes, Frogs▲* Raccoon▲ Waterfowl●	See units 4,5	Large fish, Turtles, Snakes, Mussels, Waterfowl●	See units 3-5	Crayfish		See units 1,2	See unit 6	See units 1,2		
REMARKS	3-10 miles to western border of pine.	Source for chert, quartzite, petrified wood cobbles.	Subject to spring flood.	Above normal flood level.	See unit 3	Late summer fish trap.	See unit 3		See unit 3	Flooded, or high water table	See unit 3	Steep slopes not suitable for farming.	Game trails	Includes best soil.	Sandstone quarry.	See units 1,2

Season of Availability or Yield: ○ Fall ● Winter □ Year-round ▲ Spring-Summer * Summer-Fall

FIGURE 2. *Environmental Cross-section of the Upper Neches River.*

domestic crop yield and are associated with at least one large site cluster along a small southeast tributary of Saline Creek (X41SM15,21-25).

Soils with compact subsoils derive from the Recklaw Formation and are infertile, shallow, draughty, compact, and hard to work. They are commonly observed in uplands slopes (Mowery and Oakes 1959). Soils with friable subsoils comprise the majority of upland types and it is with this soil association that the majority of archeological sites are found. Derived from Queen City and Sparta sands, these fine sandy loams and loamy fine sands form a mosaic pattern over the uplands. The best of these, such as Bowie fine sandy loam, are low in fertility and very susceptible to leaching though they are easily worked. Presently, much of farming in special crops, field crops, and vegetables takes place in these soils although heavy fertilization is necessary to produce high crop yields. All soils, except those in the marshy bottoms, originally supported hardwood and mixed pine-hardwood forest.

In summary, soils most suitable for farming in the present, and probably in the prehistoric past, are the upland redland fine sandy loams and the fine sandy loams of friable subsoils; the former is most capable of supporting repeated cropping. Brown loamy sands and sandy loams with friable subsoils would be exhausted quickly.

The Neches bottoms, partially cleared and flooded since completion of the dam in 1959, had little of the original plant cover at the time of the 1969 survey and are presently cleared to the 355 foot contour which includes all the floodplain. Reconstruction of the river valley flora is based on observations at the north and south borders of the reservoir. Figure 2 shows the microenvironmental zones of the upper Neches.

Zones 1 and 13, the uplands, include several topographic variations, including headland slopes, erosional-remnant knolls, terraces and terrace slopes, and ridges. The original mature forest is inferred from pockets surviving among fields and young forest. Dominant forms are red oak, post oak, shortleaf pine and loblolly pine, mixed with hickory, blackjack and sand jack oaks, with a thin undercover of broomsedge, small shrubs, bullnettle and grasses. Fallow fields are quickly taken over by a dense cover of broomsedge, rosinweed, partridgepea, miscellaneous grasses, and sassafras and persimmon bushes; red cedar occurs in open fields.

Understory growth in the upland forest includes a number of vines and shrubs having edible fruits — French mulberry (possibly a recent introduction into the uplands), wild plum, chinquapin (dwarf chestnut) and several varieties of wild berries and grapes.

The upland complex extends downslope to the floodplain border on both sides of the river and interdigitates with vegetation of the drained bottoms. The western uplands are close to the western limit of pines, lying 3 to 10 miles west of the Neches; major western tributary streams (Kickapoo and Flat creeks) head up in oak-hickory forest outside the reservoir, the eastern border of the Post-Oak Savannah (Gould 1962).

In the better-drained bottoms, pin oak, water oak, pecan and sweetgum form the upper story with some intrusions of post oak. Giant reed is reported to have occurred in extensive canebrakes in this zone; such pockets are now preserved only in watered upland slopes.

Well-watered sloughs are bordered by dense marsh grasses and reeds. In shallow backswamp areas, water hickory and water oaks predominate. River and stream banks also have distinctive flora dominated by black willow and willow oak.

Yield of edible fruits in the Neches forests begins in the late spring (May-June) with a few species (Hawthorne, red mulberry and wild plum) fruiting on uplands and stream broders. During summer and early fall (July to September) more appear (elderberry, muscadine, wild grape and bullnettle kernels). Autumn is the period of greatest yield, primarily in nuts — hickory, walnut, pecan, chinquapin, ironwood and acorns; some of these trees hold their nuts into winter. Berries and fruits available during the fall include huckleberry, blackhaw, persimmons, hackberry, French mulberry and buckthorn.

ANIMAL RESOURCES

Aquatic Fauna

The river is presently a plentiful source of fish, turtles, snakes, and mussels. Species inhabiting the Neches River include: catfish (channel, opelousas, blue); bullhead (black, brown, and yellow), bream (green, bluegill, longear, common redear, spotted, goggle eye sunfish), smallmouth buffalo, white perch, gar, mud pickerel, bowfin, gizzard shad, common white sucker, redhorse sucker, and golden shiner.

These fish vary in habits and amount of usable meat. Gar, gizzard shad, suckers, and shiners are bony and have little food value. Other common species run from 1/2 to 4 pounds, although the large catfish (opelousas, blue) may attain weights of 50-60 and 20-25 pounds, respectively (Zim 1963; Brown 1966). These large fish are found in the deepest parts of the river like the Big Eddy.

An important potential source of aquatic fauna are sloughs formed in the backswamp and old meanders on the Neches bottoms. These sloughs trap quantities of fish, snakes, and amphibians when they dry up in late August. At James Slough, for instance, it is possible to net or hand catch quantities of gizzard shad (the predominant species), largemouth black bass, bullhead, all species of sunfish except crappie and warmouth, carp, smallmouth buffalo, bullfrogs, and crayfish (G. Garner, personal communication). Predators attracted to these sloughs at this time — also potential game — include watersnakes, turtles, and raccoons. These natural fish traps are not confined to the bottoms; fish are similarly trapped in pockets of intermittent streams.

In addition to fish, a number of other aquatic species are available in the Neches drainage. In the original river and stream channels mussels are plentiful. Soft shell and snapping turtles can be caught by hand, set-hook or trotline. Slider turtles are wary and can only be caught in traps. Crayfish inhabit sloughs, sluggish streams, and shallow water. Frogs, (bullfrog, leopard frog, and green frog) are ubiquitous water dwellers and hibernate during winter. Alligators are also known to occur in deeper portions of the river.

Mammals

The whitetail deer is the largest (150-300 pounds) common mammal of the Lake Palestine region. Optimal range for the whitetail is oak-hickory or pine-oak forest since hardwoods furnish acorns, browse and cover (Teer 1963:29). The American black bear is no longer in the area but was seen in the last century. Bear denned in canebreaks of giant reed of which only a few relict growths remain that have not been grazed off by cattle. Eastern turkeys, another species now extinct in the Lake Palestine area, survived in Smith and Cherokee counties 50-60 years ago. They probably roosted in the bottoms from October to February and appeared in the uplands in the spring. Raccoon breed and feed along the river and its tributary streams, but they range over the whole region.

Two indigenous species of rabbits occupy the Lake Palestine region: the swamp rabbit (3-6 pounds) inhabits the bottoms, and the eastern cottontail (2-4 pounds) lives in the uplands. Similarly, two species of squirrel live in the area. The smaller "cat" or gray squirrel (ave. 14 oz.) is a high tree dweller of river and stream bottoms. The large fox squirrel (2 lbs.) is an upland dweller and is often found on the ground. The opossum (ave. 8 lbs.) inhabits both uplands and bottoms and is the easiest land mammal to catch, particularly when he feeds on persimmons in the fall.

Birds

Waterfowl, migrating along the river and streams from October through February include numerous species of ducks: mallard, redhead, ruddy, masked, ring-necked, gadwall, American widgeon, bufflehead, lesser scaup, pintail, blue-winged teal, green-winged teal, American hooded merganser. The Canada goose passes through during the winter and is found in the river. Coot and wood duck inhabit the river and streams year-round. Of a variety of upland game birds, snipe, woodcock, mourning dove and quail are the best game birds and inhabit the region year-round.

CLIMATE

Climate of the Lake Palestine area is warm temperate, humid and continental, modified by winds from the Gulf of Mexico (Mowery and Oakes 1959:4). Summers are long and warm, and in 1969 in the four counties surrounding the reservoir, the growing season was recorded as ranging from 259 to 264 days with the last spring frost occurring on May 7 to 11 and the first frost falling on November 7 to November 11. Annual precipitation is slightly greater on the east side of the river (Lindale, Smith County, 46.2", Rusk, Cherokee County, 44.2") than at weather stations west of the river (Athens, Henderson County, 40.4"; Palestine, Anderson County, 40.7"). May is the month of heaviest rainfall, followed by three dry months with some increase in rainfall in November and December (Texas Almanac: 1970:109-114).

In terms of environmental effects critical to human adaptation, this climatic sequence is important for several reasons:

1. Other than amphibians and reptiles, animals do not hibernate and are not hunted in dens. 2. Growing season is optimal, with the summer long enough for two corn crops although late summer droughts can occur. 3. Dry summer months reduce water level significantly making tributary streams poor sources of water; that is the period when sloughs and shallow streams trap fish. 4. Early spring rains and increased water flow produce spring floods which

for a short time extend the range of aquatic species and render the river bottoms inaccessible.

ENVIRONMENTAL POTENTIAL FOR HUMAN OCCUPATION

Elements of the environment which are most specific and discrete as factors influencing human settlement and movement in the Neches are components of the river system — the river, tributary streams, and sloughs. Flood and high water table in the bottoms limit sites that can be comfortably occupied year-round, seasonally limit access into the bottoms, and render some soils impossible to farm. Shrinking sloughs and streams in late summer create small distinct resources of trapped fish. Tributary streams are frequent game runs; migratory waterfowl converge on the river and sloughs in winter.

In biotic populations, there is a general contrast between drained bottom, marsh, streamside, and upland, though bottoms and uplands interdigitate and share a number of the same basic resource types. Both support varied animal populations in addition to flora yielding edible fruits and nuts. All species are available in a range of 1/2 - 3 miles. In archeological sites it is to be expected that certain species of animals will reflect different zones within the area — rabbits and squirrels occur in different species, differing between uplands and stream and river bottoms.

Seasonal flux in resources and climate (Fig. 3) poses a number of possible influences on human activities and movement. These shifts are indicated: (1) fall dispersal into small parties for hunting and nut collecting; (2) winter hunting requiring small hunting parties, both for stalking deer and visiting specific river and slough locations for waterfowl hunting; (3) spring fishing dispersed along streams and rivers associated with collection of first fruits; (4) farming from early spring to late summer, requiring work in upland fields; (5) brief convergence on low streams and sloughs in late summer to gather captured fish.

THE ETHNOGRAPHIC AND ARCHEOLOGICAL BACKGROUND

The following summary of Caddo culture is given as a basis for abstracting technological series, economic activities and concommitant residence units, social groups, and principles of organization for which we may expect to find evidence in the archeological sites in the upper Neches River. The ethnohistoric base comprises, in order of increasing specificity, the total area of the southeastern United States (Swanton 1946), the Caddo Indians (Swanton 1942) and the Hasinai Confederacy (Griffith 1954; Woodall 1969). The usefulness of this ethnographic data lies not necessarily in a direct projection of cultural behavior into the prehistoric past; doing so would negate the very real probability that prehistoric cultures differed from the historic Caddo. Many classes of data found in the archeological record are not recorded in ethnohistoric sources; hence information and reconstructions from excavation and survey comprise new data on the Caddo.

When survivors of the De Soto Expedition crossed the upper Neches and Angelina rivers in the fall of 1542, the region was inhabited by a group of 9 or 11 Caddo-speaking tribes loosely associated in the Hasinai Confederacy. During the period 1687-1772, a number of French and Spanish observers recorded the customs of the Hasinai; their records have been summarized by Griffith (1954). In using this data, it is necessary to bear in mind that this was a period of rapid change for the Hasinai, largely due to the introduction of the horse by the Spanish in 1675. Accommodation to the animal and its potential was rapid and by 1716 Griffith infers that the Hasinai were "horse Indians". The mobility of horseback travel, in conjunction with Hispano-French competition for the land and its inhabitants, induced extensive culture change.

Griffith concludes that this changed the Caddo residence pattern from continuous occupation of forest hamlets to shifting camps in response to seasonal movement of game (Griffith 1954:43, 144-149). Archeologically, this period should be marked by the presence of European crafts, fewer sites, and evidence that economic activities and locations were part of a migratory hunting pattern.

Notwithstanding this rapid change, the records of early observers give data on pre-horse culture which can be used to interpret late prehistoric sites and make some extended inferences to the period before white contact and influence.

ECONOMY

The domesticated staple of the Caddo was corn, with beans second in importance. Two varieties of corn were grown: an early short-stalked variety which Swanton compares to popcorn was planted in late April and harvested at the end of May. Following this

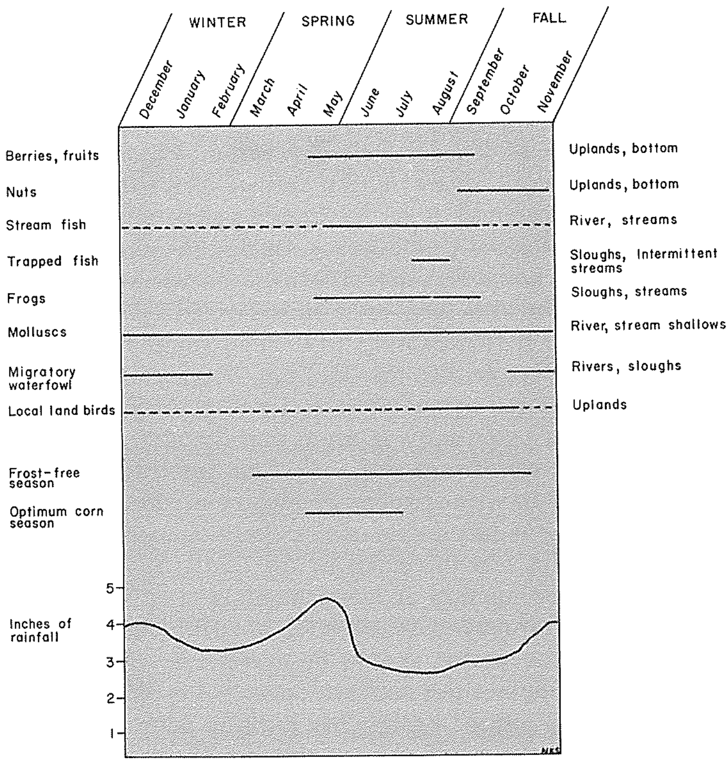


FIGURE 3. Seasonal Fluctuation in Resources and Climate.

harvest, the fields were immediately cleared and a slower maturing flour corn was planted to be harvested at the end of July (Swanton 1942: 129-131). Tilling implements were "hoes" or dibbles tipped with hickory or with blades made from buffalo scapulae or deer mandibles (Griffith 1954: 109-110). Gourds, melons, and sunflowers were cultivated as well as five or six kinds of beans some of which ripened in the spring (Swanton 1942: 127-128).

Land clearing was carried out by large work parties of men and women, apparently drawn from the whole village, who cleared and dug the fields of household units one after another beginning with the field belong to the *Xinesi*, then the *caddi*, and then fields of the remaining villagers (Swanton 1942: 128-129).

The degree to which the Caddo depended on wild plant foods is not clear from the ethnohistoric sources; but a wide variety was harvested. Wild fruits gathered included wild grapes, persimmons, plums, blackberries, white and black mulberries, and maypops. These were harvested by women who also gathered large quantities of nuts and acorns in the fall and early winter. These provided a resource, along with shelled corn and beans, that could be stored into the winter (Swanton 1942: 132-134; Griffith 1954: 121).

A number of animals were hunted, but records are vague concerning hunting group composition and organization. Elaborate ritual preparation prior to deer hunting was customary, and deer were apparently stalked and shot with bow and arrow by men using disguising headdresses. Deer were brought back to the village to be skinned and butchered. One chronicler, Casanas, indicates that deer and prairie chicken were hunted only in winter time. Ducks and geese were certainly hunted only during this period (Griffith 1954; 112-113; Swanton 1942: 134-137).

Fishing was a group occupation which began with warm spring weather, apparently involving extended family units (referred to as "families" in the literature). At this time, families moved for several days to productive fishing spots and lived on their catch while cooking quantities to carry back to the village (Swanton 1942: 138). According to Griffith, fishing was especially important in late summer when drought-diminished streams trapped fish in shallow pools (Griffith 1954: 113). Techniques of fishing are not described specifically for the Caddo, except for a reference to trotline fishing by the Nachitoches (Swanton 1946: 340). However, a wide variety of fishing techniques was used throughout the southeast, including weirs, hook-and-line, nets, snares, arrows, spears, poison, drags, and "grabbling" (catching with the bare hands) (Swanton 1946: 332-340), and it is presumed that the Caddo used these techniques.

From the above description, it is suggested that spring fishing groups were likely to be small while late summer fish-catching involved or had the potential for larger units, probably drawn from matrilocal households whose core members would be related women.

Apparently buffalo were hunted year-round though major hunts were planned for the winter season. The nearest buffalo plains were said to be more than 40 leagues distant from east Texas and the best hunting grounds were found only beyond the Brazos.

Materials Used in Technology

Plant and animal resources provided material for most native technology. Plants — reed, canes, and wood — were the most common materials used in crafts followed by clay and animal materials. Food preparation, for instance, was accomplished with wooden mortars, clay pots, reed screens, and baskets. Food was served in pottery bowls and on woven platters, and pipe smoking was an after-meal ritual. References to stone artifacts are almost absent from the record; arrowheads and cutting tools can be inferred but are not described. No pottery vessels accompanied men on the hunt; their food rested on the ground on leaves or on their own feet.

Division of Labor

Subsistence tasks: although initial land clearing was done by all villagers, male and female, Hasinai women did most planting, cultivating, harvesting, cleaning, and storing of crops. They prepared game, gathered wild foods (including nuts and acorns in the fall), ground meal in wooden mortars and cooked food. The only subsistence tasks specifically named as male activities are hunting and clearing and breaking soil for planting.

Crafts: early journals note that craft making was carried out primarily in cold rainy periods in the village. Women made mats, baskets, and pots; men made bows, arrows, moccacins, and farming tools (Griffith 1954: 121; Swanton 1942: 162-163). Housebuilding was a community activity in which men and woman of all households were required to participate (Swanton 1942: 149-152).

Structures and Communities

The basic Hasinai settlement was a scattered series of house clustering into named hamlets. Depending on the importance of the household head circular thatched houses varied in size up to 60 feet in diameter. These dwellings had a central hearth, and beds lined sections of the wall; other walls were taken up with shelves, pots, and baskets where domestic utensils (mortars, pestles, cookware) and food (corn, beans, nuts, and other foods) were stored (Swanton 1942: 148-153).

Apparently most houses were multi-family dwellings. Woodall (1919: 20), reviewing historic and ethnographic literature, infers that dwellings housed extended families and the dominant residence pattern was uxorilocality (see also Griffith 1954: 101). House sites were selected close to a location suitable for cropping and a stream providing drinking and bathing water (Swanton 1942: 163-164).

Political Organization

Like much of Caddo culture, political organization is outlined only sketchily by European observers. There is, however, indication that social stratification existed. Casanas, the first missionary to the Hasinai, indicates a series of ranked statuses:

Xinesi - Pan-tribal religious leader
Caddi - Tribal leader
Canahas - Criers
War Captain
Chayas - Subordinates to the *Canahas*
Tammas - Work group supervisors

Both the *Xinesi* and the *Caddi* were inherited positions, and their wives were designated by a special title (Swanton 1942: 170-171). The basis of this inheritance may well be a system of ranked clans, which was indicated to Swanton in about 1910 by an elderly informant. Five "clans" were named which were not consistently exogamous; a male child belonged to either his father's or his mother's clan, whichever was the "strongest" (Swanton 1931). Informant discussion of clans is inconsistent, but clans are mentioned by several sources (Swanton 1942: 163-166), leaving little doubt that they existed.

The interpretation of ranked status is difficult to solve; Woodall views the *Caddi* as a "big-man" leader (Sahlins 1968: 86-95) who retained his leadership through generosity and kinbased obligations. This contrasts with a "chief" as Service has developed the type whose re-distributive role invests him with political authority (Service 1962: 170). Such a role can be easily imagined to apply to the earlier Caddo sites with earthworks and status burials. At the present state of knowledge, the status of the Hasinai *Caddi* is still not entirely clear. As the succeeding section of the report indicates, there may be status ranking indicated by burial patterns although of a more attenuated form than in early Caddo sites.

Burial ritual, abstracted from several ethnographic sources, dating from initial contact to Parson's 1927 notes (Swanton 1942: 203-209) shows a pattern which coincides closely with the archeological data. Burials were interred singly near the house following a ritual whose elaboration and duration depended on the status of the deceased. Important "chiefs" (probably *Caddi*) took longer to bury; a *Xinesi's* burial required performance of ceremonies by all tribes. Burial goods indicative of hierarchical status are not described; it is mentioned only that men are buried with bows, arrows, and other hunting implements and woman are buried with pottery vessels.

ARCHEOLOGICAL BACKGROUND

The dominant type of settlement in the Palestine Reservoir area is a small site or site-cluster attributable to Caddo populations. General summaries of the Caddo sequence have been published in several sources (*cf.* Davis 1970: 35-58; Orr 1952; Suhm 1954: 151-227; and Webb 1960: 48-54). These describe a general trend contained in the transition from the Gibson Aspect to the Fulton Aspect marked by abandonment of large nuclear centers with special ceremonial structures, loss of elaborate status burials, and dispersal of populations into small scattered villages.

Prior to the present salvage project, research in the area of Palestine Reservoir consisted of excavation of esoteric sites like a "perpetual fire site" (Jackson 1936), amateur excavations of burials, and Johnson's survey (1961). From the 35 sites Johnson located, one was designated an Archaic site (S41 He 35), and one (X41 SM 28) included multiple burials with Alto Focus pottery and six single interments with Frankston Focus vessels. Two other sites (X41 SM 16, X41, SM 17) were tentatively designated as Alto Focus sites, and 28 of the remaining ceramic sites contained Frankston Focus pottery types. To date, no historic sites with trade goods have been identified in this part of the upper Neches.

Previous excavations are primarily useful for indications of ceremonial activities and status indicated in burial patterns. Jackson in 1931 and 1935 excavated a large ash mound and a midden overlying a large circular house pattern at the A. C. Saunders site, approximately 3 miles west of Lake Palestine dam (Jackson 1936). This site is still visible on a level upland field close to the western border of mixed pine-oak forest. Jackson made a careful comparison of the archeological remains with the descriptions of Hasinai ceremonial structures by Espinosa and Morfi and suggested that the site was a temple.

Two burial sites were reported by Johnson, and the author has visited the locations of two additional sites that had been removed by bulldozing, local amateurs and pothunters. These give general patterns of burial ritual from which some inference concerning status and community type are suggested.

Excavations by amateurs have uncovered single and multiple interments for early and late periods within the reservoir. At X41 SM 28 (41 SM 73-UT), a low bench above Saline Creek, six single interments and a multiple burial with four individuals were excavated. All burials were apprently in shallow pits, ranging from 24 inches to 40 inches below level ground surface. Details of ceramic vessels are not known, but the multiple burial is adjacent to the single graves which were spaced in a north-south row indicating that this was an established burial location. Rows of single interments are characteristic of a number of Frankston Focus interments excavated in the 1930's near Poynor, Texas, east of Lake Palestine (R. K. Harris, personal communication). Vessels found with the multiple burial are identifiable as, or similar to, pots from the T. M. Sanders Site (Sanders Focus) or the George C. Davis Site (Alton Focus). No other artifacts were recorded.

At X41 SM 6 (41 SM 77-UT) two single graves were excavated from a site approximately one mile up Saline Creek from X41 SM 28. One burial included a Ripley Engraved bottle, two Poynor engraved bowls, two effigy vessels, eight Perdiz points, a small celt and a large biface. The second grave contained two Poynor Engraved bottles, one plain carinated bowl, one effigy bowl, a small Poynor Engraved bowl, another undescribed vessel, and six Perdiz points (Johnson 1961: 219-224; field notes from survey of Blackburn Crossing Reservoir).

The author recently visited two burial locations destroyed in September, 1970, by construction on the banks of County Line Creek and one of its small tributaries. The site on the main stream apparently had one multiple burial in a pit 12 feet wide, which contained three skeletons; a cluster of four burials lay 21 feet downslope from this. These were approximately 50 meters west of two surface artifact concentrations associated with middens.

The four burials were reported to come from a single pit but, since the area covered by the graves is 21 feet across, they may have been single graves. Twenty-one pottery vessels of Frankston Focus types, one celt, and a slender bifacial tool ("Jowell Knife") were included in the triple burial. Basket or matting impressions were also reported. The items recovered from the four burials included pottery, projectile points and two pipes.

Two burials have been obliterated by construction on a south tributary of County Line Creek; a few details have been reported by local informants. One burial contained one individual and six Frankston Focus pottery vessels. Upslope from this was apparently an Alto Focus multiple burial with three small clusters of pottery associated with bone and tooth fragments.

The burial pattern clearly shows a preference for streamside locations; in some cases graves lie on the periphery of prehistoric settlements. Multiple burials are apparently most characteristic of Alto Focus graves, and single interments predominate in Frankston Focus sites. There is some suggestion that multiple interments persisted in the later period of occupation. Status implications depend on data (sex, age, artifact associations) that have not been determined; however, if multiple burials persist into a later period of occupation, this may represent continuation of ranked status. Such a situation, in which the death of a high-status individual occasioned the burial of other individuals, has been recorded at late sites on the Red River (Skinner *et al.* 1969).

SUMMARY

As the preceding outline indicates, the Caddo sites of the upper Neches offer an opportunity for research centering on the dichotomy between Alto Focus and Frankston Focus as culture types and the shifts in economy and society which may be represented by these types. Knowledge of the internal structure of small sites in each period is necessary to determine whether the occupation of the Neches in these two periods represents two distinct adaptations and social types. In burial patterns, single interments are generally characteristic of Frankston Focus sites, but the presence of multiple burials indicates that some status differentiation may be present and status may not be qualitatively different from the Alto occupation. The interpretation of the A. C. Saunders Site as a ceremonial structure is plausible, but requires comparison with other archeological site types — camps and dwellings — for validation and satisfactory definition of prehistoric settlement components.

Economy of the Neches prehistoric Caddo is not known. Corn was grown at the Davis Site, but its cultivation at Lake Palestine is yet to be proved. The large number of small sites in the reservoir may include a variety of activity — specific camps as well as village sites near which fields were cultivated.

Based on the ethnohistoric literature, environmental data, and archeological data from the upper Neches, a pattern of settlement is inferred for the Hasinai and their prehistoric predecessors (Fig. 4).

It is quite possible that all these elements of the settlement system are included in the reservoir. This representation excludes the winter buffalo hunting camp which would be considerably outside the reservoir area.

Villages contained dwellings occupied by extended families. There is evidence that matrilocality was the principle under which households were grouped. In or near dwellings a wide range of economic tasks were accomplished, including butchering, cooking, food-storage, food grinding, pottery making, basket weaving, and arrow making. *Caddi's* houses were likely to be the largest and were the scene of visits from foreign emissaries; hence they should contain non-local artifacts.

These dwellings were apparently occupied year-round except for early spring and late summer, when families moved to fishing spots, and during winter buffalo hunts.

Of the hunting, gathering, and fishing activities in the immediate reservoir area, only one — fishing — involves whole families and is likely to be represented by both men's and women's tools. The records suggest that fishing spots were visited for relatively brief periods during spring and summer and varied in location depending on the stage of flooding and condition of the river. These localities, if they are detectable in the ethnographic record, should be relatively small, show a marked percentage of fish bone and aquatic species, and a relatively small range of ceramic attributes in keeping with small kin-based groups.

THE SITES

Table 1 lists the 98 sites visited during 1969 and 1970. Those with University of Texas at Austin designations were originally recorded in 1957 by Johnson and were re-visited during the present survey. Sites X41 AN 6-8 are not described, although they are shown on the

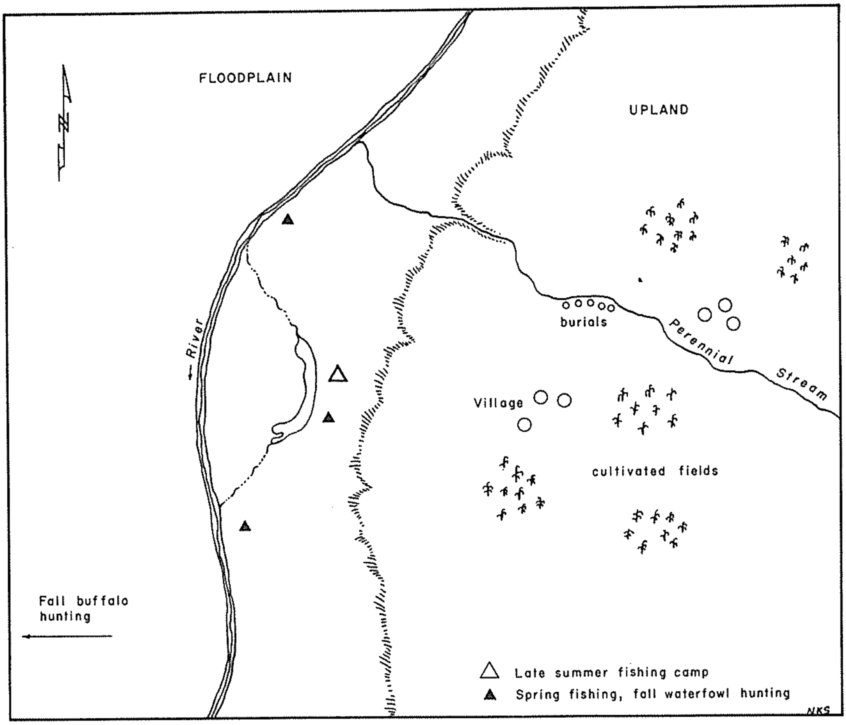


FIGURE 4. Hasinai Settlement System.

site map, because they were recorded and surface materials were collected by grids in 1970 while excavation was in progress at nearby sites. They will be described in an excavation report. Similarly, historic salt factories (S41 SM 1-4,35,36) are not described; they are included in a separate publication (Skinner 1971).

Site area refers to the surface extent of artifacts unless marked by an asterisk; these sites include dimentions of the landform on which the site rests. Sites for which dimensions were not recorded are marked "N.D.".

Microenvironmental units are those previously described and shown in Figure 2. Site situations and settlement types are summarized and defined in the succeeding section on site distribution.

SITE DISTRIBUTION AND IMPLICATIONS

Review and comparison of the sites and their distribution in Lake Palestine Reservoir are directed toward the following questions:

TABLE 1

Settlement Data at Lake Palestine

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41AN1	380'	100 x 100	1	D.Bluff above river with sandstone and Pleistocene gravels exposed below silty clay in slopes.	F.Hunting/ Gathering Camp
X41AN2	330'	70 x 200	2	B.Low terrace remnant extending to ca. 250 m. from river channel. Pleistocene gravels on slopes.	C.Hunting Station
X41AN3	330'	25 x 15	2	E.Bluff formed by intermittent stream cutting low terrace remnant. 15' above river floodplain. Dark soil exposed (probably midden); gravel in slopes below.	Probable Base Settlement
X41AN4	330'	15 x 15	2	B.Low terrace remnant 15' above river floodplain ca. 250 m. from river channel.	B.Hunting Station
X41AN5	340'	100 x 300	4	D.Low sandy knoll formed from erosional remnant between uplands and river floodplain. Artifacts exposed in E. slope 400 m. to tributary stream.	O.Base Settlement

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41CE1	370'	215 x 250*	12	H.Low knoll on upland flats, on tributary stream leading to County Line Creek.	O.Base Settlement
X41CE2	360'	30 x 40	13	J.Sloping point of upland ridge, across intermittent stream from X41CE1.	H.Sherd Scatter
X41CE3	370'	30 x 40	12	H.Upland flat above tributary of County Line Creek, near X41CE1.	I.Camp/ Settlement
X41CE4	380'	40 x 54	13	J.Resistant ridge above X41CE1,3. Outcrops of sandstone exposed below sand with clay subsoil.	I.Camp/ Settlement
X41CE5	370'	40 x 100	13	J.Sloping ridge above CE1,3; 15' above tributary of County Line Creek.	D.Gathering Station
X41CE6	360'	N.D.	12	I.On terrace ca. 40' above river floodplain; ca. 300 m. from river channel.	E.Hunting/ Gathering Camp
X41CE7	360'	60 x ?	12	Roadcut exposure on terrace flat 40' above river floodplain, at edge of perennial stream.	Sherd Scatter and Celt
X41CE8	370'	30 x 45	12	H.Knoll on upland terrace, between two intermittent drainages.	P.Base Settlement

X41CE9 (41CE39-UT)	340'	1/4 acre	12	H.Road cut exposure on terrace slope above Stone Chimney Creek.	F.Hunting/ Gathering Camp
X41CE10 (41CE39-UT)	340'	100 x 300	12	H.Terrace flat at the confluence of Stone Chimney Creek and Neches River. Slope exposure 15' above floodplain.	O.Base Settlement
X41CE11 (41CE37-UT)	350'	100 x 150	12	H.Terrace and slope along Stone Chimney Creek.	M.Base Settlement
X41CE12	355'	N.D.	13	H.Low terrace ca. 20' above river bottom.	O.Base Settlement
X41CE14	400'	10 x 10	13	I.Edge of upland flat, near escarpment 80' above river bottom.	Not designated
X41CE15	400'	8 x 8	13	I.Upland flat, ca. 400 m. from escarpment above river bottom.	H.Sherd Scatter
X41CE16	360'	100 x 200	12	H.Low terrace beside Stone Chimney Creek. Eroded surface at foot of sandstone-capped ridge.	O.Base Settlement
X41CE17	460'	60 x 40	12	H.Knoll on slope above perennial stream.	I.Camp/ Settlement
X41CE18	420'	100 x 100*	13	J.Low upland knoll.	A.Chipping Scatter

TABLE 1 (contd)

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41CE19	400'	85 x 83	13	J.Low Knoll on upland flat, ca. 800 m. from stream.	D.Gathering Station
X41CE20	400'	63 x 40	12	H.Upland bench above intermittent drainage.	P.Base Settlement
X41CE21	390'	40 x 40	12	H.Upland bench above intermittent drainage.	H.Camp/ Settlement
X41HE1 (41HE12-UT)	360'	N.D.	1	C.Site destroyed by road cut. Midden reported, surface soil removed. Crest of upland flat 40' above river bottom.	M.Base Settlement
X41HE2	370'	A-75 x 70 B-90 x 44	1	C.Terrace projection, 40' above Cobb Creek. Area A: ridge tip; Area B: low rise west of bluff.	K.Base Settlement
X41HE3	370'	400 x 900*	1	C.High bluff 50' above floodplain. Lithic debris occurs throughout site, pottery concentrated in several areas.	G.Hunting/ Gathering Camp
X41HE4	360'	50 x 100*	1	C.Knoll on upland flat, overlooking Cobb Creek, 30' below.	D.Gathering Station

X41HE5	360'	30 x 40	1	F.Knoll on terrace flat, 10' above Cobb Creek.	H.Sherd
X41HE6	350'	60 x 110	1	G.Crest and slope of knoll, 15' above Cobb Creek.	H.Sherd Scatter
X41HE7	340'	30 x 50	10	B.Slope leading down to flood-plain.	A.Chipping Scatter
X41HE8	350'	40 x 100*	10	E.Low bluff on slope leading down to Cobb Creek.	A.Chipping Scatter
X41HE9	340'	300 x 200*	4	D.Isolated erosional remnant above floodplain, separated from upland by saddle.	I.Camp/ Settlement
X41HE10	370'	175 x 110*	1	B.Gently sloping terrace rising from floodplain.	B.Hunting Station
X41HE11	360'	42 x 90	1	D.Low terrace projection, at crest of gentle slope leading down to bank of Big Eddy, ca. 400 m. east, 20' above flood-plain.	C.Hunting Station
X41HE12	360'	40 x 34	1	C.Two low knolls on low ter-race projection, 20' above floodplain.	Not desig-nated

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41HE13	360'	100 x 175*	1	D.Low knolls on terrace projection, 20' above floodplain.	H.Sherd Scatter
X41HE14 (41HE16-UT)	330'	5 x 5 (circular)	10	B.Low knoll on slope leading down to floodplain, 10' below.	K.Base Settlement
X41HE15	340'	-	10	B.Low slope leading to floodplain.	A.Chipping Scatter (single artifact)
X41HE16	340'	A- 40 x 40 B-130 x 50	3	A.Slope at foot of ridge at floodplain border.	O.Base Settlement
X41HE17	345'	100 x 120 Four areas	1,10	C.Terrace projection 20' above Flat Creek floodplain, and slope leading down to terrace.	C.Hunting Station
X41HE18	380'	A- 63 x 96 B- 69 x 72	1	F.Crest of ridge between Ledbetter and Highson Creek.	I.Camp/ Settlement
X41HE19	350'	50 x 50	1	D.Point of low terrace projection, 20' above Caney Creek floodplain.	I.Camp/ Settlement
X41HE20	370'	N.D.	1	C.Bench above floodplain.	I.Camp/ Settlement
X41HE21	360'	N.D.	1	D.Flat above slope leading to floodplain, 20' below Pleistocene gravels and cobbles exposed on site floor and slope.	F.Hunting/ Gathering Camp

X41HE22	355'	40 x 35	2	C.Low terrace projection 10' above floodplain. Lowest step on stepped ridge, below site HE23.	I.Camp/ Settlement
X41HE23	365'	44 x 25	1	D.Sloping step of terrace projection.	L.Base Settlement
X41HE24	370'	15 x 50	1	C.Sloping upland bench above X41HE23.	P.Base Settlement
X41HE25	370'	20 x 30	1	F.Eroding slope near upland crest.	D.Gathering Station
X41HE26	370'	N.D.	1	C.Terrace above Caney Creek floodplain.	D.Gathering Station
X41HE27	360'	40 x 55	1	C.Terrace projection, ca. 400 m. from river. Ca. 20' above floodplain. Same as 28, 31, 46.	I.Camp/ Settlement
X41HE28	360'	70 x 70	1	C.Crest of knoll on low terrace 20' above floodplain, ca. 100 m. from intermittent stream.	H.Sherd Scatter

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41HE29	420'	95 x 150	1	G.Low upland ridge above Cottonwood Creek.	I.Camp/ Settlement
X41HE30	410'	41 x 55	1,10	F.Low flat ridge, and its slope, above Cottonwood Creek.	I.Camp/ Settlement
X41HE31	360'	35 x 40	2	C.Low terrace 20' above flood-plain.	D.Gathering Station
X41HE32	320'	15 x 15	3	A.Upland slope above flood-plain. Sandstone outcrop in slope.	N.Base Settlement
X41HE33	400'	10 x 20	10	D.Eroded exposure on bluff 40' above floodplain.	N.Base Settlement
X41HE34	420'	15 x 20	1,10	G.Slope and low terrace above Battle Creek floodplain. Sandstone outcrop in slope.	K.Base Settlement
X41HE35 (41HE19-UT)	370'	A- 40 x 75 B- 10 x 10	1,10	F.Eroded exposures on slope of low terrace, 20' above inter-mittent stream. Slough formed in stream.	F.Hunting/ Gathering Camp.
X41HE36	380'	-	1	F.Ridge formed from terrace projection 30' above Kickapoo Creek floodplain.	D.Gathering Station (single artifact)
X41HE37	335'	30 x 40	1	E.Low terrace 15' above inter-mittent stream at edge of river floodplain.	N.Base Settlement

X41HE38	360'	20 x 20	1	D.Road cut exposure on low terrace projection, ca. 300 m. west of X41HE11.	B.Hunting Station
X41HE39	345'	50 x 50	1	E.Terrace 30' above intermittent stream. At edge of river floodplain.	N.Base Settlement
X41HE40	350'	75 x 100*	4	D.Isolated knoll (terrace remnant) in Caney Creek floodplain.	J.Camp/ Settlement
X41HE41	360'	20 x 20	1	C.Bluff slope 25' above river floodplain.	H.Sherd Scatter
X41HE42	350'	30 x 40	1	C.Slope of terrace bluff 20' above river floodplain.	I.Camp/ Settlement
X41HE43	350'	150 x 200*	1	D.Terrace slope and bluff 10' above Caney Creek floodplain.	I.Camp/ Settlement
X41HE46	340'	40 x 180*	1	B.Slope leading from low terrace to river, on north end of Big Eddy.	B.Hunting Station
X41HE47	360'	100 x 100*	1	C.Low terrace 20' above river floodplain. Most material exposed in road cut.	I.Camp/ Settlement

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
41SM5	360'	-	13	K.Low terrace projection, 20' above Saline Prairie.	D.Gathering Station (single artifact)
X41SM6 (41SM77-UT)	355'	50 x 77	4	H.Two adjacent low knolls on Saline Creek floodplain. Two burials removed by amateur excations. Single interments.	L.Base Settlement
X41SM7	400'	50 x 80	12	H.Bluff and slope to Saline Creek floodplain at junction of intermittent stream and Saline Creek.	K.Base Settlement
X41SM8	345'	N.D.	3	A.Floodplain border slope at foot of uplands.	K.Base Settlement
X41SM9	355'	N.D.	3	A.Low knoll on floodplain border at foot of uplands.	M.Base Settlement
X41SM10	330'	30 x 30	3	A.Sloping floodplain border at edge of slough. Test excavation.	N.Base Settlement
X41SM11	400'	N.D.	13	J.Bluff 60' above floodplain.	A.Chipping Scatter
X41SM12	350'	N.D.	10	K.Exposure from construction on slope of terrace 10' above Saline Creek floodplain.	A.Chipping Scatter
X41SM13	360'	70 x 145	13	K.Low terrace 20' above Saline Creek floodplain.	H.Sherd Scatter

X41SM15	410'	50 x 100	12	H.Upland flat. Part of site cluster (X41SM22-25) on bench bordered by intermittent tributary of Saline Creek.	M.Base Settlement
X41SM16 (41SM87-UT)	340'	ca. 5 acres (UT)	3	A.Sloping border of river floodplain at foot of upland slope.	M.Base Settlement
X41SM17 (41SM89-UT)	360'	ca. 5 acres (UT)	12	H.Low terrace flat bordered by two converging seasonal tributary streams; interior drainage.	M.Base Settlement
X41SM18 (41SM75-8-UT)	360'	35 x 35	12	A.Slope of low knoll at foot of eastern escarpment, at river floodplain border, adjacent to perennial stream.	K.Base Settlement
X41SM19	380'	A- 5 x 5 B- 5 x 5	13	I.Crest of upland escarpment, 40' above river floodplain.	D.Gathering Station
X41SM20	440'	20 x 44	10	K.Slope of upland ridge, sloping to head of seasonal tributary stream.	H.Sherd Scatter
X41SM21	410'	15 x 30	10	K.Slope above intermittent stream.	Not designated

SITE NO.	ELEVATION (MSL)	AREA (meters)	MICRO-ENVIRONMENT	SITUATION AND FEATURES	SITE TYPE
X41SM22	400'	A- 90 x 100 B- 30 x 60	12	H.Upland flat above spring-fed tributary of Saline Creek. Shares extensive flat area with sites X41SM23-25.	O.Base Settlement
X41SM23	400'	N.D.	12	H.See X41SM22. Small artifact concentrations on two adjacent upland low knolls.	P.Base Settlement
X41SM24	390'	N.D.	12	H.Edge of upland flat over-looking tributary stream. See X41SM22.	K.Base Settlement
X41SM25	400'	75 x 100	12	H.See X41SM22.	D.Gathering Station
X41SM26	380'	35 x 35	13	I.Upland flat 40' above Saline Creek.	H.Sherd Scatter
X41SM27	365'	N.D.	10	K.Eroded upland slope leading to confluence of tributary stream with Saline Creek, 25' below.	I.Camp/ Settlement
X41SM28	380'	ca. 3-5 acres (UT)	12	H.Low terrace 15' above Saline Creek. Six single interments, 1 multiple burial removed by amateur excavation.	N.Base Settlement
X41SM29	410'	A- 60 x 200 B-100 x 200	10,12	H.Upland flat (Area B) and long slope leading down to Frick Run Creek. Downslope area (A) exposed by road con-struction.	Base Settlement

X41SM30	400'	30 x 50	13	J.Upland crest ca. 300 m. from seasonal tributary stream.	I.Camp/ Settlement
X41SM31	420'	50 x 60	13	K.Upland ridge between two small intermittent streams.	Not designated
X41SM32	400'	10 x 10	10	H.Slope of interior upland bluff, above intermittent stream.	H.Sherd Scatter
X41SM34	350'	3 x 15	10	K.Long slope leading from upland ridge to marsh surrounding James Slough.	H.Sherd Scatter

(1) Do artifact assemblages or sets which represent distinct activities correlate with components of the environment to suggest functionally disparate units within a settlement system? (2) Do the Caddoan sites within the reservoir conform to the Hasinai ethnographic pattern?

Surveyed sites have been grouped into a series of activity-sets to test whether these sets, designated in terms of components of a settlement system, show discernible patterns of environmental association (Table 2).

In categorizing activity-sets, an attempt has been made to consider sites as integrated wholes in which site area and artifact concentration is considered, as well as the relative frequency of different activity-elements and the presence or absence of specific traits. Site area and artifact concentrations are approximate, since horizontal distribution of artifacts was not consistently recorded, and surface cover varied from site to site. In a number of cases the artifact sample is very small. However, if a number of such small assemblages occurs repeatedly in particular environmental contexts they achieve more reliability and indicate that a patterned activity is represented.

Site assemblages are grouped into seven classes: chipping scatter, hunting station, gathering station, hunting/gathering camp, sherd scatter, camp/settlement and base settlement.

SITES OF TEMPORARY OCCUPATION

A. Chipping Scatter. These are suggested as brief stops by one hunter or a small group of hunters during which tools were made or finished. The only artifacts are a few (3-13) pieces of stone debris, in some cases with a finished projectile point or biface fragments. The maximum site dimensions are 30 meters. Debris consists of secondary flakes at all-sites except X41 SM 11, which has one cortex flake.

B, C. Hunting Stations. Probably intermittently occupied sites at which resource cobbles or blanks were made into finished tools, and broken points were replaced. Most are extensive sites, from 90 to 200 yards in maximum dimensions. Large samples of chipped stone debris and tools are the sole or predominant artifacts. The full range of debris, from core to cortex flake to finished projectile points, is represented and some projectile point stems occur. Two sites have a single grinding tool (mano or basin), one has a pitted stone, and some have a small number of sherds. Sites without projectile point stems (B) are listed separately from those with broken stems (C); the latter have heavier occupational debris and are more likely to have been repeatedly or intensively used.

D. "Gathering Station". Isolated pitted stones or grinding platforms, indicating one person or a small group grinding and probably gathering wild plant food and nuts on a transient or seasonal basis. These occur with or without a small number of sherds (19 or less).

E,F,G. Hunting/Gathering Camps. Small lithic sites at which chipped stone tools were made, occasionally projectile points replaced, and vegetable foods processed. Site extent varies from 1/4 acre to 100 meters in extent. One site (X41 He 35) shows two artifact clusters differing in the occurrence of primary debris. At the cluster having only secondary debris an anvil was collected. In addition to lithic debris, these sites have unfinished points, occasional base fragments, pitted stones and pitted manos. Four of the five sites (category F) have the full sequence of lithic manufacture represented; one site (X41 Ce 16) has only secondary debris (category E). One extensive site (category G) covers a bluff 400 wide x 900 meters long. A full range of lithic debris was collected from this site although primary elements are few. Unfinished chipped stone tools and all categories of crushing and grinding tools are represented. Two sections of the site have a relatively small number (18, 39) of sherds. The presence of Archaic dart points suggests a pre-Caddoan component. The extensive distribution of artifacts suggests that this location has been frequently re-occupied by hunting and gathering parties.

H. Sherd Scatter Stations. Sites at which only sherds were found; the number varies from 1-32, and sites vary considerably in extent; most cover less than 50 meters. Some of these may represent outposts at farmed fields. In the absence of hunting tools, tool manufacture, and ground stone tools, they are presumed not to have been hunting and gathering camps or base settlements.

CAMP OR SETTLEMENTS OF MULTIPLE ACTIVITIES

Ceramics are predominant at these sites; pottery was probably made at all locations. Stone tool production and vegetable food processing is represented. These are the sites with the greatest number and largest variety of tools, indicating permanent occupations. However, ceramic sites vary in size and activity; either seasonal camps or base settlements may be represented. They are ordered in several classes by variations in site scale and range of activities present:

I. Small sites, up to 50 meters in maximum extent, which lack

TABLE 2
Site Types and Distribution

SITE SITUATION

SITE TYPE	E,W	Western Uplands						Eastern Uplands			
	A	B	C	D	E	F	G	H	I	J	K
	Floodplain Borders (M)	Low Terrace Slopes (L)	Bluffs, Erosional Remnants Above Floodplain (L)	Bluffs, Erosional Remnants Above Floodplain (M)	Low Streamside Bluffs (L-M)	Interior Elevations Near Streams (L)	Interior Elevations Near Streams (M)	Streamside Flats (M)	Interior Flat (L)	Interior Knolls, Ridges (L-M)	Erosional Remnants and Stream Slopes (L-M)
A. Chipping Station		2			1					2	1
B. Hunting Station		3		1							
C. Hunting Station		1	1	1							
D. Gathering Station			3			2		1	1	2	1
E. Hunting/Gathering Camp									1		
F. Hunting/Gathering Camp				2		1		1			
G. Hunting/Gathering Camp			1								
H. Sherd Scatter			2	1		1	1	2	2	1	3
I. Camp/Settlement			5	3		2	1	2		2	
I. Camp/Settlement				1							
K. Base Settlement	2	1	1				1	2			
L. Base Settlement				1				1			
M. Base Settlement	2		1					2			
N. Base Settlement	2			1	2			1			1
O. Base Settlement	1			1				4	1		
P. Base Settlement				1				3			

crushing and grinding tools. Sherds are dominant (8-97); secondary lithic debris, and occasional finished tools or point body fragments are a minor part of the assemblage. Since crushing and grinding tools are absent and hunting tool manufacture and use is minor, some of these may be temporary camps.

J. A site (X41 HE 40) with a small number of sherds, a core, and fragments of daub indicating a permanent structure. This may be a permanent residence.

K. Small-to-medium sites with 5-98 sherds, crushing and grinding tools, (pitted stones, pitted manos, grinding basins) and small quantities of secondary debris. Most are relatively small, though one is 90 meters in length. The range of activities represented suggest that these may be small base settlements.

L. Small ceramic sites, less than 70 meters across with 32 to 82 sherds and small amounts of primary debris.

M. Extensive sites, probably base camps, up to 200 meters across with a large sherd sample (100-381), very few primary or secondary flakes or unfinished tools, and pitted stones.

N. Base settlements, usually 50 meters or less in extent, with a small sample of unfinished tools and full lithic debris. A wide range of crushing and grinding tools are present, including pitted stones, manos, and grinding platforms. Sherd samples range from 51 to 596.

O. The largest and most intensively occupied sites; these are all probably base settlements with several permanent residences. They range up to 300 meters in maximum extent, have a relatively large number of sherds (38-439), ceramic pipe fragments, full lithic debris, finished chipped stone tools, and a variety of crushing and grinding tools.

P. Small ceramic sites, of the same order and content as categories I and F, with the addition of pipe fragments. These may be either campsites or settlements; the presence of pipes is taken as an indication of group ceremony, in the context of a smaller group or more brief occupation than base settlements at which inter-village or tribal ceremonies presumably occurred. Site size is small, no more than 50 meters in maximum dimensions, and sherd samples are usually small (13 to 18 sherds). Crushing and grinding stones are absent except at X41 SM 23, which has one pitted stone. One site (X41 HE 24) has 182 sherds and a small amount of primary lithic debris. Remaining sites have no lithic material or minimal debris (1 or 2 chips).

DISTRIBUTIONAL PATTERNS

Site locations in Table 2 are grouped according to their occurrence east or west of the river, to test whether differences in site types correlate with contrasts between east and west uplands in topography, lithic resources, soil types, and proximity to the eastern border of pine-oak forest. In addition, site locations in environmental zones 1 and 13, the interior uplands, are differentiated by their occurrence on streamside bluffs, interior ridges or knolls or upland flats, to determine if propinquity to streams governed settlement type.

As Table 2 shows, no sites were located on the river bottoms. All sites are in zone 1-4 (western uplands, and floodplain borders) and 10-13 (eastern uplands). Hence all sites are potentially occupable throughout the year without threat of flood. There is the possibility that some sites may have been covered by alluvium although sites were exposed on the alluvial slopes of the floodplain borders.

Chipping scatter sites show a slightly greater association with streamside locations expected from hunting activities than isolated interior sites, but they appear in other location. Hunting stations are more restricted in distribution than other site localities; all are on the western rim of the flood plain to which easy access is gained to the floodplain or river. In several cases, in locations south of Cany Creek, these sites are near Pleistocene terraces, and the usable stone in terrace gravels was probably a determining factor in the choice of sites. A relatively high proportion of local quartzite debris occurs at these sites and is similar to material found on the terrace cobble deposits. Three of the sites are close to good fishing localities: X41 AN 2 lies a short distance from the river, X41 HE 11 occupies a low terrace a short distance from the Big Eddy, and X41 HE 35 is close to a small slough and tributary stream. Other sites are not in close proximity to fishing localities, but their location on the boundary between floodplain and upland places them in an optimal location for hunting both upland and bottomland species. Sites with stem fragments (X41 TA 2, X41 HE 11, X41 HE 17) all have Archaic dart points and represent early hunting stations; some of the same locations have Caddoan ceramics, suggesting multiple occupations.

Gathering stations, isolated finds of pitted stone or grinding basins, show a wide distribution with a preference for interior upland localities. This distribution is what would be expected if these sites involved wild nut-gathering, since nut-bearing hardwoods are ubiquitous.

Base camps or base settlements, as well as most ceramic camp-settlement sites, are the most common and occur most frequently in the situation expected from the ethnographic literature — streamside flats with relatively fertile soils.

Since artifacts preserved at these sites are not those analogous to those used in Caddo horticulture, inference that base settlements are farming villages must be based on indirect evidence. One of these is association with fertile soils. According to ethnohistoric reports, Hasinai settlements were customarily located near streams and land suitable for farming. If the Neches River Caddo were established farmers, as they appear to have been at the George C. Davis Site and at Hasinai villages, they can be assumed to have been able to judge relative soil productivity. Lacking this pre-judgement, relative crop yield would have demonstrated the better farming locations. Hence, it is expected that probable village sites (base settlements) will be associated with good soils.

To rate soil productivity, soil types classified by the Soil Conservation Service were obtained for each site locality. These types are ranked on the basis of fertility, depth of subsoil, slope, erosion potential, and potential for flooding. Erosion potential and porosity are of primary concern for present-day farmers who practice repeated cropping with commerical fertilizer. We can assume that Caddo swidden involved cropping a field until production dropped below a certain level, and the field was let fallow. Hence, original fertility would be the deciding factor in soil productivity. Soils associated with archeological sites are categorized as low (L), low to moderate (L-M), or moderate (M) in fertility (Mowrey and Oakes 1959).

Table 3 shows the relative fertility of soils with which all activity-sets are associated. Base settlements are clearly associated with better soils. Furthermore, Caddo settlements (sets K, M-P) occur in one location, the floodplain border, which is shared by no other sites. These sites, with the exception of those (K) which lack projectile points, have complete tool kits, including crushing or grinding stones and some lithic debris. They are likely to have been base settlements rather than camps. The alluvial soil at the floodplain border, among the best in the upper Neches region, is sugggested as a primary factor in choice of these sites.

SETTLEMENT SYSTEMS OF THE UPPER NECHES

On the basis of pottery types and projectile point types, three periods of occupation are indicated represented by Archaic, Alto Focus, and Frankston Focus types. However, a number of sites lacking "index fossils" in the form of distinctive pottery or point types cannot be ascribed to a particular period; these "timeless"

TABLE 3
Relative Fertility of Soils in Association with Archeological Sites

	SOIL FERTILITY		
	Low	Low-Moderate	Moderate
Base settlements	4	3	25
Camp/Settlements	7	2	7
Hunting/gathering camp	2		3
Sherd scatter	5	4	4
Gathering station	6	3	1
Hunting station	5		2
Chipping scatter	2	4	

sites include chipping sites and isolated pitted stones or grinding stones.

Archaic base camps are restricted to the western side of the river; the primary activities represented in technological remains are tool-making and hunting. By their proximity to Pleistocene terraces and riverine resources, it is suggested that fishing and stone cobble collection were additional activities that took place at these sites. These Archaic sites include gray flint projectile points but lack cores and cortex flakes of this material. It occurs in secondary debris, retouched flakes, biface blanks, scrapers and dart points. A central Texas origin for this flint has been suggested. If this is true, these sites may represent a seasonal round of small hunting and gathering bands whose territory extended west beyond the upper Neches drainage. This is suggested by the distribution of all Archaic points, which, in addition to their concentration in hunting camps with primarily lithic components, are more common in all sites on the western side of the river. Twelve sites lying west of the Neches River have dart points. Only three sites are on the east side of the river. Furthermore, these eastern three sites include only Gary and Ellis dart points; the use of these forms may have persisted after the introduction of ceramics (Suhm *et al.* 1954: 188). Sites representing other activities in the seasonal round of these archaic bands may lie considerably west of the Neches drainage, possibly beyond the oak-pine-hickory forest in the Post-Oak Savannah or Plains where buffalo was the principal large game.

Earliest Caddo sites in the reservoir area are limited to burials on the eastern side and small clusters of base camps or settlements west of the river near the mouth of Caney Creek. These sites lie on or near the fertile floodplain border soil with which no sites are associated prior to Caddoan occupations. It has been suggested that this part of the river bottom environment attracted permanent settlement because of the farming potential of this soil. This Alto Focus Caddo population was much more sparse and scattered than in succeeding periods. The closest Alto Focus site observed by the writer outside the reservoir is located on Caddo Creek, a western tributary of the Neches six miles south of the Caney Creek cluster.

The primary occupation of the upper Neches is represented by Frankston Focus sites which account for 81 of the 85 ceramic sites. The largest are base settlement clusters on streamside flats with fertile soils in the eastern uplands. Other site types include scattered sherds, gathering stations in which pitted stones are found with a few sherds, and small campsites. The range of site types suggests villages, small hamlets, and temporarily occupied activity-specific sites separate from the permanent villages.

From the Caddoan literature, several elements of the settlement system have been inferred for the historic Hasinai including farming hamlets, spring fishing stations, and late summer fishing camps. These apparently consisted of matrilineal kin-affiliated task or residence groups and are the elements of this sytem most likely to be represented archeologically by camps or settlement sites. Other activities in the seasonal round (winter waterfowl hunting, deer hunting, and fall nut gathering) involved exclusively male or female groups and would be expected to be represented by much less archeological residue. Archeological sites representing these activities are probably chipping stations and gathering stations. The site class most likely to represent a spring or late summer fishing camp are streamside or floodplain camps or settlements (Class I). There are slightly more of this site type in this locality than elsewhere.

Base-settlement clusters vary in size and number of activity-sets; this variation could be accounted for by specific activity or work localities within the hamlet. In addition, the density of occupation apparently varies in direct proportion to the fertility of the soil.

A site cluster on Saline Creek, including sites X41 SM 15, 22-25 occupies an upland flat approximately 500 meters across at the junction of two streams. The soil is a fertile red sandy loam (Magnolia Fine Sandy Loam). The sites include four base settlements ranging in size from 50 x 100 meters to 120 x 160 meters, and one small station with one chip, a grinding basin and four sherds. One base settlement, X41 SM 22 includes a small scatter of sherds and debris slightly apart from the major portion of the site, suggesting a separate activity area. A cemetery (X41 SM 28) has been excavated by amateurs approximately 1/2 mile downstream and a burial is reported to have been removed from a stream bank at the end of one site.

A cluster on a tributary of County Line Creek (sites X41 CE 1-5) includes one extensive base settlement (X41 CE 1) and a smaller camp or settlement on a moderately fertile sand flat (Bowie loamy fine sand), at the head of a small stream. Three other sites — a small scatter of sherds, a small camp or settlement, and a grinding platform with 11 sherds — occupy slopes and ridge crests overlooking the flat.

A third cluster on Chimney Creek consists of three extensive base settlement sites (X41 CE 10,11,16) along a 3/4 mile length of the creek. Soil here is a fertile red sandy loam (Magnolia/Nacogdoches fine sandy loam). Sites range from 100 x 350 meters to 100 x 300 meters in size. A small concentration of primary debris, four pitted stones and one sherd in a 1/4 acre area is the fourth site on this drainage.

The range in activity-sets at each of these sites suggests permanent village sites with associated activity-specific areas between dwellings or at the village borders. Differences in scale between these sites parallel differences in soil fertility. The County Line Creek tributary cluster, with only one base settlement, is associated with a soil of less fertility than the two clusters with three or four base settlements. The latter clusters, on Saline Creek and Chimney Creek, are the only sites associated with red fine sandy loams, the most fertile soils of the uplands.

STONE TECHNOLOGY AND TOOLS

Stone technology is considered here as a preliminary reconstruction of the activities involved in the manufacture and use of stone tools. This provides some evidence for relating sites to economic activities, stages of manufacture, and environmental associations. The aims of analysis are the determination of steps of manufacture, quarry locations, and evidences of use.

DEBRIS AND TOOL MANUFACTURE

Chipped stone elements and tools represent steps of tool production, modification or repair. These elements are:

1. Cores: nodules with one or more flakes struck off.
2. Primary cortex flakes: percussion flakes retaining the striking platform with cortex covering the dorsal surface.
3. Secondary cortex flakes: percussion flakes with cortex partly missing from the dorsal surface.
4. Interior flakes: percussion flake lacking cortex.
5. Flake tools: retouched flakes and scrapers (Fig. 5,a,d,e). Retouched flakes are of gray flint, 3.1-3.6 cms. long. Scrapers are tan or gray secondary or interior flakes (2.2-3.0 cms. x 1.2-2.1 cms. x .4-.8 cms) with abrupt retouch on the distal end, lateral edge or both. Two specimens have visible wear on the retouched surface. One large flake of gray silicified wood has a notch 3 cm. wide and 7 cm. deep removed from one edge. It was collected at X41 AN 2.
6. Small projectile points ("arrowpoints"), which contrast in size to larger "dart" points and include Perdiz and Catahoula types. These are made of small flakes of flint or fine-grain quartzite (Fig. 5,f).
7. Lipped flakes: soft hammer flakes with a faceted lipped platform. Cortex is minimal or missing. This category includes "biface thinning flakes".
8. Biface fragments: edges or mid-sections of bifacially worked tools, presumably snapped off during manufacture.
9. Biface blanks: bifacially percussion flaked foliate bifaces without a stem or pressure flake scars. Some have knots or cortex remnants.
10. Discarded points: incomplete projectile points or point fragments that are assumed to have been discarded before use. This includes points with irregularities or "knots" and incompletely thinned or unfinished tools ("preforms") with the stem or base formed to a pattern resembling completed points (Fig. 5,g,i). Most of these can be related to one or two standard morphological types.
11. Point fragments: fragments of thinned bifaces that are recognizable as parts of completed or nearly-completed projectile points. This category includes stems, bodies, or tips. Stems and points with broken tips are tabulated separately from whole points and body fragments, to test for differences in distribution which indicate that broken points were

TABLE 4

Artifacts From All Sites

	AN1	AN2	AN3	AN4	AN5	CE1	CE2	CE3	CE4	CE5	CE6	CE7
Hammerstone	-	-	-	-	-	1	-	-	-	-	-	-
Anvil	-	-	-	-	-	-	-	-	-	-	-	-
Sandstone Frags.	-	-	-	-	-	-	-	-	-	-	-	-
Core	-	-	-	-	-	-	-	-	-	-	-	-
Flakes												
Cortex	1	6	-	-	1	1	-	1	-	-	-	-
Secondary	4	26	-	3	1	1	-	1	-	-	1	-
Interior	1	27	-	6	1	1	-	-	1	-	4	-
Lipped	-	8		4	-	-	-	-	-	-	-	-
Cortex Chip	-	1	Lithic debris reported but not collected	-	-	-	-	1	-	-	2	-
Interior Chip	12	47		-	1	1	-	-	1	-	28	-
Retouched Flake	-	-		-	-	-	-	-	-	-	-	-
Scraper	-	-		-	-	-	-	-	-	-	-	-
Arrow Points												
Preform	-	-		-	-	1	-	-	-	-	-	-
Body & Tip	-	-		-	-	-	-	-	-	-	-	-
Base	-	-		-	-	1	-	-	-	-	-	-
Whole	-	-		-	-	5	-	-	-	-	-	-
Biface Blank	-	-		-	-	-	-	-	-	-	-	-
Biface Frag.	-	-		-	-	1	-	-	-	-	-	-
Dart Points												
Preform	-	-		-	-	-	-	-	-	-	-	-
Body	1	2		2	-	-	-	-	-	-	-	-
Base	-	4		-	-	1	-	-	-	-	1	-
Whole	-	1		-	-	-	-	-	-	-	-	-
Mano	-	-		-	-	-	-	-	-	-	-	-
Pitted Mano	-	-		-	1	-	-	-	-	-	1	-
Grinding Platform	-	-	-	-	-	-	-	-	-	1	-	-
Grinding Basin	-	-	-	-	-	-	-	-	-	-	-	-
Pitted Stone (A)	1	-	-	1	1	1	-	-	-	-	-	-
Pitted Stone (B)	-	-	-	-	-	-	-	-	-	-	-	-
Pitted Basin	-	-	-	-	-	-	-	-	-	-	-	-
Gouge	-	-	-	-	-	-	-	-	-	-	-	-
Celt	-	-	-	-	-	-	-	-	-	-	-	1
Sherds	-	19	160	-	94	120	2	17	19	11	1	12
Pipe Fragments	-	-	-	-	1	2	-	--	-	-	-	-

CE8	CE9	CE10	CE11	CE12	CE14	CE15	CE16	CE17	CE18	CE19	CE20	CE21	HE1	HE2	HE3N
-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
-	2	1	-	2	-	-	3	-	-	-	-	-	-	-	-
-	1	4?	1	-	-	-	1	1	-	-	-	-	-	-	-
-	1	12	-	1	-	-	-	-	-	-	-	-	-	-	1
-	4	19	-	15	-	-	-	-	-	-	-	-	-	1	-
-	-	19	-	13	-	-	1	-	1	-	-	-	-	4	4
-	-	10	-	4	Lithic debris reported but not collected	-	-	-	1	-	-	-	-	-	2
-	-	10	-	-		-	1	-	-	-	-	-	-	5	10
-	1	91	1	67		-	11	-	1	-	1	-	-	18	33
-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
-	-	-	-	-		-	2	-	-	-	-	-	1	-	-
-	-	-	-	-		-	-	-	-	-	-	-	-	-	1
-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
-	-	-	-	-		-	1	-	-	-	-	-	-	-	-
-	-	8	-	-		-	1	-	-	-	-	-	-	-	-
-	-	-	-	-		-	-	-	-	-	-	-	-	-	1
-	1	-	-	-		-	-	-	-	-	-	-	-	-	1
-	-	-	-	-		-	-	-	-	-	-	-	1	-	1
-	-	1	-	-		-	-	-	-	-	-	-	1	1	1
-	-	-	-	-		-	8	-	-	-	-	-	-	-	-
-	-	5	2	1		-	2	-	-	-	-	-	1	1	-
-	-	6	1	-	-	-	-	-	-	-	-	-	-	-	1
-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-
-	4?	1	1	-	-	-	11	-	-	1	-	-	-	-	-
-	-	-	1	1	-	-	3	-	-	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	1	356	47	116	-	12	439	79	-	19	18	3	310	5	18
2	-	1	-	1	-	-	2	-	-	-	1	-	-	-	-

	HE3E	HE3W	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12	HE13
Hammerstone	-	-	-	-	-	-	-	-	-	-	-	-
Anvil	-	-	-	-	-	-	-	-	-	1	-	-
Sandstone Frags.	-	-	-	-	-	-	-	-	-	-	-	-
Core	-	1	-	-	-	-	-	-	-	9	-	-
Flakes												
Cortex	-	-	-	-	-	-	-	-	1	10	-	-
Secondary	-	9	-	-	-	-	-	-	6	6	-	-
Interior	37	4	-	-	-	-	3	-	2	29	-	-
Lipped	4	1	-	-	-	-	-	-	3	39	Pottery and lithic debris reported, none collected	-
Cortex Chip	43	29	-	-	-	2	1	-	3	21		-
Interior Chip	139	51	2	-	-	1	8	-	36	79		-
Retouched Flake	-	-	-	-	-	-	-	-	-	3		-
Scraper	-	-	-	-	--	-	-	-	-	1		-
Arrow Points												
Preform	-	-	-	-	-	-	-	-	-	-		-
Body & Tip	-	-	-	-	-	-	-	-	-	-		-
Base	-	-	-	-	-	-	-	-	-	-		-
Whole	-	-	-	-	-	-	-	-	-	-		-
Biface Blank	-	-	-	-	-	-	-	-	-	4		-
Biface Frag.	1	-	-	-	-	-	-	-	1	3		-
Dart Points												
Preform	-	-	-	-	-	-	-	-	-	2		-
Body	-	-	-	-	-	-	-	1	-	-		-
Base	-	-	-	-	-	-	-	-	-	1		-
Whole	-	-	-	-	-	1	-	-	-	2		-
Mano	2	-	-	-	-	-	-	-	-	1		-
Pitted Mano	2	-	-	-	-	-	-	-	-	-		-
Grinding Platform	-	-	-	-	-	-	-	-	-	-		-
Grinding Basin	-	-	2	-	-	-	-	-	-	-		-
Pitted Stone (A)	1	-	-	-	-	-	-	-	-	-		-
Pitted Stone (B)	-	-	-	-	-	-	-	-	-	-		-
Pitted Basin	1	-	-	-	-	-	-	-	-	-	-	-
Gouge	-	-	-	-	-	-	-	-	-	-	-	-
Celt	-	-	-	-	-	-	-	-	-	-	-	-
Sherds	2	39	-	1	18	-	-	58	1	-	-	6
Pipe Fragments	-	-	-	-	-	-	-	-	-	-	-	-

HE14	HE15	HE16(A)	HE16(B)	HE17(A)	HE17(B)	HE17(C)	HE17(D)	HE18	HE19	HE20	HE21	HE22	HE23	HE24	HE25
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	2	-	2	1	-	1	-	-	-	1	1	-
-	-	-	-	-	-	-	-	-	-	1	6	-	1	2	-
-	-	-	-	-	-	-	-	-	-	-	3	1	2	-	-
2	-	2	-	10	2	12	4	-	-	-	6	-	-	-	-
3	-	-	-	3	-	12	-	-	-	-	2	-	-	-	-
-	-	-	2	38	1	19	14	2	15	3	2	1	-	-	-
17	-	-	6	58	8	32	10	10	16	13	13	1	4	2	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	4	-	1	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
2	-	-	3	-	-	-	-	-	-	-	-	-	1	-	-
-	-	-	2	1	-	-	-	-	-	-	-	-	1	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	126	230	1	1	36	11	70	54	8	-	67	82	182	3
-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-

	HE26	HE27	HE28	HE29	HE30	HE31	HE32	HE33	HE34	HE35(A)	HE35(B)	HE35(A,B)
Hammerstone	-	-	-	-	-	-	-	-	-	-	-	-
Anvil	-	-	-	-	-	-	1	-	-	-	1	-
Sandstone Frags.	-	-	-	-	-	-	1	-	-	-	-	-
Core	-	-	-	-	-	-	-	1	-	5	-	-
Flakes												
Cortex	-	-	-	-	-	-	1	1	-	4	-	-
Secondary	-	-	-	-	-	-	1	-	-	-	9	-
Interior	-	-	-	-	-	-	2	2	1	-	1	-
Lipped	-	-	-	-	-	-	-	-	1	-	-	-
Cortex Chip	-	4	-	5	3	-	1	6	-	-	-	-
Interior Chip	-	1	-	1	2	1	2	6	1	6	6	-
Retouched Flake	-	-	-	-	-	-	-	-	-	-	-	-
Scraper	-	-	-	-	-	-	-	-	-	-	-	-
Arrow Points												
Preform	-	-	-	-	-	-	-	-	-	-	-	-
Body & Tip	-	-	-	-	-	-	-	-	-	-	-	-
Base	-	-	-	-	-	-	-	-	-	-	-	-
Whole	-	-	-	-	-	-	-	-	-	-	-	-
Biface Blank	-	-	-	-	-	-	-	-	-	-	-	-
Biface Frag.	-	-	-	-	-	-	1	-	-	-	-	1
Dart Points												
Preform	-	-	-	-	-	-	-	-	-	-	-	-
Body	-	1	-	-	-	-	-	1	-	-	-	-
Base	-	-	-	-	-	-	-	-	-	-	-	-
Whole	-	-	-	-	-	-	-	-	-	-	-	1
Mano	-	-	-	-	-	-	-	-	1	1	-	-
Pitted Mano	-	-	-	-	-	-	-	-	2	-	-	-
Grinding Platform	-	-	-	-	-	-	-	-	-	-	-	-
Grinding Basin	-	-	-	-	-	-	-	-	-	-	-	-
Pitted Stone (A)	5	-	-	-	-	1	-	-	-	-	-	-
Pitted Stone (B)	-	-	-	-	-	-	-	-	1	-	-	-
Pitted Basin	-	-	-	-	-	-	1	-	-	-	-	-
Gouge	-	-	-	-	-	-	-	-	-	-	-	-
Celt	-	-	-	-	-	-	-	-	-	-	-	-
Sherds	1	12	9	26	24	-	122	120	9	-	-	-
Pipe Fragments	-	-	-	-	-	-	-	-	-	-	-	-

HE37	HE38	HE39	HE40	HE41	HE42	HE43	HE46	HE47	SM5	SM6	SM7	SM8	SM9	SM10	SM11
-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-
-	-	-	-	-	-	-	-	-	-	-		-	1	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	2	1	-	-	-		-	-	2	-	-	-	1	-
2	-	5	-	-	-	-	1	-	-	-	-	-	-	15	1
-	-	-	-	-	-	-	1	-	-	-	1	-	-	24	2
-	2	7	-	-	-	-	13	2	-	-	1	1	2	16	-
-	1	-	-	-	-	-	4	-	-	-	-	7	-	8	-
7	2	32	-	-	-	34	7	-	-	2	-	-	1	26	-
-	16	23	-	-	1	14	31	-	-	-	3	4	5	157	2
-	-	-	-	-	-	-	2	-	-	-	-	-	-	1	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
-	1	1	-	-	-	-	-	-		-	-	-	1	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	-	51	20	24	14	97	1	11	-	32	21	23	101	531	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	SM23	SM24	SM25	SM26	SM27	SM28	SM29(A)	SM29(B)x	SM30	SM31	SM32	SM34
Hammerstone	-	-	-	-	-	-	-	-	-	-	-	-
Anvil	-	-	-	-	-	-	-	-	-	-	-	-
Sandstone Frags.	-	-	-	-	-	-	-	-	-	-	-	-
Core	-	-	-	-	2	-	-	-	-	-	-	-
Flakes												
Cortex	-	-	-	-	4	-	-	-	-	-	-	-
Secondary	-	-	-	-	2	1	-	-	-	-	-	-
Interior	-	-	-	-	2	1	-	-	-	-	-	-
Lipped	-	-	-	-	1	-			-		-	-
Cortex Chip	-	-	-	-	-	1	Lithic debris reported but not collected	Lithic debris reported but not collected	2	Lithic debris reported but not collected	-	-
Interior Chip	2	1	1	-	10	-			1		-	-
Retouched Flake	-	-	-	-	-	2			-		-	-
Scraper	-	-	-	-	-	-			-		-	-
Arrow Points												
Preform	-	-	-	-	-	-			-		-	-
Body & Tip	-	-	-	-	-	-			-		-	-
Base	-	-	-	-	-	-			-		-	-
Whole	-	-	-	-	-	2			-		-	-
Biface Blank	-	-	-	-	-	1			1		-	-
Biface Frag.	-	-	-	-	-	1			-		-	-
Dart Points												
Preform	-	-	-	-	-	-			-		-	-
Body	-	-	-	-	-	-			-		-	-
Base	-	-	-	-	-	-			-		-	-
Whole	-	-	-	-	-	1			-		-	-
Mano	-	-	-	-	-	2			-		-	-
Pitted Mano	-	-	-	-	-	-			-		-	-
Grinding Platform	-	1	-	-	-	1	-	-	-	-	-	-
Grinding Basin	-	-	1	-	-	-	-	-	-	-	-	-
Pitted Stone (A)	1	-	-	-	-	-	-	x	-	-	-	-
Pitted Stone (B)	-	-	-	-	-	-	-	-	-	-	-	-
Pitted Basin	-	-	-	-	-	-	-	-	-	-	-	-
Gouge	-	-	-	-	-	1	-	-	-	-	-	-
Celt	-	-	-	-	-	-	-	-	-	-	-	-
Sherds	13	79	4	32	72	596	26	32	30	37	18	7
Pipe Fragments	1	-	-	-	-	-	-	-	-	-	-	-

SM12	SM13	SM15	SM16	SM17	SM18	SM19E	SM19W	SM20	SM21	SM22(A)	SM22(B)
-	-	-	1	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	1	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	1	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-		-	-
1	-	-	-	-	-	1	-	-	Lithic debris reported but not collected	1	-
1	-	-	1	-	1	-	1	-		-	1
-	-	-	-	-	-	-	-	-		-	-
-	-	-	-	-	-	-	-	-		3	-
-	-	-	-	-	-	-	-	-		3	-
-	-	-	-	-	-	-	-	-		7	-
-	-	-	-	-	-	-	-	-		2	-
-	-	-	-	2	-	-	-	-		1	-
-	-	-	-	-	-	-	-	-		-	-
-	-	-	-	-	-	-	-	-		-	-
-	-	-	-	-	-	-	-	-		-	-
1	-	-	-	-	-	-	-	-		-	-
-	-	-	-	-	-	-	-	-		2	-
-	-	-	-	-	-	-	-	-		2	-
-	-	-	-	-	-	-	-	-		x	-
-	-	-	-	-	-	1	-	-		-	-
-	-	-	-	-	-	3	-	-	-	x	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	1	1?	-	1	-	-	-	-	x	-
-	-	-	-	-	-	-	-	-	-	x	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
1	32	114	195	381	68	4	3	15	41	31	7
-	-	-	-	-	-	-	-	-	-	-	-

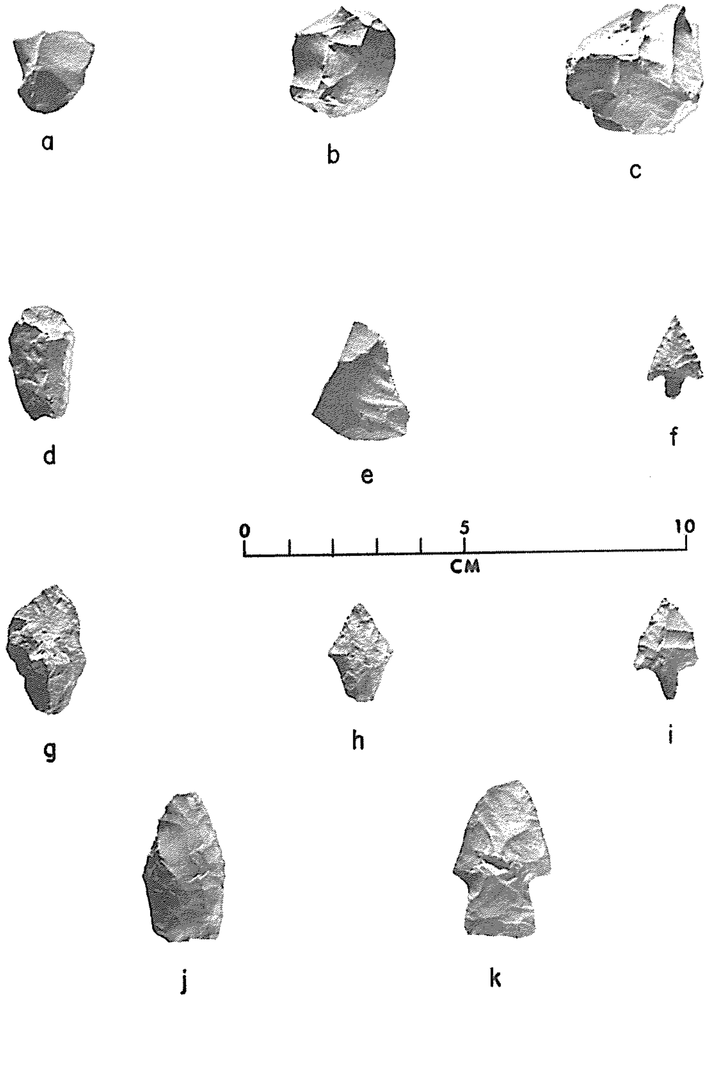


FIGURE 5. Chipped Stone Debris and Tools. a, end scraper; b,c, small flint cores; d, side scraper; e, retouched flake; f, *Perdiz* point; g, *Gary* preform; h, *Gary* point; i, *Perdiz* preform; j, *Morrill* point, probably broken from impact; k, *Carrollton* point, probably broken from impact.

replaced at specific locations or site situations in the reservoir area.

12. Cortex chips: small spalls or shatter fragments lacking the striking platform. Cortex is present on the dorsal surface. These could have occurred as shatter from any step in percussion flaking while cortex remained on the parent rock.
13. Interior chip: small spalls or shatter fragments lacking the striking platform and having no cortex.
14. Dart points: large stemmed projectile points (Fig. 5,j,k). Types collected in descending order of frequency are: *Gary, Bulverde, Yarbrough, Edgewood, Morrill, Darl, Ellis, Wells, and Trinity.* The distribution of lithic tools and debris is shown in Table 4.

SOURCE MATERIALS

Distribution of tools suggests that quarrying and tool production were accomplished during the Caddoan period of occupation within a more restricted area than during the Archaic period. One type of stone, gray flint, appears to be non-local in origin and it is suggested that this was used primarily in the Archaic period of occupation of the reservoir, which suggests a larger sphere of economic activity than during the Caddoan period.

Artifacts are of two general categories of stone: (1) course-grained rock with irregular fracture (ferruginous sandstone, course quartzite) which can be ground or pecked to produce numerous forms and surfaces, and (2) cryptocrystallines having conchoidal fracture capable of producing edged tools (flint, fine-grained quartzite, silicified wood). Coarse quartzite is found in Pleistocene gravels along the west border of the river; this material occurs in the form of hammerstones and manos. Sandstone outcrops are most frequently seen in the ferruginous beds of the eastern uplands, although some ledges are exposed by erosion on the western borders. Tools of this material include pitted stones, manos, grinding platforms and anvils.

Several types of stone have conchoidal fracture and occur in varying frequency in tools and in resource localities in the upper Neches environment. Spotty gray to black flint occurs in the form of dart points, bifaces, retouched flakes and chipping debris which does not include cortex-backed flakes or cores. This is among the finest-grain lithic material and occurs in the largest flakes and chipped stone tools. A few interior flakes and flake tools exceed 5 cms. in length.

Gray-tan to tan flint, also fine-grained, occures in all stages of chipping debris and tool forms; a few cores of this material have been found in site collections. Fine-grained quartzite varies in quality of fracture; fine-grained flakes permit flaking of thin, small points; coarser-grained quartzite is found in less symmetrical or larger tools. Banded red, yellow, and brown petrified wood tends to fracture along a plane and appears in few finished projectile points. Gray granular silicified wood, which fractures in a coarse conchoidal pattern, occurs in large cores, bifaces, and unifaces.

Table 5 shows the distribution of all debris and tools by material on both sides of the river. Although tan flint is clearly the predominant material on both sides of the river, there is a larger percentage of quartzite and gray flint elements on the west side of the river.

It is suggested that these differences reflect quarrying from several localities. Quartzite, banded silicified wood, and some tan flint occur in the Pleistocene terrace gravels on low slopes east of the river. No sources of gray, blue-gray, or spotted flint have been found locally, so it may be non-local in origin, possibly from limestones or gravels in central Texas (R. K. Harris, personal communication). Raw material at sites is limited to pebbles and small cobbles of quartzite, flint pebbles 4 to 10 cms. in diameter, and a few heavy quartzite and gray silicified wood cores. The significance of these differences in distribution in terms of quarrying and tool manufacture are indicated in Tables 6 to 9 which show specific steps in tool manufacture for different materials.

From differences in frequency of occurrence of different steps of manufacture in specific materials, several patterns in lithic resource utilization are suggested. Cores and initial cortex flakes of gray flint are absent from all sites, which supports the identification of this material as non-local.

Tan flint is predominant on both sides of the river. However, comparison of steps of production occurring at eastern and western sites in Tables 7 and 8 shows a significantly higher proportion of early-stage flakes (cortex and secondary) on the eastern side of the river, suggesting that the source of this material may lie east of the river.

Quartzite cores are markedly more frequent on the west side of the river, evidence of quarrying at Pleistocene gravels, and indicate that cobbles were carried to sites where stoneworking was begun.

Silicified wood debris occurs in very small numbers and does not include lipped flakes. This is probably due to the refractory quality

TABLE 5
Distribution of all chipped stone elements by material

	WEST		EAST	
	No.	%	No.	%
Gray flint	231	15.7	72	10.6
Tan flint	784	53.5	560	76.3
Quartzite	378	25.8	72	10.6
Banded/silicified wood	74	5.0	17	2.5
	1467	99.0	681	100.0

TABLE 6
Distribution of Cores

	WEST	EAST
Gray flint	0	0
Tan flint	2	2
Quartzite	37	7
Silicified wood	1	0

TABLE 7
Number of Stone Flakes at Sites West of the Neches River

	Cortex Flakes	Secondary Flakes	Interior Flakes	Lipped Flakes	Total
Gray flint	0	5	44	15	64
Tan flint	16	35	114	27	192
Quartzite	9	7	3	10	29
Silicified wood	12	14	2	0	28

TABLE 8
Number of Stone Flakes at Sites East of the Neches River

	Cortex Flakes	Secondary Flakes	Interior Flakes	Lipped Flakes	Total
Gray flint	0	11	15	3	29
Tan flint	23	46	46	27	142
Quartzite	11	17	9	2	39
Silicified wood	2	7	0	0	9

TABLE 9
Stages of Lithic Manufacture
Represented in Flakes of Tan Flint

Cortex Flakes		Secondary Flakes		Interior Flakes		Lipped Flakes	
W.	E.	W.	E.	W.	E.	W.	E.
8.3%	16.2%	18.2%	32.4%	58.5%	32.4%	14.2%	19.0%

of this material which flakes irregularly and appears in very crude projectile points and preforms.

That gray flint was used more frequently during the Archaic occupation than in later periods is suggested by the debris and tools. Table 10 shows the material from hunting stations with Archaic components. Site X41 HE 11 is a lithic site with Archaic points predominant; X41 AN 2 and X41 HE 17 are predominantly lithic, with Archaic projectile points and few sherds.

Together, these three sites total over 15% of the chipped stone elements collected from all 98 sites. This disproportionate amount can be attributed to two factors: (1) they are sites with extensive occupation debris, and (2) they were exposed by land clearing and construction. In spite of the fact that all percentages are thus exaggerated, the proportion of gray flint, quartzite, and silicified wood debris exceeds normal expectations and indicates that the local Pleistocene terraces and distant gray flint sources were primary origins of lithic material which was worked at Archaic sites.

TABLE 10
Debris from Archaic Sites

	Total Elements At Site	Percent of Total Survey Collection
Gray flint	87	29%
Tan flint	215	7%
Quartzite	127	28%
Silicified wood	29	32%

That gray flint was not utilized for tools in the Caddoan period is suggested in Table 11; there are no arrowpoints of this material. Furthermore, there is a contrast between east and west in materials predominant in arrowpoints, which parallels the difference shown in manufacturing stages in Tables 6-8. Only quartzite arrowpoints appear on the west side of the river; tan flint arrowpoints predominate on the east side.

TABLE 11
Distribution of Projectile Points by Materials Used

	WEST		EAST		TOTAL	
	Arrow	Dart	Arrow	Dart	Arrow	Dart
Gray flint		9		7		16
Tan flint		11	19	1	19	12
Quartzite	7	13	4	6	11	19
Silicified wood		2		3		5

It is suggested from these distributional differences that the Caddoan period of occupation was marked by a decreased geographical range of stone resource utilization in contrast to that of the Archaic population.

PROJECTILE POINT MORPHOLOGY

The dart point forms found at Lake Palestine sites (Table 12) fall within the range of types associated with Middle or Transitional Archaic periods, with an age range of 2000 B.C. to A.D. 1000 (Bell 1958, 1960; Suhm and Jelks 1962).

TABLE 12
Distribution of Projectile Point Types

	DARTS									ARROWS		
	Straight Stem			Contracting Stem		Expanding Stem						
	Morill	*Yarbrough*	*Carrollton*	*Gary*	*Wells*	*Trinity*	*Ellis*	*Darl*	*Edgewood*	*Perdiz*	*Bonham*	*Catahoula*
X41AN2	—	—	1	—	—	1	—	—	—	—	—	—
X41CE1	—	—	—	—	—	—	1	—	—	7	—	—
X41HE2	—	1	—	—	—	—	—	—	—	—	—	—
X41HE3N	—	—	—	1	—	—	—	1	1	—	—	—
X41HE7	—	—	1	—	—	—	—	—	—	—	—	—
X41HE11	—	2	—	2	—	—	—	—	—	—	—	—
X41HE17	—	—	3	3	1	—	—	—	1	—	1	1
X41HE18	—	—	1	—	—	—	—	—	—	—	—	—
X41HE27	1	—	—	—	—	—	—	—	—	—	—	—
X41HE35	—	—	—	1	—	—	—	—	—	—	—	—
X41HE37	—	—	—	1	—	—	—	—	—	1	—	—
X41HE38	—	1	—	—	—	—	—	—	—	—	—	—
X41HE39	—	—	—	2	—	—	—	—	—	—	—	—
X41SM9	—	—	—	1	—	—	—	—	—	—	—	—
X41SM17	—	—	—	—	—	—	—	—	—	1	1	—
X41SM22	—	—	—	2	—	—	—	—	—	8	—	—
X41SM28	—	—	—	1	—	—	—	—	—	2	—	—

TOOLS OF GRANULAR STONE

The following artifacts are described and grouped by categories reflecting tool form and the process by which it was modified. Hammerstones and anvils are assumed to have been used in crushing and hammering. Pitted stones may have been used for holding nuts to be crushed and are similar to objects from southeastern sites which are occasionally referred to as "nutting stones". Manos, grinding slabs, and grinding basins all show abrasive wear possibly from grinding vegetable foods.

Hammerstones and Anvils

These tools show crushed and pecked surfaces; hammerstones (Fig. 6a) are end-battered cobbles or cores, 5.0-10.0 cms. long and 4.0-6.0 cms. wide. Sandstone or quartzite platforms with pecked surfaces or pockmarked depressions are termed "anvils", since the wear pattern appears to be the result of direct hammering (Fig. 6b). Most anvils are fragments of ferruginous sandstone, unmodified except for hammering on one surface. They are 13 to 19 cms. long, 10 to 17 cms. wide, and 4.5 to 8 cms. thick. One specimen is a broken, waterworn quartzite cobble, 8.5 cms. long, 8.5 cms. wide and 4.5 cms. thick.

Pitted Stones

Small concave pits, averaging 4.5 cms. deep and 2.8 cms. wide are found in one or both faces of tabular pieces of ferruginous sandstone. The most common (Class A) is a pecked concavity in an otherwise unworked slab of sandstone, 6.5-18.0 x 5.5-14.5 x 2.5-8.0 cms. (Fig. 6c). Others (Class B) have one or both faces surrounding the pit worn smooth, though not necessarily flat; dimension range of these is 8.5-11.5 x 4.5-8.5 x 2.5-5.5 cms. (Fig. 6d). Pits in the unmodified slabs are deeper than in those with smooth surfaces, and in the smoothed stones the pits are also usually smoothed. None was observed to have pecking that indicated that they were platforms for bipolar flaking.

Pits also occur in the center of basins, 8.0-17.0 cms. wide and .6 to 1.7 cms. deep, in sandstone slabs; both basin and pit are unsmoothed (Fig. 6e).

By ethnographic example, these tools are tentatively interpreted as "nut stones". Various observers of southeastern tribes observed stones being used for crushing nuts, and these are the only objects analogous to pitted stones. Two stones were used in crushing nuts; references do not describe them explicitly but refer to them as large

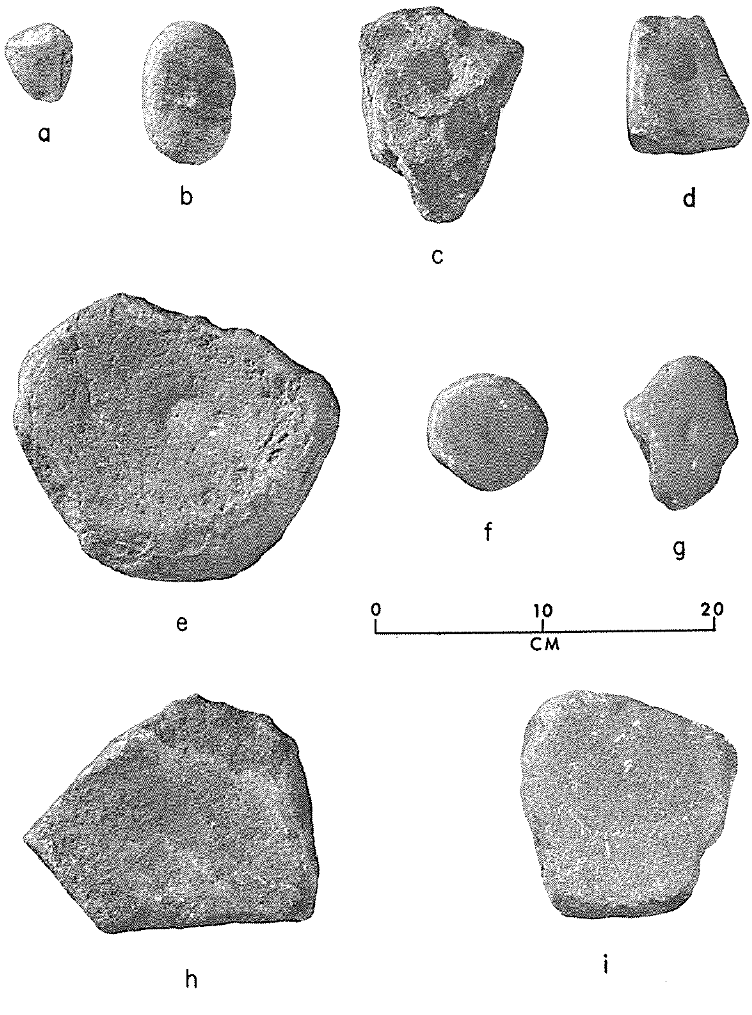


FIGURE 6. *Pecked and Ground Stone Tools. a, hammerstone; b, anvil; c, pitted stone (A); d, pitted stone (B); e, pitted basin; f, mano; g, pitted mano; h, grinding platform; i, grinding basin.*

and heavy. One observer states that a round stone was used to crush nuts in a "thick and hollowed" stone (Swanton 1946: 364-366). Consequently, hammerstones, manos, and some of the concavely ground basins described below, particularly those with pitted centers, may have been also used for tools in crushing nuts.

Ground Platforms and Basins

Some ferruginous sandstone slabs and basins have surfaces worn from grinding. Platforms are irregularly shaped tablets up to 6.5 cms. thick with evenly ground surfaces of 12 cms. to 18 cms. and a maximum depth of 1.7 cms. (Fig. 6h). Basins have circular concave ground surfaces (Fig. 6i). These objects may include some of the "thick and hollowed" stones used in grinding nuts.

Manos and Grinding Platforms

Small bifacially ground tablets, "manos", are usually made of ferruginous sandstone (Fig. 6f); four are quartzite cobbles. These are likely to have been used for grinding wild plant foods rather than corn. Ethnohistoric accounts describe wooden mortars for pulverizing grain (Swanton 1942: 131) but give no references to hand-held grinding stones. Grinding surfaces on one or both faces are flat to slightly laterally convex, indicating reciprocal motion. A few have rounded surfaces and were probably used in rotary grinding. Outline is variable and most are not carefully finished or formed; they range from rectanguloid to ovoid. Length is 7.0 to 11.5 cms., width ranges from 5.0 to 8.5 cms., and thickness varies from 2.5 to 5.0 cms. Frequently manos have a small pit in one or both grinding surfaces or in the unworked face (Fig. 6g). Pits in the ground faces of pitted manos are shallow, narrower, and less variable in size than those in pitted slabs, indicating that pits were reduced with grinding.

Sandstone Fragments

Occasionally unmodified tabular sandstone fragments occur at Caddoan settlements. These are 3.0 to 4.4 cms. thick and possibly are fragments of grinding platforms, pitted stones, or spalls from the manufacture of these tools.

Gouges

These two specimens ("Clear Fork Gouges") are bifacially worked from ferruginous sandstone tablets, assymetrically lenticular in cross section with a tapering round base. The blunt distal end is steeply flaked. Some cortex is retained on the flat dorsal surface and one specimen is obviously smoothed from wear on this surface, from the abruptly retouched end to the middle of the tool. Dimensions are: 6.0-6.7 x 4.7-5.1 x 1.9-2.2 cms.

Celt Fragment

One end of a ground stone tool, probably a celt, occurred at X41 CE 7. This is a smoothed rod of conglomerate (7.7 x 3.3-3.7 cms.) which is oval in cross section.

POTTERY

Pottery listed in Table 4 is included as evidence of cooking or storage vessels which provide an index of these domestic activities at each site. The purpose of this section is to consider attributes appropriate for determining stylistic microtraditions and to suggest the approximate range of time represented by ceramic sites.

The pottery types and categories of decoration listed in Table 13 occur throughout the upper Neches, indicating widespread exchange in decorative styles. Frankston Focus types (*Poynor Engraved, Maydelle Incised, Bullard Brushed*) are predominant. Basic technological features are also similar throughout the reservoir. Few sherds are highly polished; 10 to 60% are brushed, and the remainder are smoothed to a matte finish. Decorative treatment is by engraving, incising, punctating, pinching, or neckbanding. Paste and core color ranges from gray to buff. Orange spots and fire-clouding on the surface indicate poorly controlled firing. Jars with brushed bodies and rims decorated while the clay was still plastic (*Maydelle Incised, Bullard Brushed*) have smudged exteriors more commonly than other types, suggesting that these were used for cooking.

Of approximately 4,800 sherds, 215 have bone temper and 23 have shell temper; the rest, about 95%, are grog-tempered. Bone-tempering occurs in 35 out of 98 sites but is present in no more than 10% of sherds from any site. These are distributed over the entire reservoir area and do not correlate with any settlement type or environment. A few bone-tempered sherds have incised designs which indicate that the forms *Canton Incised, Kiam Incised* may be restricted to bowls and jars. The majority are plain body sherds which cannot be associated with specific vessel forms or use.

One technological feature, shell temper, shows a restricted distribution. Shell tempering occurs in five sites, four of which (X41

CE 1, X41 CE 17, X41 SM 10 and X41 SM 21) are located in the eastern uplands. The fifth, X41 HE 33 is in the western uplands at the northern end of the reservoir. Shell tempering is common in late Caddoan sites on the Red River (Suhm, et al. 1954: 199-215) which lies on the north and east of the Neches. There is a possibility that this distribution represents contact with Red River Caddo although these sherds lack decoration and cannot be identified with decorative styles of that area.

Chronology

The establishment of a Caddoan archeological chronology in this region has been based primarily on the basis of regional comparisons and derivation of horizon markers for periods which have been assigned approximate dates (*cf.* Krieger 1946, Davis 1970). In the Neches drainage, C-14 dates recently obtained at the George C. Davis Site span the period of approximately A.D. 800 to A.D. 1150 (Dee Ann Story, paper presented at the 1970 Caddo Conference, Magnolia, Arkansas). Probably the Alto Focus sites in the Lake Palestine area date close to this period. At the historic level, types of the Allen Focus (usually identified by the type *Patton Engraved*) are dated from A.D. 1600 to A.D. 1800, by association with European trade goods (Suhm, et al. 1954: 221). Stylistic continuity between the pottery in these historic burials and Frankston Focus types (*Poynor* and *Hume Engraved*) is fairly clear; a recent trial seriation of burial vessels demonstrates close resemblances between the two (Shafer 1967). On the basis of these comparisons, it is suggested that Caddoan occupation in the Lake Palestine reservoir falls approximately in the span from A.D. 1000 to A.D. 1600.

Ceramic Pipes

Most pipe fragments are from elbow pipes decorated by punctate or engraved designs, similar to those at Jackson's "Perpetual Fire Site" (Jackson 1936: Plate 28). Those at Alto Focus sites, X41 AN 16 and X41 AN 24, are undecorated pieces.

Ethnohistoric accounts do not tell who made pipes or the material from which they were made. However, smoking in several ritual contests is recorded. These included: (1) formal feasts at chief's residences and dwellings of men with lesser status; (2) greeting ceremonies, performed in a special "very large arbor" at which peace was pledged by chiefs to missionaries; (3) feasts at the chief's residence after a successful raid with display of scalps taken in battle suggesting validation of warrior status; (4) initiation of novice

TABLE 13

Pottery From All Sites

	Engraved							Incised				
	Sanders	Holly	Poyner	Misc.	Neck Banded	LaRue Neck Banded	Zoned Punctate	Hachure	Davis	Kiam	Maydelle	Misc.
AN2	-	-	-	1	1	-	-	-	-	-	-	2
AN3	-	-	3	1	-	-	-	-	-	1	4	-
AN5	-	-	2	-	-	-	-	-	-	1	-	8
CE1	2	2	13	1	4	-	-	11	-	-	1	5
CE2	-	-	Not Classified			-	-	-	-	-	-	-
CE3	-	-	-	-	-	-	-	-	-	-	-	-
CE4	-	-	1	2	-	-	-	-	-	-	-	1
CE5	-	-	-	-	-	-	-	1	-	-	-	1
CE6	-	-	Not Classified			-	-	-	-	-	-	-
CE7	-	-	-	-	-	-	-	-	-	-	-	-
CE8	-	-	-	-	-	-	-	-	-	-	-	6
CE9	-	-	-	-	-	-	-	-	-	-	-	-
CE10	-	-	1	3	-	-	-	1	-	-	-	2
CE11	-	-	-	1	-	-	-	-	-	-	-	-
CE12	-	-	-	1	-	-	-	-	-	1	-	4
CE15	-	-	-	-	-	-	-	-	-	-	-	-
CE16	-	-	5	2	6	-	4	-	-	-	-	2
CE17	-	-	-	-	-	-	1	-	-	-	-	-
CE19	-	-	2	-	-	-	2	1	-	-	-	3
CE20	-	-	-	1	-	-	-	1	-	-	-	-
CE21	-	-	-	-	-	-	-	-	-	-	-	-
HE1	-	-	7	4	-	-	1	8	-	-	-	10
HE2	-	-	-	-	-	-	-	-	-	-	-	-
HE3N	-	-	-	-	-	-	-	-	-	-	-	1
HE3E	-	-	-	-	-	-	-	-	-	-	-	-
HE3W	-	-	1	-	-	-	1	1	-	-	-	-
HE5	-	-	-	-	-	-	-	-	-	-	-	-
HE6	-	-	1	-	-	--	-	-	-	-	-	-
HE9	-	-	-	1	-	-	1	3	-	-	-	1
HE10	-	-	-	-	-	-	-	-	-	-	-	-
HE13	-	-	-	-	-	-	-	-	-	-	-	-
HE16N	-	1	-	10	-	-	2	6	-	-	-	11
HE16S	-	-	9	-	-	-	-	1	-	-	-	7
HE17	1	-	3	-	-	-	1	4	-	-	-	4
HE18	-	-	2	-	-	-	1	-	-	-	-	4

Nail Punctate	Tool Punctate	Weches Punctate Incised	Pinched	Brushed Bowls	Bullard Brushed	Brushed Body	Plain	TOTAL
1	–	–	–	–	–	2	12	19
1	–	–	1	–	1	52	96	160
–	–	–	–	–	–	31	52	94
18	9	–	4	4	34	351	136	595
–	–	–	–	–	–	–	–	2
–	–	–	–	–	1	4	12	17
–	–	–	–	–	–	9	6	19
–	–	–	–	–	–	1	8	11
–	–	–	–	–	–	–	–	1
2	–	–	–	–	1	3	6	12
–	–	–	–	–	–	13	14	33
–	–	–	–	–	–	1	–	1
4	–	–	–	–	–	56	63	130
–	–	–	–	–	–	4	6	11
3	7	–	–	1	–	15	84	116
–	–	–	–	–	2	7	3	12
–	2	–	–	1	4	243	170	439
2	–	–	–	–	–	35	41	79
–	–	–	–	–	–	6	5	19
2	–	–	–	–	–	6	8	18
–	–	–	–	–	–	1	2	3
6	2	–	3	–	1	70	182	294
–	–	–	–	–	–	2	3	5
–	–	–	–	–	–	9	8	18
–	–	–	–	–	–	–	2	2
–	–	–	–	–	–	15	21	39
–	–	–	–	–	–	–	1	1
–	–	–	–	–	–	5	12	18
–	1	–	–	–	–	13	38	58
–	–	–	–	–	–	–	1	1
–	–	–	–	–	–	5	1	6
4	9	–	–	–	–	13	174	230
6	–	–	–	–	–	14	89	126
16	–	–	–	–	2	9	40	81
2	–	–	–	–	1	36	24	70

	Engraved						Incised					
	Sanders	Holly	Poyner	Misc.	Neck Banded	LaRue Neck Banded	Zoned Punctate	Hachure	Davis	Kiam	Maydelle	Misc.
HE19	-	-	-	9	-	-	1	-	-	-	-	-
HE20	-	-	-	-	-	-	-	-	-	-	-	-
HE22	1	-	-	1	-	-	-	1	-	-	-	5
HE23	-	-	1	1	-	-	-	1	-	-	-	3
HE24	1	-	1	6	-	-	4	2	-	-	-	6
HE25	-	-	-	-	-	-	-	-	-	-	-	-
HE26	-	-	-	-	-	-	-	-	-	-	-	-
HE27	-	-	-	1	-	-	4	-	-	-	-	-
HE28	-	-	2	-	-	-	-	-	-	-	-	1
HE29	-	-	-	-	-	-	-	-	-	-	-	-
HE30	-	-	-	-	-	-	-	-	-	-	-	-
HE32	-	-	4	1	-	-	-	-	-	-	-	6
HE33	-	-	1	4	-	-	2	-	-	-	-	6
HE34	-	-	-	-	-	-	1	-	-	-	-	1
HE37	-	-	3	2	-	-	2	2	-	-	-	6
HE39	-	-	1	-	-	-	-	2	-	-	-	1
HE40	-	-	-	1	-	-	-	1	-	-	-	-
HE41	-	-	-	-	-	-	-	-	-	-	-	-
HE42	-	-	2	-	-	-	-	-	-	-	-	-
HE43	--	-	4	8	-	-	4	3	-	-	-	1
HE46	-	-	-	-	-	-	-	-	-	-	-	-
HE47	-	-	-	-	-	-	-	1	-	-	-	1
SM6	-	-	-	1	-	-	-	1	-	-	-	2
SM7	-	-	-	1	-	-	-	-	-	-	-	-
SM8	-	-	-	3	-	-	-	-	-	-	-	2
SM9	-	-	-	-	-	-	-	-	-	-	-	7
SM10	-	-	13	16	8	1	19	20	2	4	-	19
SM12	-	-	-	-	-	-	-	-	-	-	-	-
SM13	-	-	-	3	-	-	-	-	-	-	-	-
SM15	-	-	2	2	-	-	-	-	-	-	-	6
SM16	-	-	Not Classified			-	-	-	-	-	-	-
SM18	-	-	-	-	-	-	-	-	-	-	-	2
SM19	-	-	-	-	-	-	-	-	-	-	-	1
SM20	-	-	1	1	-	-	-	-	-	-	-	1
SM21	-	-	1	1	-	-	-	-	-	-	-	1

Nail Punctate	Tool Punctate	Weches Punc-tate Incised	Pinched	Brushed Bowls	Bullard Brushed	Brushed Body	Plain	TOTAL
-	2	-	-	-	-	12	30	54
-	-	-	-	-	-	1	7	8
-	-	-	-	-	-	1	58	67
-	-	-	-	-	-	3	73	82
4	-	-	1	-	-	7	150	182
-	-	-	-	-	-	2	1	3
-	-	-	-	-	-	-	1	1
-	-	-	-	-	-	-	7	12
-	-	-	-	-	-	-	6	9
1	-	-	-	-	-	6	19	26
2	-	-	-	-	-	2	20	24
2	-	-	-	1	-	41	67	122
-	-	-	-	-	-	52	55	120
-	-	-	-	-	-	-	7	9
1	-	-	-	-	-	37	29	82
1	1	-	1	-	-	24	19	49
1	-	-	-	-	-	4	13	20
-	-	-	-	-	-	8	16	24
-	-	-	-	-	-	4	8	14
2	-	-	-	-	-	24	51	97
-	-	-	-	-	-	-	1	1
-	-	-	-	-	-	3	6	11
-	-	-	-	-	-	11	9	24
-	-	-	-	-	-	6	14	21
-	-	-	-	-	-	13	5	23
-	2	-	-	-	-	10	82	101
30	11	2	2	-	7	168	208	530
-	-	-	-	-	-	-	1	1
-	-	-	-	-	-	13	16	32
-	-	-	-	-	1	60	43	114
-	-	-	-	-	-	-	-	2
1	-	-	-	-	-	-	20	23
-	-	-	-	-	-	3	3	7
1	-	-	-	-	-	3	8	15
-	-	-	-	-	-	26	12	41

	Engraved							Incised				
	Sanders	Holly	Poyner	Misc.	Neck Banded	LaRue Neck Banded	Zoned Punctate	Hachure	Davis	Kiam	Maydelle	Misc.
SM22	–	–	–	1	–	–	–	–	–	–	–	2
SM23	–	–	–	–	–	–	–	–	–	–	–	1
SM24	–	–	–	3	–	–	–	–	–	–	–	5
SM25	–	–	–	–	–	–	–	–	–	–	–	–
SM26	–	–	–	1	1	–	–	–	–	–	–	–
SM27	–	–	–	–	–	–	–	1	–	1	–	1
SM28	–	–	–	2	–	–	1	–	–	–	–	1
SM29	–	–	2	1	1	–	–	4	–	–	–	1
SM30	–	–	–	–	–	–	–	–	–	–	–	2
SM31	–	–	–	1	–	–	–	1	–	–	–	1
SM32	–	–	–	–	–	–	–	–	–	–	–	–
SM34	–	–	3	–	–	–	–	–	–	–	–	–

Nail Punctate	Tool Punctate	Weches Punctate Incised	Pinched	Brushed Bowls	Bullard Brushed	Brushed Body	Plain	TOTAL
-	-	-	-	-	2	19	13	37
-	-	-	-	-	1	7	4	13
-	-	-	-	-	-	38	33	79
-	-	-	-	-	-	2	2	4
-	3	-	-	-	-	18	9	32
-	1	-	-	-	1	19	48	72
2	1	-	-	-	1	43	47	98
1	-	-	-	-	1	24	23	58
-	-	-	-	-	-	29	19	50
1	-	-	-	-	-	16	17	37
-	-	-	-	-	-	8	10	18
-	-	-	-	-	-	-	4	7

shamans; and (5) smoking by elders, "captains", shamans and other officials (unspecified) on the evening of the September harvest ceremony, apparently at the chief's residence (Swanton 1942: 158-227).

Social correlates of pipe smoking can be summarized as follows: (1) pipes were smoked by adult males; (2) smoking was part of a validating ritual signifying acquisition or perpetuation of status — chief, religious practitioner, or warrior; (3) the practice was part of commensality and ritual effecting a bond between villages, tribes, or European representatives; (4) smoking took place in the presence of congregations of varying sizes but within a permanent village with established ritual localities; and (5) associated feasts required a relatively large supply of available food.

From this we should expect pipes to occur in permanent village sites or ceremonial locations in association with village sites at which permanent continuous residence is indicated by a concentration and variety of activities.

CONCLUSIONS AND RESEARCH DIRECTIONS

The data gathered in this survey have been used to isolate patterns of settlement and relate these patterns to the environment of the upper Neches River. While new data have been gathered during the survey, and distribution of sites tends to support some interpretations of prehistoric settlement systems, this report is intended to serve as a foundation for further research.

The purpose of excavation will be to test a series of hypotheses concerning settlement in the upper Neches which have been implicitly or explicity posed in the survey report.

1. In the earliest period of occupation of the upper Neches it was visited intermittently by small hunting parties whose total exploitive territory is not included in the reservoir. Two sites with Archaic components have been selected for excavation to further define the activities of these early occupations. It is expected that midden deposits will be lacking as will concentrated and localized deposits indicating camp floors. Tools other than those associated with hunting and tool manufacture will be absent or minimal. Nonlocal flint is expected to appear in greater frequency in the Archaic components than in Caddoan components and sites.

2. Caddoan occupation of the upper Neches represents a shift in settlement to small economically self-sufficient swidden villages whose extent of social interaction was markedly more limited than

that of early Caddo nuclear centers.

Earliest Caddoan occupation of the upper Neches consists of small widely-scattered sites, possibly economically independent, but probably with social ties to distant settlements. Settlements to which the small Alto Focus cluster may have been related include settlements across the river with which the multiple burials are presumed to have been associated: a mound site on Caddo Creek, 6 miles south; the Pace McDonald Site, 25 miles south; or the George C. Davis Site, 50 miles south. The first objective of salvage excavation is to determine if Alto Focus sites in the reservoir represent permanent or seasonal occupation.

3. Excavated Frankston Focus sites are expected to provide evidence for assigning sites to one of the elements of the settlement system abstracted from Hasinai data. Sites selected include base settlements, camps or settlements and hunting/gathering stations. Ethnographic equivalents are hamlets, fishing camps or hunting camps. Strategy for excavation and analysis of these sites is to be based on the contrasting models summarized below:

Hamlets	*Seasonal Camps*
Direct or indirect evidence of structures.	No evidence of structures.
Concentrated and multi-activity debris and artifacts, including midden, chipped stone tool debris, stone tools, tool repair, cooking and storage.	Thinly spread debris, from intermittent occupation, with chipped stone tools and tool manufacture debris the primary stone artifacts. Pottery limited in numbers.
Faunal remains representing year-round hunting, mussel collecting and fishing.	Limited faunal remains, biased toward spring and summer fishing or fall and winter hunting.
Variety of forms in all tools with artifacts representing variety in activity-group composition. Evidence of sex age group aggregations in ritual.	Limited variety in tools and tool forms, indicating restricted task group.

4. If Caddoan hamlets and villages can be defined ar-

cheologically, a corresponding community of related and cooperating females can be determined as micro-traditions in pottery decoration. This does not require that strict matrilocality is assumed, only that a stable and cooperating task group of related females is characteristic of the base settlement.

Recent work in the Midwest (Deetz 1965) and the Southwest (Longacre 1970) has pioneered the use of ceramic attributes as a means of identifying matrilocal segments of a single community. Although Caddoan villages present a different type of community structure, a similar approach is applicable in the study of settlement change in the upper Neches. Such ceramic studies should help clarify the change in community structure accompanying the Gibson-Fulton transition.

Woodall (1969) has recently designated two prehistoric tribes in the upper Neches on the basis of ceramic similarities between sites in two areas of the river valley. The division between these two tribes lies a short distance north of Saline Creek. Pottery collected during survey has not been analyzed by attributes which permit evaluation of Woodall's model, and relatively few sites have been located in the area of his northern tribe. Attribute analysis for excavated sites is proposed for a test of the hypothesis that underlies Woodall's work — that social distance correlates with geographical distance as an expression of community autonomy among the prehistoric Caddo.

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As in any archeological report, this is the product of cooperation and work of a number of people who deserve as much credit as the author. The 1969 season's work in Lake Palestine was directed by S. Alan Skinner, research archeologist at Southern Methodist University. Alan and his assistant, James Baker, directed most of the survey and test excavation. During the 1970 season, the author was assisted in additional survey by E. Pierre Morenon, graduate student in anthropology at Southern Methodist University.

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BOOK REVIEW

The Harlan Site, CK-6, A Prehistoric Mound Center in Cherokee County, Eastern Oklahoma. Robert E. Bell. Oklahoma Anthropological Society, Memoir No. 2, January, 1972. 266 pp., 57 plates, 17 figures, 15 tables.

The Harlan Site was a major ceremonial center and settlement of the Caddo Indians, principally between A.D. 950 and A.D. 1250. With an area of twenty to twenty-two acres, several mounds, several houses and hundreds of burials, the site is very complex. Seven mounds were excavated. Among them there were three burial groups, one series of superimposed houses, one single house and one ceremonial mound. In addition, single houses were cleared in three other, non-mound situations and other areas were explored. In spite of the number of houses, debris from tool making and general living is scarce.

Excavations began in 1949 as a salvage project of the Fort Gibson Reservoir and were completed in 1958. Only those who have directed large salvage programs can appreciate the tribulations of large quantities of field data together with insufficient funding. The usual out is to publish a sloppy report. Dr. Bell has certainly not done that. Indeed, I find the format and editing to be most excellent.

Bell reports the site in terms of activity units. These are areas in which the Indians, not just the archeologists, were busy. In other words, a unit is a mound or a house and represents a universe. In each of these (mounds, houses, or burial areas) he discusses the stratigraphy, the artifacts and the burials when present. There are some forty Carbon 14 dates from the site. These seem to be an adequate sample and to have internal consistency.

Shortcomings of the effort are in the poverty of data on physical anthropology and diet, both due to poor preservation of bone material in the soil. Because Harlan was primarily a ceremonial center, there is not a great amount of information on domestic affairs, but what emerges is good solid material on architecture, stone tools and ceramics.

The Harlan Site is the only published report, to my knowledge, that has a reasonable balance of data on mound construction, domestic structures, artifacts and culture change. Bell does a thorough job on temporal change at the site using his stratigraphic interpretation together with radiocarbon dating. Because of this balance, it will be the descriptive monograph on the Gibson Aspect, if not all of the northern prehistoric Caddoans.

The Harlan Site is not a trip with the new archeology; but who was doing new archeology between 1949 and 1958? There are, however, some thoughtful conclusions. Among them the reader will find a gentle reminder that changing the terminology of time-space divisions does not solve the problem of cultural classifications based on social groupings.

In summary, this is a fine report, well presented and well illustrated. If it does not settle Caddoan problems, it does present data and context with which to build a better understanding.

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Information for Contributors

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