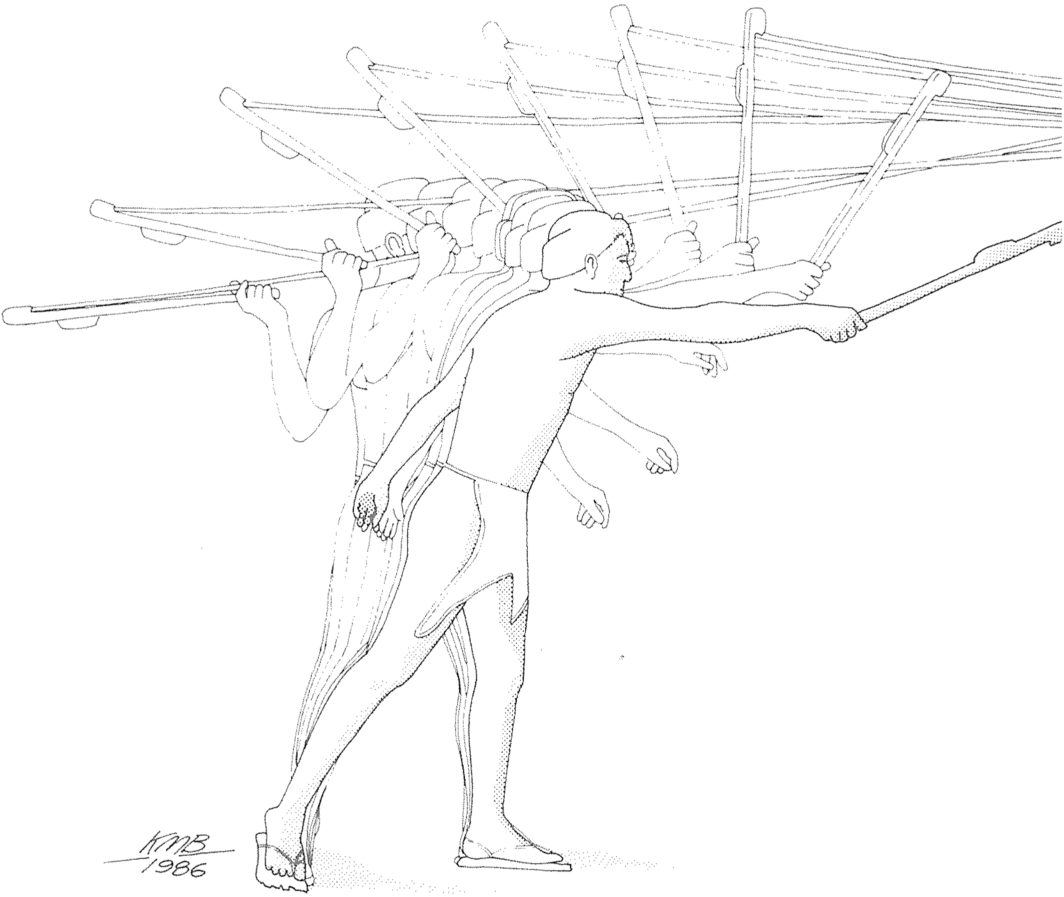
BULLETIN OF THE TEXAS ARCHEOLOGICAL SOCIETY



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TEXAS ARCHEOLOGICAL SOCIETY

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

The *Bulletin* is published annually for distribution to the members of the Society. Opinions expressed herein are those of the writers and do not necessarily represent the views of the Society or editorial staff.

Officers of the Society 1984–1985

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Dedication

This volume of the *Bulletin* is dedicated to Thomas N. Campbell in appreciation of his many contributions to the Society, Texas archeology, and the ethnohistory of southern Texas. From valedictorian of the graduating class of the Munday, Texas High School in 1925 to Professor Emeritus at The University of Texas at Austin since 1978, Tom Campbell has distinguished himself as a student, teacher, scholar, and individual.

He has three advanced degrees in Anthropology: from The University of Texas, a M.A. (1936), and from Harvard University, a second M.A. (1940) and, after interruption for military duty, a Ph.D. from Harvard (1947). A member of TAS since 1938 and a Fellow since 1962, Tom Campbell has served the Society as a Regional Vice President (1947–48, 1952–56), Editor (1958–61), Vice-President (1963), and President (1964). He also has edited *American Antiquity,* the journal of the Society for American Archaeology (1962–66), the *Texas Journal of Science* (1953–56), and, in his always helpful manner, innumerable student papers.

A popular and much respected teacher at UT Austin, Tom Campbell taught his first class as a graduate student teaching assistant in 1934 and continues active today as a special advisor. He also continues his long and productive career in research. Among his many notable contributions are co-authorship (with J. Charles Kelley and Donald J. Lehmer) of the first truly scientific archeological study in Texas, *The Association of Archaeological Materials with Geological Deposits in the Big Bend Region of Texas,* published by Sul Ross in 1940. His reports of sites on the Texas coast, written in the characteristically clear Campbell style, stand as major sources of information for the archeology of the Western Gulf coast. They include four published in the Society's *Bulletin:* the Johnson site in Volume 18, the Kent-Crane site in Volume 23, sites on five islands in Laguna Madre in Volume 27, and (with Jack Q. Frizzell) the Ayala site in Volume 20. Since retiring from full-time teaching in 1978, he has been devoting his attention to a long-time interest, ethnohistory. The results are impressive, for he has unraveled much of the confusion surrounding the numerous, but little known, Indian groups in south Texas, as well as provided researchers with models of how important tidbits of information can be wrestled from early documentary sources. Being a modest man, Tom Campbell might deny this and would probably make some humorous, but relevant remark, about how much remains to be done.

Dee Ann Story

Contents

The Atlatl Assessed: A Review of Recent Anthropological Approaches to Prehistoric North American Weaponry

D. Bruce Dickson

ABSTRACT

This paper reviews recent anthropological analyses of a basic tool in the technical inventory of the prehistoric peoples of North America: the *atlatl* or spearthrower. The *atlatl* is described, its major variant forms defined and the areal distribution of these forms discussed. Experimental studies of *atlatl* performance are reviewed with special attention paid to the contribution of weights or "bannerstones" to that performance. Ethnographic examples of *atlatl* use are noted. The general replacement of the *atlatl* by the bow-and-arrow in North America is considered with particular reference to the reasons for that replacement and for the retention of the *atlatl* as a special purpose tool in some areas. The change in projectile point size occasioned by that replacement is examined. Evidence of the ritual and symbolic retention of the form of the *atlatl* subsequent to its functional supercession by the bow-and-arrow is noted.

INTRODUCTION

Traditionally, anthropologists have approached technology and material culture in formalistic ways; they have undertaken taxonomic or classificatory studies, plotted spatial and temporal distribution patterns or focused on changes in form and distribution over time (cf., Lane Fox 1858, 1875; Krause 1902, 1905; Cressman and Krieger 1940; Kellar 1955; Oswalt 1973, 1976). The emerging interest in "cultural ecology" in recent years, however, has led anthropologists generally to turn their attention from mere formal studies and to focus instead on the cultural strategies developed by human groups to accommodate or adapt themselves to their environments. As a consequence, anthropologists concerned with tools and technology have attempted to broaden their understanding of the role of these phenomena in human adaptive strategies. To effect this broadening, some scholars have attempted to assess tool function, performance or patterns of wear through the experimental replication of prehistoric tools or techniques (e.g.

Semenov 1964; Ahler and McMillan 1976; Hayden 1979), or by close observation of living practitioners of ancient arts (e.g. Clark 1952; Gould 1969, 1978; Yellen 1977; Binford 1978). Far less commonly, scholars have examined the image or role of tools and technology in the symbolic system or mental universe of their users. The "anthropocentric perspective" taken by Hall (1977) is a prime example of this last approach.

This paper reviews some recent applications of these various approaches to the analysis of a basic tool in the technological inventory of prehistoric North American aboriginal peoples: the *atlatl* or spearthrower. In doing so I hope to present an overview of the anthropological study of an important aspect of North American material culture.

The *Atlatl* Described: The Formal Definition of the Tool and Its Major Variant Types

Although generally known to Americanists as the *atlatl,* that rudimentary tool for increasing the propulsion of aboriginal spears or darts has been variously referred to in the literature by a host of other names. A list of alternative terms for the weapon would have to include throwing board, throwing stick, dart thrower, spear-sling, hand board, spear-thrower (Howard 1974: 102); the Australian aborigine name, *wommera* (Coon 1976: 97); the French *propulseur* or *propulseur a crochet* (de Mortillet 1891); the German *Wurfbrett* (Seler 1890, 1892), *Wurfstock* (Uhle 1888), *Wurfholz* (von Luschan 1896), *Speerschleuder* (Spratz 1956) and the most Teutonically scholastic expression *schleudervorrichtungen für Wurfwaffen* (Krause 1902), which translates literally to "sling contrivances for projectile weapons." Equally exotic are the 16th and 17th century Spanish labels such as *tiradera* (Noguera 1945), *bohordo y amiento* (Swanton 1938: 357), *lanzadardo* and *estolica* (Massey 1961: 82). According to Massey, the last term is an hispanicization of a South American Indian name for the weapon. Of course, the most widely accepted word, *atlatl,* is derived from the Indian language *Nahua,* and refers to the military weapon responsible for what Brundage (1972) aptly calls "the rain of darts" encountered by the Spanish conquistadors in their assault on the Aztec empire.

Whatever one choses to call it, the tool consists of two basic parts: (1) a stick or board generally less than two feet in length equipped with a notch or hook to engage a projectile shaft and (2) a "dart" or spearshaft generally 50 to 70 percent longer than the board which engages and cradles it (Peets 1960: 108–110). For consistency, we shall refer to both parts of the tool collectively as the *atlatl* and its two constituent parts as the throwing board and dart or dartshaft, respectively. The *atlatl* is used as follows:

> These two elements are held in the thrower's hand with the projectile in a superior position. the long axis of both being approximately parallel. The spear is steadied with the aid of the fingers and sometimes rests on the knuckles. Motion is imparted

> by an overhand throwing movement. A sharp snap of the wrist at the moment of release initiates the independent flight of the dart. The spearthrower remains in the hand of the user (Kellar 1955: 283).

The throwing board is generally made of a single, solid piece of wood which ranges in cross-section from round to oval or rectangular in shape. The proximal end of the throwing board is generally fashioned into a hand grip of some kind while the distal end is modified to accommodate the butt of the spear or dart. Thus, as Cressman and Krieger (1940: 22) note:

> . . . *atlatls* may be described according to three main criteria: (1) the general shape and proportions of the body shaft, (2) the mechanism for engaging the projectile, and (3) the provision for gripping.

These authors go on to state that, throughout the world, a "great variety of means (are) employed to satisfy these three requirements." However, from the standpoint of classification, variation in their second criteria, "the mechanism for engaging the projectile," has been considered most important. For example, Krause (1902), following von Luschan (1896), states that throwing boards can be sorted into three basic classes worldwide based on the shape of the distal end: the male, the female, and the "hybrid" (*Zwitterhaften*) (see Figure 1). This latter term has generally been translated as "mixed" (cf., Cressman and Krieger 1940; Kellar 1955: 282; Mildner 1974: 7) or "compound" (Baker and Kidder 1937: 52) in English.

A "male" throwing board is characterized by a projecting hook or spur at its distal end. The butt of the dartshaft, which is often grooved or indented to receive the spur, is placed against this projection when the dart is cradled on the throwing board prior to being thrown. Such hooks are often carved from a separate piece of material and then fastened to the throwing board (see Hester 1974a, b). Wood, bone, stone, horn and antler were commonly used but Metraux (1949: 245) notes that such hooks were also made of shell and copper. Alternatively, both hook and throwing board may be fashioned from a single piece of wood. Mildner (1974: 19) refers to separate hooks as forming the "attached" type and to those carved directly on the throwing board as "integral" hooks. Based on existing archeological evidence, Mildner (1974: 19) gives temporal primacy to the attached form, at least in the Great Basin, but he notes that:

> Webb (1950: 347) has suggested that the integral (wooden) spur was later replaced by attached spurs. This development would allow for the continued use of an *atlatl* that had a wooden integral hook broken off or given too much wear; or that it would be ultimately easier to mend an *atlatl* with a broken or loose attached spur. Strong (1969), however, has pointed out that an attached hook may have been difficult to keep immobilized after throwing several large darts (Mildner 1974: 19).

In contrast to the male type, the "female" throwing board lacks a hook or spur. In its simplest form, the female type is characterized merely by a deep groove or channel on its dorsal surface into which the dartshaft is placed. The tapered butt of the dartshaft is engaged to the throwing board by the terminus of the groove. More elaborate versions of the female type occur, however. According to Cressman and Krieger (1940: 26, 28):

> . . . in Melanesian and Micronesian weapons, the spear itself is equipped with a hook which engages the hollow at the back of the groove in the thrower. On the other hand, some Greenland specimens show a hollow cup at the back of the groove into which the spear butt fits.

As its names implies, the "hybrid," or "mixed," throwing board possesses features of both the male and female types. This variety has both groove and spur or hook (Krause 1902, 1905). However, the hooks are relatively small and generally set flush with the top of the groove on the dorsal surface of the throwing board (see Baker and Kidder 1937: 52). Often such hooks are made of a separate piece of bone that has been attached at the rear of the groove and extended forward "horizontally or at a slight upward angle to facilitate disengagement at some point in the throwing arc" (Cressman and Krieger 1940: 28).

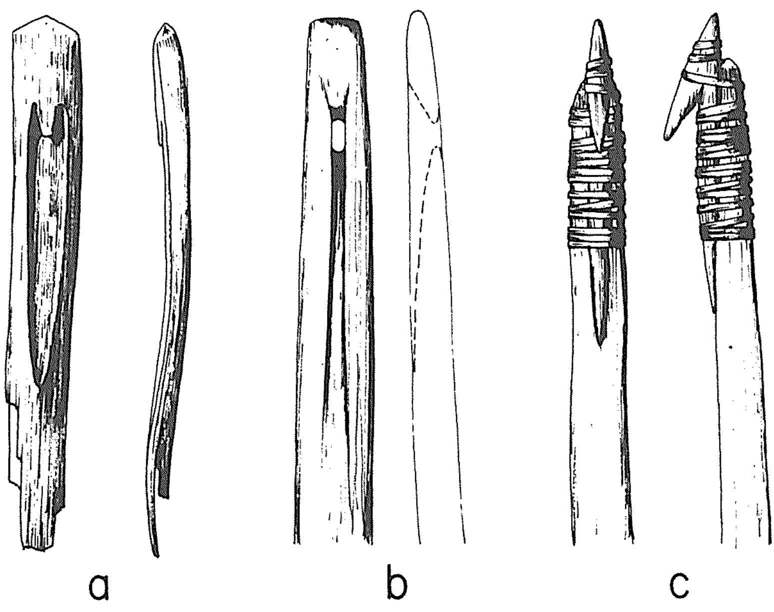

Figure 1. Three basic classes of mechanisms for engaging the dartshaft at the distal end of the throwing board. According to Krause (1902, 1905), *atlatls* worldwide may be sorted into these three classes: (a) hybrid or mixed (*Zwitterhaften*) (b) female; full perforation represented here may or may not be present (c) male with "attached" rather than "integral" spur.

The proximal end of the throwing board, which is gripped by the user, shows a great deal of variation as well (see Figure 2). Most commonly the proximal end of the implement is left smooth and unshaped but this is by no means always the case. According to Krause (1905: 624), to facilitate gripping, the proximal ends of Australian throwing boards are often roughened with indentations or notches or are covered with resin or gum or wrapped with cords of human hair. A similar effect was achieved through the use of wrist or hand loops made of cordage which Massey (1961: 81) reports were attached to several throwing boards recovered from archeological sites in Baja California.

A slightly more elaborate means of improving the grip of the throwing board is illustrated in Figure 2, b. On this specimen the proximal end has been shaped to fit the user's hand by carving palm-sized indentations on one or both sides of it a few inches above the butt (also cf., Krause 1905: Plate I, 16; Kellar 1955: 294, Figure 4, b-c). Often such palm-sized indentations were accompanied by a single hole drilled just above them to accommodate the index finger. Such carving and shaping of the proximal ends of the throwing boards seems to have become particularly well developed among the Eskimos of the North American arctic. A number of boards collected from the arctic in historical times are so carefully shaped and worked that, for all the world, they seem intended as tiny, surrealistic bass violas or fiddles. It was also common in the North American arctic to insert one, two or even three pegs perpendicular to the throwing board's shaft (see Figure 2, c-d). These pegs were then gripped with the fore and middle fingers (cf., Kellar 1955: 295, 303). Small shells or stones, attached to the throwing boards with resin or gum, apparently served the same purpose in Australia (Krause 1905: 621), and Ekholm (1962) has identified the U-shaped shell or stone objects found throughout northern Mexico and the southwestern United States as "fingerloops" which were formerly lashed to the proximal ends of throwing boards there. Cord or sinew was also used to provide southwestern throwing boards with handles (Kellar 1955: 303; see Figure 2, f). The tighter hold on the throwing board, which such pegs, shell or stone objects, or cords or sinew provided, was also obtained by widening the proximal end of the board, drilling finger holes directly through it and then narrowing the stick below the holes to fit the palm of the hand (see Figure 2, e). This latter form of *atlatl* grip occurred widely in the New World (Nuttall 1891: 203, Plate II, 1-20; Krause 1905: Plate IV; Metraux 1949: 246, Peets 1906: 109, Figure 1, c).

In addition to the wide variation in the treatment of the proximal end or grip, throwing boards vary in the degree to which they exhibit nonfunctional decoration. Certainly the most elaborate decorations are found on the throwing boards of the Aztecs. A particularly impressive example of such decoration is located in the Museum of Anthropology and Ethnology of Florence (Defuentes 1963: Illustration 17). The proximal end of this specimen is smooth and exhibits no modifications for gripping but the medial portion of the throwing board all the way to its distal end is covered with intricate carved and gilded representations of what appear to be warriors and/or deities set within complicated fret work. It is intricate decoration of this nature that no doubt led Cressman and Krieger (1940: 32) to the conclusion that many Aztec and Maya *atlatls* were too elaborate for practical use and served instead as emblems of rank. Perhaps a singular lack or "practical purpose" also led to the crafting of the Ecuadorian *atlatl* described by Metraux (1948: 245) as "covered with artistically-wrought gold plate."

Less spectacularly decorated *atlatls* are found in North America. Read (1891, cited in Kellar 1955: 300) illustrated a throwing board collected from the Northwest Coast of North America. Typical Tlingit animal motifs had been carved on this specimen and then inlaid with Haliotis shells. Carved *atlatl* throwing boards are also known from southeastern North America. Cushing recovered two such specimens at the Key Marco site in Florida where,

> . . . the remarkable preservation of normally perishable artifacts has given us one *atlatl* with its spur carved as a rabbit and another with the handle grip in the outline of the head and neck of a roseate spoonbill's eyes (Cushing 1896: Plate XXXII-4, cited in Kehoe, Foster and Hall, n.d.: 17–18).

Less sophisticated decorations are known from western North America. Southwestern Basketmaker throwing boards recovered from dry caves are often adorned with what appear to be stone and feather amulets (Guernsey and Kidder 1921: 80; Palter 1976: 505; McGregor 1965: 182), while an *atlatl* throwing board from Roaring Springs cave in Oregon had been painted with red ochre (Cressman and Krieger 1940: 38).

The *Atlatl* Apportioned: A Brief Overview of the Spatial and Temporal Distribution of the Weapon

No attempt will be made here to exhaustively survey the historic and prehistoric distribution of the *atlatl*. Readers interested in such surveys are urged to consult the works of Krause (1905), Cressman and Krieger (1940), Kellar (1955), Spratz (1956) and Driver and Massey (1957). For our purpose it will be sufficient to note that the *atlatl* appears to be an exceedingly old weapon which was present in Europe by at least the end of the Upper Paleolithic period. According to Campbell (1976: 398), the oldest definite evidence of the *atlatl* comes from La Placard cave where the Magdalenian levels produced fragments of a "male" type throwing board hook dated to around 14,000 B.C. However, other scholars are willing to attribute far greater antiquity to the weapon and conclude that it was present in Europe at a much earlier time in the Upper Paleolithic period (Krause 1905: 124; Cressman and Krieger 1940: 36; Massey 1961: 81). Actually, if the tanged points made on Levaillois flakes in Mousterian tool inventories were meant to be hafted on *atlatl* darts, the tool may have appeared as early as 80,000 or more years ago.

Of course the place (or places) of origin of the *atlatl* are unknown. However, based on the widely-scattered locations of the peoples who have retained the tool into historical times, we are probably safe in concluding that the use of the *atlatl* spread broadly until, by the end of the Pleistocene or beginning of the Holocene, it had become an important element in the technological inventory of peoples over much of the Old World.

The recovery of *atlatl* parts in association with extinct ground sloth bones and feces at Gypsum Cave, Nevada, led to the conclusion that the weapon was

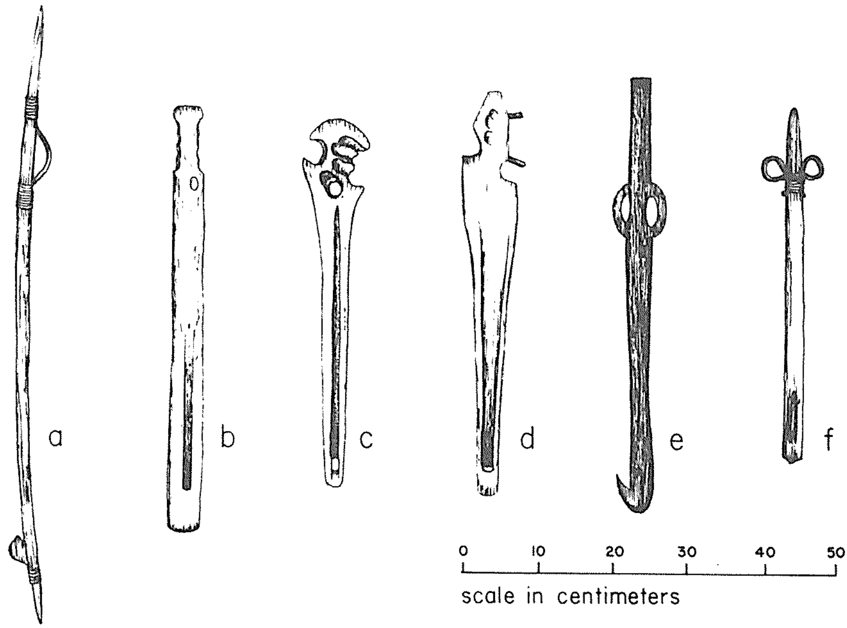

Figure 2. Some variations in the grip or proximal ends of *atlatl* throwing boards: (a) single bark loop attached with sinew wrapping set at right angles to the plane of the "attached" type male *atlatl* spur or hook and to one side of the shaft, Las Palmas culture, Baja (after Massey 1961: 86); (b) Eskimo throwing board in which the proximal end has been slightly shaped and narrowed to accommodate the palm of the user and a hole has been drilled for his forefinger (after Kellar 1955: 294, Figure 4c); (c) front view of another Eskimo throwing board showing the shaft groove for aligning the dart and the carefully carved grip with a notch for the thumb and a hole for the forefinger (after Cushing 1895: 339, Figure 29); (d) somewhat less elaborately carved Eskimo throwing board with pegs inserted in the proximal end for the forefinger and little finger and a carved indention for the thumb (after Krause 1904: Plate II, 27); (e) modern Yucatecan throwing board with two carved wing-like extensions which have been perforated to accommodate the user's first two fingers (Peets 1960: 109, Figure 1c); (f) southwestern throwing board from Grand Gulch, Utah, with rawhide cord or thong grip. A single piece of rawhide was folded and a hole drilled through it. The throwing board was then forced into the hole until the rawhide came to rest in a shallow groove carved on the shaft to receive it. The ends of the rawhide were then pressed forward against the edges of the shaft and fastened with sinew to form the loops (after Pepper 1905: 110–111).

also present in the New World during the Late Pleistocene (Harrington 1933; Kellar 1955: 305). However, recent radiocarbon determinations have placed the age of these specimens at 900 and 400 B.C. (Heizer and Berger 1970; Aikens 1978: 146). Nonetheless, the Late Pleistocene points of the Paleo-Indian tradition, such as Sandia, Clovis and Folsom, could surely have served as effective *atlatl* dart tips.

According to Cressman (1977: 105), the earliest definite archeological record of the *atlatl* in the New World comes from Fort Rock Cave in Oregon. At this site, an "attached" type *atlatl* spur was recovered and dated to approximately 8,500 years ago. Evidence for the prehistoric use of the *atlatl* in North America is best in the Southwest and Great Basin where the special conditions found in dry caves there have resulted in the preservation and recovery of numerous complete (or nearly complete) specimens of the weapon (Mildner 1974). In addition, the presence of the *atlatl* at least during the Archaic period in eastern North America is well documented from a variety of grave lot contexts (e.g. see Tuck 1970; Webb and Haag 1939; Webb 1946). In the absence of actual *atlatl* remains, the presence of the weapon in other parts of North America is generally inferred on the basis of projectile points present at Ventana Cave in southern Arizona by about A.D. 1. Among peoples of the Anasazi tradition on the Colorado Plateau, the *atlatl* appears to have remained the primary weapon until near the end of the Basketmaker III or Modified Basketmaker period between about A.D. 500 and A.D. 700 (Lipe 1978: 369). In the Trans-Pecos region on the eastern margins of the Southwest, Kelley (1950: 72) reports that the bow-and-arrow did not appear until around A.D. 900.

In the midwestern United States, this technological transition seems to have taken place sometime after A.D. 400 (Ford 1974: 402) but may have occurred later in the Northwest, where according to Griffin (1978: 254), the *atlatl* did not give way to the bow-and-arrow until sometime between A.D. 700 and 900. Ford (1974: 402) goes so far as to suggest that the replacement of the *atlatl* by the bow-and-arrow may have been an important factor in the breakdown of the Hopewell Interaction Sphere in the eastern United States. He proposes that the greater efficiency of the bow as a military weapon may have heightened conflict and reduced peaceful interaction and in turn led to the Hopewell decline. Alternatively, he suggests that the presumably greater hunting effectiveness of the bow may have allowed local groups to exploit sufficient wild resources on their own without reliance on the regional exchange of foodstuffs presumed to have been an important function of the Hopewell Interaction Sphere. Muller (1978: 302), however, feels both these theses to be too simplistic.

Despite the widespread acceptance of the bow-and-arrow in place of the *atlatl*, the replacement was not absolute in either the New World or the Old. Perhaps due to their relative isolation, the peoples of Australia, New Guinea, Micronesia and Melanesia retained the *atlatl* into historical times (Krause 1905; Kellar 1955; Cressman and Krieger 1940). Likewise, certain Arctic and Subarctic peoples, including the Aleuts and some Eskimo groups, continued to use the *atlatl*. However, northern peoples generally either possessed the bow-and-arrow as well, or at least were familiar with it. They seem to have retained the *atlatl* primarily for use in sea-mammal hunting and water fowling since, in these contexts, the *atlatl* has a number of advantages over the bow-and-arrow, which we discuss below.

The *atlatl* was also retained by peoples at the opposite end of the scale of social complexity from the Eskimo: the civilized societies of southern and central Mesoamerica such as the Aztecs and the Toltec-Maya. Among the former peoples, the *atlatl* seems to have served as a kind of artillery weapon used to launch heavy spears in close support of phalanxes of massed infantry (Nuttall 1891; Driver 1961: 380). On the margins of Mesoamerica, simpler peoples are also reported to have been using the *atlatl* at the time of the Spanish conquest. Massey (1961) found reference to the weapon in use in Baja California during the 17th century, Heizer (1938) reports its historic use in the Santa Barbara channel area of southern California and throwing boards dating to the 15th century have been recovered at the Key Marco site in coastal Florida (Gilliland 1975: 38). In addition, Swanton (1938) reports that the DeSoto expedition was attacked by Indians using *atlatls* on the Gulf Coast near the mouth of the Mississippi River. It is uncertain whether or not the presence of the *atlatl* in these four coastal settings indicates that the weapon was retained there for specialized use in marine hunting, as it was in the arctic, or whether it was abandoned in those localities also with the coming of the bow-and-arrow and only later reintroduced by diffusion from the high cultures of nearby Mesoamerica (cf., Sturtevant 1960: 31; Kellar 1955: 335). In this context it is interesting to note that both the *atlatl* darts used against DeSoto's men on the Gulf Coast and those used against Cortez's army in Mexico were reported to have been mounted with three-pronged dart points (Swanton 1938: 358; DeFuentes 1963: 169).

Perhaps an analogous situation existed in South America. There also the *atlatl* was reportedly used by the Inca and other civilized peoples as a military weapon as well as by surrounding societies of markedly lower levels of social and technical complexity in Ecuador and northwest Brazil as far south as the Rio de la Plata (Metraux 1948: 244–245, 247; also cf., Cressman and Krieger 1940: 28; Uhle 1909). Despite these survivals or specialized retentions, the bow-and-arrow had largely supplanted the *atlatl* in North America by historic times. By then, as Driver (1961: 58) notes: ". . . the bow-and-arrow was almost everywhere the chief weapon used. . . . The spearthrower is reported by European observers only in the far north and extreme south with a huge gap in the middle."

The *Atlatl* Observed: Experimental Assessments of *Atlatl* Performance.

Although most scholars would agree that the purpose of the *atlatl* is to increase the amount of "thrust" or propulsive force, which a user can put behind a spear or dart, they have disagreed as to precisely how this increase was effected. According to Howard (1974: 102),

> . . . archaeological literature commonly attributes increased leverage and centrifugal force as the primary factors in the thrust provided by the *atlatl*. Actual ex-

> perimenters have enforced this consensus by implying that the *atlatl* raises the dart, or spear, in a high arc above the thrower and flips, whips, or otherwise performs in a catapulting fashion.

Howard's own experimental work led him to a different conclusion. According to him (Howard 1974: 102), the function of the throwing board is merely to prolong the contact between the spearman and his missile and thus allow him to concentrate a greater percentage of the total force of his throw behind the dart. In using the throwing board, a spearman is in effect lengthening his reach and therefore applying force to the dart for a moment longer than he would be able to do with his arm alone.

Howard's interpretation receives some support from Brues (1959: 465) who notes in her classic paper, "The Spearman and the Archer," that different body morphologies are suited to different forms of weaponry. She suggests that since "the determining factor in the efficiency of the spear is the velocity with which the weapon leaves the hand," individuals with long, linear, "ectomorphic" body builds would tend to be the most effective spearmen. She too interprets the throwing board as an artifical extension or lengthening of the human arm designed to increase that velocity. Thus, according to Brues (1959: 464–465), the throwing board

> . . . affords a means of compensating for the disadvantage of a short arm in the use of the spear. Possibly it was devised as a means of adapting the spear to the use of peoples of more lateral build, who would not have been apt to have developed the spear themselves but might have received it from others. The possibility that the throwing stick represents a compromise with body build finds confirmation in the fact that the very linear spear-users of Africa generally throw the spear with the bare hands; apparently the throwing-stick has little to offer to a physique with maximum built-in speed leverages.

However, the physics of the *atlatl* are of less interest to anthropologists than the practical performance characteristics and capabilities of the weapon. Assessing the performance of the *atlatl* has been approached primarily in three ways. First, by field testing actual *atlatl* specimens (or workshop prototypes) in what has come to be called "experimental archeology." Second, by observing the rapidly diminishing ranks of living peoples who still make and use the *atlatl*. And finally, by examining historic and ethnographic accounts of aboriginal *atlatl* use.

Published accounts of performance tests with the *atlatl* begin with the work of Browne (1940), Davenport (1943), Hill (1948), Evans (1959), Peets (1960), Mau (1963), Hobbs (1963) and continue into the present with the more recent works of Spencer (1974), Howard (1974) and Palter (1976). Many of the earlier experiments were notably unsuccessful. For example, Browne (1940: 211) states bluntly that "any close degree of accuracy is impossible with the *atlatl* and the spear." Hill (1948) and Hobbs (1963) are nearly as skeptical about the accuracy and overall utility of the weapon. Since the *atlatl* has been an important part of the human technical inventory for thousands of years, we are forced by the evidence of its very persistence and ubiquitousness to conclude that it offered some advantage to its users. However, the fact that these modern scholars appear to have been unable to master the *atlatl* certainly points up the dangers and limitations inherent in any such tests. Lacking living mentors, the experimenter is forced in a matter of weeks or months to teach himself a skill, the mastery of which may have taken the people who actually used the weapon years of constant and closely-supervised training and practice. Given such a limitation, can we ever hope to simulate the actual performance capabilities of such a prehistoric tool? Probably not, but the tests of those scholars who have managed to obtain more positive results than Browne and company give us at least some indication of the *atlatl's* ancient capacities.

Such capacities can be measured along three lines: maximum distance, accuracy and penetration. Comparing the results of his own experiments with those of some of his predecessors, Spencer (1974: 52) states,

> . . . my viable dart throws averaged about 50–60 yards (46–55 meters) in distance. I feel better distances are possible. Browne (1940) mentions distances of 81 yards (74 meters). Hobbs (1963) reports average distances of 38.6 yards (35 meters). Hill (1948) records 46.6 yard (43 meters) average distances for what he calls "medium weight" darts. All these distances are different and doubtless different types of *atlatls* and darts were used.

In addition, Peets (1960: 109) reports distances averaging slightly more than 57 meters (62 yards) for an unweighted throwing board and Palter (1976: Figure 1, 105), who would seem to hold the World Cup for the *atlatl,* achieved tosses of around 108 meters (118 yards) with a similarly unweighted board. Howard (1974: 104) and Hobbs (1963: 6) achieved distances only about half those reported by Palter; their tosses averaged around 59 meters (64 yards) and 37 meters (40 yards) respectively. However, their experiments are perhaps more useful since they compare their *atlatl* results with the average distances they achieved with the hand-thrown spear. Howard's figures indicate that the use of the throwing board resulted in a 42 percent increase in the average distance he was able to obtain. These percentage increases are no doubt more significant indicators of the effectiveness of the throwing board than the gross distances reported by the other experimenters.

Krause (1905: 621–622) states that using the throwing board, one should be able to cast a spear three or four times further than with the bare hands. He confirms this through reference to the ethnographic literature of his time noting:

> . . . an Englishman saw a native of Port Jackson (Sidney) aiming the spear sling at a mark 276 feet (84 meters) away. While spears can be thrown 50 to 75 feet (15 to 23 meters) with the bare hands, from the spear sling they easily reach 200 to 300 feet (61 to 91 meters). Indeed, according to Clutterbuck, the Australians are said to have made even 150 yards (137 meters) with the spear sling. Whether these last state-

> ments are entirely accurate we can not decide, but one constantly sees references to great distances attained by aid of the spear sling.

Assessing the *atlatl* along the second dimension, accuracy, is a still harder task to undertake experimentally. As noted above, Browne (1940), Hill (1948) and Hobbs (1963) all find the *atlatl* to be a basically inaccurate weapon. On this point Browne (1940: 212) is most emphatic:

> I consider myself an average individual, have an expert rating with both large and small bore rifles, a few trophies from archery tournaments, but after six months of intensive practice with *atlatl* and spear I wouldn't be sure of hitting a buffalo at thirty yards once out of ten shots. With a bow, anyone can register eight hits out of ten shots at this distance and on this size target after a week's practice.

On the other hand, Evans (1959: 160) states that after a few minutes practice, "a target a foot in diameter could be pierced at 20 to 30 feet (6 to 9 meters) about four out of five times." Davenport (1943: 33) does Evans one better when he states that "in a short time I was hitting within a three-foot circle at a distance of about 80 paces." And Spencer (1974: 52) states that his "subjective opinion is that the *atlatl* and dart is a very accurate hunting weapon. . . . Accuracy with my dart and *atlatl* combination seemed best at distances of 20–30 yards (18–27 meters)." Once again, the problem of learning ancient skills by oneself (combined no doubt with the varying quality of the *atlatls* used in the experiments), makes the results of these tests difficult to assess.

At this point we are better served by turning briefly and selectively to the ethnographic record. Coon (1976: 97), for example, notes that the Aleuts of the Northern Pacific Bering Straits region used the *atlatl* in hunting from their skin boats or *bidarkas*. According to him, ". . . the early Russian accounts state that the Aleuts cast (*atlatl* darts) with deadly accuracy and killed men, animals, and birds as efficiently as the Russians could with firearms." An eyewitness account of the accuracy of the *atlatl* may be found in Foster's (1948: 107) ethnography of the central Mexican people of Tzintzuntzan. The *atlatl* was retained among these people for use in a single activity—duck hunting. According to Foster (1948: 107), large numbers of villagers gather with their canoes to take part in an annual communal duck hunt on a major lake near Janitizio. Describing the use of the *atlatl* during the hunt, Foster says that "the aim of skillful men is deadly, and literally thousands of ducks are killed on this day." The weapon is also used in the smaller-scale hunts that precede and follow this annual event. The Aleut and Mexican examples indicate rather clearly that, in the hands of an experienced hunter, the *atlatl* can be an exceedingly accurate weapon, which is probably superior to the hand-thrown spear. At least in part, this accuracy may result from the "superior grip and control of his spear" which, according to Howard (1974: 104), the *atlatl* affords its user.

Finally, penetration, the third dimension of *atlatl* performance to be discussed, is surely the crucial one for any projectile weapon. After all, whatever its range or accuracy, the extent to which the missile it projects is able to penetrate and damage the target is the final measure of the utility of such a device. Recognizing the importance of this dimension, gun and archery equipment manufacturers have developed a number of techniques for measuring relative projectile penetration. Although some of these techniques have been used by Pope (1923) in appraising aboriginal arrow penetration, none of the experimental studies of *atlatl* performance have made use of them. In fact, of all the *atlatl* experimental studies cited above, only Hill (1948) and Cole (1972) are at all concerned with this aspect of dart effectiveness. Hopefully, future performance studies will remedy this deficiency. Meanwhile, lacking empirical data, we are forced to approach the problem of *atlatl* dart penetration, first through the ethnographic record, and second on theoretical grounds.

An ethnographic example of just exactly how forcefully and successfully an *atlatl* dart can sometimes puncture its target is provided by Garcilaso de la Vega, a chronicler of the DeSoto expedition in the southeastern United States during the 16th century. Describing the effect of an *atlatl* dart wound on a member of the expedition, Garcilaso relates that,

> . . . the dart of long arrow with which they wounded our Spaniard . . . had three barbs in the place of one, similar to the three largest fingers of the hand. The barb in the center was a hand-breadth longer than the two on the sides, and thus it went through the thigh from one side to the other. The two side barbs were lodged in the middle of the thigh and in the poor Spaniard's leg, because they were harpoons and not smooth points. The butchery was such that he expired before they got his wound dressed, the poor fellow not knowing whether to complain more of the enemy who had wounded him or of the friends who had hastened his death (Swanton 1938: 358).

In the same context Garcilaso notes that the *atlatl* was used against the Spanish in Peru. There, according to him, "they shoot darts with it with extreme force, so that it has been known to pass through a man armed with a coat of mail" (Swanton 1938: 358).

How is such penetration achieved? From basic physics we learn that the force with which any projectile strikes its target is a product of its mass times its velocity (Arons 1965: 127–128). Cole (1972: 1) refers to this force as the "impact pressure" of the projectile. In large measure, it is the impact pressure of the dart which determines the extent or degree of its penetration. However, as Cole (1972: 1) notes, the contact area of the projectile point and the resistance of the target material enter into this determination as well. *Atlatl* users seeking to increase the penetration and/or range of their weapon would thus have three options:

1. Increase the velocity of the dart without changing its mass.
2. Increase the mass of the dart without changing its velocity.
3. Increase both the velocity and mass of the dart.

It would appear that the velocity achieved by the dart is largely a function of the human force that can be concentrated behind it when it is thrown. If Howard (1974) is correct in asserting that the purpose of the throwing board is to prolong contact between the dartshaft and the thrower's arm, then one should be able to increase the velocity of the dart by increasing the length of the throwing board. However, there are natural constraints on such increases. Most obviously, the overall body size, reach and strength of the individual *atlatl* user would place a limit on the extent to which the throwing board would be lengthened (Davenport 1943: 34). Further, Peets (1960: 110) and Evans (1959: 160) state that the size of both the throwing board and the dart must be in proportion to one another if the weapon is to be effective. These scholars suggest a dartshaft-to-board length ratio of no less than about 3 to 1 is necessary if the balance of the weapon is to be maintained (Palter [1976: 503] denies that such a limit exists).

Increasing the mass of the dart and/or the dartshaft without changing the velocity at which it is thrown is perhaps a simpler way to increase penetration and range, but here too, physical limitations are encountered. First, one can always increase the mass of the dart by enlarging the projectile point attached to its tip. However, siliceous rock, of which most projectile points are made, tends to be relatively fragile. Although larger points may weigh more, they also are more likely to break on impact. The inconvenience of such breakage eventually would offset performance benefits. Secondly, any enlargement of the dart's mass heightens the friction and wind resistance encountered by the missile in its flight. At some point the performance benefits conferred by increased mass are negated by the decline in velocity resulting from greater friction.

The existence of these physical limitations on the expansion of the length of the throwing board and the mass of the dart were probably discovered experimentally by *atlatl* users over the course of millennia. No doubt such long-term experience also resulted in the recognition of something approximating an optimal balance between board length and dart mass. With the development and application of this balance, the maximum range and penetration capabilities of the simple *atlatl* would have been reached. Deviation from this length:mass ratio could only have resulted in a decline in performance.

At this point the matter of the tool's technological evolution may have come to rest among many *atlatl*-using peoples. I would suggest, however, that experimental efforts at improving *atlatl* range and penetration did not everywhere stop with the recognition of the optimal length:mass ratio. Instead, a new avenue of investigation seems to have begun, at least in North America. That avenue apparently involved aboriginal experiments with the use of weights or "bannerstones" to enhance the effectiveness of the *atlatl*.

The Problem of *Atlatl* Weights or "Bannerstones"

Bannerstones, or what Willey (1966: Figure 5–5, 254) prefers to call "problematical ground-and-polished stone objects," have been recovered in

North American contexts, especially in the eastern United States, virtually since the beginnings of scientific archeology there (e.g. Fowke 1896; Jones 1873; Holmes 1897). Such objects were made from a wide range of raw materials including slate, limestone, greenstone, quartzite, marble, jasper, galena, hematite and steatite. According to Palter (1976: 503), they range in weight from as little as 30 to as great as 800 grams. Bannerstones are equally variable in shape (see Figure 3). Although many are fairly flat in cross-section, they range from rectangular, oval, sub-oval, lunate, triangular, circular, to "reel-shaped" (*sic*) in plan. More bizarre cylindrical, loaf- or boat-shaped, irregular and winged forms are also commonly reported. Grooves on or holes through the objects suggest that they were hafted. Generally the flat bannerstone forms exhibit one or more holes drilled or perforated through them from front to back, while the cylindrical and winged varieties often have had holes drilled through them longitudinally. Considering the formal variety of these "problematical" objects, it is not surprising that they have been known by a great number of terms. Alternative labels include gorget, birdstone, boatstone, butterfly stone, forearm bow guard, charmstone, pendant, fishing weight as well as many others.

As these names imply, the objects have been variously interpreted as items of personal adornment or luck, bow guards, fishing gear as well as *atlatl* weights.

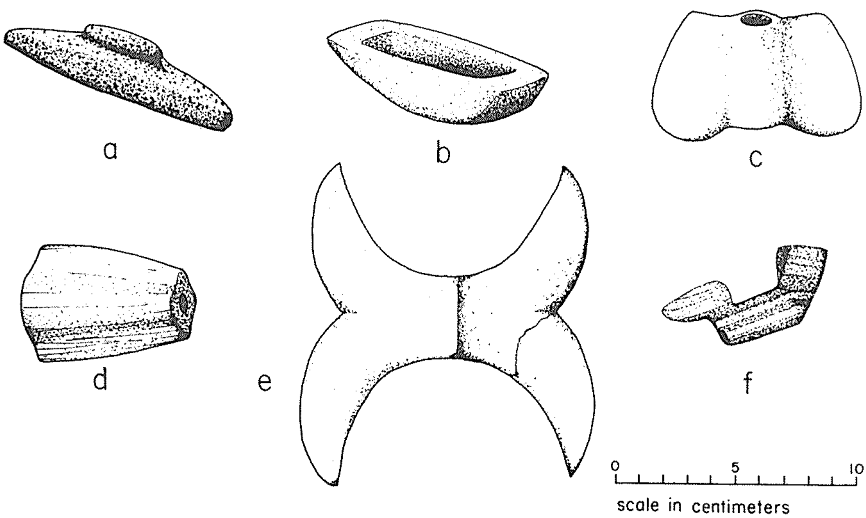

Figure 3. Six different examples of "problematic stone implements" often classed as *atlatl* weights in the eastern United States: (a) "boatstone" from Alabama (after Willey 1966: 254, Figure 5-5, d); (b) specimen from Indiana (after Jennings 1974: 144, Figure 4.7; (c-d) perforated, bannerstones from Laurentian culture, New York (after Willey 1966: 263, Figure 5-15, 11 and kk); (e) "winged bannerstone" from Archaic context in Indiana (after Willey 1966: 254, Figure 5-5 c); (f) "birdstone" from Archaic context in Indiana (after Willey 1966: 254, Figure 5-5, a).

And, Curren (1977: 97) notes, evidence for all of these interpretations have been recovered from time to time. For example, in the Southwest and Great Basin, a limited number of *atlatls* have been recovered intact from dry caves with weights still attached to their throwing boards (Mildner 1974; Hester 1974b; Guernsey 1931, Plate 50; Fenenga and Wheat 1940). However, the boat-shaped or grooved pebbles found to have been mounted on these throwing boards represent only a few of the types or classes of "problematical stone objects", which have been interpreted as *atlatl* weights. As far as the large, winged and cylindrical bannerstones of eastern North America are concerned, the evidence for their use as *atlatl* weights is much more indirect. The acceptance of the idea that they were formerly mounted on throwing boards seems to be based on two lines of evidence. First, the longitudinal and transverse holes drilled through them would appear to allow them to be so mounted. Second, as Palter (1976: 505) notes, graves excavated by Webb and Haag (1939) at the Mclean 11 site and by Webb (1946) at Indian Knoll, both in Kentucky, contained winged bannerstones apparently in linear alignment with socketed "attached type" male *atlatl* hooks and *atlatl* handles. Although the wood of the throwing boards had long since decayed, the excavators interpreted these alignments to mean that the weights were formerly mounted on them. Other alignments were also noted at the sites and alternative interpretations of the mounting of the bannerstones are possible, so more will be said of these data below.

Since the correct functional interpretation of these "problematical objects" is crucial to the remainder of our discussion, we must digress for a moment and consider the disagreement that currently surrounds the subject. This discord is perhaps well illustrated by three papers: an early work by Butler and Osborne (1959), a provocative recent paper by Curran (1977), and a spirited rejoinder to that paper by Starna (1979). Butler and Osborne (1959) define and illustrate three types of "*atlatl* weights", or bannerstones, from the northwestern United States. The three types are reproduced in our Figure 4. Note that the classes differ so widely in form that only an archeologist steeped in the literature of his profession would conlcude that such disparate objects as these were really made to serve the same purpose. In fact, even members of the archeological tribe do not entirely share Butler and Osborne's views. For example, in eastern North America, the perforated oval, circular and rectangular ground-and-polished stone objects which Butler and Osborne would surely class as "Type I *atlatl* weights" are more often interpreted as "stone gorgets" or even as "forearm bowguards" (Curren 1977: 97). In his interesting and imaginative paper, Curren (1977) adds a new interpretation by suggesting that, at least in the East, such artifacts were used as ceramic manufacturing tools. He adduces this idea largely by juxtaposing illustrations of classic Early Woodland period Adena "stone gorgets" with drawings of wooden implements commonly used by modern ceramists in decorating and shaping pottery. The formal correspondence between these two classes is striking indeed and Curren (1977: 97–99) attempts to strengthen this identification by suggesting that the appearance of stone gorgets is generally correlated with the rise of ceramic manufacture in the eastern North American archeological record.

However, in a still more recent paper, Starna (1979) strongly demurs. According to him, the formal parallel between the ancient stone gorgets and the modern ceramic shaping tools are spurious. To support his counterargument he notes that, while ancient stone plummets and modern brass plumb bobs share a formal similarity, no one is willing to conclude that the ancient tool was part of an aboriginal land-surveying complex. He further disputes Curren's suggestion of a temporal correlation between the appearance of gorgets and ceramics in the East. While conceding that data bearing on this point is not entirely clear, he notes that gorgets have been recovered in contexts, which both pre- and post-date the appearance of ceramics (Starna 1979: 337–338). Starna (1979: 338–340) prefers instead to interpret these stone objects as items of personal adornment possessing both social and religious connotations, that is, as gorgets in *sensu stricto*. He feels such an interpretation more satisfactorily accounts for the obvious effort lavished on their manufacture, their common appearance in mortuary contexts with individuals of both sexes and the fact that they are often made of lightweight material, such as copper and shell, as well as stone.

No attempt is made at resolving Curren and Starna's interpretational dispute here. Suffice to say, both their papers strongly indicate that Butler and Osborne's "Type I *atlatl* weights" may have served very different tasks. The likelihood of that being the case is further strengthened by the fact that, according to Mildner (1974: 15, 21), only Butler and Osborne's Type II and Type III *atlatl* weights have actually been recovered mounted on *atlatl* throwing boards in archeological contexts in the Great Basin and the Southwest.

Thus, clear archeological evidence exists to demonstrate that stone weights were sometimes attached to *atlatl* throwing boards in North America. This evidence comes from the western United States where a limited number of *atlatls* with such stones still attached have been recovered from dry caves. Somewhat more ambiguous evidence from graves in the eastern United States indicates at least an association between certain classes of bannerstones and *atlatls*. However, a broad range of other "problematical stone implements" have been more-or-less arbitrarily included in the functional category "*atlatl weight*" despite the fact that association between many of these forms and actual *atlatls* has been inferential, tenuous or nonexistent. Further, alternative functions for many of these stone objects are highly plausible. In other words, archeologists are unable to precisely agree on what was and what was not an "*atlatl* weight." With that rather unencouraging caveat in mind, let us turn to an examination of some recent experimental attempts at gauging the effects of weights on *atlatl* performance.

The most common approach to the problem is to assume that the weights were mounted on the *atlatl* throwing board. Palter (1976: 502) summarizes as follows the results of experiments with weighted throwing boards done by a number of scholars:

> Clayton Mau, as a result of his experimentation with a weighted spear thrower, claims that he was able to increase the range of his projectiles by between 15% and 25% (Mau 1963: 11). Orville Peets, on the other hand, concluded from similar experiments that the attachment of spear thrower weights made no appreciable difference in the average range of his tosses (Peets 1960: 109). Calvin Howard has concluded that spear thrower adjuncts are disadvantageous based upon recent experiments which revealed an 18% decrease in the range of a projectile thrown with the aid of a weighted spear thrower (Howard 1974: 104). Still another experimenter, Malcomb Hill, concluded that the addition of weights to the shaft of a spear thrower might be functional when employing light-weight darts, but he doubted their utility in the case where heavier projectiles are in use (Hill 1948: 41–42).

Hobbs (1963: 6) was able to achieve an average increase in distance of about 3.2 per cent with his radically modified, weighted "super." Unfortunately, there is not a shred of archeological evidence to suggest that an *atlatl* of Hobbs' design was ever used in prehistoric North America. Palter's experiments revealed inverse correlation existed between the weight of the various bannerstones, which he attached to the throwing board, and the distance he was able to hurl the dartshaft. The greater the weight, the shorter the toss. According to him, "the minimum weight tested which still permitted maximum efficiency comparable to the non-weighted spear thrower was 75 grams" (Palter 1976: 502). This latter conclusion corroborates the results of Spencer (1974: 52). Spencer made an exact replica of an *atlatl,* which had been recovered archeologically, with a boat-shaped weight of approximately 60 grams attached to its throwing board. In his experiments with this replica, Spencer found that the presence or absence of this 60 gram bannerstone had virtually no effect on the distances he was able to toss the dartshaft. Despite his test results, Palter (1976: 505–509) is not entirely willing to reject the notion that throwing boards were weighted in order to improve *atlatl* performance and suggests that although rigid boards do not benefit from the weights, perhaps *flexible* ones might, like the type recorded in Australia (Krause 1905: 623–624). This hypothesis seems plausible and should prove easily testable. However, it fails to account for the fact that most of the *atlatl* weights recovered *in situ* in the Great Basin and elsewhere are mounted on rigid throwing boards (cf., Hester 1974; Mildner 1974).

Thus, most experiments appear to indicate that the attachment of a bannerstone weight to a throwing board has at best a negligible, and at worst a distinctly adverse, impact on *atlatl* performance. Results such as these have led some scholars to suggest that throwing-board weights were designed to enhance performance by indirect means. Peets (1960), for example, suggests that it is necessary to maintain a balance between the throwing board and the dartshaft on the fulcrum of the thrower's hand. Thus, if one were to use a heavy dartpoint or a harpoon, it would be necessary to place a bannerstone on the end of the throwing board to counterpoise the weight on the opposite end of the dartshaft. The notion that bannerstones served to counterbalance the throwing board is also shared by Lewis and Kneberg (1958) and Hobbs (1963: 6). Palter (1976: 503), however, rejects Peets' argument on the grounds that the exceedingly large dartshafts and small throwing boards of the Australian aborigines do not conform to the latter's "balance formula" and thus suggest that is not necessary to maintain an equilibrium between throwing board and dartshaft. In fairness to Peets, however, it must be noted that he suggests that such counterbalancing would be useful primarily where the hunter himself was precariously situated, such as in a kayak or on slippery footing (Peets 1960: 110). This suggestion is, of course, especially difficult to test.

McGregor (1965: 182), on the other hand, concludes that *atlatl* weights, at least in the Southwest, served merely as charms or good luck pieces. Both he and Palter (1976: 505) muster evidence to demonstrate that at least some of the supposed "weights" mounted on *atlatls* recovered from southwestern dry caves were too light to have served as anything but symbols or charms. Kellar (1955: 304) considers it possible that weights mounted near the distal end of the throwing board might aid performance but notes that, on some southwestern specimens, such weights were "attached too near the handle for any practical benefit." Finally, Johnson (1971: 190–193) musters evidence to suggest that southwestern and Mexican *atlatls* were sometimes decorated with clearly nonfunctional items such as "cruciform" stones. However, these authors have yet to prove that *all* bannerstones were merely talismans or embellishments. The weights recovered in association with *atlatls* in eastern North America tend to be larger than those referred to by McGregor. Therefore, instead of being intended to enhance the performance of the *atlatl,* Hudson (1976: 47) suggests that such weights made the throwing board "suitable for secondary use as a war club." Here too, the actual placement on the throwing board of those bannerstones recovered *in situ* argues against the interpretation.

Taking a different tack, Cole (1972) refers to basic physics to explain why weighted throwing boards would fail to enhance *atlatl* performance. He notes that the range and penetration of the dart is largely the product of its mass times its velocity, and that the velocity of the dart is in turn a function of the force with which it is thrown. The force of the throw is determined by the strength of the thrower; augmented by the lengthened contact between his arm and the dartshaft provided by the throwing board. Increasing the weight of the throwing board by attaching a bannerstone to it does nothing to enhance either the force of the throw or the period of contact between arm and dart. Conversely, excessively heavy weights can, as Palter (1976) demonstrates, reduce the force of the throw by making the throwing board more awkward and difficult to handle.

However, since range and penetration can be increased by maintaining the velocity and increasing the mass of the dartshaft, Cole (1972: 3–4) suggests that bannerstones, especially the winged and cylindrical varieties known from eastern North America and the arctic, may actually have been placed on the *dartshaft* rather than the throwing board. He further hypothesizes that the purpose of the bannerstone "wings" on these specimens was to provide a real (or perhaps an imagined) stabilizing effect on the dart's flight. Cole strengthens his case by referring to the classic alignments of bannerstones and throwing board hooks reported by Webb and Haag (1939) and Webb (1946). Although Cole concedes that the bannerstones and hooks do occur in linear patterns in the graves at these sites, he notes that Webb's Indian Knoll photographs:

> . . . are all the more impressive for the number of weights and hooks shown side-by-side (Webb 1946: Figs. 17a, d, 20c, f). Webb believed that the side-by-side placement of a weight and a hook was an example of . . . an *atlatl* having been intentionally broken, with the broken parts being placed next to each other in the burial (Webb 1946: 326–327). The same placement, however, could have resulted from a spear, with an attached weight, having been placed in the burial with the *atlatl*, assuming that the weight was attached to something in the first place (Cole 1972: 4).

Cole (1972: 4) also cites the early experiments done by Parker (1917: 193) who found that "a spear can be thrown at least 25 percent farther when assisted by a winged weight placed on the tail end of the spearshaft." Thus the notion that bannerstones were shaft- rather than board-mounted has the potential for resolving some of the anomalies in our current understanding and should be systematically tested through field experimentation.

In summary, North American *atlatl* throwing boards do in some instances appear to have been weighted. However, only a limited number of throwing boards have actually been recovered with the weights or bannerstones still in place. Weights recovered *in situ* have generally been light and fairly limited in formal variation. Thus, although a wide range of types of "problematical stone objects" have been called *atlatl* weights, it seems probable that many of these objects actually served very different purposes. This is especially likely to have been true of the larger, heavier stone objects.

Experimental studies of the contribution of throwing board weights to *atlatl* performance indicate, for the most part, that such weights offer little benefit and, depending on their size and weight, may actually decrease dart range. Since throwing board weights seem to have a largely negative effect on *atlatl* performance, at least five alternative hypotheses have been advanced to explain their use in North America:

1. Although bannerstones do not seem to contribute to the performance of either heavy darts or rigid throwing boards, perhaps the range of light-weight darts (Hill 1948) or flexible throwing boards (Palter 1976), neither of which have been sufficiently tested experimentally, may have benefited from the use of such weights.
2. Bannerstones might have been attached to the throwing board to counterbalance an especially heavy point or harpoon head mounted on the dartshaft (Peets 1960).
3. Bannerstones, as well as other objects or materials found attached to throwing boards and dartshafts, were really magical charms or goodluck pieces designed to enhance the performance of the *atlatl* exclusively by supernatural means (McGregor 1965: 182).
4. Bannerstones, at least in eastern North America, did not contribute to *atlatl* performance but allowed the throwing board to be used secondarily as a war club (Hudson 1976: 47).
5. at least some bannerstones, notably the large, winged and cylindrical varieties of

eastern North America, were not mounted on the throwing board at all. Instead, these weights were used on the dartshaft in order to increase the "impact pressure" of the missile and perhaps to stabilize it in its flight (Cole 1972).

Like the hypothesis which they are designed to replace, none of these five theses provide an entirely satisfactory explanation of the bannerstone phenomenon. It would appear that "theoretical closure" in this area is impossible at present and the rejection of any of these alternative hypotheses must await systematic field experimentation and the recovery of additional archeological evidence.

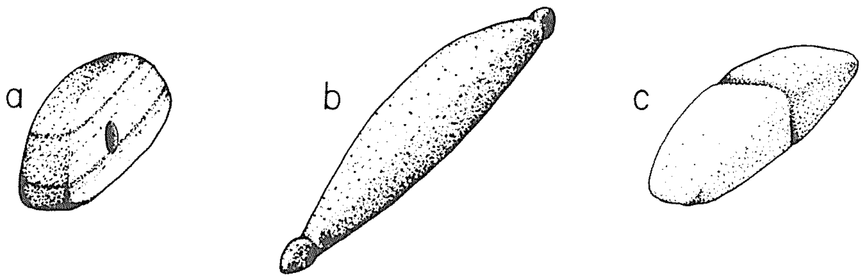

Figure 4. Three basic classes of "problematic stone implements" from the northwestern United States interpreted as *atlatl* weights by Butler and Osborne (1959): (a) Type I (b) Type II (c) Type III.

The *Atlatl* Abandoned: A Brief Discussion of the Reasons for Technical Supercession of That Weapon by the Bow-and-Arrow with Some Notes on Its Limited Retention.

As noted above, the bow-and-arrow seems to have entered the North American technical inventory sometime during the last millennium before Christ. Over time the bow-and-arrow replaced the *atlatl* as the primary military and hunting weapon on the continent. The reasons for this replacement are perhaps obvious and will be but briefly attended to here. Less obvious are the reasons for the retention of the *atlatl* by certain aboriginal peoples in the face of the widespread acceptance of the bow-and-arrow by most. Several hypotheses regarding this retention will be advanced.

The first and most obvious advantage of the bow-and-arrow over the *atlatl* would appear to be the greater "casting power" or range of the former weapon. In an interesting study, Pope (1923, 1962) tested a large number of aboriginal bows from various museum and private collections to determine their casting power and penetration under controlled conditions. The thirteen bows from the New world tested by Pope (1962: 2–21) cast arrows between 101 and 230 meters

(92 and 210 yards) with a mean distance of 167 meters (153 yards), and a standard deviation of 37 meters (34 yards). Using the distance figures presented by the *atlatl* experimenters summarized earlier, the *atlatl* was reportedly capable of distances ranging from about 42 to 70 meters (39 to 64 yards) for a mean distance of 62 meters (57 yards) and a standard deviation of 16 meters (15 yards) under controlled conditions. The mean of Pope's arrow-cast distances is thus about 164 percent greater than the mean dart casts. However, Krause (1905: 621–622) reports *atlatl* casts observed by travelers and ethnographers ranging between 61 and 137 meters for a mean distance of 93 meters and a standard deviation of 31 meters. Pope's reported mean casts are thus only about 79 percent farther than those reported by Krause. Nonetheless, the range of the bow-and-arrow seems to be clearly greater than that of the *atlatl.*

Less obvious advantages of the bow have also been noted by various authors. First, the bow-and-arrow is perhaps an easier tool to use from the cover of an ambush or game blind. Hill (1948: 38) states that although it is not impossible to do so, the *atlatl* is a difficult weapon to use in thick woods with little elbow room. This difficulty stems, according to Mau (1963: 12), from the body movements one must utilize to launch the dartshaft. Such launching requires:

> . . . a vigorous, and perhaps conspicuous, swing of the arm. This, one can imagine, often was sufficiently evident to an agile animal or other game to enable it to make good its escape from the missile. By contrast, when using the bow, the arrow can be launched, with a minimum of movement on the part of the archer and from almost any position (Mau 1963: 12).

Thus the bow can probably be used with less effort under such conditions and can be done so with less body exposure. This latter advantage would be especially important in warfare. A third major advantage of the bow-and-arrow stems from its use of lighter, shorter shafts. As Evans (1959: 161) puts it: ". . . while it is possible to carry only two or three short spears, 20 to 30 arrows can easily be carried in a quiver." The shorter length of the arrow over the spear would also make travel through heavily wooded terrain much easier. However, the disadvantage presented by the bulky nature of the *atlatl* dartshafts may have been overcome in another way. Lahren and Bonnichsen (1974) present archeological evidence to suggest that Clovis fluted points were mounted on short, cylindrical foreshafts made of bone. The authors hypothesize that such foreshafts were in turn stuck into socketed spearshafts. In this way, a hunter would need to carry only one or two socketed spearshafts for use with a whole quiver full of foreshaft-mounted dart points. As Lahren and Bonnichsen (1974: 149) note: "Retrieving the lance and inserting another foreshaft and point composite could have been done in seconds. This method would be far more efficient than carrying a number of lances. . . ." If such foreshaft mountings were used with *atlatl* darts by Paleo-Indian (and later) peoples, it would have enabled them to overcome some of the inconvenience of large dart shafts. Frison and Zeimens (1980: 234) however, feel these supposed foreshafts are really bone projectile points.

In any case, if one considers the greater range, weaponry and convenience of the bow-and-arrow compared to the *atlatl,* it is easy to understand why the former replaced the latter. Less obvious perhaps, are the reasons for the retention of the *atlatl* by some peoples in the New World after the introduction of the bow-and-arrow. For instance, the ethnographic record indicates that many peoples who used boats to hunt marine or aquatic animals preferred the *atlatl* over the bow-and-arrow. As Kellar (1955: 337) reminds us, bow strings of animal or plant fibers tend to dampen and stretch when exposed to moisture for prolonged periods. Further, the larger size of the *atlatl* dartshaft would not be a particular disadvantage where extra spears could be carried in a boat rather than on the hunter's back. Of course, at medium range, such large shafts and projectile points would strike the quarry with equal or greater force and penetration than the arrow. As Cressman and Krieger (1940: 30) point out, size, force and penetration would be especially desirable in the hunting of large sea mammals such as walrus. Further, the bow-and-arrow must be used with two hands while an *atlatl* dartshaft can be loaded and cast with only one hand by an experienced user. This means that a lone hunter could hold his paddle and steady his boat with one hand and launch a dart with the other (Cressman and Krieger 1940: 30; Mau 1963: 12). Finally, marine and aquatic hunters and fishermen commonly attach lines to their projectiles so they will be able to recover their quarry after killing or wounding it on the water. As Peets (1960: 110) notes:

> . . . the arrow is unsuited to carrying a line such as were even the best Indian ones. The modern bow-fisher uses a very thin waterproof line on an efficient reel, but some experiments I made several years ago with Indian-type equipment were spectacular failures, though at the time I had the Delaware Championship in archery and the distance record. The arrow, though heavy and having a steel broadhead could not handle the wet, sandy line. The first jump of the arrow was far too rapid, and the inertia of the line seemed to be increased by it. And when there was enough line in the air to have the wind catch it, all accuracy was lost.

The *atlatl,* on the other hand, apparently suffers no such disadvantage and the ethnographic record contains numerous accounts of that tool being used to cast shafts with lines attached to them. The Angmagsalik Eskimo used the *atlatl* to launch toggle-head harpoons from their kayaks when seal hunting. The combination of the *atlatl* with the Angmagsalik harpoon resulted in a composite tool consisting of 33 separate parts including the line and seal-skin floats (Oswalt 1976: 99). This composite tool brought together two of the most effective devices in the technical inventory of early man. The harpoon is present in Europe at least by 7,000 B.C. (Bordes 1968: 165–166) and may have been known in North America by this time as well (Cressman 1977: 115). We may perhaps surmise from this that the combination of the *atlatl* and the harpoon is a very ancient innovation indeed. With all these advantages in mind it is easy to understand why, despite its replacement elsewhere by the bow-and-arrow, the *atlatl* was retained by peoples as diverse as the Aleuts of the Arctic, who used it for marine hunting and waterfowling (Coon 1976: 97), and the Brazilian forest peoples, who used it in hunting turtles and spearing fish from their canoes (Cressman and Krieger 1940: 35).

Finally, as noted earlier, the *atlatl* was retained by peoples such as the Aztecs and the Inca for use primarily as a military weapon. Unlike the warfare of simpler peoples, the military operations of the civilized peoples of the Americas depended more upon set battles between masses of troops than on ambush or stealth. It would appear that the weight and penetration of the *atlatl* dart provided the damaging close support for the Aztec and Inca infantry much as artillery does for modern armies. Among the Inca levies, the bow-and-arrow had a distinctly lower status. According to Metraux (1949: 229), it was a weapon used primarily by auxiliary or irregular troops drawn to the Inca armies from the forested regions on the edge of the empire. Metraux surmises that the chief reason for the Inca's neglect of the bow was the absence of suitable wood for their manufacture in the highlands. In any event, Garcilaso de la Vega reports that the Spanish feared the *atlatl* far more than the bow-and-arrow in their encounters with the Incas during the Conquest (Swanton 1938: 358).

Dart Points and Arrow Points: Are They Really Different?

As is the case with the style or form of many elements of culture, the size and shape of stone projectile points have altered through time. As a consequence, projectile points can be sorted into types and these types arranged in order of their appearance. This placement of projectile points into presumed chronological order on the basis of their formal variation is termed "seriation;" it is the ease with which projectile points can be "seriated" that lends them their particular charm for the archeologist. However, most scholars would agree that projectile point morphology reflects more than mere stylistic convention and change; variation in size and shape is also presumed to relate to variation in the specific tasks for which points were intended.

For example, over most of North America, small projectile point types tend to date to sometime after 500 B.C. or later (cf., Cambron and Hulse 1960; Bell 1960; Perino 1968; Ritchie 1961; Kehoe 1966; Suhm, Krieger and Jelks 1954; Heizer and Hester 1979; Turner and Hester 1985). Of course this size change is useful in seriational dating but it is generally interpreted as more than mere stylistic alteration; it is seen instead as indicating the replacement of the *atlatl* by the bow-and-arrow. This interpretation is in turn based on the assumption that *atlatl* dart points in general must have been larger than arrow heads due either to: (1) technical limitations: that is, large points and shafts were simply too heavy to be propelled by the bow-and-arrow, or (2) technical evolution: that is, "it has been a general trend in the development of projectile weapons, from spear to bullet, that the size of the projectile has decreased and the velocity increased" (Brues 1959: 463).

The assumption that *atlatl* points were generally larger than arrow points has become so deeply embedded in the literature that archeologists routinely assign projectile points to the *atlatl* dart or arrowhead category on the basis of size or weight alone (Fenenga 1953: 309–310). Such assignment is not without empirical, or at least inferential, basis. Kidder (1938) states the evidence for the assumption as it appeared to the last generation of archeologists:

> (1) that all prehistoric stone-headed arrows so far found in the Southwest bear points weighing less than 35 grains [2.27 grams, F.F.]; (2) that at Pecos and other former settlements of the arrow-using Pueblo peoples there occur hundreds of points of comparable weight for every one of large size; (3) that in Pueblo sites such large points as have been found hafted have usually been set in short handles for use as knives, but never in arrows; (4) that small points, which can hardly have been other than arrowheads, appear in great quantities among the bones of slaughtered buffalo in the trap-ravines of the Great Plains, while on the other hand, the heads of all Basketmaker spear-thrower darts that have come to light are much larger and heavier than those which we can be sure were arrowheads. I had, of course, considered the possibility that the ancient heavy points, from Folsom, Signal Butte and elsewhere, were arrowheads, but I was unable to see why, if they were serviceable for that purpose, they should have been replaced by the small points apparently exclusively employed by tribes of the same region in later times (Kidder 1938: 156–157).

Fenenga (1953) attempted to test this assumption by weighing 884 chipped stone projectile points from various sites in the western United States. His analysis revealed that the collection showed a distinctly bimodal distribution based on weight: "the overwhelming majority of the points (92.3%) weighed less than 3.49 grams; in the other, virtually all of the points (99.6%) weighed more than 4.5 grams" (Fenenga 1953: 313). All the same, as Thomas (1978: 461) notes, demonstrating that North American projectile point populations tend to cluster bimodally by weight is not the same as proving that one cluster consists exclusively of *atlatl* darts, the other of arrowheads.

Thomas (1978) approached the problem from a different direction. He measured 142 complete stone-tipped arrows and *atlatl* darts drawn primarily from the ethnographic and archeological collections of the American Museum of Natural History. These measurements provided him with a population against which he could quantitatively test various hypotheses about darts and arrows. Initially he found that, while there is general correlation between the size of the arrowshaft and the size and weight of the arrow point, this correlation is by no means perfect. Further, there seems to be no particular relation between the size of the *atlatl* dartshaft and the size of the dart point, although dartshafts as a group are demonstrably larger than arrowshafts (Thomas 1978: 469).

To answer the most important question, "Are arrowheads smaller than dart points?", Thomas computed the means for 5 variables (length, width, thickness, neck width and weight) and then calculated a t-test for each. His results indicated that all five variables differed between the dart points and the arrowheads in his population. However, to answer the question fully, he had to turn from univariate to multivariate statistical tests. Thomas (1978: 469) chose to use discriminant analysis, which is a technique designed "to form linear combinations of the variables, weighted in such a way as to distinguish between preexisting groups (in this case darts and arrows)."

This multivariate analysis led to the following conclusions: (1) dart points *are* demonstrably larger than arrow points but the most important dimension in determining this is overall *width* rather than weight, length, neck width or thickness; (2) a set of equations could be generated, which would classify other projectile points of uncertain function into one or the other with about 86 percent certainty (Thomas 1978: 470–471). Thomas' work is both comforting and useful. It is comforting to receive formal confirmation of the widely held assumption that dart points and arrowheads differ from one another in discernible, measurable ways. It is useful to possess a set of equations which will allow projectile points of unknown function to be labeled with some confidence as either dart or arrow points. Still, one question remains: when the bow-and-arrow replaced the *atlatl* in North America, was the resulting change in projectile point size merely a stylistic alteration or was it the result of technical limitations or technical evolution?

It is possible, according to experiments by Fenenga (1953: 319) and Browne (1940: 213), to use small projectile points (or no points at all) on the tips of *atlatl* darts. Further, as Ahler and McMillan (1976: 166) have pointed out, the archeological and ethnographic documentation of the use of small projectile points against animals like bison are sufficiently abundant to demonstrate that large projectile points are not necessary to bring down large game. Conversely, Browne (1940: 213), an experienced archer, demonstrated experimentally that large points, well within the size range of *atlatl* dart tips defined by Thomas (1978), can be shot effectively with a bow-and-arrow. Pope (1962: 56) notes the deep penetration of large arrow points such as the "English Broadhead" used with the longbow in the late Middle Ages.

Atlatl performance experiments conducted by Spencer (1974: 5) suggest that the use of large points to tip *atlatl* darts does have a practical advantage since, according to him, "a point which is too light gives the dart a characteristic uplift in its flight pattern one-third of the way into its flight." Davenport (1943: 33) also concludes that a heavy point enhances "the shaft's ability to hold a true flight." Further, according to Brues (1959: 463): "the amount of kinetic energy embodied in the projectile, and consequently the amount of destruction that it can produce in the object which brings it to a stop, is . . . a product of the mass of the projectile and its velocity. Hence the size of the weapon can profitably be decreased if its velocity increases." Or, as Browne (1940: 213) put it, "the arrow gets its penetration by speed, the spear by weight." Assuming the bow can propel a shaft at greater velocity than the *atlatl*, the arrival of that tool in North America would have meant that smaller points could have been used with the same effect as the older, larger ones. These small points might also have traveled farther due to their lighter weight and lower wind resistance (Brues 1959: 5) and although Davenport's (1943: 33) experiments indicate that large points stabilize the flight of *atlatl* darts, there is no evidence to suggest that such stabilization is necessary with arrows.

But why was the replacement of the large projectile point by the small one so complete? Would we not expect that natural conservation of stylistic considerations might still have favored the continued use of the older forms? Perhaps so but, given the brittle nature of most siliceous stone, larger stone points would tend to break on impact more readily than smaller points. Thus, although the replacement of large projectile points by smaller ones might have been stimulated initially by technological advantage, the final transformation would have had an economic cause: when larger points ceased to confer much advantage in performance, the greater material and labor "costs" involved in their manufacture and replacement would lead to their abandonment.

On a slightly different front, Ahler and McMillan's (1976: 166–167) study of wear and damage patterns on a large population of projectile points led them to conclude that a significant percentage of the artifacts in this class actually were sometimes used as stemmed scrapers, knives, or multipurpose tools. They further conclude: ". . . that extremely small (points) would not function as efficiently for hafted cutting, scraping or prying activities as would large specimens, due to limitations in structural strength and length of usable cutting edge (of) the smaller tools."

Thus, the blades needed for these scrapers, knives and multipurpose tools would presumably not have been affected by the shift away from the *atlatl* to the bow-and-arrow and would not have declined in size. The continued manufacture and use of such stemmed tools after the adoption of the bow perhaps masks the real abruptness with which the shift from large to smaller sizes took place among points actually used as projectiles. In summary, although small points can be used as *atlatl* dart tips or as hafted, multipurpose tools, the performance of such tools declines when one does so. Likewise, although large points can be used with the bow-and-arrow, there is no reason to do so since the increased shaft velocity, which can be achieved with the bow, allows small points to travel as far or farther than large points and yet do the same damage on impact. Additionally, such small points are not as fragile and need less raw material in their manufacture. It would thus appear that the bimodality in projectile point size and weight observed by Kidder (1938), Fenenga (1953), Thomas (1978) and numerous other scholars results from the balance struck between the demands of tool performance and efficiency on the one hand, and raw material and labor "costs" on the other.

As we have noted, it has often been assumed that the projectile points were reduced in size over time due to some inherent technical limitation (e.g. "bows cannot shoot larger projectile points") or simply as a result of stylistic change or drift. I suspect we are better served by regarding the change to have been the result of an infinite number of informal experiments done by generations of observant, practical people. Like ourselves, these ancient Americans could learn from their experience and make rational decisions about both the costs and the benefits of their actions.

Hall's Anthropocentrism: The Ritual and Symbolic Retention of the *Atlatl* After Its Technical Replacement

The replacement of the *atlatl* by the bow-and-arrow in eastern North America was an important event, which seems to have occurred in an almost universal fashion in the technical sphere during the first millennium after Christ (cf. Ford 1974: 402; Griffin 1964: 247, 1978: 254). However, in the ideological and religious spheres, this transformation was not nearly so complete. Robert L. Hall (1977: 514) argues, in a provocative recent paper entitled "An anthropocentric perspective for eastern United States prehistory," that despite its technological supercession by the bow-and-arrow, the form or image of the *atlatl* persisted as a powerful element in the moral and symbolic life of eastern aboriginal peoples as flat-stemmed pipes, ceremonial staffs, fetishes, society emblems, and symbols of command long after its actual technical function was forgotten. Hall explains this symbolic retention by reference to a general notion that weapons have an ideational and symbolic value as well as a material function. Function and symbol are to some degree separate phenomena which, it would seem, can survive and diffuse independent of one another. Although he does not cite it, a modern example of such symbolic independence can be found on modern U.S. Army uniform insignia. One still finds the engineers represented by medieval castles, the infantry by crossed muskets and, until quite recently, the artillery by crossed muzzle-loading cannons. Obviously none of the aforementioned weapons are still in our military inventory, yet they live on symbolically in our military insignia. So, it would appear, did the *atlatl* in the time of the bow.

One of the clearest formal survivals of the *atlatl*, according to Hall (1977: 504), are the long, flat-stemmed stone pipes known historically in the eastern United States. At least some forms of these historical pipes are traceable "step-by-step back to the Hopewell platform pipes as much as two millennia older." The odd flat shape of the stems of these pipes provides no particular advantage to the smoker. Since it extends in front of the tobacco bowl, it would appear to be merely a decorative convention. However, referring both to the historic and prehistoric versions of the flat-stemmed pipe, Hall (1977: 504) notes:

> . . . a Hopewell effigy platform pipe with an attached flat stem looks like a flat *atlatl* with effigy spur. The animal form on the bowl is almost invariably positioned to present a nose or beak where an *atlatl* spur is needed. The usual curvature of the pipe platform places this spur closer to the main axis of the *atlatl*. The flat stem in ethnographic collections is almost invariably covered with a wrapping of porcupine quill braid over the half near the mouth end, a practice I see related to the wrapping needed to attach *atlatl* finger loops or possibly the fetishes sometimes found on *atlatls*.

In other words, Hall sees the form of the *atlatl* to have been conjoined with, or transformed into, the flat-stemmed pipe in Late Woodland times or earlier. One of the three *atlatls* recovered at the Key Marco site in Florida is an excellent example of the kind of throwing boards which apparently served as the prototype for the platform pipe (Kehoe, Foster, Hall n.d.: 18). The male spur or hook on the distal end of specimen 40609 from the site "is carved in the form of a thumping rabbit, the handle end turned down in a graceful volute" (Gilliland 1975: 133, Plate 83). The similarity between this *atlatl* spur and a platform pipe is striking indeed.

Hall (1977: 502–515) also musters evidence to suggest that a complex symbolic and ideological association existed between smoking, tobacco, weapons, life and water symbolism and peaceful interaction. According to him, this association of ideas and symbols centered in historic times on the smoking of the Calumet pipe, the famous "peace pipe" so prominent in the popular image of the American Indian. Hall suggests that the *atlatl*-shape of the flat-stemmed pipe symbolically conveys the message that a weapon of war has been transformed into an emissary of peace, a concept as evocative as the Old Testament injunction to "beat swords into plowshares." Hall elaborates on his interpretation by suggesting that since the symbolism of the Calumet was widely shared and undertaken in eastern North America, the ceremonialism surrounding the pipe was an effective means of fostering peaceful interaction between different peoples. As he notes: ". . . one cannot ignore the economic and political values of interaction of this kind, for late prehistoric and historic Indians as well as for prehistoric Hopewellians 2,000 years before" (Hall 1977: 515).

The platform pipe, in Hall's view (1977: 505), greased the very workings of the Hopewell Interaction Sphere: it "may not have been merely an item exchanged; it may have been part of the very mechanism of exchange." While this is an attractive notion, it is not without its critics. Turnbaugh (1979: 686–687), for example, musters evidence to suggest that at least over portions of the East, the spread of Calumet ceremonialism was a post-contact rather than an ancient phenomenon. Yet, even if Hall is correct in identifying the origins of the Calumet complex in the Hopewell tradition, we must still proceed with caution. Surely religious and symbolic systems are often conservative. Witness the American penchant for building modern versions of Gothic and Romanesque cathedrals. Yet, how far can we extrapolate backwards from the social forms which operate inside these modern cathedrals to the interpretations of the societies that built the originals at Chartres, Rheims or Salisbury? Further, although symbolic systems are often conservative, they are also designed to communicate complex ideas in a simple fashion. When their conservatism begins to impede this communication, the symbolism presumably will change. Hall suggests that since the *atlatl* eventually disappeared altogether from the weapons inventory in eastern North America, the association between the shape of the flat-stemmed pipe and the military weapon began to dim as well. Eventually, the *atlatl*-shaped pipe gave way to the new "Hako" type pipe. This later variety was long, thin and very much in the shape of an arrow. In adopting the form of the current military weapon, the arrow, pipe makers sharpened the image conjoining warfare and the sacred peace ceremony of the Calumet (cf., Turnbaugh 1975, 1977, 1979). A parting in this regard would be to remind the reader that such "symbolic updating" occurs in our culture as well. Witness the recent transformation of uniform insignia in the air defense branch of the U.S. Army artillery: the two crossed cannon have given way to one cannon and one guided missile.

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Winnie's Mound (41BU17): A Study in the Prehistory of Burleson County, Texas

Bradley F. Bowman

ABSTRACT

Winnie's Mound (41BU17) is a relict levee of the Brazos River constituting a slightly raised landform in the broad flood plain. Test excavations conducted in 1983 combined with extensive surface collecting indicate a long period of prehistoric use for this locality, from Paleo-Indian to Late Prehistoric times. The excavations revealed the existence of a small, spatially-confined, prehistoric cemetery containing burials from two different time periods. Evidence for prehistoric structures was also found. Diagnostic lithic artifacts in the sample show a mixing of central and eastern Texas styles suggesting that the Brazos River may have been a traditional boundary between two geographically-distinct populations.

INTRODUCTION

The Winnie's Mound Site (41BU17) has been heavily surface hunted by local collectors for many years. Its archeological importance was evident by the diverse point types and human remains collected on the surface over a very large area showing signs of cultural debris. The possibility of site destruction dictated a need to excavate a test unit to see if any cultural material could be found intact. At a depth of 40 cm, a flexed burial (6, Figure 7), was located. At that time, the author contacted Dr. Harry Shafer of Texas A&M University who offered his assistance and encouragement to continue excavations during the summer and fall of 1983.

A small, prehistoric cemetery containing flexed and secondary interments in a deep midden deposit was discovered in the following months. The excavated portion of the site was disturbed by many years of cultivation and by a road construction project during World War II when a large amount of earth was removed from the cemetery for use as fill (David Wilson, personal communication). The destruction of the uppermost layers of the cemetery would explain the complete lack of Toyah Phase and historic materials found in most other areas of the site.

Winnie's Mound is located on an ancient river terrace in the river flood plain approximately two km west of the present day Brazos River in Burleson County, Texas, and is the highest point for three km in any direction. The site appears to have been occupied at least seasonally from Paleo-Indian through Late Prehistoric times. At present it is a corn field with an elevation of 73 meters (240 feet) above mean sea level.

NATURAL SETTING

The site is situated on an elevated ancient river terrace in close proximity to a relict river channel of the Brazos River. Cultural debris is scattered over an area of approximately 120,000 square meters. A broad flood plain extends southwest from the site for 5.3 km to a high valley wall, which rises rapidly up to an elevation of over 91 meters (300 feet), and to the northeast two km to the present day Brazos River, which is the easternmost border of Burleson County. Sloughs and bayous still exist in the general area, evidence of the ancient river's course. The majority of the flood plain is under cultivation and the uplands are heavily wooded. Thirty-six inches of rain fall on the area annually. Major fauna includes whitetail deer (*Odocoileus virginianus*), bobcat (*Lynx rufus*), jackrabbit (*Lepus californicus*), opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor*).

Flora in the uplands consists of a post oak (*Quercus stellata*) canopy with an understory of yaupon (*Ilex vomitoria*), hawthorn (*Crataegus sp.*), willow (*Salix nigra*), sycamore (*Platanus occidentalis*), and green ash (*Fraxinus pennsylvanica*), which are the dominant species along the creeks and rivers.

EXCAVATION PROCEDURE

The numerous human remains scattered on the surface were a positive factor in locating the cemetery. At the onset, it appeared to be a large, dark, sandy circle surrounded by red clay but this later proved to be an ancient slough or depression, which had filled in by an accumulating midden deposit.

Once a datum point had been established, units were laid out in 2 by 2 meter squares. The total excavated area encompassed 13 units or 46 square meters (Figure 7). Work proceeded in arbitrary 10 cm levels until sterile clay was encountered. Due to limited time and labor force, all soil was troweled, locating all artifacts and features *in situ*, then discarded, with the exception of three units. These three units were troweled and screened through ¼ inch hardware cloth. All cultural materials were collected and stored in individual bags which correlated to each level.

Stratigraphy was not visually apparent as the deposits appeared to be a homogeneous mass. Due to the large amount of rodent activity which had taken place, erosional episodes that occurred between occupational periods further confused the issue. Stratigraphy was later detected during analysis and a simple mathematical formula was applied to each unit. This proved to be successful in relating all units to each other regardless of their nonconforming depths and irregular predepositional surfaces, thus producing four distinct cultural levels with nearly sterile strata between occupied levels.

Each unit's actual depth was divided by 15. The resulting figure was then divided into an artifact's elevation above sterile clay, producing any one of 15 mathematical levels. Example: Unit C-4 has an actual depth of 170 cm from surface to sterile clay; 1/15th of 170 cm = 11.33 cm. Each 11.33 cm for the purpose of discussion will be considered as one level. An artifact encountered at 140 cm above sterile clay would be treated as 140 cm ÷ 11.33 cm = 12.36 cm, placing it in the 12th of 15 mathematical levels.

Unit C-3 has an actual depth of 110 cm; 1/15th of 110 cm = 7.33 cm. An artifact encountered 90 cm above sterile clay would be treated as 90 cm ÷ 7.33 cm = 12.28 cm, placing it in the 12th of 15 mathematical levels. When this procedure was applied to each artifact or feature encountered, they consistently lined up on four levels with sterile zones in between. In two cases, there were two mathematical levels which contained the same cultural debris and were consolidated to become one stratum, thus producing 11 recognized strata (See Table 5).

LITHIC TECHNOLOGY

Debitage from three units was analyzed by 10 cm levels with the hope of producing information on the kind and quantity of artifacts produced at the site. Comparison of raw materials to finished artifacts should determine if the artifacts described in this paper were manufactured at the site or elsewhere and also the methodology of manufacture employed. Strategies from Shafer (1973) were used exclusively as a guideline for all analysis of debitage.

A search for chert procurement sites was conducted and was successful in locating deposits of chert in the form of nodules, which were deposited by the Brazos River in the present day channel and in other areas of the valley. These nodules generally exhibit a rich brown cortex with interiors ranging in color from light tan to gray with an occasional occurrence of mottled olive and black. Local chert is defined as any material readily obtained in the general area and is based on the knowledge gained from inspection of the procurement sites. Nonlocal cherts included material known to be obtained in the San Gabriel River basin and types totally unknown to the author. The distinction of local versus nonlocal is purely subjective on the author's part and is based on the aforementioned research. While it is possible for some small amounts of nonlocal chert to be transported to the local area by rivers, my research shows that a size and quantity large enough to produce finished lithics is highly improbable.

Terminology

The following terms are used in this paper:

Cobbles - are defined as water-tumbled nodules of chert.

Cores - Cobble that has been partly reduced by flake removals.

Primary Flakes - Retains all of the cortex on dorsal side; these were flakes removed from the outside of a cobble.

Secondary Flakes - Retains only a small amount of cortex, usually on only one facet.

Tertiary Flakes - Retains none of the original cortex.

Hard Hammer Percussion - A method of flake removal using materials as hard or harder than the material being reduced, producing thick flakes with fractured or beveled points of impact. (Shafer 1973: 67–69)

Soft Hammer Percussion - A method of reduction using a material softer than the material being worked to remove flakes and usually producing thin, curved flakes exhibiting a lip at the point of impact. (*ibid.*: 116–118)

Discussion

Due to the scarcity of river cobbles located at the site, it is assumed that cores were produced elsewhere and transported to the site. Nonlocal cherts show up only late in the manufacturing process, which could imply reworking of artifacts already in the possession of the aborigines. One very large blue chert blank identical to chert observed west of Georgetown, Texas, was discovered as a surface find at the site. This find suggests the possibility of a trade network with other areas. However, at present, there is not enough information available to support this theory, due to the very small percentage of nonlocal cherts to local cherts and the lack of nonlocal cores.

Methodology of chert reduction changes with each stage of manufacture (see Tables 1, 2, and 3.) Primary flakes in the sample were removed far more frequently by hard hammer techniques than by soft hammer percussion and the existence of nonlocal material in this category is rare; none were encountered in Unit C-5 (Table 2), with the largest percentage (1.59%) discovered in Unit E-6 (Table 3).

Secondary flakes were produced mainly by hard hammer reduction methods but the use of the soft hammer technique begins to increase while the local to nonlocal chert ratio remains about the same.

The last stage of production studied was tertiary flakes. The use of hard hammer drops dramatically and the use of soft hammer becomes the most consistently used method of reduction. This category also provided the largest percentage of nonlocal cherts ranging from (2.01%), Unit C-3 (Table 1), to a (4.74%), Unit E-6 (Table 3).

THE ARTIFACTS

A total of 189 lithic artifacts was recovered from the site. Table 4 records all information regarding measurements and chert types, while Table 5 records provenience for each artifact. In most cases, typology was dictated by Turner and Hester (1985). Any deviation from this text will be stated in the following descriptions.

By comparing material types found in the artifact assemblage (Table 4) to debitage recovered (Tables 1–3), it becomes apparent that the nonlocal artifacts were not produced at the site, but were probably reworked; nonlocal debitage is most prevalent in the form of tertiary flakes, the last stage in chert reduction. Crude tool forms are made almost exclusively of local chert while the projectile point assemblage includes (15%) nonlocal cherts.

The disturbed nature of the strata produces a possibility that at least some artifacts were displaced, although it appears that diagnostic point types occur in their expected sequence (see Table 5).

Artifact Descriptions

Arrow Points

Scallorn (N=3; Figure 1,A,B) Triangular serrated blades with straight to convex bases. All examples show strongly barbed shoulders, nice workmanship, and are made of local tan and brown chert.

Dart Points

Bell (N=1; Figure 1,C) One example was recovered. It is extremely well made of a nonlocal blue chert. This specimen has been reworked as one barb is missing, but retouched, and has a short concave blade, due to reworking.

Darl (N=1; Figure 1,D) The long, serrated blade with a slightly ground, concave base is a typical example of this dart point form. It exhibits average workmanship and is of a local gray chert.

Edgewood (N=3; Figure 1,E, F) Three examples of this type were recovered. All are made of local cherts. They have concave bases, showing signs of grinding, with short triangular blades. Two of the three have broken distal ends.

Ensor (N=2; Figure 1,G) No complete examples were recovered. Both have broken distal ends. One example appears to have been aborted in manufacture. Both are made of local tan chert having straight to slightly convex bases with deep notches and prominent shoulders. Both have slightly convex, long, triangular blades.

Frio (N=2; Figure 1,H) These have almost straight triangular blades, wide notches, and prominent shoulders. Bases are straight with a deep U-shaped notch exhibiting some grinding. One is rather crude with a beveled blade made of local tan chert. The other is of nonlocal banded chert of good workmanship.

Gary-Kent (N=6; Figure 1,I, J) These two types have been combined for the purpose of this paper, as the points recovered do not fit either definition exactly, but fall nicely between the two. Of the six examples, four are contracting stemmed with two having nearly parallel stems. Bases are mixed, from straight to convex, with one example having a slightly concave base. All have triangular straight blades, one being finely serrated. All are made from local gray and tan chert.

Hoxie (N=1; Figure 1,K) This basal-ground, nearly parallel-stemmed point exhibits a deeply concave base with a nearly straight, beveled, serrated blade and is manufactured of local gray chert.

Lange (N=2; Figure 1,L,M) Large, triangular blades with prominent shoulders and expanding stems are the dominant features of this type. Bases on both are nearly straight. All examples are of local gray chert of fair workmanship. One example is lacking its distal end.

Marcos (N=5; Figure 2,A,B) All five specimens are made of local chert. Two seem to have been broken in manufacture, while two lack distal ends. All exhibit wide, convex, triangular blades and broad, convex bases with deep corner notches producing long barbs. Two show excellent workmanship, while one is quite crude.

Plainview-like(N=1; Figure 2-C) This projectile point, made of local tan chert, is lanceolate in shape with a concave base. It is basal-ground and exhibits edge grinding on approximately 40 percent of its total length.

San Patrice (N=1; Figure 2,D) One example of this type was recovered. It is of local chert and of exceptional workmanship. The fluted base is deeply concave with basal grinding. The blade is leaf-shaped and constitutes over 80 percent of the total length.

Yarbrough (N=3; Figure 2,F) All are produced from local chert, one having a triangular-shaped blade, the others having leaf-shaped blades. All three have slightly concave bases—two having expanding ground stems and one a nearly parallel stem. Workmanship could be considered crude.

Unclassified Dart Points

Form 1 (N=1; Figure 2,E) This example exhibits a triangular blade with asymmetrical barbs; one long and curved and the other very short. The stem has nearly parallel edges and a straight base. This artifact is made of local gray chert of average workmanship.

Form 2 (N=5; Figure 2,G, H) This form like Forms 4 and 9 is common to the lower strata; Dr. Thomas Hester (personal communication) suggests they are all variations of the same type. He terms them "Early Corner Notched." This loosely-defined group could be classified as Gower or Uvalde. The wide variation of typological traits in the sample, and the wish to avoid controversy, has prompted the author to describe them as three separate forms. Form 2 has a strongly expanding stem with a deep, U-shaped notch. Only one example lacks heavy basal grinding. Blade shape varies greatly, some are very broad and triangular with long barbs, others are beveled and convex with sharp prominent shoulders. Three examples are of local tan chert, while two are of nonlocal blue and black. Workmanship is good.

Form 3 (N=4; Figure 2, I, J) This side-notched type exhibits a leaf-shaped blade, slight angular shoulders, and a slightly concave, almost straight base. Two examples are of local tan chert, one is of nonlocal blue, and the other is of an orange translucent material of unknown origin. Workmanship is good.

Form 4 (N=2; Figure 2, K, L) These small points are more Gower-like than Form 2 or 9 and may be a variation of that type. Both examples exhibit a short

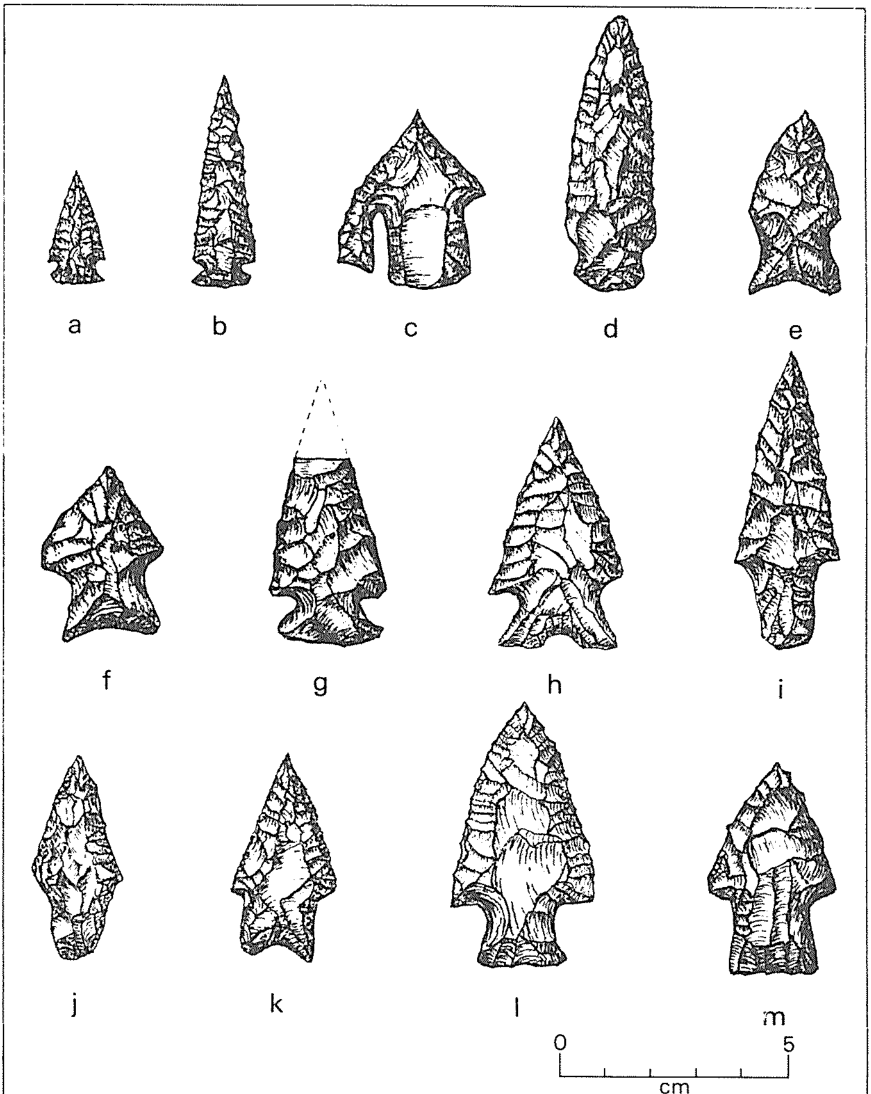

Figure 1. Arrow and Dart Points from Site 41BU17. Scallorn, A, B; Bell, C; Darl, D; Edgewood, E, F; Ensor, G; Frio, H; Gary-Kent, I, J; Hoxie, K; Lange, L, M.

thick triangular blade, beveled in one example, and nearly absent shoulders. Ground stems are almost rectangular with pronounced U-shaped notches in the base. Both examples are of local tan and gray chert.

Form 5 (N=2; Figure 3,A,B,) Long, narrow leaf-shaped blades with weak shoulders and a thinned, flared base, concave in one example and slightly convex in the other, describes these examples. Both are of local chert, one tan and one gray, with crude workmanship.

Form 6 (N=1; Figure 3,C) This basal-ground example appears to have been abandoned in manufacture, then exposed to extreme heat. It is diamond-shaped in cross section with very weak shoulders and a slightly expanding stem. It is made of a local gray chert.

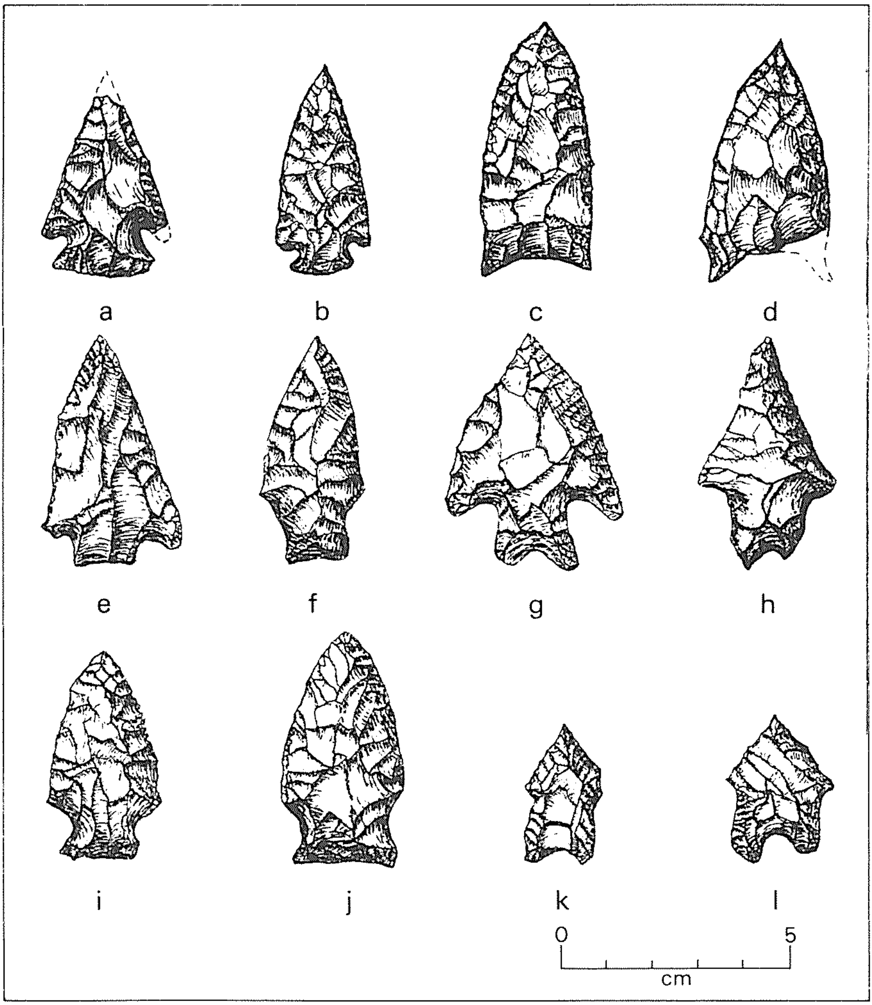

Figure 2. Dart Points from Site 41BU17. Marcos, A, B; Plainview-Like, C; San Patrice, D; Form 1, E; Yarbrough, F; Form 2, G, H; Form 3, I, J; Form 4, K, L.

Form 7 (N=1; Figure 3,D) This specimen is of crude workmanship and of local gray chert. It has a leaf-shaped blade and side notches located about one-fifth of the way from this point's concave base.

Form 8 (N=1; Figure 3,E) One example having a heavy, serrated, triangular blade and a strongly expanding stem culminating in a straight base was recovered at the site. It is made of a light-gray local chert and is poorly made.

Form 9 (N=5; Figure 3, F, G) This type is the last described variant of Hester's "Early Corner Notched" series, showing traits of Hoxie, Uvalde, and Gower. Of the five examples recovered, three are missing distal ends. The two complete examples have triangular blades with nearly straight to slightly convex edges. Shoulders vary from slight to prominent. Stems are strongly expanding and flare outward in all examples. Thinned bases have deep U-shaped notches. Stems and bases are smoothed in four of the five examples. Three are of local chert and show fair craftsmanship but are thick in appearance, while two are non-local—one blue chert and one unknown material, showing better workmanship.

Biface Failures (N=72)

A total of 72 bifaces broken in manufacture were found representing all occupied strata. Without exception, these are of local tan and gray chert.

Awl (N=1; Figure 3,H)

This specimen is of local tan chert with a thinned, flaring base and a long, needle-like blade culminating in a sharp tip. It exhibits good craftsmanship.

Corner Tanged Biface (N=1; Figure 3,I)

This knife was manufactured from local tan chert. It is beveled from right to left on the ventral surface and shows considerable wear. A small amount of cortex is visible on the "tang" portion of this artifact. It is of excellent workmanship.

Drills (N=2; Figure 3, J,K)

One incomplete specimen is triangular in cross section with nearly parallel edges. It is of local tan chert. The other, unifacial in design, was produced from a secondary local tan chert flake. The thin, short bit was formed by pressure flaking.

Ovate Bifaces (N=8; Figure 4, A)

Eight specimens were recovered which vary in quality of workmanship, size, and material. Seven examples are made of local tan, gray, and brown chert. One, the largest showing the best workmanship, is of a chocolate brown material of unknown origin.

Bifaces, Group I

Group I represents seven tools which are conducive to woodworking and were probably hafted. To demonstrate this, the author produced reproductions of these tools and, with little difficulty, used these to carve a wood atlatl. Each example's bit is angled at about 45° from the center plane of the tool.

IA (N=4; Figure 4, B) Included in this group are three specimens of local tan chert and one a black chert of unknown origin. They show a striking resemblance in bit design to tools termed Guadalupe bifaces described by Turner and Hester (1985: 216–218). They are nearly triangular in cross section and have a radically concave bit produced by the removal of many short flakes from the dorsal side.

IB (N=2; Figure 4, C) Two examples of this tool were recovered and are similar in design to IA except that the bit was formed by the removal of long, straight flakes from the ventral surface and a number of shorter flakes from the dorsal, producing a thinner, slightly concave cutting edge. This could be interpreted as a chisel version of IA.

IC (N=1; Figure 4, D) A small, thin biface with a concave bit retaining

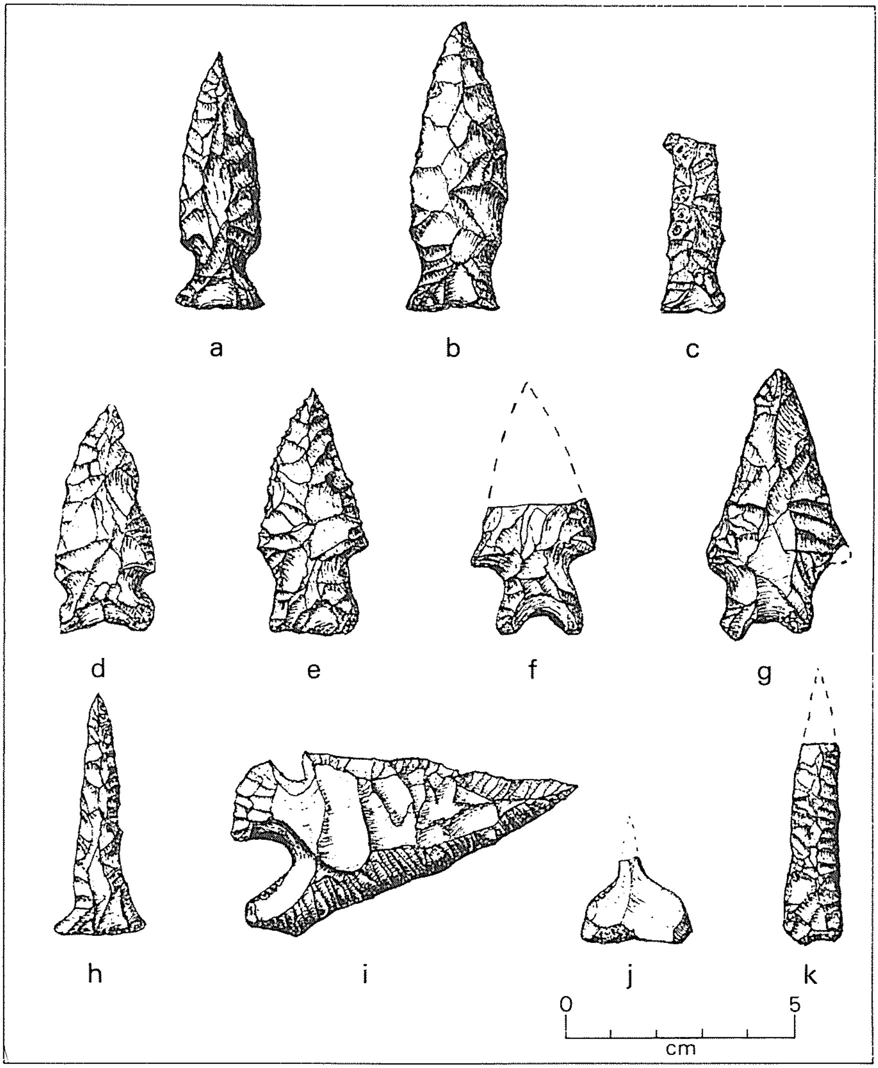

Figure 3. Dart Points, Awl, Corner Tanged Biface and Drills from Site 41BU17. Form 5, A, B; Form 6, C; Form 7, D; Form 8, E; Form 9, F, G; Awl H; Corner Tanged Biface, I; Drills, J, K.

much of the original cortex on its ventral surface. This example was produced from a local chert cortical flake that was bifacially worked only around the bit area.

Bifaces, Group II

Six hand-held carving or chopping tools are represented in this group. These possibly could serve the same function as Group I bifaces.

IIA (N=2; Figure 5, A) These two crude examples were manufactured from medium-sized local tan river cobbles. They retain most of the original cortex and

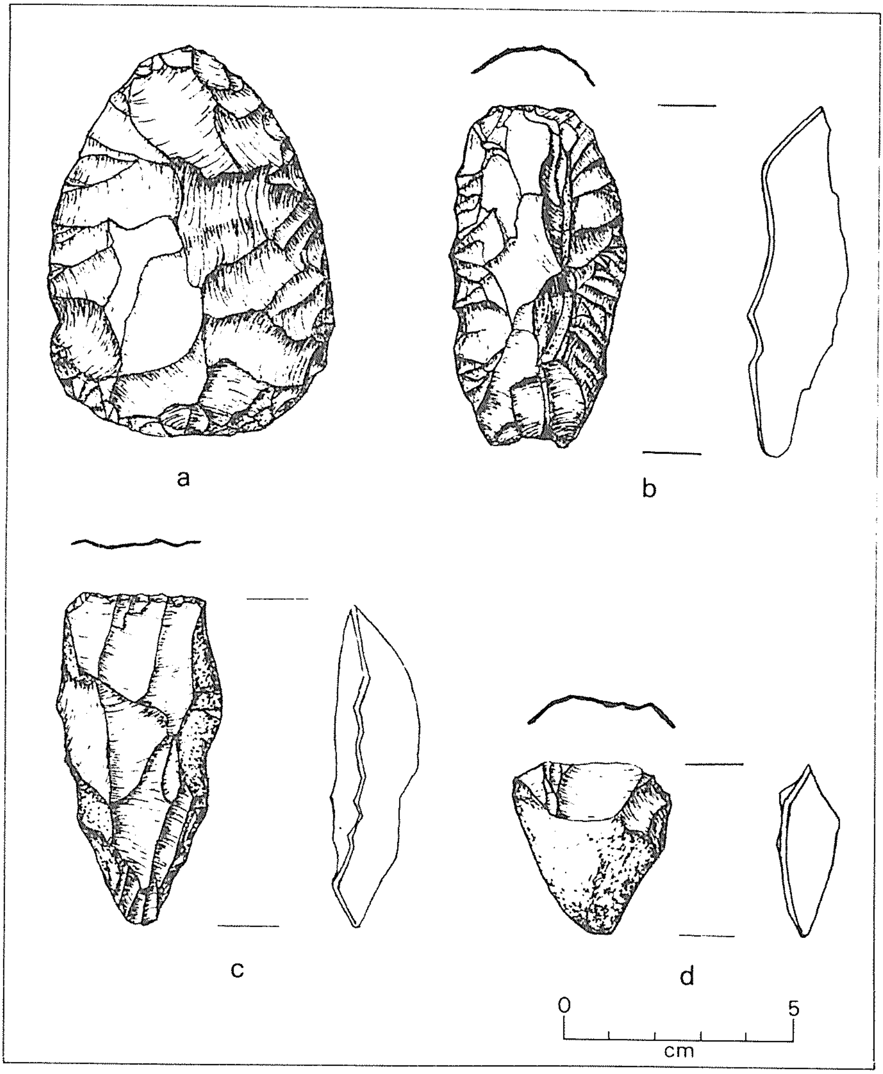

Figure 4. Ovate and Group I Bifaces from Site 41BU17. Ovate Biface, A; Biface IA, B; Biface IB, C; Biface IC, D.

are bifacially worked to produce a concave bit in one instance and a nearly straight bit in the other.

IIB (N=4; Figure 5, B) All specimens are manufactured from local river cobbles by hard hammer reduction. One end has been bifacially reduced at approximately 30° to produce a sharp edge. Bit design varies from nearly straight to convex and angular.

Unifacial Artifacts

Unifacial Group I Six distinct types of artifacts, which could be classed as scrapers, are present in this collection. All are manufactured from local tan and gray chert with one exception of silicified wood.

IA (N=11; Figure 5, C) Each example of this class exhibits one worked convex side. Seven examples are thick and retain much of the original cortex while four are secondary hard hammer flakes showing no cortex.

IB (N=6; Figure 5, D) Six implements have one worked end. Four are large hard hammer flakes retaining much of the cortex while two are secondary flakes showing no cortex.

IC (N=1; Figure 5, E) This tool consists of a hard hammer primary flake with two worked parallel convex edges. It is of a local gray chert.

ID (N=2; Figure 6, A) Both examples exhibit three worked edges; one is a small secondary flake showing good workmanship, the other a primary flake crudely formed.

IE (N=3; Figure 6, B) A concave scraping edge is the distinguishing feature of this group. Two examples are of local chert and retain much of the original cortex while one is of poor quality silicified wood.

IF (N=2; Figure 6, C) Two tools are included in this group. One example retains some cortex while the other is completely void of this trait.

Battered Stone

Hammerstone (N=2; Figure 6, D) These small cobbles of local river chert are heavily battered on one side showing multiple step fractures on approximately 40 percent of total surface area. Each retains much of the original cortex.

Smoothed Stone

Mano (N=2; Figure 6, E,F) One example is of soft sandstone exhibiting a convex, smoothed ventral surface and an altered dorsal surface which shows signs of pecking. The other is a small quartzite cobble showing signs of wear on both ventral and dorsal surfaces and a battered lateral edge.

Ceramics

Potsherds (N=5) All specimens are classed as "sandy paste" with very fine grain sand as a temper. Colors range from almost black to dark gray with brown mottled exteriors. By measuring the curvature of one large rim sherd, an estimated outside diameter of 36 cm was obtained for this vessel.

Fired Clay

A total of 1,958 pieces of fired clay was recovered from the three screened units. These vary in size and shape from almost marblelike to irregular with eroded exteriors. Colors range from black to mottled reds and tans. A small sampling was sliced and the interiors examined. There were no tempers in use and, in most cases, they were thoroughly fired. There appeared to be three distinctly different explanations for the many clay fragments. They shall be treated as such in the following text.

Type I (N=38; Figure 6, G,H) These irregularly-shaped burned clay pieces have one concave surface and a convex opposite side. The diameter of the concave surface varies from 1 mm to 5 cm (See Table 6.) These are accidentally fired daub coating used in the wattle and daub construction. Due to the nature of the

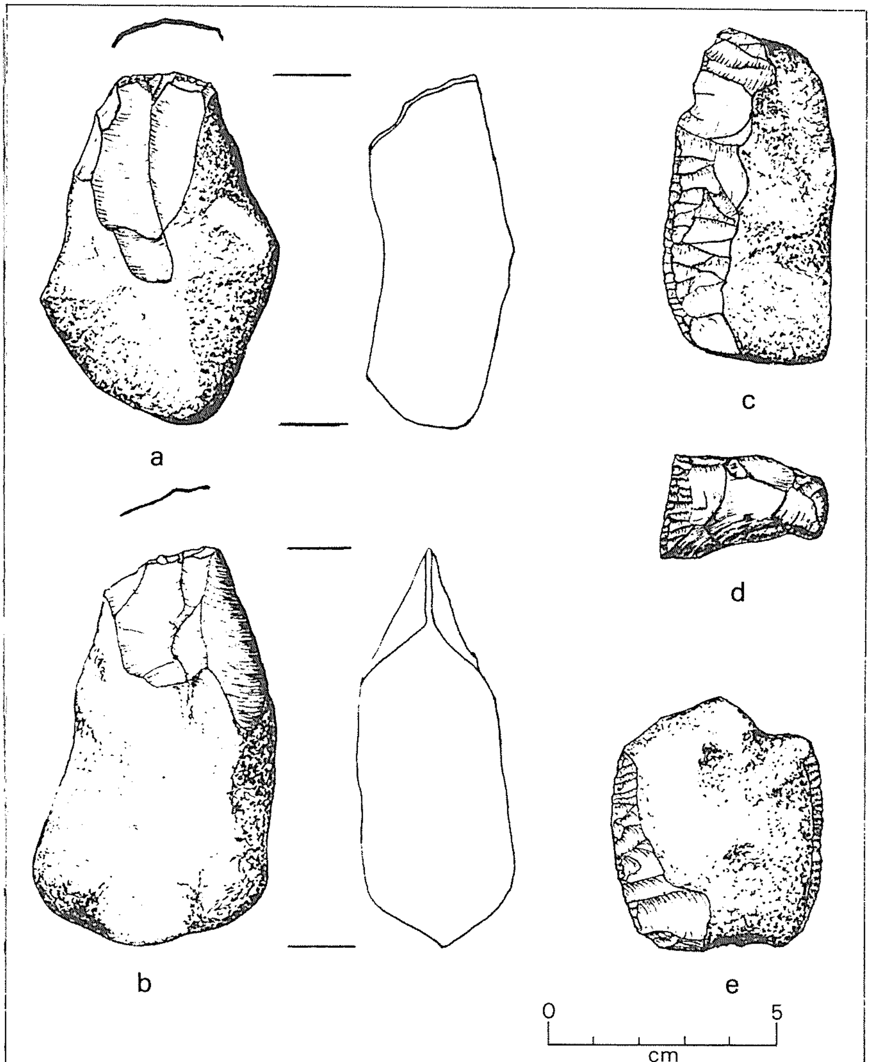

Figure 5. Group II Bifaces and Group I Unifaces from Site 41BU17. Biface 11A, A; Biface IIB, B; Uniface IA, C; Uniface IB, D; Uniface IC, E.

soil, no post hole molds or other evidence of a permanent structure was revealed during excavation. Fired daub was noted throughout the occupations at Winnie's Mound (see Table 6).

Type II (N=42, Figure 6, I,J) These were used to transfer thermal energy in food preparation by being heated and then placed in a container of food. The use of fired clay seems to be an East Texas and Louisiana custom, especially in areas devoid of natural rock that could be used in cooking (Patterson 1975). In Late Prehistoric times, fired clay nodules have been documented at Poverty Point,

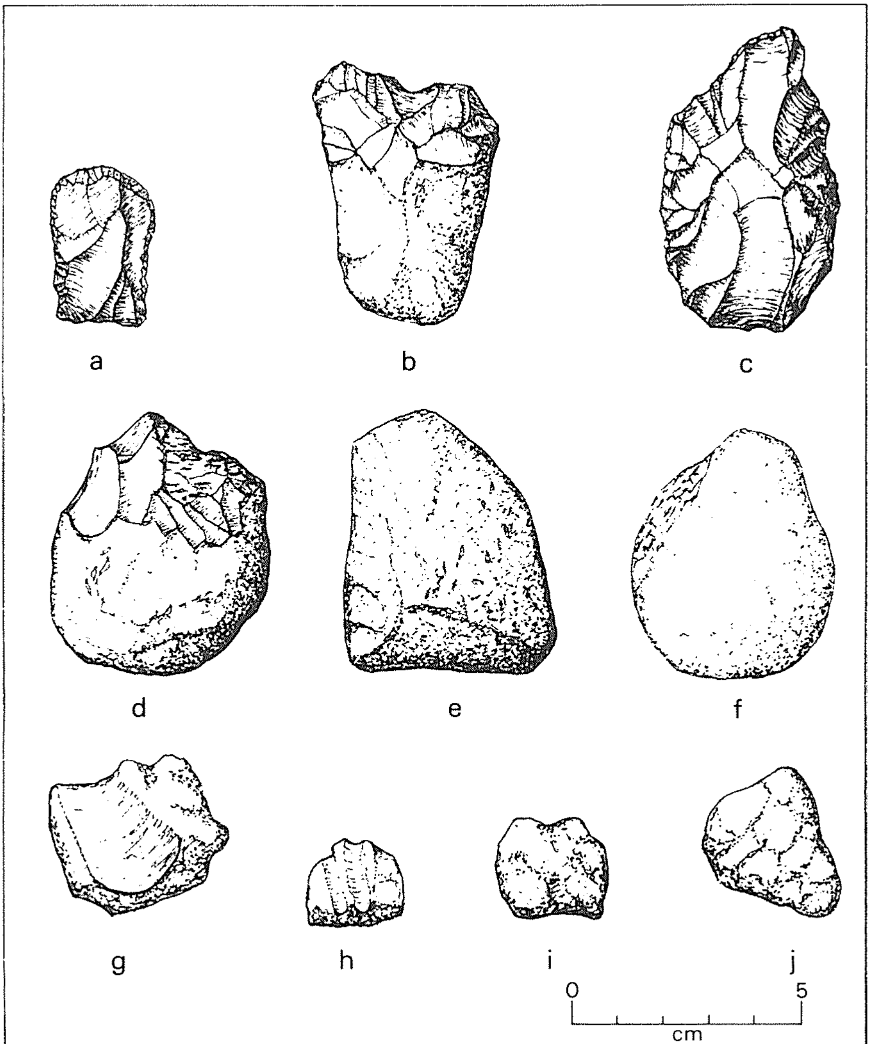

Figure 6. Group I Unifaces, Smoothed Stone, and Fired Clay from Site 41BU17. Uniface ID, A; Uniface IE, B; Uniface IF, C; Hammerstone, D; Mano, E, F; Type I Fired Clay, G, H; Type II Fired Clay, I, J.

Louisiana (Webb 1968) and in southeast Texas (Shafer 1968; Aten 1967). At Winnie's Mound, where an undisturbed hearth was located, it contained large quantities of these fired clay balls. They vary in size and distribution (see Table 6).

Type III (N=42) These large burned clay balls were without exception found in association with hearths. They appear to have been heaped around the fire as mud balls, then fired as the hearth was used. On close examination, they are fired on the side closest to the fire and almost unfired on their opposite surface. They range in size from 5 cm to 10 cm in diameter (see Table 6).

Faunal Remains

Large amounts of poorly preserved or fragmented bone were recovered from the excavation and, in most cases, it was impossible to separate erosionally displaced human bone fragments from animal bone. Of the 15 identifiable specimens recovered, 11 were whitetail deer (*Odocoileus virginianus*), three were red-eared turtle (*Chrysemys scripta elegans*), and one example of a beaver tooth (*Castor canadensis*) was recovered in Stratum 7. Fresh water bivalve shell and bird bone fragments were recovered from all occupied strata, but identification of species was impossible due to poor condition.

Burials

The cemetery contained 12 identifiable burials and many displaced human teeth and bone fragments that could not be assigned to any known burials. Although charred human molars and other bone were encountered, there is not enough evidence to prove or disprove the existence of cremations at this site. The homogeneous character of the soil made it impossible to discern burial pits and no artifacts discovered could be interpreted as grave goods. When burials were complete enough to warrant the effort, they were removed in blocks of matrix, wrapped in plaster casts, then transported. In instances when only a few fragments of bone were encountered, this procedure was not employed. They were individually collected, marked, and bagged.

Figure 7 shows the horizontal distribution of burials and the excavated area. Figures 8 and 9 demonstrate the vertical distribution of burials in four units. Due to the fact that an unknown quantity of soil was removed for construction purposes from the surface of the midden, all measurements will be given from sterile clay up.

Burial 1 (Figure 10) This young adult was interred in a bundle fashion. The skull was facing 255° W-SW and lying on its right side. There was an elevation of 45 cm from sterile clay to the underside of this burial and 65 cm to the uppermost point placing this individual in Stratum 3. Skeletal material recovered was only partially complete and composed of skull, long bone shafts, rib fragments, and a pelvic fragment. Teeth are well worn but lack dental caries or evidence of abscess. Sex is undeterminable.

Burial 2 (Figure 11) This individual is an adult of undeterminable sex in a tightly flexed supine position. Alignment of this burial is only slightly off a N-S plane, with the skull in the southernmost direction. From sterile clay to the uppermost portion of this individual is a distance of 140 cm, the lowest 130 cm, placing it in Stratum 8. The skull has been severely damaged by a chisel plow. Mandibles and maxilla were never recovered but enough skull fragments were recovered to re-assemble a nearly complete, elongated cranium exhibiting a gracile brow. All skeletal material was normal and showed no signs of osteological abnormality except the right ulna, which had a well-healed fracture approximately 8 cm from the olecranon. A small, tan chert ovate biface and two biface fragments were recovered from the fill soil.

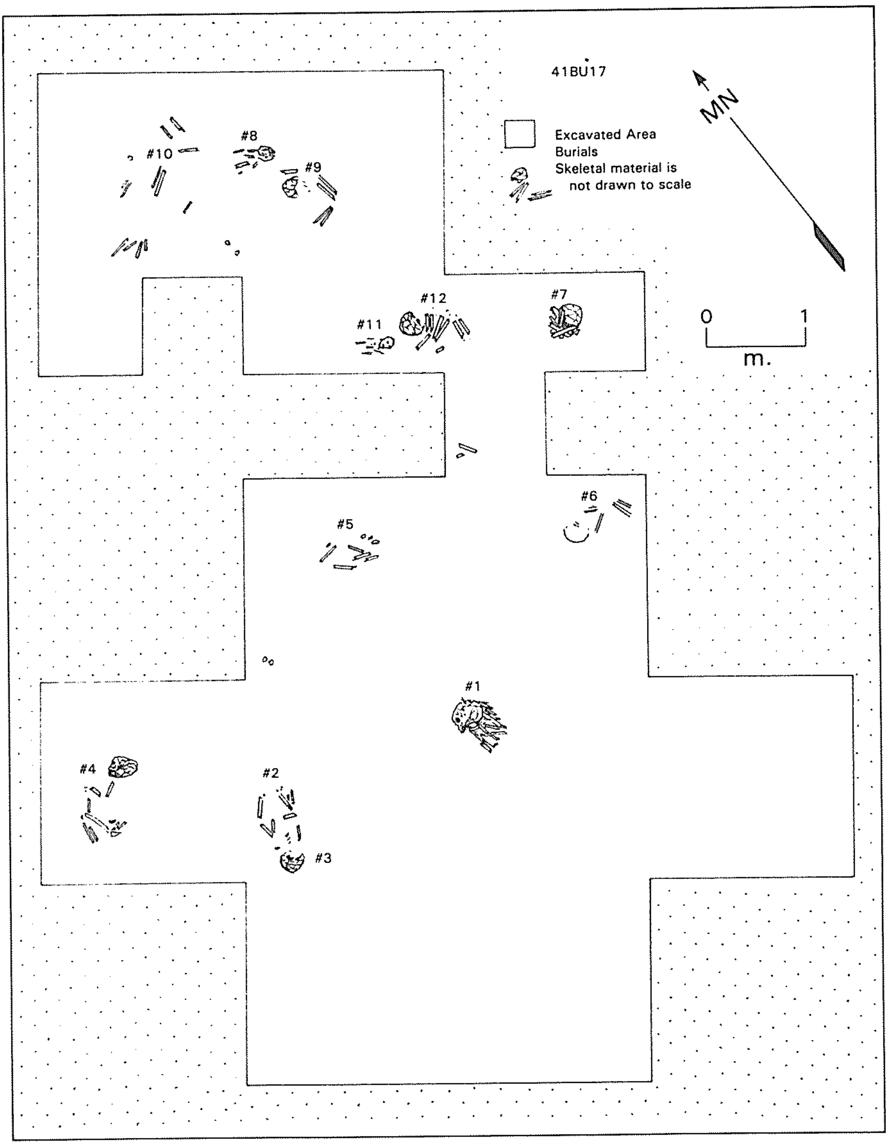

Figure 7. Cemetery Plan. Site 41BU17.

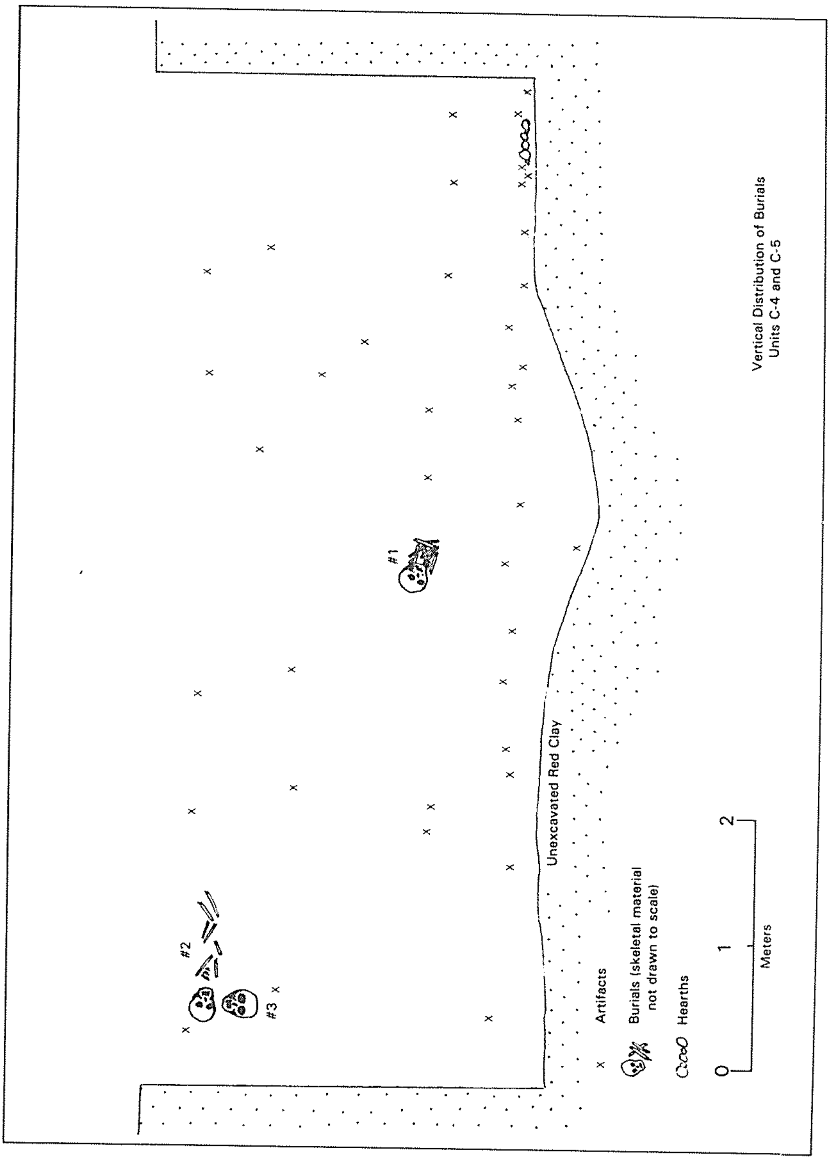

Figure 8. Vertical Distribution of Burials. Site 41BU17.

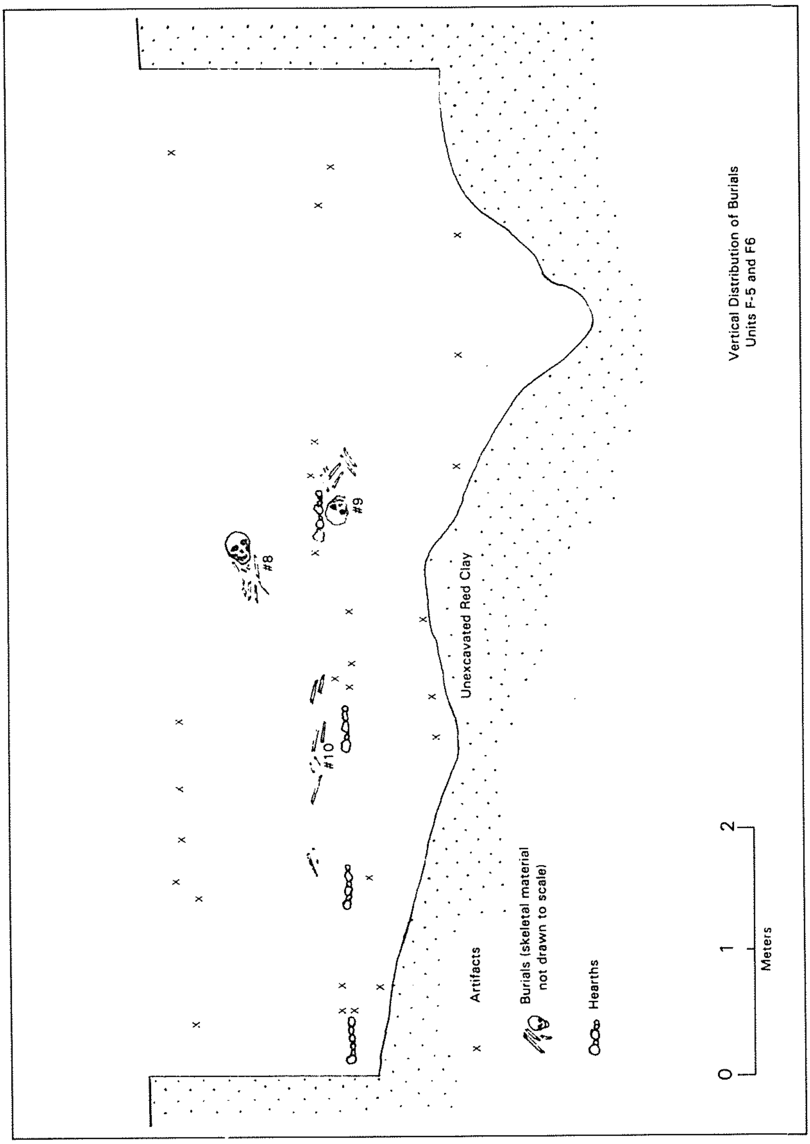

Figure 9. Vertical Distribution of Burials, Site 41BU17.

Burial 3 Ten cm directly beneath the cranium of Burial 2 was a robust adult male skull in an inverted position facing 30° N-NE. The mandible was partially articulated and a small amount of foreign bone was located in the vicinity of the foramen magnum. Although the material could not be positively identified, the author suggests it is the remaining fragments of the first cervical vertebra. All third molars had erupted and were fully developed. Dental caries were absent but teeth are heavily worn. There is no evidence present to suggest that Burial 2 intruded upon a complete burial. In this case, it seems this skull was interred alone.

Burial 4 (Figure 12) This loosely-flexed adult was lying on its right side

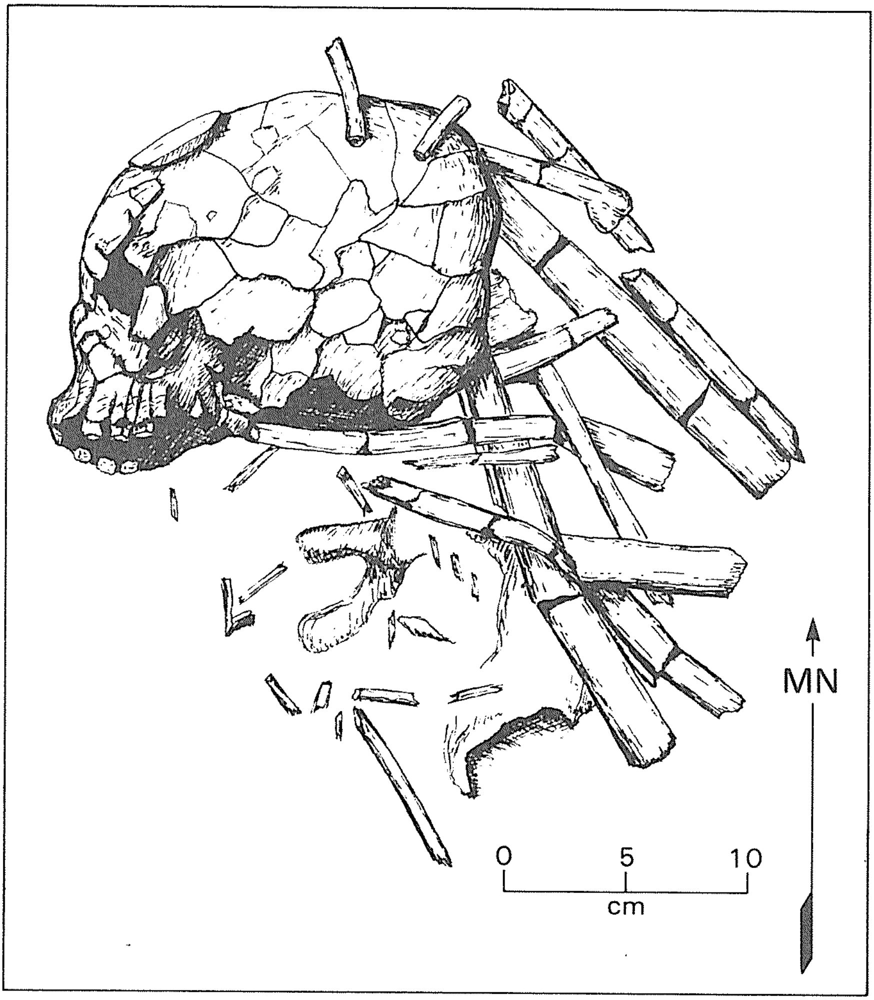

Figure 10. Burial #1. Site 41BU17.

facing 330° N-NW and is located in Stratum 3. Recovered bone consists of a crushed skull, a mandible, long bone shafts, and a few pelvic fragments. Facial features are gracile in appearance. Teeth seem to be free of dental caries and are heavily worn. All third molars have erupted.

Burial 5 This individual was located in Stratum 3 with an elevation of 40 cm above sterile clay. Due to poor preservation and its disarticulated condition, very little could be ascertained from this burial. Recovered bone consists of a few long bone shafts, three skull fragments, and one well-worn molar.

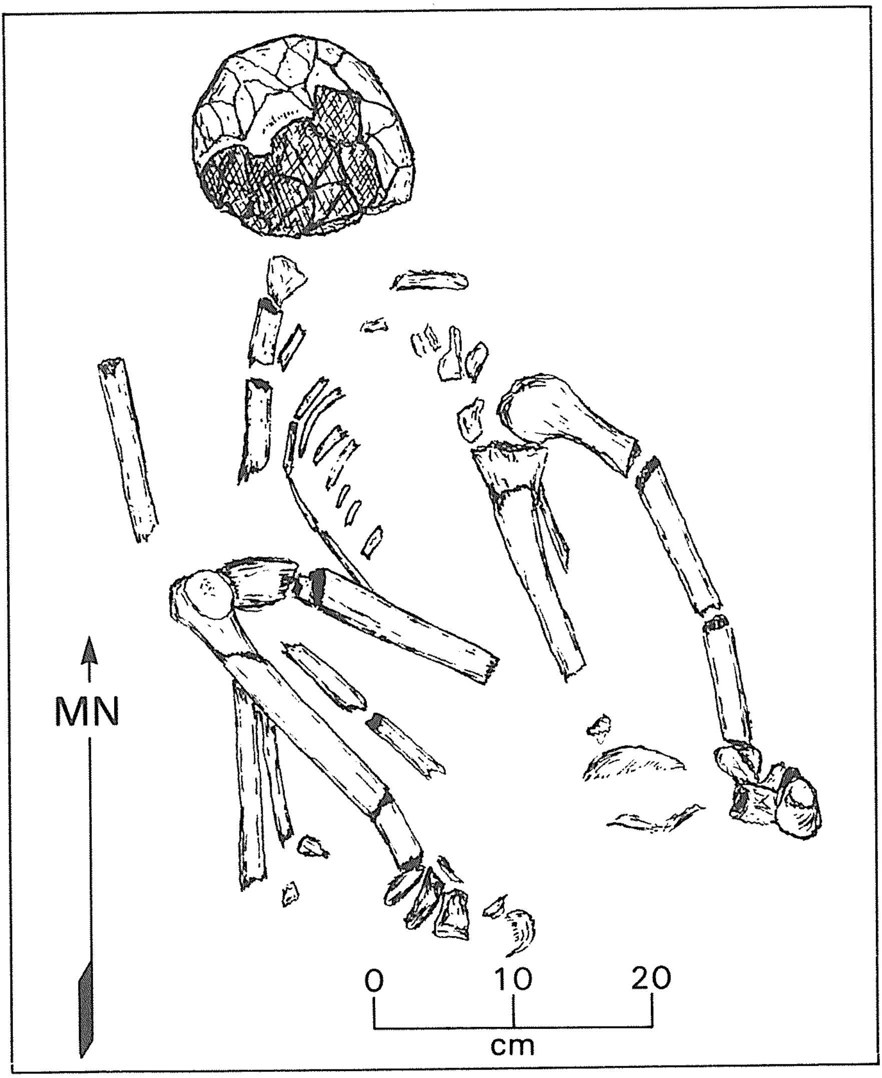

Figure 11. Burial #2. Site 41BU17.

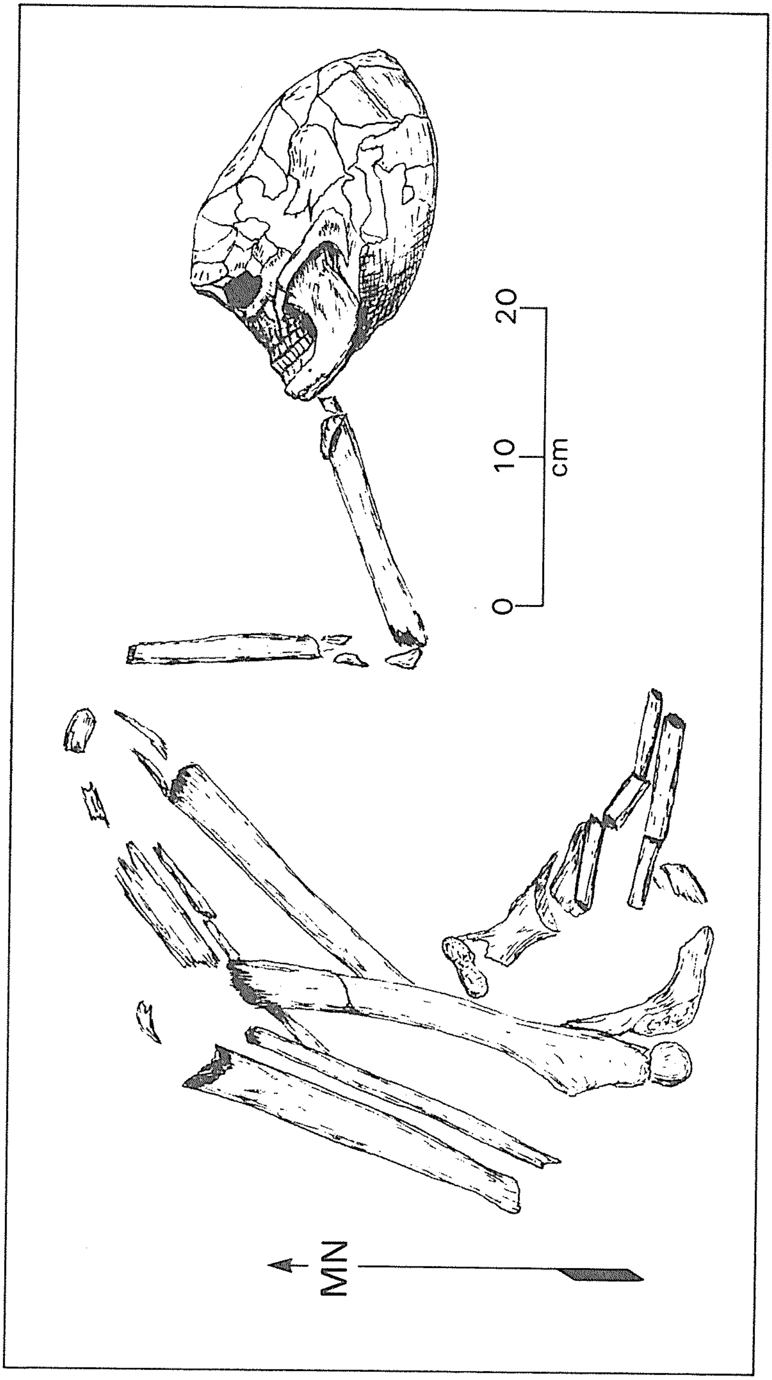

Figure 12. Burial #4. Site 41BU17.

Burial 6 Stratum 8 yielded the least preserved individual encountered. The only skeletal material recovered was five molars and one premolar in occlusion lacking all mandible and maxillary material. A light discoloration in the soil marked the outline of the cranium, ulnas, radii, and femur. It appeared to be flexed, lying on its left side facing approximately 30° N-NE.

Burial 7 (Figure 13) This secondary interment or bundle was the second and last encountered. This adult consists of a crushed skull, disarticulated mandible, and teeth showing a few small dental caries. Other skeletal material includes long bone shafts and a few rib fragments.

Burial 8 Stratum 8 provides an individual lying 60 cm - 75 cm above sterile clay which has been devastated by the chisel plow. Establishing orientation, sex, or interment style is impossible due to condition, but the examination of surviving teeth suggests the probability of adult status.

Burial 9 A hearth intruded upon Burial 9 producing burned skull fragments and a generally disturbed interment. It appears to be flexed but original orientation and age could not be established. This individual rests in Stratum 3 and has

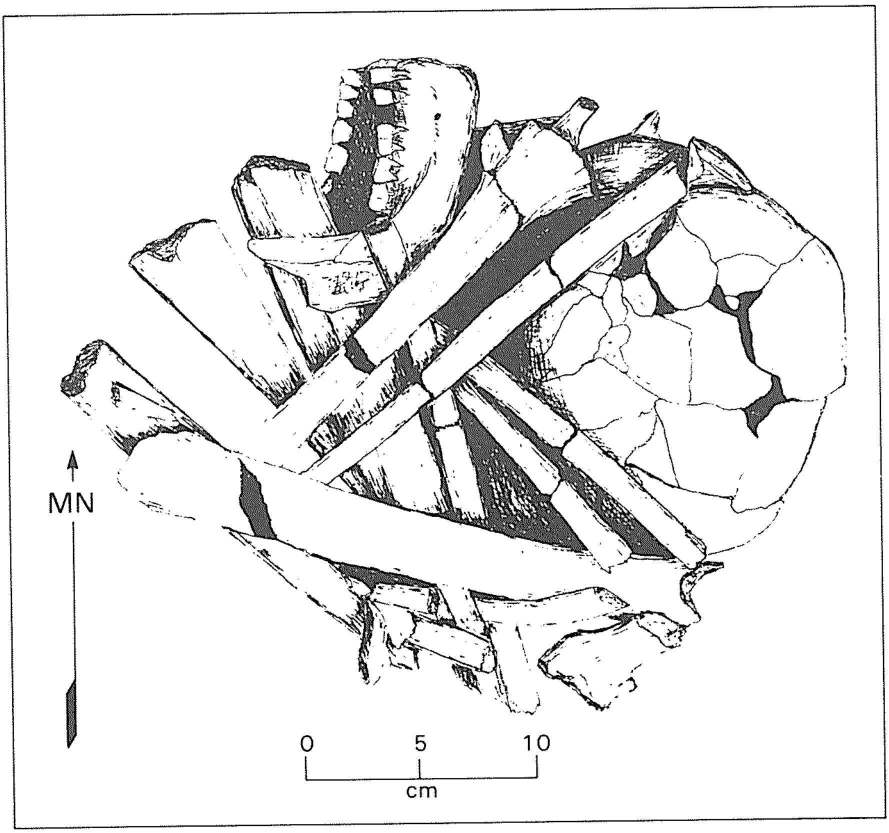

Figure 13. Burial #7. Site 41BU17.

an elevation of 30 cm at its lowest point and 40 cm. at its highest point above sterile clay.

Burial 10 An erosionally displaced burial was encountered in Stratum 4. This severely disarticulated individual was strewn over a four square meter area with only long bone shafts and a few skull fragments recovered. Original orientation and statistical information was impossible to determine.

Burial 11 A small child approximately four or five years of age was recovered associated with Burial 12. In this instance, bone preservation was very poor, but a partially complete crushed skull and a few long bone shafts were recovered. Orientation of this individual was on a NW-SE plane with the head being placed to the southeast.

Burial 12 This flexed adult was positioned on its left side facing 90° east and was buried in Stratum 3 with child burial 11. No teeth, mandible, pelvis, or maxillary bones were recovered, so age and sex could not be determined. This interment seems to have been disturbed either by aboriginal excavations at the site or erosion, as only a few skull fragments and an incomplete count of long bone shafts were encountered.

DISCUSSION

Twelve burials were recorded at 41BU17 in 1983 and at first it was assumed that all were from the same time period. However, during analysis, while charting artifacts and burials on a vertical graph (Figures 8 and 9), it became evident that there were two groups of burials from different time periods. Group One, consisting of Burials 1, 4, 5, 6, 7, 9, 10, 11, and 12 were interred during a much earlier occupation than the Group Two burials (2, 3, and 8).

Since the original surfaces from which the burials were introduced was not evident by visual inspection, it was necessary to conduct an experiment to try and estimate which strata would have been the most likely level from which each group of burials was introduced.

A pit was dug using only a bovine scapula and a sharp stick—tools that were available to the aboriginal groups. It soon became apparent that to excavate a hole of great depth in this manner was impractical. This experience seemed to suggest that the graves were rather shallow. Most interments were flexed and on their sides and since the human body in this position would require a minimum depth of 50 cm from the surface to the bottom of the pit, an estimated average figure of 70 cm was adopted for the purpose at hand. Hall (1981: 78) noted that at Allen's Creek burials were interred in a deposit only after an accumulation of 40-90 cm of sand. This observation reinforces the hypothesized figure of 70 cm. When this figure is applied vertically to the deposits, which Group One burials were enveloped in, it places a possible original surface at Stratum 7, which yielded Lange dart points, or in the Late Archaic context 2250–2600 BP (Prewitt 1981: 13).

When the same theory is applied to Group Two, they would be placed in an unknown zone that was destroyed by the removal of earth for fill; possibly the missing Toyah Phase noted in other parts of the site (see my comments in the Introduction).

At present, this time frame is purely speculative and the hope exists that a similar cemetery in the general area with better soil conditions will be excavated to either prove or disprove this estimated chronology for the interments at 41BU17.

In four cases out of the 12 burials, little or no information was gained to shed light on Winnie's Mound mortuary practices due to three major disruptive forces.

Burial 10 was severely scattered by an apparent erosional episode that obliterated any traces of this individual's original resting place. Interments 5 and 9 were displaced by aboriginal excavations with Burial 9 being further disturbed by an intrusive hearth in the vicinity of this individual's skull, producing charred cranial fragments and other burned bone. The third and most disruptive force occurred in historic times when the cultivator's chisel plow virtually destroyed Burial 8 and removed all traces of mandibular and maxillary materials from Burial 2.

Group One burials were reduced in number from nine to six by the aforementioned disruptive forces. Of the remaining six, two are secondary interments or bundle burials. This mortuary practice to date has not been documented in Burleson County or, in fact, in any of the surrounding counties, with the nearest examples coming from Austin County to the south at Allen's Creek (Hall 1982).

There appear to be three logical explanations for the existence of bundle burials at the site. One, an individual would die at the site and the remains would be consigned to a scaffold or tree until decomposition freed the bones of flesh. At that time the bones would be collected and interred in the cemetery. The second possibility is that an individual would die elsewhere. After decomposition had taken place, the remains would be collected and transported to the cemetery for interment. Either case would require more effort expended for the deceased than the use of a simple interment. Thirdly, a burial could have been accidentally disturbed by aboriginal excavations, the remains collected and reinterred in the cemetery. Any of these possibilities seem to imply that this particular parcel of land held meaning, either religious or territorial, to the populations being discussed.

The remaining individuals of this group were all buried in a flexed position. Numbers 6 and 12 were interred on their left sides, 6 facing north and 12 facing east. Burial 4 was on its right side, facing N-NW.

It is interesting to note that at 41BU17 there is almost no consistency in grave orientation while at 41BU16 (Roemer 1985), a few km to the north, some consistency is evident in the five burials discovered. Orientation in one case is impossible to discern because of its disturbed nature, but all the others recovered face in either a northern or a southern direction. 41BU16 also includes a single group interment consisting of an adult female and a five-year-old child nestled between her stomach and flexed legs (Steele 1985).

At 41BU17 a flexed adult lying on its left side (12), was located with a small child (11), approximately the same age as the one at 41BU16. In this instance, the child's orientation appears to be on a NW-SE plane or aligned with the spine of the flexed adult. Steele (1985) notes, "the possibility of a catastrophic situation taking the lives of two individuals within a few days of each other." Unfortunately, at Winnie's Mound, as well as 41BU16, there is no evidence to suggest the cause of death.

The Group Two burials consist of three individuals, one of which was destroyed by a plow. The surviving burials are those of a flexed individual in a supine position (2), and an inverted skull (3), lying directly below the skull of Burial 2. The association between these two burials is unclear. While the possibility of Burial 2 intruding on the remains of Burial 3 exists, there is no evidence to suggest that this was the case. With the exception of the skull and articulated mandible, there was no skeletal material in or around those burials that could be assigned to individual 3.

The author is unaware of any documented case in Central Texas where an individual was interred in an inverted position or, for that matter, a severed head being interred with another individual as a trophy.

The people of Winnie's Mound made use of a geographically-confined area for a cemetery. This practice has been documented in other areas of Texas. The Loeve-Fox site (Prewitt 1981: 62) has a large number of burials within a three meter diameter circular area and at Allen's Creek, Hall (1981: 76) notes, "The earliest occupation took place within and about an irregularly-shaped basin or depression at the edge of a bluff." Hall (*ibid.*) further states that occupying such a place would provide "a well-protected pocket" for aboriginal occupation.

The first group of interments at Allen's Creek, as well as at Winnie's Mound, was not introduced until this depression had filled up with sand to a level great enough for this purpose -- 40 - 90 cm (Hall 1981:78). This scenario seems to fit perfectly with the series of events at Winnie's Mound and the parallels between the two sites should not be underestimated.

SUMMARY

Winnie's Mound was occupied by small bands of hunter gatherers, perhaps in some instances semipermanently, as suggested by the wattle and daub structures (see Figure 6). The occupation extended from Late Paleo-Indian times, documented by San Patrice and Plainview-like dart points in Stratum 1, to a Late Prehistoric Austin Phase in Strata 10 and 11, as characterized by Scallorn arrow points and sandy paste pottery.

By comparing debitage to finished artifacts, it seems the artifacts made of nonlocal material were not produced at the site but were manufactured elsewhere. This suggests that these people traveled or traded far into Central Texas during certain times of the year, bringing back points made of nonlocal materials and would explain the complete lack of crude tools made of those materials. There is little evidence to support the theory that a structured trade network existed, but the possibility exists and should in the future be researched.

The area of aboriginal occupation at Winnie's Mound encompasses many acres of a high ancient river terrace. The cemetery is located in a slight depression on the side of the terrace. Debris from the occupations began to fill in the depression creating a sandy midden deposit, which in time allowed the easy interment of the first group of burials. Although no material suitable for radiocarbon dating was recovered, and all inference to time is based on diagnostic point type associations, this group seems to be derived of individuals of Late Archaic times or a date approximating 2400–2600 B.P.

A period of time elapsed during which the cemetery area was used for other purposes, probably by other groups. Eventually the second group of burials was introduced in the still-accumulating deposits, probably associated with Toyah Phase people or a possible date of A.D. 1200. After examining the existing skeletal material, it appears that these people were free of bone disease and dental problems, with the exception of heavy tooth wear, and were gracile in facial appearance.

The artifact assemblage represents a blend of eastern and Central Texas types. The many untyped points are probably local variations of these artifacts and suggest to the author that the Brazos River could be a boundary used by both groups throughout the site's occupation.

In the author's opinion, this project has created questions that when answered will fill in many gaps in Texas prehistory and demonstrates the need for more controlled excavations in the area between the Little River and the Navasota's respective confluences with the Brazos River.

ACKNOWLEDGMENTS

The author wishes to thank Dr. Harry Shafer of Texas A&M University for his continued advice and support during the course of this project. His deep concern for local archeology and willingness to share of himself has made this report possible. The author is also indebted to the following people: Phil Scamardo, the landowner, for his permission to work at the site; Dr. Gentry Steele of Texas A&M University for his advice in the analysis of human and faunal remains; Michael Sweatt of Bryan for his help in the field; and my wife, Deborah, for the many hours spent in the field and typing my manuscripts.

Table 1. Tabulation of Debitage: Unit C-3

	Method of Reduction	Chert Types	0–10	20	30	40	50	60	70	80	90	100	110	Chert Type %
			Levels in Centimeters											
Cobble			—	—	—	—	—	—	—	—	—	2	3	
		Local	—	—	—	—	—	—	—	—	—	2	3	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	—	—	0%
Cores			—	4	7	—	4	6	1	3	8	12	5	
		Local	—	4	7	—	4	6	1	3	8	12	5	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	—	—	0%
Primary Flakes	Hard Hammer Percussion		14	22	10	5	25	21	23	33	64	60	45	
	Soft Hammer Percussion		4	—	5	2	2	2	4	8	7	6	4	
	Fragments		6	—	7	3	0	6	7	6	11	17	8	
		Local	24	22	22	10	27	28	34	46	81	83	57	99.3%
		Nonlocal	—	—	—	—	—	1	—	1	1	—	—	.69%
Secondary Flakes	Hard Hammer Percussion		49	32	19	41	27	41	25	71	86	88	54	
	Soft Hammer Percussion		9	1	10	11	14	18	10	21	9	21	17	
	Fragments		10	—	8	21	3	3	9	15	23	24	19	
		Local	68	33	37	73	43	62	42	106	118	132	88	99.12%
		Nonlocal	—	—	—	—	1	—	2	1	—	1	2	.86%
Tertiary Flakes	Hard Hammer Percussion		20	9	26	16	12	11	30	34	45	52	41	
	Soft Hammer Percussion		85	47	85	70	87	72	80	138	174	168	106	
	Fragments		52	27	46	75	48	69	82	136	125	127	68	
		Local	153	83	155	148	145	152	185	303	337	343	213	97.99%
		Nonlocal	4	0	2	13	2	—	7	5	7	4	2	2.01%
		TOTALS	249	142	223	244	222	249	271	465	552	577	370	

Table 2. Tabulation of Debitage: Unit C-5

	Method of Reduction	Chert Types	0–10	20	30	40	50	60	70	80	90	Chert Type %
			Levels in Centimeters									
Cobble			—	—	—	—	—	2	—	—	—	
		Local	—	—	—	—	—	2	—	—	—	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	0%
Cores			—	—	1	1	—	2	2	1		
		Local	—	—	1	1	—	2	2	1	—	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	0%
Primary Flakes	Hard Hammer Percussion		4	3	2	5	6	14	12	5	—	
	Soft Hammer Percussion		1	—	—	—	2	—	2	—	—	
	Fragments		1	—	—	—	2	—	6	—	—	
		Local	6	3	2	5	10	14	20	5	—	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	0%
Secondary Flakes	Hard Hammer Percussion		13	6	4	2	10	30	22	16	—	
	Soft Hammer Percussion		5	4	1	8	6	7	10	1	—	
	Fragments		12	5	2	7	—	5	10	3	—	
		Local	30	15	7	17	15	42	41	20	—	98.94%
		Nonlocal	—	—	—	—	1	—	1	—	—	1.06%
Tertiary Flakes	Hard Hammer Percussion		7	3	7	6	14	25	20	13	1	
	Soft Hammer Percussion		10	14	13	13	30	47	33	16	1	
	Fragments		13	3	10	19	14	24	26	15	—	
		Local	30	17	30	38	52	86	79	44	1	97.67%
		Nonlocal	—	—	—	—	6	2	—	—	1	2.33%
		TOTALS	66	38	40	61	84	156	143	70	2	

Table 3. Tabulation of Debitage: Unit E-6

	Method of Reduction	Chert Types	0–10	20	30	40	50	60	70	80	90	100	110	Chert Type %
			Levels in Centimeters											
Cobble			—	—	1	—	—	—	—	—	—	—	—	
		Local	—	—	1	—	—	—	—	—	—	—	—	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	—	—	0%
Cores			1	2	—	—	1	1	1	—	—	3	1	
		Local	1	2	—	—	1	1	1	—	—	3	1	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	—	—	0%
Primary Flakes	Hard Hammer Percussion		1	1	—	2	6	3	3	7	7	8	1	
	Soft Hammer Percussion		—	—	1	1	—	—	—	1	1	2	—	
	Fragments		1	—	1	3	1	3	—	2	2	3	1	
		Local	2	1	2	6	7	6	3	10	10	13	2	98.4%
		Nonlocal	—	—	—	—	—	—	—	—	—	1	—	1.59%
Secondary Flakes	Hard Hammer Percussion		4	8	9	16	13	6	14	9	15	8	3	
	Soft Hammer Percussion		—	—	3	2	1	—	4	2	2	—	—	
	Fragments		4	—	3	7	5	3	3	2	1	3	1	
		Local	8	8	15	25	19	9	21	13	18	11	4	100%
		Nonlocal	—	—	—	—	—	—	—	—	—	—	—	0%
Tertiary Flakes	Hard Hammer Percussion		7	2	3	4	15	4	3	5	8	12	1	
	Soft Hammer Percussion		12	8	19	14	31	10	18	20	28	19	4	
	Fragments		8	9	22	12	15	11	13	15	14	11	3	
		Local	23	18	42	30	61	25	34	36	45	40	8	97.26%
		Nonlocal	4	1	2	—	—	—	—	4	5	2	—	4.74%
		TOTALS	38	30	62	61	88	41	59	63	78	69	15	

Table 4. Artifact Dimensions

Artifact Class	Length	Width	Thickness	Width of Stem at Neck	Width of Base	Chert Local	Chert Nonlocal
	(Dimensions given in centimeters)						
Lithics							
Arrow points							
Scallorn	2.4–4.4	1.3	.3–.35	.7–.8	1.1–1.2	3	—
Dart points							
Bell	3.8	3.5	5.5	1.8	1.9	—	1
Darl	6.0	1.9	.8	1.3	1.45	1	—
Edgewood	3.7–4.1	2.0–2.8	.8–.9	1.5–1.8	1.8–2.1	3	—
Ensor	3.2–4.7	2.5–2.8	.6–.7	1.2–1.5	2.2–2.4	2	—
Frio	4.9–5.0	2.9–3.0	.48–.8	1.8–2.0	2.5	1	1
Gary-Kent	4.5–5.0	1.9–2.6	.55–.8	1.2–1.7	1.1–2.0	6	—
Hoxie	4.3	2.4	.65	1.7	1.8	1	—
Lange	5.2–5.8	2.3–3.0	.7–.8	1.1–1.6	1.6–1.9	2	—
Marcos	4.0–5.5	2.1–2.9	.4–.8	1.1–1.8	1.3–2.1	5	—
Plainview-like	5.5	2.6	.65	2.5	2.4	1	—
San Patrice	5.5	3.0	.4	2.5	3.0	1	—
Yarbrough	4.4–5.2	2.2–2.7	.8–.85	1.2–1.7	1.4–2.0	3	—
Unclassified dart points							
Form 1	5.0	3.1	.8	1.3	1.2	1	—
Form 2	5.1–5.3	2.8–4.0	.6–.9	1.4–1.6	1.6–1.9	3	2
Form 3	4.6–5.0	2.2–2.7	.7–.75	1.4–1.9	1.6–2.3	2	2
Form 4	3.2	1.6–2.3	.5	1.4–1.8	1.5–2.0	2	—
Form 5	5.5–6.6	1.7–2.0	.6–.9	1.0–1.5	1.9	2	—
Form 6	5.5	1.4–1.5	.6–.7	1.1	1.3–1.4	1	—
Form 7	5.0	2.0	.68	1.6	2.0	1	—
Form 8	5.1	2.2	.95	1.5	1.9	1	—
Form 9	5.9	2.7–3.0	.9–1.1	1.5–1.8	1.2–2.0	3	2
						45	8
						85%	15%

	Length	Width	Thickness	Width of Bit	Width of Base		
Bifaces							
Awl	5.4	.7	.6		1.9	1	—
Corner-tanged biface	7.5	4.5	.6			1	—
Drills		.7–1.1	.45–5.5			2	—
Ovate bifaces	6.0–10.1	3.9–6.0	.7–1.7			7	1
Group I							
I A	5.7–7.3		1.7–1.8	2.7–3.1		3	1
I B	7.2–7.3		1.1–1.9	2.5–3.4		2	—
I C	5.0		.7	3.0		1	—
Group II							
II A	7.5		2.5–2.7	2.5		2	—
II B	5.9–9.2		3.0–5.0	2.5–4.5		4	—
Unifaces							
Group I							
I A	3.5–7.0	1.2–3.5	.4–1.6			11	—
I B	4.5–5.5	1.3–3.0	.4–.6			6	—
I C	3.4	2.4	.9			1	—
I D	.7	2.6	.5–1.2			2	—
I E	3.4	2.3	1.2–2.5			3	—
I F	5.0–5.5	3.0–4.5	3.0–7.2			2	—
						48	2
						96%	4%
Battered Stone							
Hammerstones	6.0–6.5	5.0–5.9	4.0–5.6				
Smoothed Stone							
Manos	5.4–6.2	3.4–5.5	2.7–5.0				
Ceramics							
Pottery	2.0–10.0	1.3–6.7	.75–.95				

Table 5. Provenience of Artifacts

Artifact Class	STRATA 11	10	9	8	7	6	5	4	3	2	1	TOTAL
Lithics												
Arrow points												
Scallorn	—	2	1	—	—	—	—	—	—	—	—	3
Dart points												
Bell	—	—	—	—	—	—	1	—	—	—	—	1
Darl	—	—	—	—	1	—	—	—	—	—	—	1
Edgewood	—	—	—	—	—	—	—	1	—	2	—	3
Ensor	—	—	2	—	—	—	—	—	—	—	—	2
Frio	—	—	—	—	—	—	—	2	—	—	—	2
Gary-Kent	—	2	4	—	—	—	—	—	—	—	—	6
Hoxie	—	—	—	—	—	—	—	—	—	1	—	1
Lange	—	—	—	—	2	—	—	—	—	—	—	2
Marcos	—	3	2	—	—	—	—	—	—	—	—	5
Plainview-like	—	—	—	—	—	—	—	—	—	—	1	1
San Patrice	—	—	—	—	—	—	—	—	—	—	1	1
Yarbrough	—	—	—	—	1	—	1	1	—	—	—	3
Unclassified dart points												
Form 1	—	—	—	—	—	—	1	—	—	—	—	1
Form 2	—	—	—	—	1	—	—	—	—	3	1	5
Form 3	—	—	—	—	—	—	—	1	—	2	1	4
Form 4	—	—	—	—	—	—	—	2	—	—	—	2
Form 5	—	1	—	—	—	—	—	—	—	1	—	2
Form 6	—	—	—	—	—	—	—	—	—	—	1	1
Form 7	—	—	1	—	—	—	—	—	—	—	—	1
Form 8	—	—	1	—	—	—	—	—	—	—	—	1
Form 9	—	—	—	—	—	—	—	2	—	3	—	5
Point fragments	—	1	2	—	3	—	—	1	—	2	1	10

Bifaces												
Biface failures	—	7	9	—	10	3	8	7	—	19	9	72
Awl	—	—	—	—	—	—	—	—	—	—	1	1
Corner-tanged knife	—	—	1	—	—	—	—	—	—	—	—	1
Drills	—	1	1	—	—	—	—	—	—	—	—	2
Ovate bifaces	—	—	1	—	—	—	—	2	1	—	4	8
Group I												
I A	—	—	—	—	—	—	—	—	—	—	4	4
I B	—	—	—	—	—	—	—	1	—	—	1	2
I C	—	1	—	—	—	—	—	—	—	—	—	1
Group II												
II A	—	—	—	—	—	—	—	—	—	—	2	2
II B	1	—	—	—	—	—	—	—	—	—	3	4
Unifaces												
Group I												
I A	—	2	1	—	2	—	—	6	—	—	—	11
I B	—	2	—	—	—	—	—	4	—	—	—	6
I C	—	—	—	—	1	—	—	—	—	—	—	1
I D	—	1	—	—	1	—	—	—	—	—	—	2
I E	—	—	2	—	—	—	—	1	—	—	—	3
I F	—	—	—	—	—	—	1	—	—	—	1	2
Battered Stone												
Hammerstones	—	—	—	—	—	—	—	—	—	—	2	2
Smoothed Stone												
Manos	—	—	—	—	1	—	—	1	—	—	—	2
Ceramics												
Pottery	—	3	2	—	—	—	—	—	—	—	—	5
TOTAL	1	26	30	—	23	3	12	32	1	33	34	194

Table 6. Tabulation of Fired Clay

		Levels in Centimeters										
		0–10	20	30	40	50	60	70	80	90	100	110
UNIT C-3												
Type I—Daub	1 mm	—	—	—	—	—	—	—	—	—	—	—
Wattle Diameter	3 mm	—	—	—	—	—	1	2	2	1	—	—
	5 mm	—	—	—	—	—	1	—	—	—	1	—
	7 mm	—	—	—	—	—	—	—	—	—	—	—
	1 cm	—	—	—	—	—	—	—	—	—	1	—
	2 cm	—	—	—	—	—	2	2	—	—	—	1
	3 cm	—	—	1	—	—	1	—	—	—	1	—
	4 cm	—	—	—	—	—	1	—	—	—	—	—
	5 cm	—	—	—	—	—	1	—	—	—	—	—
TOTALS		—	—	1	—	—	7	4	2	1	3	1
Type II	0–1.5 cm	1	5	9	5	13	42	39	72	75	136	60
Diameter	1.5–4 cm	7	5	11	21	52	76	84	117	138	159	118
	4–6 cm	3	—	1	7	12	6	4	4	17	23	8
TOTALS		11	10	21	33	77	124	127	193	230	318	186
Type III Diameter/TOTALS	6–10 cm	—	—	—	—	—	1	2	—	4	—	2
UNIT E-5												
Type I—Daub	1 mm	—	—	—	—	—	—	—	—	—	—	—
Wattle Diameter	3 mm	—	—	—	—	2	—	—	—	—	—	—
	5 mm	—	—	—	—	—	—	—	—	—	—	—
	7 mm	—	—	—	—	—	—	—	—	—	—	—
	1 cm	—	—	—	—	—	—	—	—	—	—	—
	2 cm	—	—	—	—	1	2	—	—	—	—	—
	3 cm	—	—	—	—	—	1	—	—	—	—	—
	4 cm	—	—	—	—	1	—	—	—	—	—	—
	5 cm	—	—	—	—	1	—	—	—	—	—	—
TOTALS		—	—	—	—	5	3	—	—	—	—	—

Type II												
Diameter	0–1.5 cm	6	4	7	12	12	31	25	10	5		
	1.5–4 cm	—	9	10	17	22	42	58	22	—		
	4–6 cm	—	—	1	—	3	1	2	2	1		
	TOTALS	6	13	18	29	37	74	85	34	6		
Type III												
Diameter/TOTALS	6–10 cm	—	—	—	—	2	—	1	—	—		
UNIT E-6												
Type I—Daub												
Wattle Diameter	1 mm	—	—	—	—	—	—	—	3	—	—	—
	3 mm	—	—	—	—	1	1	—	—	—	—	—
	5 mm	—	—	—	—	—	—	—	—	—	—	—
	7 mm	—	—	—	—	—	—	—	—	—	—	—
	1 cm	—	—	—	—	—	—	—	—	—	—	—
	2 cm	—	—	1	1	—	—	—	1	—	—	—
	3 cm	—	—	—	—	—	3	—	—	—	—	—
	TOTALS	—	—	1	1	1	4	—	4	—	—	—
Type II												
Diameter	0–1.5 cm	3	1	10	12	19	3	20	23	8	15	—
	1.5–4 cm	5	9	5	11	32	12	24	15	34	43	1
	4–6 cm	—	—	—	—	3	—	2	1	2	1	—
	TOTALS	8	10	15	23	54	15	46	39	44	59	1
Type III												
Diameter/TOTALS	6–10 cm	—	—	—	—	—	—	—	—	—	—	—

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Three Caches of Guadalupe Tools From South Texas

Kenneth M. Brown

ABSTRACT

Three caches of Guadalupe tools from south Texas are described and compared metrically and microscopically. The Lindner cache of nine tools, from Medina County, is an isolated find from the flood plain of Hondo Creek, and all nine specimens appear unused (or at least freshly resharpened). The Granberg cache was found in a Bexar County occupation site, and at least three of the four tools show some use wear in the form of edge attrition. The Peterson cache of six tools from Atascosa County was also apparently an isolated find, and all six show an identical configuration of abrasive (?) polish on surfaces adjacent to the working edge. Other topics such as recognition of caches, method of manufacture, experimental use wear, and the problem of distinguishing percussor damage from traumatic use wear are discussed. While the shape, size, and method of manufacture of all three caches are quite similar, microscopic examination shows each cache has its own microwear signature that distinguishes it from the others, suggesting these are *tool sets,* not simply random collections of tools, and the differences may be due to differing stages in the use life of tool sets, or to different hardnesses of the material being worked.

INTRODUCTION

This study began when Mr. O. R. Lindner of San Antonio visited the lab at the Center for Archaeological Research and brought for identification a collection of nine Guadalupe tools found on his Medina County property (Figure 1). I borrowed the tools for study and later visited the location of the find. After studying the tools, I became curious to see what characteristics other Guadalupe tool caches might have, and was able to examine a small cache from the Granberg II site. The study became a comparison of two caches, and there the matter rested until Bobbie McGregor and Fred Valdez brought to my attention a third cache at the Witte Museum, this one donated long ago in 1942. These are the only Guadalupe tool caches I have been able to locate and study. Reportedly another cache may have been found at the Morhiss site, but I have not tried to locate or document it. Yet another cache has been reported at the J-2 Ranch site, but on

Figure 1. Location of Guadalupe tool caches.

examination it has proven to consist of Clear Fork tools or protoforms (see appendix). Since this study has grown in such unplanned fashion, maintaining continuity of the text and observational consistency has been a persistent problem, especially since the Lindner tools were returned to their owner before I obtained the Peterson cache on loan from the Witte Museum. Any inconsistencies in the tool descriptions must be laid to this cause, and I plead *nolo contendere*.

I have tried to accomplish several things in this paper: 1) to explain how Guadalupe tools were made, something that has been poorly understood for some time; 2) to provide detailed individual descriptions of the tools, because existing descriptions in the literature are too uncommon or inadequate; 3) to discuss some of the realities and limitations of microwear observation, such as distinguishing between manufacturing damage and use damage; and 4) to see what characteristics these cached tools might have in common and whether these can tell us anything about why the tools were cached.

> A cache is an accumulation of useful material that is hidden away for future recovery and utilization. Such things as food, clothing, tools, and raw materials may be placed in a cache. Similar types of association between cultural objects are found in

> human burials and trash pits, but these are not caches according to the definition above because recovery and utilization are not normally anticipated (Tunnell 1978: 1).

Caches are for the most part the product of *logistically organized behavior.* That is, procurement of resources in relatively large quantities, too large to be transported at once, by special task groups at a specific, preplanned location. Caches are an important feature of hunter-gatherers employing *collector* (rather than *forager*) economies (Binford 1980: 10, 12; 1982) and are organized with regard to some anticipated route or routine of behavior. The material is left behind because it is too heavy to carry, or will not be needed until some future predictable date (see, for example, Shutler 1956), or because multiple stashes of supplies must be provided for contingency use. A metate, for example, may be left at a site both because it is too heavy to carry and because planned travel might lead away from concentrations of the seeds that were being ground on the metate. A cache of eight introduced chert cobbles (three of which had been tested; Calhoun 1965) found on Hog Bayou in Calhoun County and another cache of about 50 tested cobbles found in the Cypress Creek watershed in Harris County (Hale and Freeman 1978: 90–98) are possible archeological examples from Texas. Thomas (1983: 81–82) provides a useful discussion of caches and distinguishes between resource caches and tool caches in the Great Basin, where ethnographic sources record rabbit nets, bird nets, deadfall parts, fishing equipment, digging sticks, snares, and milling stones having been cached (see Osborne and Riddell 1978 and Wallace 1978 for some California examples). Many of these were put in field storage because they were needed only in certain locations at certain times of the year. Tool caches may consist of sets of similar tools, like the Kelly Field projectile point cache (Hester 1972) or like the caches reported in this paper, or they may sometimes consist of tool kits, like the Hawkins cache of Dalton points, bifacial preforms, "adzes," edge damaged flakes, end scraper, sandstone abraders, and other items (Morse 1971). Another example, this one from Missouri, is a cache of ten agricultural hoes and two "spades", all with silica polish, plus a cobble hammerstone that was probably provided for retouching them. These were found in a pit about 30 cm deep with otherwise sterile fill, associated with a Mississippian structure (Southard 1976). Occasionally caches are found that seem to represent a series of artifacts whose manufacture was in progress; an example is a slab-lined cache of obsidian and quartzite preforms, a flake, a projectile point, a bone flaking tool and a lump of yellow ocher found in the Warner Valley in Oregon (Weide and Weide 1969). In other cases, caches may have little to do with logistically organized behavior and may in fact be special offerings with supernatural meaning, or were ritual items stored away from camps to shield them from contact with society members who were not privy to their use or meaning. The famous Mount Livermore cache of hundreds of arrow points, both complete and fragmentary, a "large point, and a few flat beads" (Janes 1930: 8) found under a cairn on the summit of Mount Livermore, may well be an example. The Hutton cache (Hutton 1976), an El Paso Polychrome olla with an incised slate tablet, pecked pebble, and quartz crystals, found at the edge of a playa, might be another. Other caches with diverse arrays of rare goods, such as the Tobin Ranch cache (Moore and Wheat 1951), are sometimes interpreted as traders' caches, although this has never actually been demonstrated.

Caches may be left 1) marked but without a storage facility; 2) in a natural, unprepared storage facility; or 3) in a prepared storage facility. Some kind of marker is usually necessary to allow the material to be relocated, and some kind of facility is usually necessary to prevent the material from being dispersed. Cached food, for example, must be sealed from predators.

How, then, are archeologists to recognize caches: how, for example, can cached material be distinguished from discarded material, especially since discards may also occur in a facility, such as a trash pit? This might be termed the *cache-trash problem*. Some evidence of a prepared facility or a marker perhaps ought to be expected as evidence of logistically organized behavior, if an accumulation of artifacts is to be identified as a cache. Paradoxically, though, since caches are frequently isolated, they are rarely recovered by archeologists, who concentrate on sites. Perhaps this very isolation should be regarded as evidence of caching. Most caches reported to archeologists have already been removed from the ground, and it is not clear whether a facility of some sort was present. Finds such as the Millsap cache (Millsap and Dickson 1968), the Johnson, Palo Duro, and Potter County caches (Witte 1942), McWilliams cache (Tunnell 1978), Brush Creek cache (Hammatt 1970b), Anadarko cache (Hammatt 1970a), and a cache at 41 FY 314 (Nightengale, Jackson, and Moncure 1985: 33–34) all seem to be ambiguous with respect to the presence of a facility. Others, such as the Whitzitt cache found under a flat rock (Witte 1942), the High Lonesome bead cache found in a pot marked with a cairn (Kelly 1977), the Indian Mesa cache found under a pile of rocks inside a rockshelter (Eagleton 1955); the Gibson, Weaver-Ramage (Tunnell 1978), LeVick (LeVick 1975), Heerwald (Lintz 1978), and Brookeen Creek (Mallouf 1981) caches, all in small, shallow pits; and Feature 8 near the Road Cut site (Hughes and Willey 1978), in a large, charcoal-stained, possibly baked pit, seem to indicate a facility. The last example, like many other finds of biface preforms or blades in north Texas and Oklahoma, might represent material buried for heat treating, in an environment where it is easier to transport the lithic material to a source of firewood than to carry the extra firewood for heat treatment to an archeological site. Other caches of biface preforms, however, seem to comprise material that would not require heat-treating, such as a cache of welded tuff preforms found near Sterling, Idaho (Pavesic 1966). Other problems of interpretation arise in areas with acidic soils which degrade bone, introducing the possibility that "caches" may actually be burial offerings. In such cases, definition of a facility is critical: does it have the properties of a grave, or of a cache pit? Other "caches", such as the small tightly packed concentrations of chert flakes sometimes found in occupation sites, may be heat-treating loads, true caches, or simply the result of prehistoric clean-up activities. Helm and Turner (1975) give an example from Missouri. A very similar feature was found at Skillet Mountain Four (41 MC 222) in Choke Canyon Reservoir.

In practice, recognition of a facility such as a pit is often difficult or impossible. Most of the shallow cache pits reported in Texas and adjacent areas seem not to have contrasting fills, so that the only way to judge whether a facility is present at all is from the configuration of the objects themselves. The Road Cut cache seems to be an exception. Another exception are the various-sized bell-shaped, often elaborately floored pits found in excavated 18th century Wichita-speaking villages such as the Stansbury site (Stephenson 1970: 71) and the Vinson site. These have been termed "cache pits" in the literature, but might be better regarded as *storage pits,* since they presumably functioned to protect crops from rodents and the like during the occupation of a sedentary village and perhaps had nothing to do with logistically organized movement.

Markers, belonging to the class of *things that stick up in the air,* are almost never found (the Mount Livermore cairn and the possible cairn at the High Lonesome site serving as all too rare exceptions). Pragmatically, then, archeologists are usually forced to turn to other circumstances of recovery for identification of caches. In practice, single items are almost never identified as caches, while clustered multiple items, especially multiple occurrences of the same item, may be identified as caches. Accordingly, while there are many known instances of Guadalupe tools found buried in sites or exposed on the surface, these are not ordinarily regarded as being deliberately cached, but rather as discards, since there is no *prima facie* evidence of intended future use. Operationally, then, single items even if associated with a facility are not likely to be identified as cache items, while tightly clustered arrays of identical items are most likely to be regarded as a cache even if no facility is recognized. The condition of the item may or may not be decisive; the Gibson and Brookeen Creek finds, for example, were regarded as caches rather than trash even though unmodified flakes constituted the bulk of the material recovered. Here, the isolation of these finds seems to indicate the operation of logistically organized behavior. In a few cases, the carefully patterned or layered arrangement of items in a cache seems to indicate they are not discarded, even when there is no evidence of a formal facility (see Slesick 1978).

With the foregoing in mind, let us consider the three caches reviewed in this paper. The Lindner cache was found buried in flood plain sediment of Hondo Creek; no pit was visible when I visited the site in 1984, although the artifacts had already been removed from the cutbank. Nothing that could be considered an occupation site was visible near the cache. The Peterson cache was apparently an isolated find also, occurring about 150 meters away from the nearest occupation site, although the information on location is not firsthand, and we have no information at all on the depth of the find or the presence of a pit. The Granberg cache was found in an occupation site; again, a cache pit was not found, although conceivably a small one might have been overlooked in the midden fill.

MANUFACTURING SEQUENCE FOR GUADALUPE TOOLS

The manufacturing sequence given below was written as a description of the Lindner cache, but it applies equally to all three caches insofar as can be determined, except for the details of edge angle, length, and platform width. Evidently all of the tools were made from elongate chert cobbles. In the Lindner cache all except specimens 3, 5, and 7 have some cobble cortex remaining. In some cases it can be seen that the craftsman took advantage of the natural shape of the cobble, using a naturally occurring ridge on the cobble as the dorsal keel on the finished tool. In several cases, dorsal decortification flakes have been removed from both lateral edges, stopping short of the dorsal ridge so as to leave a narrow strip of cortex running down the spine of the tool and extending onto the butt. Apparently the manufacturing sequence was as follows:

1] a cobble was selected and truncated by a heavy percussion blow from a large hammerstone. In effect, the cobble was "quartered" although only the end was removed. This left a somewhat hollow striking platform on the end of the cobble, generally without any discernable ripple marks. The truncation surface was not produced exactly at right angles to the long axis of the cobble, but rather at an angle of about 50–60° to the edge of the cobble which was destined to become the dorsal ridge (Figure 2);
2] using the truncation facet as a platform, the bit was trimmed into a rounded shape by removing a series of decortification flakes from what was to be the dorsal surface of the tool;
3] again using a heavy hammerstone, a severe blow was struck on the truncation facet about 4 cm back from the trimmed arcuate edge, removing a long (about 10–11 cm), narrow but thick cortex flake from the core;
4] the ventral side of this flake was used as a platform from which to remove part or all of the cortex from the dorsal side. The aim here seems to have been to regularize the lateral edges, and perhaps more importantly, to make the lateral edges less acute;
5] if the ventral facet was straight when it came off the core, little further modification was done; if irregular, flakes were detached as needed from the ventral facet so as to straighten the ventral face of the tool;
6] the bulb of percussion was removed from the ventral face by a percussion blow delivered at one of the distal corners using the dorsally flaked surface as a platform. Sometimes more than one flake removal was necessary to produce a straight juncture between the bit facet and the ventral surface, and sometimes a removal from the opposite corner was necessary to restore the symmetry of the ventral face;
7] final trimming of the rounded bit facet was done using a light blow delivered with a small hammerstone. In many of the specimens, considerable care was obviously taken to produce an even, carefully trimmed edge that was symmetrically arcuate. Because of the edge angle, these final trimming

> scars frequently hinged out abruptly a centimeter or two from the edge. In some cases these trimming scars truncate dorsal flake scars.

One important observation concerning step number 1 is in order. The remnant of the quartering facet preserved on the tool generally lacks the typical ripple marks left by direct percussion, as noted above. The reason for this is that the fracture type associated with cobble quartering is not a typical "cone fracture," according to Tsirk (1979: 84), and lacks the characteristic distally-directed ripples.

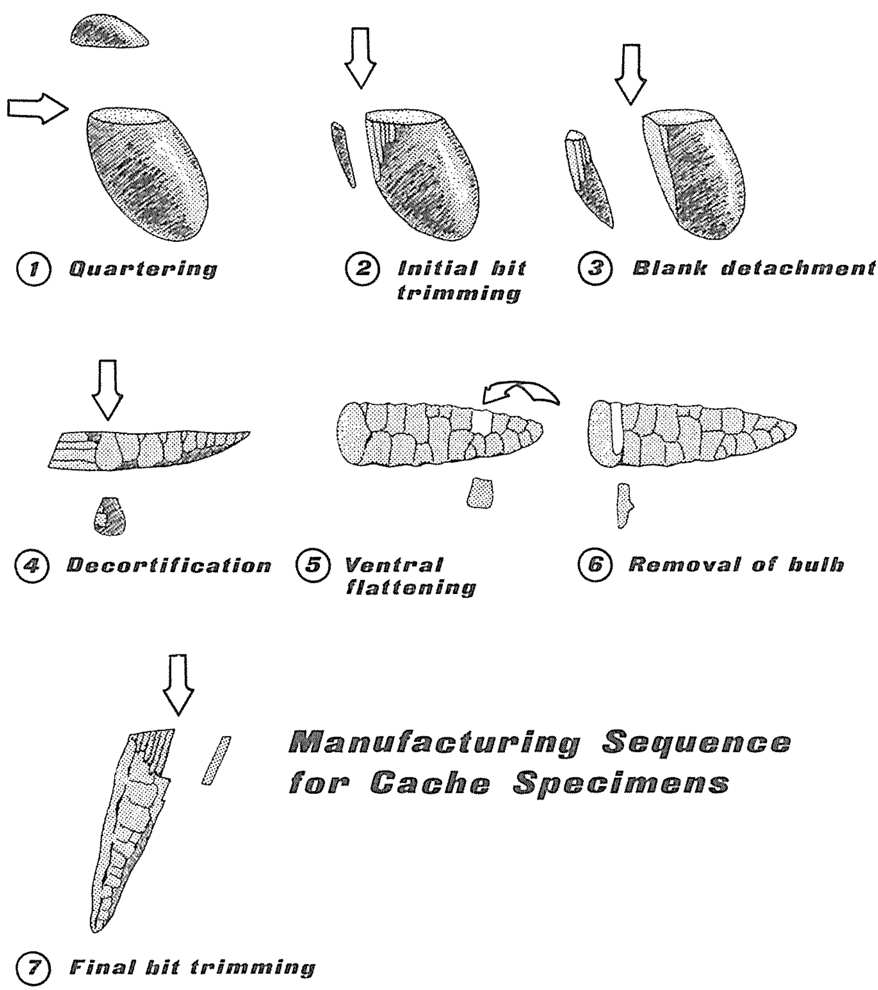


Figure 2. Manufacturing sequence for cache specimens. Arrows indicate direction of percussion blows, which in stages 5 and 6 are directed toward the viewer. Abrasion of lateral edges also occurs, but is not indicated here.

TERMINOLOGY

The truncation facet or original flake platform mentioned in steps 1 and 2 above is here termed the *bit facet.* The ridge- or keel-like surface is termed the *dorsal surface,* and the opposite flatter face is termed the *ventral face;* these correspond to the dorsal and ventral surfaces of the original flake as well.

A series of standard measurements was taken on each tool in all three caches, as follows (Figure 3):

1] dorsal length: the maximum length of the tool, from the butt (proximal) end to the tip of the bit;
2] ventral length: distance from the butt end to the proximal edge of the bit facet;
3] maximum bit width;
4] maximum tool width;
5] maximum tool thickness;

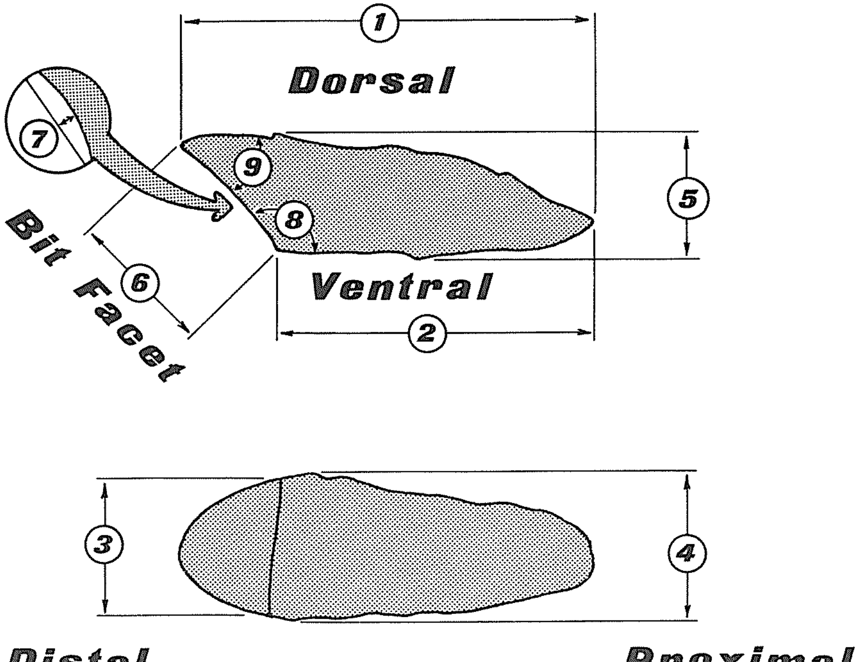


Figure 3. Landmarks and measurements on a Guadalupe tool. Numbered measurements correspond to those defined in the text: 1) dorsal length; 2) ventral length; 3) maximum bit width; 4) maximum tool width; 5) maximum tool thickness; 6) bit thickness (e.g. distance from bit apex to intersection with ventral face); 7) maximum depth of bit concavity (the maximum amount of "dishing" of the bit facet, usually just a millimeter or two); 8) bit facet/ventral angle; 9) bit spine-plane angle (working edge angle).

6] bit thickness: measured parallel to the bit facet, from the tip of the bit to the proximal edge of the bit facet (Figure 3, variable 6). Corresponds approximately to the platform depth of the original flake, except that the bulb of percussion has been removed;
7] maximum depth of bit facet concavity;
8] bit facet/ventral angle: the obtuse angle between the bit facet and the ventral face of the tool;
9] bit spine-plane angle: the working edge angle, between the bit facet and the dorsal face;
10] weight.

MICROSCOPIC EXAMINATION

All of the tools were examined at low power (7× and above, usually not above 40× but where necessary up to 80×) with a stereozoom microscope. Edges were not opaqued but were carefully washed before examination. The methods and goals of this study were essentially the same as an earlier examination of a stone tool assemblage from Choke Canyon (Brown *et al.* 1982). The bit edge, both lateral edges, and both faces were examined microscopically. Microscopic features were measured with a microscope scale accurate to 0.1 mm; larger features were measured with a standard set of sliding vernier calipers accurate to 0.02 mm. Edge angles were measured with a goniometer, and only one measurement near the center of the tool was taken, rather than taking several and averaging the results, because the working edge angle changes radically as measurement moves away from the center of the bit. Several Guadalupe tool replicas were also made and examined microscopically for comparative purposes.

THE LINDNER CACHE

In 1982, Mr. O. R. Lindner found five Guadalupe tools lying exposed on freshly slumped dirt at the base of a newly made bulldozer cut into the high cutbank along Hondo Creek, on property he owns ten kilometers southeast of Hondo in Medina County (Figure 4, 5, a). Investigation of the cutbank immediately above revealed a matched pair of tools (specimens 1A and 1B, Figure 6, a, a′, b, b′) in place, and further probing revealed a second pair (specimens 2A and 2B, Figure 6, c, c′, d, d′), this one separated by a few centimeters. Nine tools are present, all complete and evidently all members of a single cache that apparently lay buried by about five meters of Hondo Creek alluvium. Mr. Lindner marked the spot and in March, 1984, I visited the site and estimated the depth below the terrace surface at 5.0 meters with a K+E hand level. A tenth tool has since been found about 200–300 meters downstream, but we have no idea whether it is related. The Lindner cache is of particular interest because there is considerable uniformity in size, shape, and methods of manufacture, possibly enough to justify proposing that all were made by a single craftsman. Two of the paired tools, 1A and 1B, are almost exactly the same size and shape and are made of very similar chert. The other pair differs in shape but both specimens are made of similar material contrasting with that of the first pair. I thought at first that each pair of specimens had been made from one parent cobble. Closer inspection shows that each specimen was made from a separate cobble, but that the pairs comprise specimens that were probably deliberately selected so as to match the color and texture of the chert as closely as possible.

Geologic Context of the Lindner Cache

While the Lindner cache was found an estimated 5 meters below the Hondo Creek terrace surface (actually the eroded surface lies only about a meter above, but the depth estimate was run from an uneroded area), the entire exposed terrace section is estimated at 9.8 meters. The total thickness is unknown; the present channel is gravel choked, but Mr. Lindner reports that in the past a channel 2–3 meters deep has existed here, indicating that the alluvium may be as much as 13 meters deep here (water is now present only in discontinuous pools, but according to Mr. Lindner the water level in the creek is greatly depressed by excessive irrigation drawdown). All of the exposed portion is presumed to be of Holocene age. A moderately well-developed soil is present at the top of the section, but no obvious paleosols were seen in the cutbank. The terrace surface is covered with large hackberry and mesquite trees along with some persimmons and sumacs. While the age of this surface is unknown, a Late Prehistoric date would be quite consistent with analogous geomorphic settings elsewhere in South Texas. A sample of sediment from the cache findspot consists of yellow (8YR 6.5/5), mostly medium and fine sand (1.0 to 3.0 phi) with small amounts of very fine sand, silt, and clay, and it appears to be very representative of the section as a whole, which is quite homogeneous except for the appearance of gravel bars which will be discussed in more detail below. The sediment is extremely cohesive and the cutbank is resistant to slumping. The sediment reacts strongly to dilute HCl and is probably weakly cemented by carbonate derived from Cretaceous formations upstream, since there appears to be too little clay present to account for its cohesiveness. In the vicinity of the cache and elsewhere in the section are scattered, occasionally somewhat clustered snail shells. Most prominent are *Rabdotus* sp. snails, including both adults and juveniles; these nearly always occurred in the cutbank with the long axis of the shell horizontal, but with the spire oriented in various directions. Present in smaller frequencies are *Helicina orbiculata tropica* and *Polygyra* sp. shells. This is a typical semiarid south Texas Holocene land snail assemblage. Only one aquatic snail (tentatively identified as *Gyraulus parvus*) was observed. None of the snails show obvious abrasion from transport.

The Hondo Creek valley is constricted at the Lindner site (from about 4.3 km wide to about 1.5 km wide) by a sandstone bedrock ridge that projects westward into the valley from its eastern margin, following an ENE-WSW fault

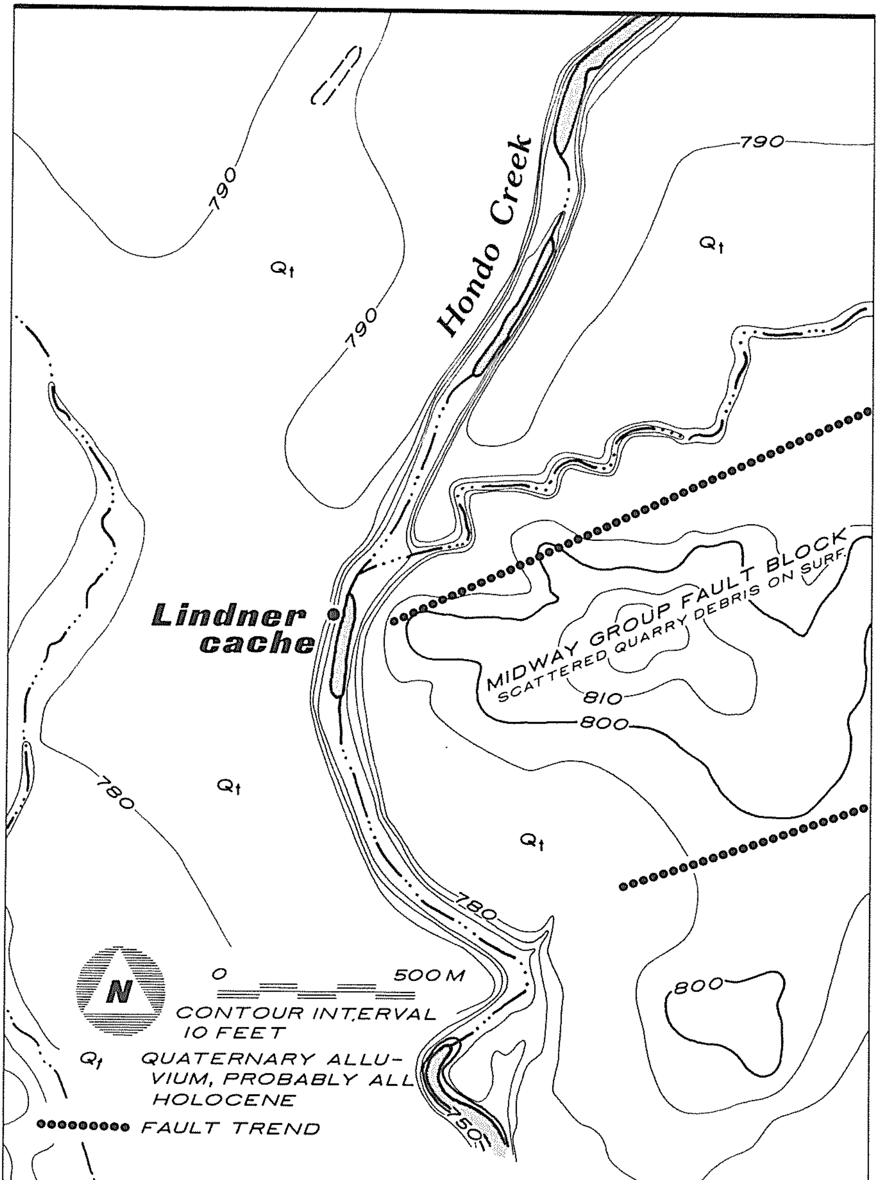
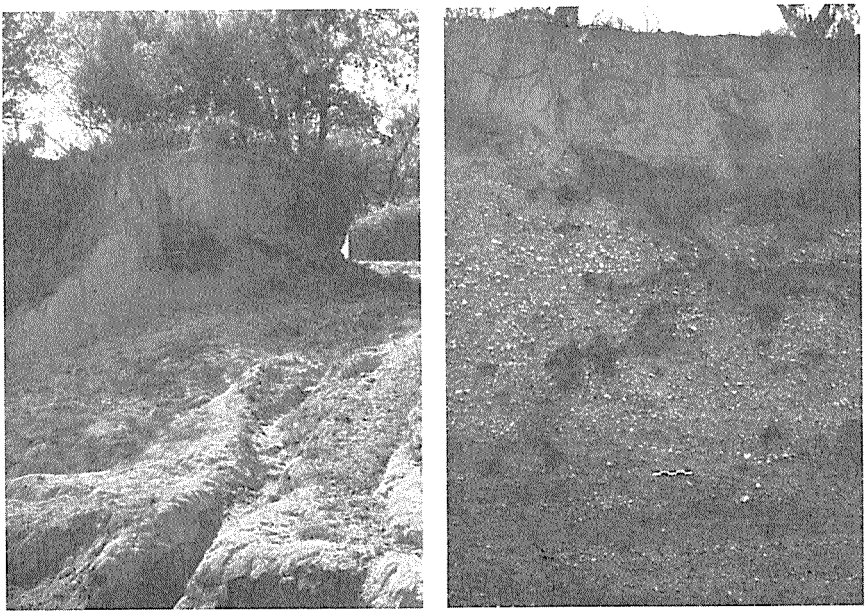


Figure 4. Topographic map of Lindner cache environs.



a b

Figure 5. Lindner cache environs. a, looking east-southeast at Lindner cache findspot in bulldozer cut through Hondo Creek alluvium. Tools were found where 50 cm scale is resting. b, looking southwest at cutbank with thick gravel deposit about 40 meters upstream from bulldozer cut.

trend. The San Antonio sheet of the Geologic Atlas of Texas indicates the ridge is a downthrown block and it is mapped as part of the Midway Group (Figure 4). The ridge rises to a peak 150 meters above the terrace surface about 750 meters back from the creek, and is covered with a thin, stony, gravelly soil supporting a dense growth of chaparral, with occasional outcrops of brown ferruginous sandstone bedrock. Chipping debris and stone tool manufacturing failures, many of them patinated in varying extent, occur wherever these scattered gravels occur. A small collection by the Lindners includes few readily identifiable artifact types, but possible examples of La Jita(?), Early Corner Notched(?), Early Triangular, Nolan (?), Marcos (?), and Ensor (?) points and small bifacial plano-convex and biconvex Clear Fork tools are present. Apparently most of the ridge is covered with a thin sheet deposit of quarrying debris. The gravels are relatively small in size and occur as lag deposits as high as the peak of the ridge 252 meters (827 feet MSL). These gravels seem somewhat smaller in caliber than the Uvalde Gravels mapped at the western valley margin at 265 meters (870 feet) and below (see the San Antonio sheet), but like the Uvalde Gravels, are mostly chert. North of this ridge a small nameless intermittent tributary of Hondo Creek flows parallel to the main creek, then turns westward where it is confined by the ridge, flowing along its base to join Hondo Creek a short distance upstream from where the cache was found.

The bedload in Hondo Creek is chert and limestone gravel, probably representing a mixture of reworked Uvalde chert gravels and limestone clasts from the Edwards Plateau upstream. The chert ranges from rather massive cobbles (the largest collected was 23 cm in diameter and weighed 6.35 kg) to small pebbles. Large cobbles are fairly common. Limestone clasts were not examined but seemed to be smaller.

About 30 to 40 meters upstream from the cache site the cutbank forms a sheer vertical wall, and exposed here is a thick, multistoried sequence of channel gravels filling almost the entire terrace section to within 30 cm of the surface (Figure 5, b). Evidently Hondo Creek made a bend here, perhaps deflected by the sandstone ridge or by enchannel boulders and flowed (speculatively) southwest into the area now masked by terrace deposits. Evidently this channel was stable and aggrading for thousands of years, for the sequence of channel gravels is over nine meters thick. There seems to be almost no evidence of lateral migration, except for a small bar about 40 cm thick, three meters below the surface, which extends to the south and is exposed in the bulldozer cut. This bar is about two meters above the level of the cache and pinches out west of it. The indicated channel width seems to be roughly the same as the present channel, although it is hard to be sure without knowing the orientation of the paleochannel. While the channel stability suggested by this exposure seems quite remarkable, equally remarkable is the relative homogeneity in caliber of the gravel. Most are about 2–3 cm in diameter, smaller than the maximum size of the modern channel load; the largest cobble noted in the cutbank was about eight cm long. In general, the average caliber seems to be significantly smaller than in the modern channel, and there seemed to be no conspicuous trends in caliber and little well-defined stratification in this paleochannel sequence. Evidently a channel shift did occur near the top of the section, however, for anywhere from about 30 cm to a meter of overbank sands cap the channel sequence, indicating the channel had moved but was still depositing overbank sediment. The next event in the sequence was the beginning of the present incisive phase.

It should be noted that the presence of abundant channel gravels throughout the aggradational history of Hondo Creek probably has less to do with the velocity or volume of stream flow than it does the relatively high gradient of the creek and the relative nearness of the Edwards Plateau. The Balcones Escarpment lies only about 25 km upstream.

We can summarize the geologic context of the Lindner cache by noting that it was left on the sandy flood plain of Hondo Creek, some 30 or 40 meters southeast (?) of the contemporary creek, which was gravel-floored like its modern counterpart, although not so coarsely. At the same time or perhaps slightly later a fire was evidently built on the flood plain nearby, for a small deposit of wood charcoal was found in the south wall of the bulldozer cut, about a meter west of and an estimated 20 cm or so above the level of the cache. Some time afterward, the creek extended a marginal gravel bar near this area, but by then the cache had been capped by a couple of meters of overbank sands. It is possible the Guadalupe tools in the cache may have been made of chert cobbles collected from the creek, but the average length of the tools (about 10–11 cm) seems somewhat longer than would be afforded by most of the small chert cobbles seen in the cutbank. Most of the gravels capping the sandstone ridge also seem too small. Possibly the tools were made from Uvalde Gravels collected along the valley margin to the west, where Highway 173 now lies.

Description of the Lindner Specimens

In essence, microscopic examination seems to show that all nine specimens are in nearly pristine condition. No significant edge rounding or polish was seen on the bit edges, in fact no damage at all that can be attributed to use except for occasional small nicks and occasional small invasive scars or short, broad step fractures infrequently occurring on the bit facet. There is frequently extensive percussive crushing of the edge and heavy step fracturing, at various scales, on the dorsal face of the tool, but this is attributed to hammerstone damage left by manufacture of the tool and is not considered use wear. It is identical to hammerstone damage on the replicas. While it seems possible that heavy use, for example in adzing hardwoods, might produce the same kind of edge crushing and step fracturing here attributed to manufacturing damage, it is doubtful that the two sources of modification could be distinguished microscopically. Edge crushing and battering is frequently more pronounced near the corners of the working edge, because the bit spine-plane angle increases progressively away from the center of the bit (it should be pointed out also that the single measurement taken at the center of the bit does not adequately record the range of edge angles displayed by the bit) and toward the sides becomes so steep that hammerstone retouch of the edge was difficult to achieve.

A few specimens show small areas tentatively regarded as having use polish on ventral flake scar ridges. Most likely this is some kind of hafting polish. It was seen only on a few specimens, was never well developed, and generally occurred toward the proximal end. No polish was seen on the dorsal face.

Most specimens have at least some rounding and smoothing of lateral edges; this does not represent platform preparation related to bifacial "thinning", since in many cases substantial smoothing and rounding was done after final bifacing, and in some cases rounding and smoothing are very heavy, exceeding what would be required to prepare the edge for flake removal. This is perhaps a better argument for hafting than the tentative presence of haft polish noted earlier. The term "thinning" as used above is somewhat misleading, since it appears the craftsman avoided actually thinning the biface and tried instead simply to increase the lateral edge angles so as to produce a thick, durable edge. In fact, most of the lateral edges on these tools are fairly heavily battered, not from failed attempts to thin the edge but from an apparent intent to produce a massive, dulled edge that would withstand hard use.

Specimen 1A (Figure 6, a, a′)

Specimens 1A and 1B, according to Mr. Lindner, were found paired with the ventral surfaces in contact and with the same proximal-distal orientation.

Specimen 1A is made of light brownish-gray chert with a small patch of yellow-brown cobble cortex at the butt end. It is the most carefully made and symmetrical of the nine specimens, and a very close match to 1B in size and form. The ventral face is gently concave from front to back, with flake removals originating from both lateral edges. The dorsal side has a sharp, prominent ridge running down the center. The small bit trimming flakes hinge out about 24 mm from the edge of the bit.

At 7× to 28× the bit edge appears essentially pristine; the dorsal side has a columnar fluted appearance from the narrow percussion flake removals that form the bit. A few of these have hinged out at about 2–4 mm from the edge. Along the bit edge are many microscopic flake scars on the dorsal surface, mostly short and step fractured. One section of the edge at the left corner (oriented with the bit away from the viewer, and with the dorsal side up) shows moderate crushing. All this damage could have been produced by percussor scrubbing. The bit facet has a few small nicks and some shallow step-fractured scars.

Lateral edges: major projections on both edges show heavy rounding; smaller projections frequently show moderate rounding. Some rounding extends into re-entrants somewhat. The lateral edges show more modification than the bit.

Surface polish: the only visible surface polish is on the ventral face near the extreme proximal end, with light polishing on flake scar ridges on the last 12 mm of the tool.

Specimen 1B (Figure 6, b, b′)

This specimen is made of light gray-brown chert, slightly lighter in color than 1A. It has a small patch of light gray cortex at the butt end. The chert is similar to that used for specimen 1A, but the difference in color and texture seems adequate to indicate both did not come from the same cobble. This specimen is almost exactly the same size as specimen 1A, but less well made. The ventral side is uneven but otherwise essentially straight from one end to the other. The dorsal side is irregular, with a central knot. The bit is less dished than on specimen 1A.

At 7× and above the bit edge appears essentially pristine except for slight rounding and polish on a very small section near the center, and another one mm back from the edge on the right side. The bit facet has one medium-sized hinge fracture (nine mm wide, four mm long) and a few small nicks.

Lateral edges: light to heavy smoothing is present on a few projections; on the whole, rounding and smoothing is less well developed than on specimen 1A. The edges are mostly just percussor-battered.

Surface polish: this sample lacks the ventral/proximal polish seen on specimen 1A; the dorsal ridge shows no haft wear.

Specimen 2A (Figure 6, c, c′)

Specimens 2A and 2B were also paired, reportedly with the ventral faces in contact, but with the proximal and distal ends reversed. These two tools are made of similar chert, possibly but not definitely from the same core. Specimen 2A is made of light brownish-gray chert. Yellow-brown cortex is present on a small patch on the ventral side, at the right distal corner on the bit facet, and covering most of the dorsal ridge and extending onto the butt. The dorsal ridge is a natural one formed by the original shape of the cobble. The ventral face is gently concave.

At 7× to 28× the working edge appears essentially pristine; a couple of small projections near the center of the edge have light rounding and polishing, conceivably from platform preparation. The bit facet has three small nicks and a small step fracture.

Lateral edges: show light to heavy smoothing, but with little polishing, mostly on prominent projections but also on straight portions of one edge, beginning a short distance from the bit. The right edge has less noticeable smoothing than the left.

Surface polish: light polishing is visible on a few ridges near the butt end (beginning about 23 mm from the end).

Specimen 2B (Figure 6, d, d′)

This specimen is unrepresentative of the group because of its pointed bit and acute spine-plane angle, and perhaps would not be regarded as a Guadalupe tool had it not been associated with the others. It is made of light brownish-gray chert similar to specimen 2A, but slightly darker. Both cherts are grainy textured. The dorsal ridge is covered with cobble cortex just as in specimen 2A, and the cortex also extends onto the butt end. No cortex is present on the ventral surface. The cortex is a light yellowish tan, lighter and less brown than on specimen 2A.

At 7× to 10× the bit edge appears pristine; the graininess of the chert has resulted in considerable percussor crushing of the edge, but no noticeable edge rounding was seen.

Lateral edges: show light to heavy smoothing on projections, but no real polish developed. The right edge has somewhat less rounding. Major projections are severely percussor-battered.

Surface polish: slight polish is visible near the butt end on ridges and facets, and possibly near the bit, on flake scar ridges. The dorsal cortex-covered ridge shows no polishing.

Specimen 3 (Figure 7, a, a′)

Specimen 3 is made of light gray homogeneous, relatively fine-grained chert with no visible cortex; the ventral surface is quite flat, much of it formed by the original ventral flake facet. This specimen is short and thick.

At 7× to 9×, the bit edge appears pristine except for slight rounding at the center and in a small area on the right side. Both areas are in front of resistant

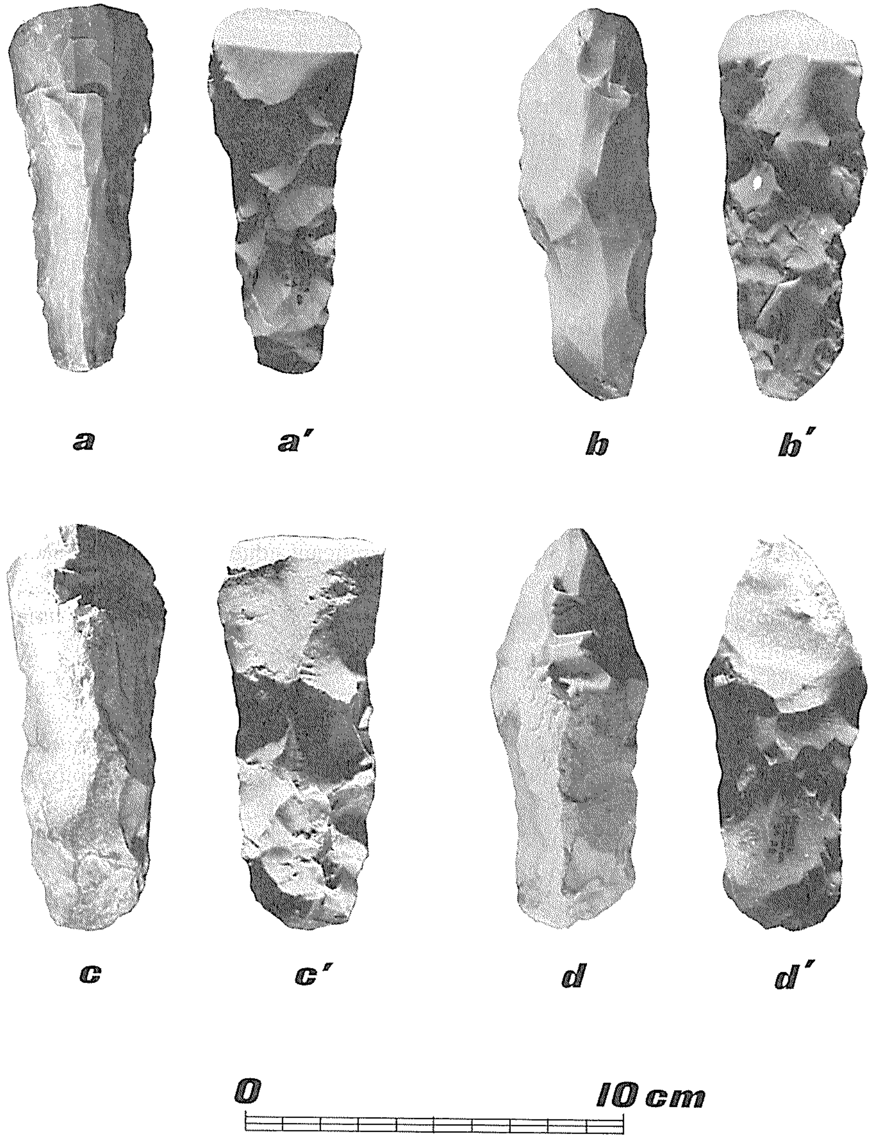


Figure 6. Guadalupe tools from the Lindner cache. Left photo of each pair is dorsal view, right photo is ventral view. a, a′, specimen 1A; b, b′, specimen 1B; c, c′, specimen 2A; d, d′ specimen 2B. All specimens oriented with distal (bit) end at top.

step fractures and might represent platform modification left from attempts to remove step fractured areas.

Lateral edges: the right edge has heavy rounding toward the.distal end with scattered examples of light to moderate rounding toward the proximal end. The right edge has no noticeable rounding.

Surface polish: none visible on either ventral or dorsal surface.

Specimen 4 (Figure 7, b, b′)

This tool is made of light grayish-tan fine-grained chert. The dorsal ridge is covered with cobble cortex, extending onto the butt; the cortex is yellow-brown subsurface, with a chalky white surface layer. Concentric lighter colored zones of cortex parallel the bit edge, indicating that the distal end of the tool conforms closely to the original cobble shape. The ventral face is irregular but fairly flat. Unlike the other specimens reported here, the bit facet seems to have been formed by a blow struck from the left bit edge.

Under magnification the bit facet can be seen to have one or two small nicks, a few small invasive scars, and one short, broad hinged scar about 7 mm wide and 3.5 mm long. The bit edge seems somewhat more battered and irregular (at 12×) than on the other specimens, but no significant edge rounding was seen except at the right-hand corner.

Lateral edges: are heavily battered, with fairly heavy edge rounding in some places, although not continuous.

Surface polish: none visible.

Specimen 5 (Figure 7, c, c′)

This example is made of light gray and gray-brown chert of variable texture; the light gray areas are grainy, but the bit portion of the tool is formed entirely of the more vitreous gray-brown chert. No cortex is present.

At 16×, the edge appears somewhat crushed. There is no visible edge rounding except for a couple of minor occurrences. The bit facet has some small nicks and invasive scars. The edge seems more irregular and crushed than most of the specimens, but not extensively step fractured.

Lateral edges: show light to heavy rounding, especially on the grainy light gray portion of the tool.

Surface polish: none visible.

Specimen 6 (Figure 7, d, d′)

This specimen is long and narrow, with a narrow bit. It is made of fine-grained grayish-brown chert with a narrow strip of brown cobble cortex remaining on the dorsal ridge, plus another small patch on the butt. The bit is carefully shaped. A couple of the flake scars on the ventral face reach completely across the body of the artifact. In tranverse cross-section the specimen is triangular.

Under magnification the bit edge appears pristine except for several very small invasive scars on the bit facet. No edge rounding is visible.

Lateral edges: are battered, but show no rounding except for light rounding in a couple of places.

Surface polish: possible light polish is visible on several ridges central to the ventral face.

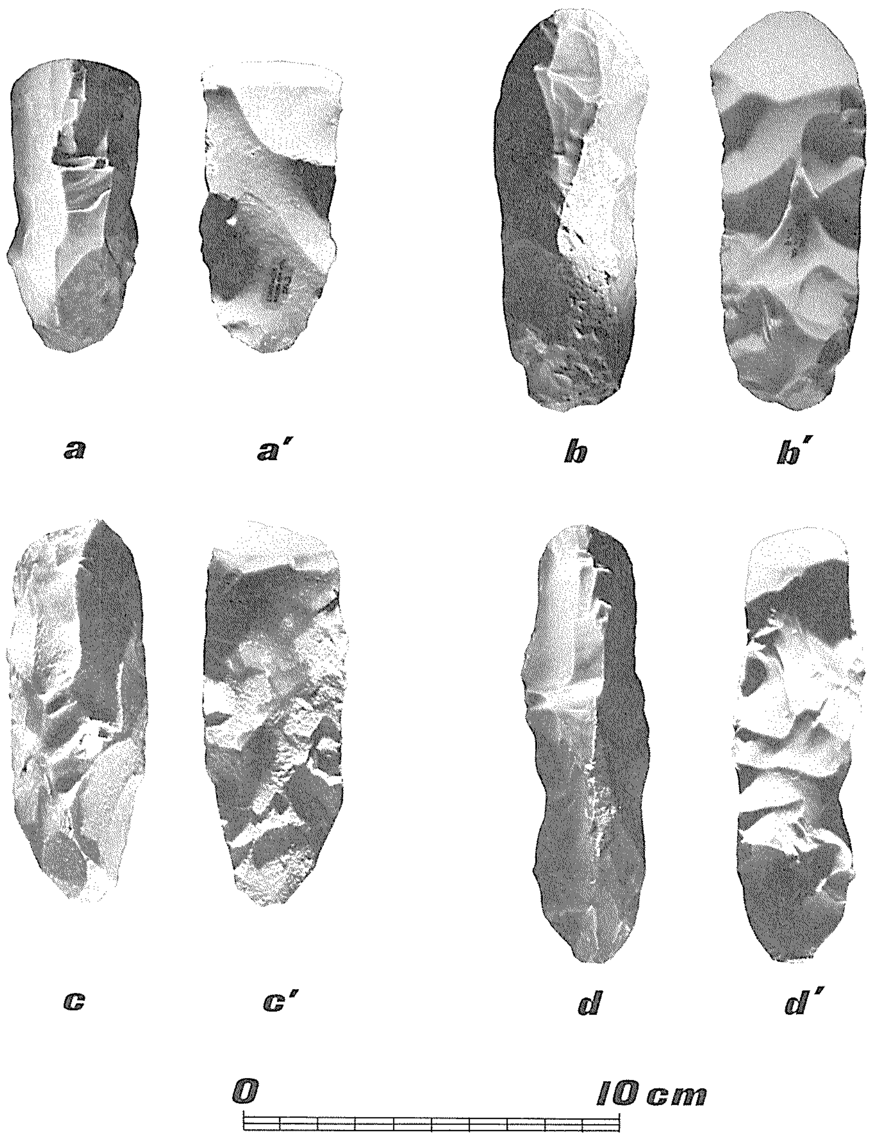


Figure 7. More Guadalupe tools from the Lindner cache. Left photo of each pair is dorsal view, right photo is ventral view. a, a', specimen 3; b, b' specimen 4; c, c', specimen 5; d, d', specimen 6. All specimens oriented with distal (bit) end at top.

Specimen 7 (Figure 8, a, a')

This specimen is made of light tan-gray chert. No cortex is present. The bit facet is very acute as in specimen 4. The distal half of the dorsal ridge has been removed by a large flake scar originating from the bit facet and hinging out at the midpoint of the tool. One area of the remaining dorsal ridge is battered as if the craftsman had tried to remove part of the remaining ridge by striking it from the right side.

At 7×, the lefthand portion of the bit edge has a series of small, deep nicks invading the dorsal face, perhaps from an attempt to remove an intersecting facet. The edge as a whole appears relatively pristine and sharp. The bit facet has a couple of small hinged scars near the center, plus one short, wide step fracture 10 mm wide and 1.5 mm long. There is no noticeable edge rounding except for very slight rounding visible at 14× on a relatively straight section of edge on the left side of the bit.

Lateral edges: heavy rounding is present on major projections, none or at most light rounding visible elsewhere.

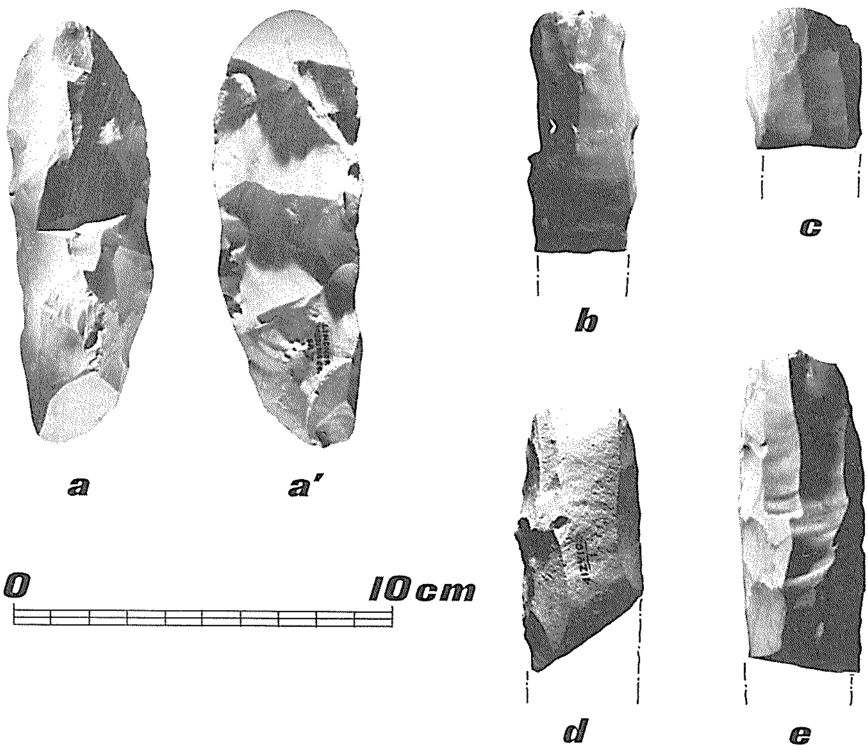


Figure 8. More Guadalupe tools from the Lindner cache and Guadalupe tool failures from various other sites. a, Lindner specimen 7, dorsal view; a′, Lindner specimen 7, ventral view; b, Guadalupe tool failure from 41 BX 228 (specimen DB2:1–2, N974 E988, level 4b; see Black and McGraw 1985: figure 32, c); c, Guadalupe tool failure from 41 BX 228 (specimen DB2:1–13, same provenience as "b," Black and McGraw 1985: figure 32, d); d, Guadalupe tool failure from 41 ZV 183; e, Guadalupe tool failure from 41 BX 274. All specimens oriented with distal (bit) end at top. b–e were broken, perhaps during use, by fractures originating at the working edge and plunging into the body of the tool to emerge on the ventral face.

Surface polish: slight polish on flake scar ridges near the proximal third of the ventral face.

Summary Observations on the Lindner Cache

All of the tools in the Lindner cache appear to be essentially in mint condition, suggesting either that they had been prepared and never used, or else used but resharpened shortly before being cached. The only evidence which might suggest use consists of occasional small edge nicks and small invasive, stepped, or hinged scars appearing in low frequency on the bit facet of most specimens, since damage to the bit facet would not be expected as a result of manufacture. Damage like this might result if the tool were used as an adze and, becoming caught in the wood, had to be rocked back and forth to free it. But the frequency of these scars is too low to make this seem likely. Other damage to the bit edge, such as crushing, step fracturing of the dorsal face, and occasional edge rounding, especially near the corners, is attributed to percussor damage during manufacture. If any of this damage is due to use of the tool, it cannot reliably be distinguished from manufacturing damage. Possible light polishing was tentatively identified on several of the tools, usually on the ventral side near the proximal end. If valid, this may represent haft wear, but is only tentatively identified.

The uniformity of the specimens in the cache is substantial, at least in comparison with other known examples of Guadalupe tools (Table 1), and might justify the hypothesis that all were made by a single craftsman. At least four of the tools were paired when found, although since the other five had already slumped from the wall of the bulldozer cut, we do not know whether they, too, were grouped in some way. The two known pairs seem to have been matched on the basis of size, shape, and/or the nature of the raw material.

The evidence from the Lindner cache would seem to suggest perhaps that all of the tools were prepared by a single craftsman and laid aside, either for hafting, for trade, or in anticipation of some future task for which the tools were intended. Perhaps the relatively large number of tools indicates the magnitude of the task or the severity of wear expected. That Guadalupe tools were hafted in use seems fairly certain, judging by the consistent presence of lateral edge smoothing. Whether these particular tools were hafted when cached is unknown, although the fact that specimens 1A and 1B were found with the ventral surfaces in contact probably argues against it.

THE GRANBERG CACHE

Hester (1980: 147–149) and Hester and Kohnitz (1975) briefly review the stratigraphic context of a cache of four Guadalupe tools found at the Granberg II site (41 BX 271). During 1974 excavations by the Southern Texas Archaeologi-

Table 1. Metric Attributes of Guadalupe Tools from the Lindner Site

Speci-men	Dorsal length (mm)	Ventral length (mm)	Maximum bit width (mm)	Maximum tool width (mm)	Maximum thickness (mm)	Bit thickness (mm)	Maximum depth of bit facet concavity (mm)	Facet/ ventral angle (degrees)	Bit spine-plane angle (degrees)	Weight (gm)
1A	105.06	91.94	41.26	41.36	30.14	28.70	3.16	113	70	125.5
1B	114.36	94.22	38.44	39.50	29.76	31.40	1.58	124	54	140.3
2A	117.30	112.68	45.14	46.00	30.32	30.32	1.38	119	58	182.9
2B	108.00	60.44	34.72	44.84	28.44	46.68	0.50*	160	32	116.9
3	86.62	74.56	39.98	39.98	29.76	25.32	0.88	114	67	131.6
4	109.28	82.56	40.16	40.58	23.04	30.10	0.00**	149	41	110.0
5	108.38	95.78	32.86	40.32	24.74	18.44	0.30*	132	55	124.0
6	121.66	109.02	26.90	34.48	24.68	20.54	0.76	129	63	112.3
7	111.48	108.34	32.18	39.90	27.62	23.08	0.00***	146	47	134.4

*estimate
**no concavity over most of bit facet
***bit facet is slightly convex

cal Association these were removed from the east wall of excavation unit 3S at a depth of 2.29 meters (90 inches) below the existing ground surface (the original depth apparently was about 1.8 meters, but a deposit of recent backfill was present over the excavated area) in stratum 8, which is described as a compact, charcoal-stained zone about 10 cm thick occurring near the midpoint of a thick sequence of channel gravels. Since these tools (specimens 15, 16, 17, and 18) were found in the profile wall rather than the excavation unit, no information on the arrangement or spacing of the artifacts is available. Another specimen (number 12) was found in the 84 to 90 inch level in the excavation unit, and a sixth Guadalupe tool (specimen 19) was found at the same level near the northwest corner of the excavation unit, but outside it in an area cleared of overburden with a backhoe.

Description of the Granberg Specimens

The four specimens in the Granberg cache differ in several ways from the Lindner specimens:

1] all are smaller (the average weight of the Granberg tools is only about 60% of that of the Lindner specimens; Table 2);
2] all have bit facets canted to left or right to some extent;
3] the average working edge angle is about 11 degrees less acute;
4] all have somewhat less cortex remaining;
5] in general the Granberg tools appear somewhat less well made and less uniform than the Lindner tools;
6] at least three of the four tools have some damage to the bit edge that is tentatively interpreted as use wear rather than percussor damage.

The smaller size of the Granberg tools is perhaps due to the smaller caliber of the gravels available as source material. The average weight of the four Granberg specimens (80 gm) is intermediate between that of the Lindner tools (131 gm) and that of specimens from the Panther Springs Creek site (66 gm), reported by Black and McGraw (1985: Table 15, form 1 specimens). For the most part the technique of manufacture appears to be the same, except perhaps in the method of initially quartering the cobble. For the Granberg specimens a method of quartering was evidently used that resulted in the tool blank being struck off at an angle other than 90° to the plane of the striking platform. As a result, bit facets on the Granberg tools are canted either to left or right when viewed from the ventral side. Somewhat less cortex is present on the Granberg tools, but when present, usually appears as a small patch covering the proximal end. I suspect this remnant cortex was a deliberate feature of the tool, perhaps intended as a cushion of less brittle, shock-absorbent material left covering the point of contact between the butt end of the tool and the haft [?]. This feature is found on tools from both caches.

Table 2. Metric Attributes of Guadalupe Tools from the Granberg Site

Specimen	Dorsal length (mm)	Ventral length (mm)	Maximum bit width (mm)	Maximum tool width (mm)	Maximum thickness (mm)	Bit thickness (mm)	Maximum depth of bit facet concavity (mm)	Facet/ ventral angle (degrees)	Bit spine-plane angle (degrees)	Weight (gm)
15	96.70	81.02*	23.70	30.54	26.48	26.82*	0.40**	108	61	76.8
16	87.96	73.98	31.94	31.56	31.18	28.90	0.50**	110	74	100.5
17	72.98	55.44	38.48	38.76	23.12	22.50	1.00	132	74	59.1
18	100.96	82.32	23.26	29.52	30.10	22.50	0.20**	146	52	83.4
12	93.00	85.00	21.94	29.22	25.26	13.54	0.50**	123	77	79.8
19	129.72	114.80	24.60	33.10	38.16	27.66	0.20**	119	57	182.9

*Estimate.
**No concavity over most of bit.

Although none are heavily worn, at least three of the Granberg cache specimens have some damage to the bit edge that is tentatively interpreted as use wear. The assessment is uncertain because most of the damage to a completed edge originates as percussor damage during the manufacture or rejuvenation of the tool. Both hard hammer percussion and use of the tool (assuming some kind of adzing use) can be expected to produce crushing of the edge and severe fracturing with stepped or hinged terminations. Percussor crushing or fracturing is perhaps more likely to create damage that is localized at restricted impact points, unless the edge is also raked with the percussor to even it, in which case the distinction between use wear and manufacturing damage is likely to be difficult or impossible to make. Edge rounding is probably more likely due to use wear than to manufacture, although again if the edge is scrubbed with the percussor it may simulate attrition through use. A certain amount of localized edge rounding also originates through crushing of the edge. In assessing the condition of the bit edges from all three caches, the degree of rounding, its location, and the degree of localization of edge fracturing have been used as critical tests, but evaluation is frankly a matter of judgment (see Vaughan 1985: 23). Another attribute which may have some bearing is the presence of small flake scars on the bit facet. These would probably not be expected as a result of manufacture, but might occur in storage (either before or after excavation) or use; they seem to appear in about equal frequency in both caches.

Another way to try discriminating between different sources of edge damage is to look at known examples of rejuvenation failures. Figure 8 (b, c) shows two specimens from the Panther Springs Creek site (41 BX 228) and two from 41 ZV 183 and 41 BX 274 (Figure 8, d, e). All four are overshot rejuvenation fragments (or possibly tools that failed during use). Apparently in each case a resharpening flake has been struck off from the distal face using the bit facet as a platform, but the flake has overshot, passing through the body of the tool and expanding as it emerges on the ventral side, breaking the tool in two. In these fragments the central part of the working edge can be expected to have only percussion damage, while the lateral remnants of edge presumably have accumulated use wear sufficient to prompt resharpening (regardless of whether the specimens broke during use or failed during attempted resharpening). In all four cases the section of edge adjacent to the rejuvenation flake scar is sharp and undamaged; the other portions of the working edge have no diagnostic wear visible, but show a substantial number of minute, stacked step fractures. The specimen from Zavala County, made from a very grainy chert, has a working edge that appears rounded and somewhat crumbled at 40×.

Another approach is to make and use Guadalupe tool replicas in the same way that the archeological specimens are thought to have been used (replicas pictured in Figure 14 have not been used). Severe adzing of seasoned mesquite wood with a replica showed that the tool was more durable than expected. Heavy blows were required to drive off flakes from the working edge. Initial use damage consisted of percussion rings of large radius (similar to Figure 14, e, a cache specimen), some microscale crumbling of the edge, small scale step fracturing, and occasional small irregular flakes removed from the bit facet. Continued use resulted in more flakes being driven off the dorsal facet until the working edge assumed an irregular, scalloped shape. Thirteen of these tiny flakes were collected, ranging in length from 1.5–6.0 mm and in width from 3–11 mm; seven had feathered terminations, three were step-fractured or broken, one was hinge fractured, and two were indeterminate. The deep reentrants formed by these flake removals generally had sharp edges, while the intervening edge projections were either crushed and rounded or relatively sharp. Target material of different hardness, and especially different work habits would probably have produced different results. I would expect that a softer wood and less violent but more prolonged use might produce less flaking of the edge and more generalized edge rounding. In large part, though, the condition of the edge on the replica and on the Granberg specimens agrees fairly well.

Specimen 15 (Figure 9, a, a′)

This specimen is made of gray chert and is unusual because the truncation facet (or bit facet) has rolled over toward the ventral face and there is no ridge between the bit facet and ventral face; instead a small patch of brown cobble cortex is present. The bit is rounded in plan view but narrow, almost pointed. Viewed from the ventral face, it slants slightly to the left. Several heavy percussion blows have been delivered to the dorsal ridge of this tool from both sides in an apparent attempt to reduce the height or acuteness of the ridge (see also specimen 18).

Under magnification most of the bit edge shows little rounding; at 40× only light edge rounding is visible in a few places (Figure 14, c). One short segment to the left (when viewed from the dorsal side) of the center of the bit is heavily battered, probably from hard hammer percussion. The ends of the working edge show somewhat more rounding; some sections of edge are minutely step fractured. The bit facet shows considerable damage from several small, deep invasive scars (note also the unresolved fracture shown in Figure 14, e).

Lateral edges: show light to heavy rounding.

Ventral face: no substantial evidence of smoothing or polish, although possible light smoothing of flake scar ridges near one lateral edge may be a byproduct or intentional edge dulling.

Dorsal ridge: in addition to the percussor damage noted above, there is rounding and smoothing on several of the high spots on the ridge and in one location, possible incipient faceting is visible. This may be evidence of haft wear.

Specimen 16 (Figure 9, b, b′)

This specimen is made of light gray chert with a patch of cortex at the butt end and a very small strip on the proximal part of the dorsal ridge. The ventral surface is slightly concave from the proximal to distal ends. Viewed from the ventral side, the bit facet slants to the left.

The bit edge of this tool is irregular because of the removal of several short, heavy percussion flakes with step or hinge terminations from around the periphery. These may be rejuvenation flake scars or use damage. At 40–60×, light to moderate rounding and crushing of the edge can be seen. Moderate rounding of the edge was seen where a couple of the possible rejuvenation flakes had been removed, possibly indicating some use after resharpening.

Lateral edges: light to heavy smoothing is visible at 40×.

Ventral surface: a peak formed by intersection of flake scar facets near the distal end shows possible rounding and smoothing visible at 14× and above. Other flake scar ridges at the extreme proximal end and near the midpoint of the ventral surface show definite polishing. A longitudinal scar ridge near the proximal end has a series of microscopic flakes removed from it.

Specimen 17 (Figure 9, c, c′)

This is a relatively short tool made of fine-grained tan chert with small white inclusions, with a patch of cortex on the butt end. The bit is evenly rounded but is asymmetrical, projecting to the left when viewed from the ventral side, with the bit slanting downward to the right. The ventral face is essentially straight in profile.

Under magnification, light to moderate rounding of edge projections (especially near the center of the bit) and some straight edge segments is visible, but even more distinctive is rather continuous minute step fracturing extending onto the dorsal surface immediately back from the edge. The lack of clustering of this step fracturing at impact points and its small scale perhaps suggest it represents use wear rather than percussor damage. One edge projection shows rounding and light polish extending slightly onto the dorsal surface.

Lateral edges: have light to moderate smoothing, more pronounced than on the bit edge, but not heavy.

Ventral surface: one very small area near the proximal end, slightly off-center from the midline of the tool, is burnished to a mirrorlike finish. This resembles burnishing seen on Clear Fork tools from Choke Canyon (Brown *et al.* 1982: 68) and interpreted as haft wear, although no striations were seen at magnifications up to 80×.

Specimen 18 (Figure 9 d, d′)

This tool is made of grainy, matte-textured grayish tan chert with no cortex present. The bit is rather acutely pointed. The tool is narrow but thick with the dorsal ridge peaking about two-thirds of the way toward the distal end; it has been struck both from the left and right sides on the proximal side of the peak in an attempt to remove the high spot, but the blows produced only small hinge flakes.

The bit facet appears undamaged except for obvious, recent excavation damage. At 40× light to heavy edge rounding is visible, mainly on projections and mainly at or near the corners of the working edge, but light rounding is present on some straight edge sections and in reentrants. Moderate rounding is present on a projection at the center of the edge, and extending back onto the dorsal face on the corresponding flake scar ridge, suggesting that on this tool, at least the first few millimeters of the dorsal side came into contact with the material being worked. Microscale step fracturing is present along the edge on the dorsal face.

Lateral edges: show light to heavy rounding, with possible abrasive faceting on one projection.

Ventral face: possible light polish is visible on one flake scar ridge in the medial section, and on another one in the proximal third of the tool.

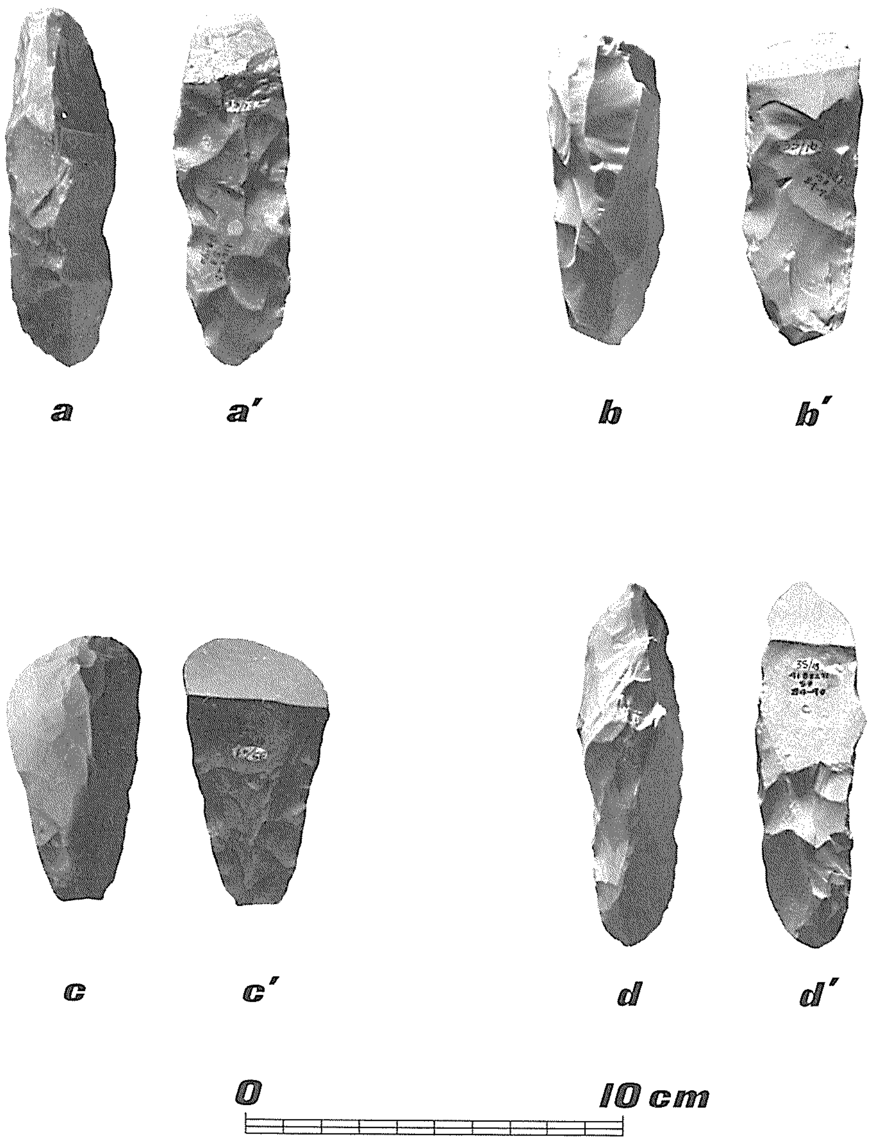


Figure 9. Guadalupe tools from the Granberg cache. Left photo of each pair is dorsal view, right photo is ventral view. a, a′, specimen 15; b, b′, specimen 16; c, c′, specimen 17; d, d′, specimen 18. All specimens oriented with distal (bit) end at top.

Isolated Specimens

The other two Guadalupe tools found at the same level in or near excavation unit 3S are described below, for comparative purposes.

Specimen 12

This tool is made of light gray chert, with no cortex present. The ventral face is irregular but fairly straight. Viewed from the ventral side, the bit facet slants to the right. The bit appears to have been rounded in shape, but subsequent damage has left it pointed at the center. The dorsal ridge has been struck from both sides to reduce its height, as in specimens 15, 18, and 19. The bulb of percussion for the tool blank has been removed by a transverse flake scar.

This tool looks as if it has suffered severe, very percussive use. Under magnification, the bit facet shows only a couple of small invasive scars. Viewed dorsally, the bit edge left of the centerline is heavily battered, step and hinge fractured, probably representing use damage. One large hinge fracture 7 mm long and 11 mm wide may be use damage. Another area 9 mm wide and 4 mm back from the edge is heavily step fractured. At 40×, a few slightly rounded projections are present, but most of the edge has large scale hinge fractures present, leaving relatively acute edges. The proximal end of the tool also has a few small step fractures which might indicate stress against a haft.

Dorsal face: at 40×, polish can be seen on flake scar ridges near the center of the bit, up to 7 mm back from the edge; the polish is not extensive but is well developed, almost burnished.

Lateral edges: mostly light rounding or no rounding; moderate to heavy rounding on just a few edge projections.

Ventral face: no evidence for abrasive modification except immediately along one lateral edge, where a couple of smoothed flake scar ridges intersect the edge; possibly a byproduct of intentional edge dulling.

Specimen 19

The largest by far of the six tools from the Granberg site that were examined, this is the only one comparable in size to the Lindner tools. It is narrow, thick, and crudely made of grainy light-gray chert with no cortex remaining. Viewed from the ventral face, the bit facet slants to the left. The dorsal ridge has been heavily battered in an attempt to reduce its height. The bulb of percussion for the tool blank has been removed by a transverse flake scar. The ventral face is concave from the proximal to distal end.

The bit facet of this tool shows considerable modification. Part of the facet at the apex of the bit has been removed by four flake scars originating from the right side (viewed from the ventral face) and extending transversely across the facet. These are presumably rejuvenation scars, and the rejuvenated edge appears to have experienced some battering afterward. Two of the scars appear to overlap the other two. Other damage to the bit facet consists of a large, deep hinge fracture and several smaller invasive, step, or hinge fractures.

The bit edge at both corners (especially the left corner, when viewed ventrally) is severely crushed and step fractured, probably from percussor damage. Elsewhere some minor step fracturing extends onto the bit facet. Edge rounding is infrequent: one remnant projection with rounding and smoothing over small scale step fracturing is present (the smoothing almost obliterates the fracturing), and another projection shows moderate rounding. This tool seems to have had fairly heavy use, although evidence of edge attrition has mostly been removed by the postulated rejuvenation and by spalling off of short, wide, step-terminated flakes during use. A couple of remnant projections suggest less percussive use producing some edge rounding at some previous stage in the history of the tool.

Lateral edges: have either no rounding or light to moderate rounding.

Ventral face: light polish is present on flake-scar ridges near the proximal end.

THE PETERSON CACHE

These specimens (accession number 42-4-69-G) were donated to the Witte Museum in 1942 by Mr. J. C. ("Poss") Peterson, now deceased, who found them (evidently in 1938) on his property north of Kyote in northwestern Atascosa County (Figure 10). In November, 1985, Kay Hindes and I interviewed J. W. Kenney, the present landowner, and Tobey Tomblin, who had driven Mr. Peterson to San Antonio in a Model A Ford in 1942 to donate the specimens to the Witte Museum. While Mr. Tomblin was not present when the tools were originally found and did not remember the artifacts themselves, he did remember where Peterson said he found the artifacts, and pointed out the findspot to us (Figure 11). Apparently one artifact, not part of the cache, was found south of Siestedero Creek while digging a well that is still present on the property; just north of the well, in the creek channel, some mammoth bones and teeth were found, and a short distance upstream, a few meters from the creek, "the others were found," according to Mr. Tomblin. Evidently this was the findspot for the Guadalupe tool cache, near some large live oaks pointed out by Mr. Tomblin. The location is in a bend of the creek, with the terrain sloping gradually to the south, but with a more abrupt cutbank about three meters or higher to the west, exposing the Reklaw Formation sandy clay substrate. The topsoil here is similar in texture to sediment at the Lindner site, and consists mostly of fine and medium sand (1.0 to 3.0 phi), with some very fine sand and little silt or clay; it is mapped as part of the Sinton series (Dittmar and Stevens 1980). The dominant vegetation consists of mesquite, an occasional retama, and large live oaks along with introduced grasses away from the creek channel, and willows and pecans along the creek. The nearest known occupation site is farther up Siestedero Creek, about 150 meters away, where a site now designated 41 AT 90 has produced Gower (?), La Jita (?), Langtry, Ensor, Perdiz, and a variety of other chipped stone artifacts. No occupation debris was visible in the immediate vicinity of the reported cache findspot when

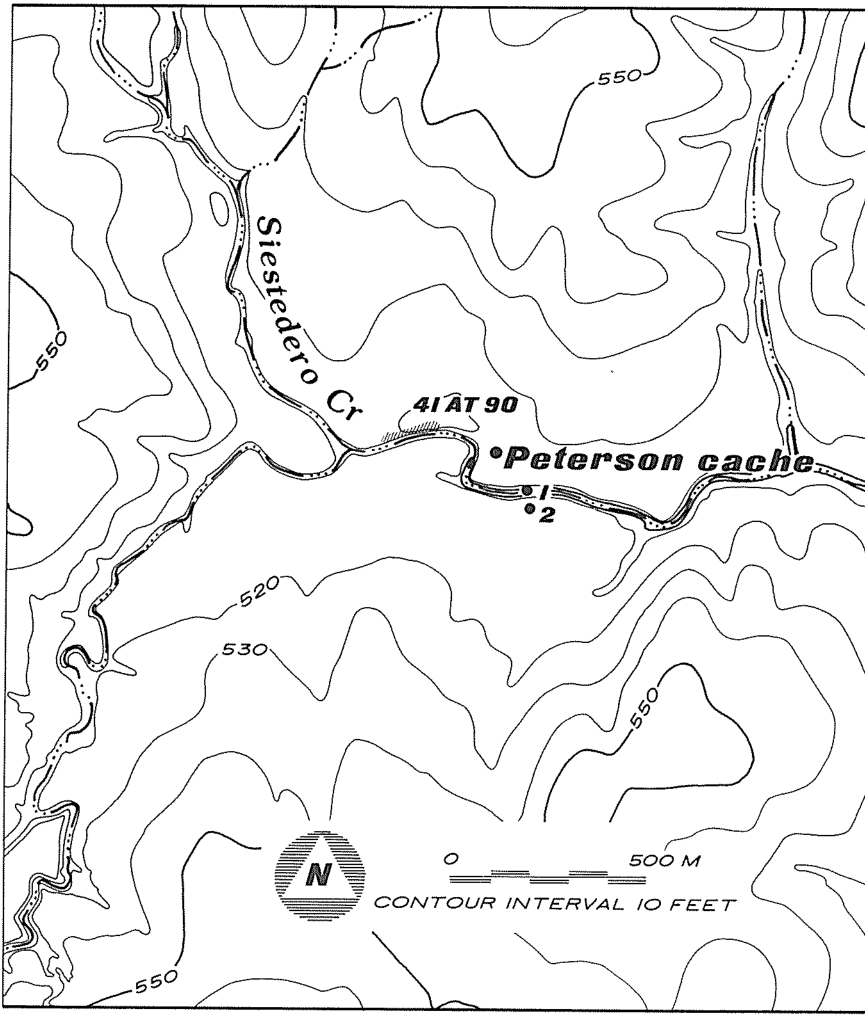


Figure 10. Topographic map of Peterson cache environs. Number 1 indicates location where mammoth bones were found in creek bed; number 2 indicates location of another unspecified artifact said to have been found during excavation of a well.

we visited the site, despite the fact that the pasture has been root plowed since Mr. Kenney acquired it. Nothing is known about the stratigraphic context of the cache.

Figure 11. Kay Hindes standing near the spot where the Peterson cache is believed to have been found. Looking southwest, with Siestedero Creek in the background.

Description of the Peterson Specimens

Of the three caches studied, this one seems to show the greatest consistency in manufacture (Table 3). The Peterson cache has the lowest coefficients of variation for seven out of nine attributes measured; only *maximum thickness* and *bit thickness* are less variable in the other caches. The average coefficient of variation (.0939) is smaller than that for the Lindner (.1495) and Granberg (.1414) caches, introducing the possibility that, as in the Lindner case, all of the components of the cache might have been made by a single craftsman. Aside from this, the Peterson tools seem to be intermediate in most respects between the other two caches (Table 4). We may also observe that:

1] all except specimen 6 are comparable to the Lindner cache in the degree to which the bit is carefully trimmed;
2] most do not have bits markedly canted to left or right;
3] like the Granberg tools, most have little cortex remaining;
4] these tools have the most acute spine-plane angle of any of the three groups.

The most remarkable aspect of the Peterson cache is the rather uniform pattern of wear on the bit, but unlike the Granberg tools there is not much evidence of attrition of the edge itself. Instead, abrasive (?) polish appears (usually only weakly or moderately developed, but in the case of specimen 6, quite pronounced) chiefly on the dorsal face adjacent to the working edge and to a lesser degree on the bit facet adjacent to the working edge. On both faces the polish is concentrated at the center of the bit. The dorsal polish is best developed in a zone about four to five millimeters back from the edge, but continues to diminish gradually further back. From microscopic examination it is clear that this polish favors high spots on the tool surface, such as flake scar ridges and other small projections, but in the more pronounced examples extends into the flake scars themselves, indicating that the material being worked was a semi-yielding substance, neither as pliable as animal tissue nor as hard and unyielding as hardwood. Some kind of soft wood may be indicated. In a few cases poorly developed striations were seen, usually on the dorsal face and usually parallel to the long axis of the tool. These might have resulted from the abrasion of microflakes generated by edge attrition, but they are generally quite shallow and poorly defined, and always occur in association with surface polish. Isolated burnished spots were found, usually on the ventral surface, and these are perhaps infrequent indicators of ventral haft wear.

This type of use wear seems to correspond to the "wood polish" reported by Keeley (1980: 35–42), although Keeley describes surfaces viewed at much greater magnifications (up to 500×) than were used here. Keeley describes wood polish as very bright, smooth, additive in nature, with broad, shallow striations. Vaughan (1985: 33–34; Plates 17–18, 43–52) confirms and amplifies Keeley's findings, also at high magnifications. The principal development of polish on the Peterson specimens in a zone four or five millimeters from the working edge probably indicates the average depth of penetration of the bit. The asymmetrical development of the polish, favoring the dorsal surface over the bit facet, probably indicates an adzing rather than a chopping motion (see Keeley 1980: 38). Although I have interpreted the polish described here as abrasive in nature, Anderson (1980) supports Keeley in maintaining that wood may produce cumulative silica polish in the same way that grasses produce "sickle gloss." She notes that wood cells may contain deposits of silica, calcium carbonate, and calcium oxalate, and her scanning electron microscope studies suggest some of this material may adhere to the working edge; another cause is localized dissolution and redeposition of silica from the tool itself, perhaps aided by friction-generated heat. In other recent studies, Meeks *et al.* (1982), studying sickle gloss, maintain that polish is not additive, while Unger-Hamilton (1984) maintains that it is both abrasive and additive. However, neither of these studies deals with wood as a target material.

Although the Witte Museum has not assigned individual specimen numbers, I have assigned temporary numbers for reference purposes.

Specimen 1 (Figure 12, a, a′)

This tool is made of variegated light-gray chert with no remaining cortex. The ventral face is quite flat, and the bit is canted slightly to the left when viewed

Table 3. Metric Attributes of Guadalupe Tools from the Peterson Cache

Specimen	Dorsal length (mm)	Ventral length (mm)	Maximum bit width (mm)	Maximum tool width (mm)	Maximum thickness (mm)	Bit thickness (mm)	Maximum depth of bit facet concavity (mm)	Facet/ ventral angle (degrees)	Bit spine-plane angle (degrees)	Weight (gm)
1	113.48	87.02	34.58	39.74	29.66	35.42	1.90	130	51	127.0
2	107.96	72.28	33.80	35.92	27.16	43.00	1.72	137	46	113.1
3	103.76	76.40	38.68	40.98	28.86	36.08	1.30	136	44	115.9
4	109.76	90.26	32.92	39.42	25.22	30.38	1.06	127	53	116.6
5	102.10	89.28	37.36	39.44	31.90	33.92	1.80	111	66	137.4
6	99.52	79.12	31.38	35.30	23.50	24.50	0.36	143	50	97.6

Table 4. Means for Three Guadalupe Tool Caches (Granberg: 4 tools; Peterson: 6 tools; Lindner: 9 tools)

	Dorsal length (mm)	Ventral length (mm)	Maximum bit width (mm)	Maximum tool width (mm)	Maximum thickness (mm)	Bit thickness (mm)	Facet/ventral angle (degrees)	Bit spine-plane angle (degrees)	Weight (gm)
Granberg	89.65	73.19	29.35	32.60	27.72	25.18	124.00	65.25	79.95
Peterson	106.10	82.39	34.79	40.77	27.61	28.29	130.67	51.67	117.93
Lindner	109.13	92.17	36.85	38.47	27.72	33.88	131.78	54.11	130.88

ventral side up; it is fairly evenly rounded, and is formed on the dorsal face by shallow, parallel flake scars, many of them fairly narrow. The dorsal ridge has been removed by a long, narrow flake scar possibly originating at the butt end (the direction of travel is difficult to determine). On the ventral side, about three fourths of the intersection of the bit facet and the ventral face has been removed by a long, narrow flake scar originating from one lateral edge. Iron oxide stains are present but not conspicuous; tool marks like these frequently indicate contact with a plow, but there is so little recent chipping of the cache that contact with a hand tool or some metal object during curation might be indicated.

At 40× the bit appears heavily worn, for the most part, with light to moderate edge rounding and smoothing, and moderate rounding over short, stacked step fractures. A prominent edge projection to the right of the bit center is heavily rounded and battered. A few areas also show only light rounding, probably where use percussion has carried away worn sections of the edge. The bit facet has very poorly developed, weak polish visible only near the working edge, especially on one side where the texture of the chert is grainer. Similar polish is visible in some places on the dorsal surface immediately adjacent to the working edge.

Lateral edges: battered, light to moderate rounding; the left edge (viewed ventrally) appears more heavily battered and rounded.

Ventral face: an irregular, discontinuous, patchy area of mirrorlike burnishing was noted on the ventral face over an area 14 × 4.5 mm across, near the midpoint of the tool on the right side (held with the distal end away from the viewer). The polish is hard to see, and no striations were visible at magnifications up to 60×. Smaller isolated patches of the same polish were also seen on the left side. This polish is confined to minute high spots on the grainy surface of the chert and was evidently created by friction with a hard, unyielding substance; it perhaps represents haft polish, although the ventral flake scar ridges do not appear polished.

Specimen 2 (Figure 12, b, b′)

This tool is made of light gray, homogeneous chert with light brown cobble cortex on the dorsal ridge (only on the proximal third), extending to the proximal end. The dorsal ridge has been flattened by a long, narrow flake scar originating from the bit facet and ending abruptly at the cortex on the proximal end. About half of the intersection of the bit facet and the ventral face has been removed by a flake scar originating from one lateral edge. The most interesting aspect of this tool is the presence of pronounced polish on the dorsal face of the bit and on a small area of the ventral side near the proximal end (see below).

The bit is somewhat narrow and arched; the bit edge is even and shows little evidence of traumatic percussion, but does show fairly consistent light to heavy rounding and smoothing, with some moderate rounding over short step fractures; some edge projections show heavy rounding. The central part of the bit edge shows less rounding and smoothing, with more battering and more damage to the bit facet. This is also the part of the edge where use polish is most heavily developed on the dorsal face. The nature of this relationship is unclear.

A few shallow, broad flake scars with step terminations have been removed from the bit facet. These vary in size, with the largest (4.42 mm long by 6.78 mm wide) located near the center of the bit. A few deeper, more irregular nicks are also present.

Surface polish: this specimen has well-developed polish on the dorsal face, originating at the bit and extending back from it up to 8.5 mm (Figure 14, d). The polish is clearly abrasive or attritional in nature, not accretional, and covers both the ridges and hollows formed by flake scars. It is best developed near the center of the bit but is asymmetrical, with another well-polished area on the right half of the bit (viewed dorsally). Faint, parallel striations can be seen originating at the bit edge and oriented parallel to the long axis of the tool. These are by no means well developed and can be seen only at magnifications of 40× and above with low-angle grazing light (Figure 15, b). One small area of the bit facet adjacent to the right edge (viewed ventrally) has a small irregular burnished area with parallel striations running at an angle of perhaps 30° (estimated) to the trend of the edge. A third area of polish covers a flake scar ridge on the ventral face, 17 mm from the proximal end; no striations are visible here.

Specimen 3 (Figure 12, c, c′)

This specimen is made of light gray-brown chert with a very small patch of cream-colored cortex remaining at the proximal end and a rust stain on the bit facet. It has a strongly arched, very symmetrical bit, carefully trimmed with long, narrow, parallel flake scars giving a columnar fluted appearance on the dorsal face. The ventral face is flat.

The lateral parts of the working edge appear relatively pristine, for the most part showing only light edge rounding and shallow step fractures from percussor trimming; the central part of the working edge, however, shows some concentrated wear consisting of heavy rounding over step fracturing and edge crushing. Edge wear is concentrated at the apex of the working edge and is directly adjacent to polishing on the bit facet.

Lateral edges: show heavy percussor crushing and step fracturing, for the most part, but little evidence of edge rounding, though a few edge projections are heavily rounded.

Surface polish: light polishing is evident on the bit facet adjacent to and as much as 3.5 mm back from the working edge. The polish is best developed near the edge, becoming less pronounced away from it, resembling that seen on the bit facet of specimen 1. The dorsal surface has fairly pronounced polishing present as much as 32 mm back from the working edge, but again concentrated chiefly near the edge and at the apex of the bit. The polish is present both in flake scars and on flake scar ridges but is somewhat better developed on the ridges.

Specimen 4 (Figure 12, d, d′)

This specimen is made of dark grayish-brown chert, somewhat mottled, with a strip of brown cobble cortex covering part of the dorsal surface along the

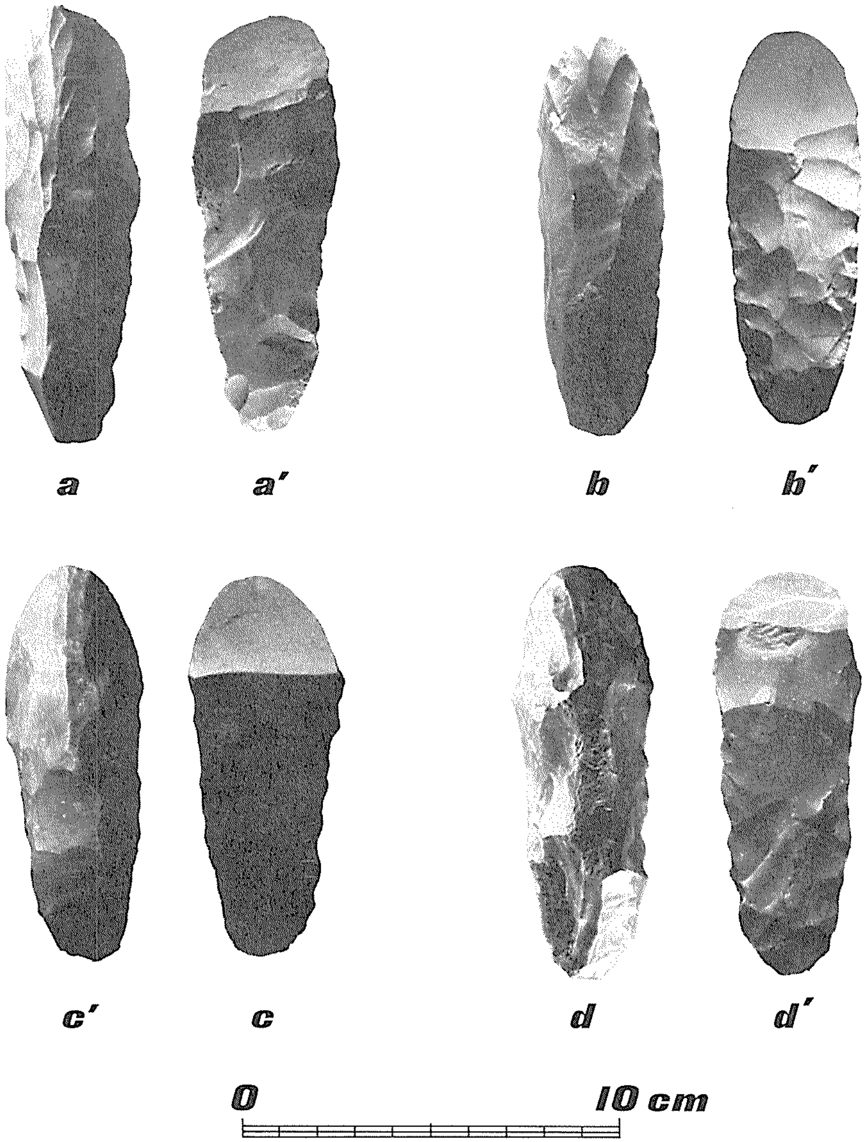


Figure 12. Guadalupe tools from the Peterson cache. Left photo of each pair is dorsal view, right photo is ventral view. a, a′, specimen 1; b, b′, specimen 2; c, c′, specimen 3; d, d′, specimen 4. All specimens oriented with distal (bit) end at top.

midpoint of the tool. There is no dorsal ridge, the cortex providing a somewhat rounded dorsal face. The ventral face is flat, but twists slightly from one end to the other. The bit is symmetrical and strongly arched, slightly canted to the right.

At 20× and above, the lateral parts of the working edge show heavy crushing and step fracturing produced by percussor battering; the apex or central part shows light to heavy rounding over crushing of the edge. Rounding occurs both in reentrants and on edge projections but is more pronounced on the latter. Several small flake scars are present on the bit facet; these range from rows of small nicks 0.2 mm wide and 0.2 mm long to abruptly terminated oval or D-shaped scars up to 3.0 mm across and 1.3 mm long.

Lateral edges: light to heavy rounding, mostly on edge projections, over frequently heavy percussor crushing and step fracturing of the edge.

Ventral face: the distal third of the tool has a couple of small, irregular, highly burnished patches in a flake scar. The proximal third has a couple of small, highly burnished areas on flake scar ridges (Figure 15, d). All of these probably represent haft wear.

Surface polish: like specimen 3, this tool has light to moderate surface polish on the bit facet, chiefly near the working edge, and especially near the central part of the edge (Figure 15, a). The polish also covers most of the small nicks and scars on the bit facet, suggesting they were also created as a byproduct of use. Polish is best developed in a zone about 3.5 mm wide next to the edge. Some poorly developed striations are present on this polish and are most easily seen at about 30× with high angle lighting; these trend approximately parallel to the long axis of the tool but there is some variety in orientation. A few of these may originate at the working edge but the better defined examples begin about 3.5 mm from it.

Again, as in the case of specimen 3, the dorsal surface has moderately well-developed polish, both in flake scars and on flake scar ridges, although it is better developed on the latter; a few small high spots on ridges are highly burnished. Most of the polish lies in a band about 4.5 mm wide along the edge, with the polish heaviest near the working edge and along its center. A few weakly developed striations are present, some of them oriented at about 30° to the working edge, others roughly at right angles to it. These are faint and quite difficult to observe.

Specimen 5 (Figures 13, a, a′)

This tool is made of very light gray, homogeneous chert that has a very grainy appearance under magnification. Small impurities and fissures are stained red from contact with iron oxide in the soil. No cortex remains. The bit is symmetrical, somewhat less arched than the other examples, and is slightly canted to the right. A dorsal ridge is present only on the proximal third of the tool, having been removed by bit-trimming scars on the distal part. Like most of the other tools in the cache, this one has a carefully trimmed bit, with a columnar fluted dorsal face.

Small-scale step fracturing and crushing of the working edge extends onto the dorsal face for about half a millimeter along most of the edge, giving it a somewhat minutely beveled appearance under magnification; parts of this edge are lightly rounded, with heavy rounding of only a few edge projections. Edge attrition is less than expected, since coarse-textured cherts like this generally develop edge wear prematurely. On the dorsal face are a few flake scars about 6 mm long with step terminations, and a couple of larger stepped or hinged scars about 3 cm long, but all of these are regarded as trimming scars, not use wear.

Lateral edges: pronounced percussor crushing and battering, a few small lateral snap facets; as would be expected with this grainy textured chert, edge rounding is rather pronounced, especially toward the proximal end.

Ventral face: no use wear was noted.

Surface polish: poorly developed polish is present on the bit facet, at the same location as in the other specimens, e.g. near the edge (most of it within 4.5 mm) and concentrated at the apex of the bit (along a segment about 1 cm long). Moderate rounding of flake scar ridges and light to moderate surface polish (predominantly on ridges) is evident on the dorsal surface, mostly within about 3.5 mm of the working edge, chiefly at its center. A few very small well-burnished high spots are visible in the same area. Also noted were a few very small weakly polished or burnished flake scar ridges near the proximal end.

Specimen 6 (Figure 13, b, b′)

This specimen is atypical in shape, size, and in extent of use wear. It is the smallest specimen in the cache and has the least carefully trimmed bit. It is made of light gray variegated chert with a remnant of light brown cobble cortex on the proximal third. The ventral face is slightly arched from front to back. The bit is small, moderately arched, and slightly canted to the left. The facet-ventral angle is rather pronounced. A large flake scar on the bit facet, together with a corresponding scar on the dorsal face, carrying away part of the work edge, apparently represent damage occurring since the tool was found.

At 30 to 40× the surviving lateral part of the working edge can be seen to have nearly continuous small-scale crushing, interspersed with small step fractures about 7–12 mm long. The center of the working edge, however, has been modified by the removal of a series of overlapping flake scars taken off the bit facet; these are deep, usually short and broad, with step or hinge terminations. The largest is about 1.5 mm long and 6.7 mm wide. The surviving lateral part of the bit edge also has a series of smaller flakes taken off the bit facet. All of the damage probably represents traumatic percussive use wear, concentrated especially at the apex of the bit. Doubtless this tool has more damage to the bit facet than its companions because of the angle of the working edge to the body of the tool (as indicated by the exceptionally high facet-ventral angle). Interspersed between these crushed edge segments are other areas showing moderate rounding and smoothing of the edge. The central part of the edge shows light rounding of the edge where it has been modified by flake removals on the bit facet.

The most distinctive aspect of this tool is the unmistakable polish on both the bit facet and the dorsal face. The bit facet polish is not very conspicuous

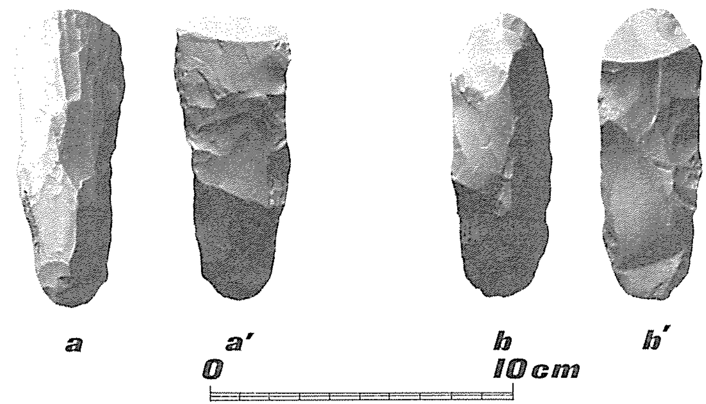


Figure 13. More Guadalupe tools from the Peterson cache. Left photo of each pair is dorsal view, right photo is ventral view. a, a', specimen 5; b, b', specimen 6. Both specimens oriented with distal (bit) end at top.

Table 5. Coefficients of Variation for Three Guadalupe Tool Caches (Granberg: 4 tools; Peterson: 6 tools; Lindner: 9 tools)

	Dorsal length	Ventral length	Maximum bit width	Maximum tool width	Maximum thickness	Bit thickness	Facet/ventral angle	Bit spine-plane angle	Weight
Granberg	.1194056	.1465762	.2149006	.111419	.114554	.1103679	.1275112	.1426914	.1853997
Peterson	.0488884	.0828562	.0722368	.054435	.100880	.1663507	.0778793	.1371632	.1040738
Lindner	.0854048	.1768962	.1438055	.076281	.094586	.2759800	.1185247	.2155959	.1582495

without magnification, but at low magnification can be seen over essentially the entire facet except where removed by recent damage. As in the other specimens in this cache, polish is most pronounced near the working edge and especially near the center or apex of the bit. Some of the small flake scars penetrating the bit facet have polish developed on them, while others are free of polish.

Surface polish on the dorsal face is much more pronounced and is visible even without magnification; it is more highly developed on this specimen than on any of the others in the cache. Conspicuous rounding, in some places bordering on faceting, of flake scar ridges is present on the dorsal face (Figure 15, c, e). It is most pronounced near the working edge and especially near the center of the bit. This abrasion of flake scar ridges is simply the result of prolonged and severe polishing. Heavy polish is present on the dorsal face near the central working edge both on ridges and in flake scars, but toward the sides of the dorsal face and well back from the edge it diminishes markedly, occurring chiefly on ridges and only faintly in flake scars. Some detectable polish occurs over the entire distal half of the tool; only the most proximal 33 mm of the tool is free from polish. On two or three dorsal trimming scars at the center of the bit, closely packed parallel striations can be seen, oriented at right angles to the edge and precisely parallel to the long axes of the trimming scars; these extend up to 6.3 mm from the edge (Figure 15, e).

Lateral edges: severe percussor crushing and battering, with light to heavy edge rounding. Some areas have light polishing over edge battering.

Ventral face: a few small burnished spots such as have been found on the other tools are visible on the ventral face. Also present is light surface polish similar to that on the rest of the tool, occurring mostly along the lateral edges (both on flake scar ridges and in the scars themselves) and at the proximal end (mostly on ridges). This polish is poorly developed and is noticeable only at 20× and above. Nothing comparable in extent has been seen on the other tools in the cache, where small burnished spots are generally the only ventral wear visible.

SUMMARY AND CONCLUSIONS

All of the Guadalupe tool collections reported here presumably represent caches, despite the fact that there is no evidence for a pit or other facility associated with any of the finds. The best evidence for regarding these as caches is the fact that each group was tightly clustered when found (except for the Peterson collection, for which we have only the notation "found in one cache" on the accession card). Moreover, the internal homogeneity of the Lindner and Peterson groups is sufficient to suggest that, conceivably, in each case a single craftsman might have been responsible for the knapping and deposition of the group.

All of the tools considered here are rather similar in shape and size, and insofar as can be determined conform to the manufacturing sequence defined for the Lindner cache. As a rough measure of the variability of each cache, we may average all the coefficients of variation for the nine different variables measured (omitting maximum depth of bit concavity) to obtain an average coefficient of variation (bearing in mind also that the different variables are by no means independent). These are: Lindner, .1495; Granberg, .1414; and Peterson, .0939. To get some impression of what this means in terms of absolute variability, if we compare these to a completely unrelated tool class, we find for example an average coefficient of variation of .1759 for Late Prehistoric two-beveled knives at Choke Canyon (Brown *et al.* 1982, Table 8). All of the Guadalupe tools, then, are less variable than the beveled knives, which are more susceptible to breakage and resharpening.

If we may characterize all three caches as essentially the same in manufacture, then, the difference in use wear is all the more remarkable. Even more so is the fact that for the most part each cache is coherent in terms of its microwear characteristics. The Lindner tools appear to be essentially unused (or if not mint specimens, then freshly resharpened ones). The Peterson tools are characterized by a very consistent pattern of matching dorsal and bit facet polish concentrated at the center of the bit. The target material indicated is clearly semi-yielding in texture, possibly a substance like soft wood. The Granberg tools, on the other hand, seem to have some traumatic, percussive bit damage, damage which is thought to be more extensive than would be expected to be inflicted by a percussor during manufacture. The target material may be hard wood. Adzing of mesquite with a replica did not exactly duplicate the bit wear on the Granberg tools, but the analogy seems close enough.

With the exception of the use-polished Peterson cache, trying to recognize use wear on such roughly made artifacts as the Guadalupe tools reported here is a difficult task. Hard hammer percussion, when applied to a steep platform angle (54° for the Lindner specimens, 65° for the Granberg tools), results in severe percussor damage to the stone being worked, leaving percussion rings, crushed and step fractured or hinge fractured edges, and possibly even rounded, crumbled, or nibbled edges if scrubbing or raking of the edge was done to prepare the striking platform (Figure 14, a, b). The difficulty lies in the fact that if Guadalupe tools were used as some sort of adzelike woodworking tool (which seems to be the best explanation advanced yet) their customary use was probably rather percussive as well. It seems very likely that a hafted tool struck forcibly against a fairly hard wood might suffer damage which is hard to distinguish from percussor damage (in the case of the Peterson cache, a softer wood is postulated as the contact material, resulting in much less edge trauma). Many of the Guadalupe tools examined microscopically show heavy step fracturing at the center of the bit edge. Is this because it is the center of the working edge that receives the heaviest use, or is it because particularly forceful trimming blows were delivered here in an attempt to strike off the distal part of the dorsal ridge? Much of the heavy step fracturing seen on some of the Granberg specimens looks just like the sort of wear that might be produced by heavy percussive use on dense wood, but it also tends to intergrade with the kind of edge damage seen on unused, freshly made experimental specimens. Many of the tools show stairstepped flake scars with hinged or stepped terminations on the dorsal face; are these manufacturing scars, successive macroscars driven off during percussive use, or successive rejuvenation scars?

As the discussion above indicates, microwear examination for this kind of tool class—*percussive cutting tools*—is weighted with uncertainty. The intersection of (presumed) stressful use and stressful manufacture means that a good deal of overlap between use and manufacturing traces can be expected. Only where less abusive target material was worked, as with the Peterson cache, can we have more confidence in our ability to distinguish use wear from manufacturing traces.

In summary, then, while all the Guadalupe tools reviewed here can be considered equivalent in *manufacture,* each cache seems to have its own microwear signature that distinguishes it from the others, suggesting these are *tool sets,* not simply random collections of tools. It seems likely, perhaps, that each set was made and disposed of by a single craftsman (at least in the case of the Lindner and Peterson caches) and disposal was probably a single event, there being no evidence that tools were added to the group over a span of time. In the case of the Lindner cache, the original number of tools in the cache (unknown, but at least nine) may indicate something of the scope or severity of the anticipated task. It may be, as well, that all of the tools in a cache were intended for use with just one haft or helve, each tool being unhafted and set aside as it became worn. This might account for the striking uniformity of the tools. In the Peterson cache, all the tools were worn, perhaps indicating the task was completed and the exhausted tools were set aside for future resharpening. Here, six tools were involved. Likewise, the four Granberg tools may have also been set aside for rehabilitation.

The condition of a particular tool is probably contingent on several different variables, such as:

1] type of target material, whether hardwood (mesquite, juniper, guayacan, oak, walnut, pecan), soft wood (willow, sycamore, cottonwood) or some material other than wood;
2] condition of target material (green or seasoned);
3] length of use episode;
4] force employed in use, or other relevant work habits;
5] frequency and nature of resharpening.

The observations reported here are based on a sample of only three caches. As more caches of Guadalupe tools are found in the future it will be interesting to see whether the patterns perceived here will be borne out in later studies. Will newly discovered caches form coherent microwear groups, or will there be variability in wear that crosscuts caches?

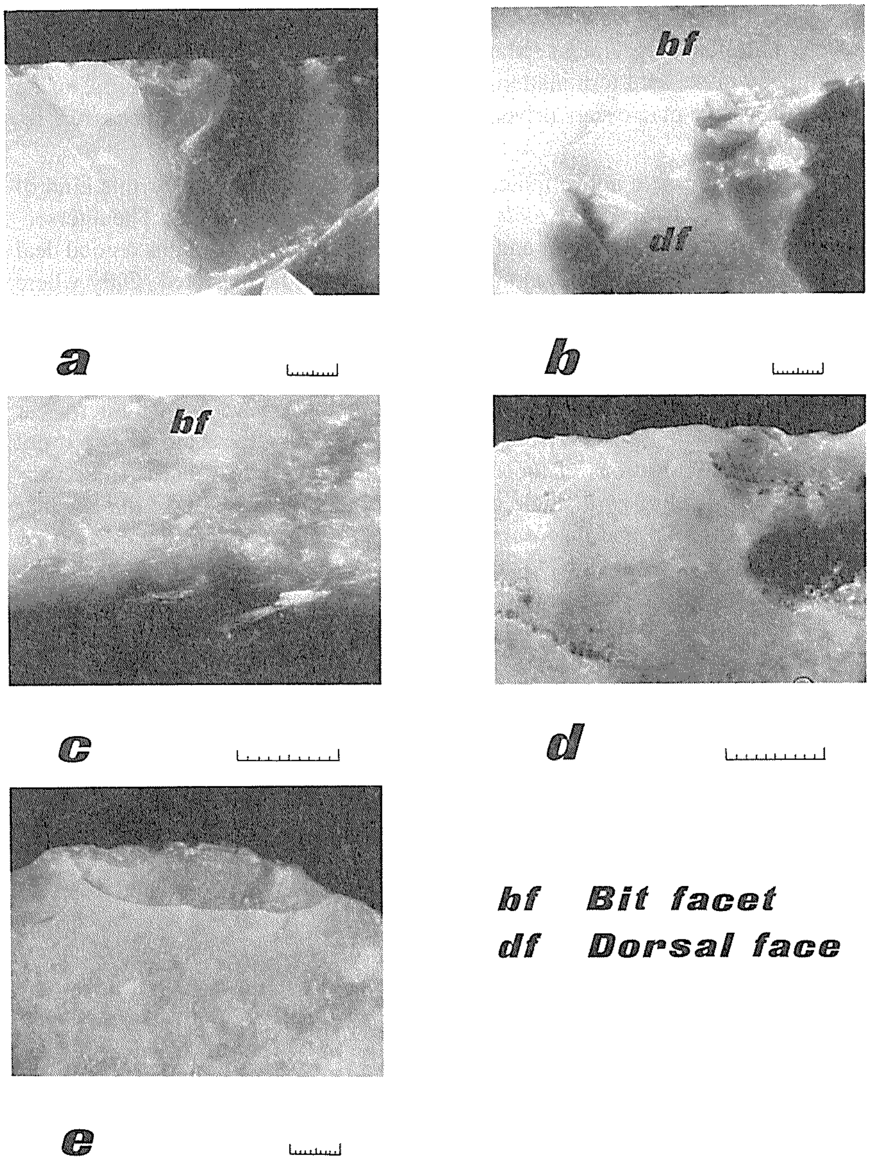


Figure 14. Photomicrographs of Guadalupe tools and replicas. Scale is 1 mm long, with small divisions tenths of a millimeter. a, unused working edge of chert replica, viewed from dorsal face, showing percussor crushing and trimming scars; b, more oblique view of replica edge; note percussor crushing; c, Granberg specimen 15, showing relatively pristine section of working edge (orientation similar to "b"); d, Peterson specimen 2, showing polish on working edge and dorsal flake scars (orientation is similar to "a"); e, Granberg specimen 15, unresolved fracture (incipient use failure?) on bit facet.

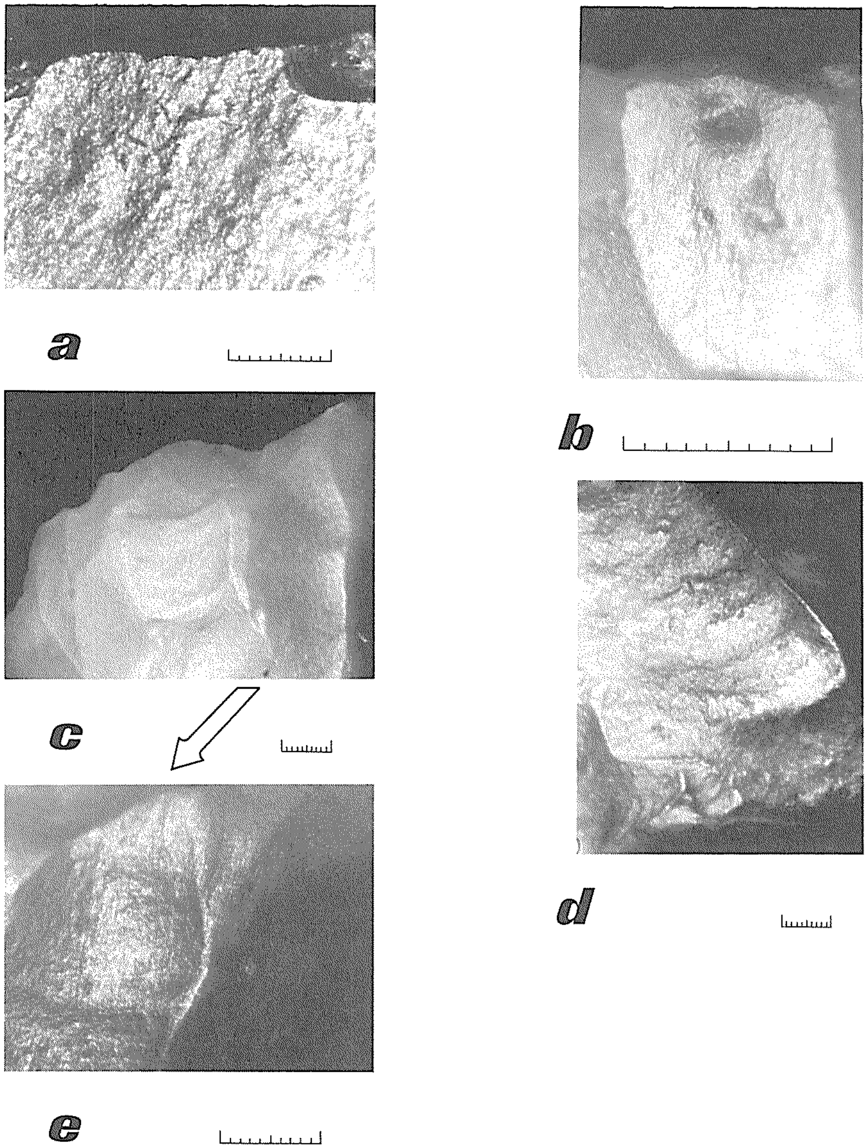


Figure 15. Photomicrographs of Guadalupe tool cache specimens. Scale is 1 mm long, with small divisions in tenths of a millimeter. a, Peterson specimen 4, polish on bit facet truncated by D-shaped scar to right; b, Peterson specimen 2, polish and longitudinal striations originating from working edge at apex of bit on dorsal face; c, Peterson specimen 6, polish on dorsal face near working edge; d, Peterson specimen 4, polish on flake scar ridges, proximal end, ventral face; e, enlargement of prominent flake scar seen at right side of "c," showing polish and weak striations. a–c, e are oriented with working edge at top of frame.

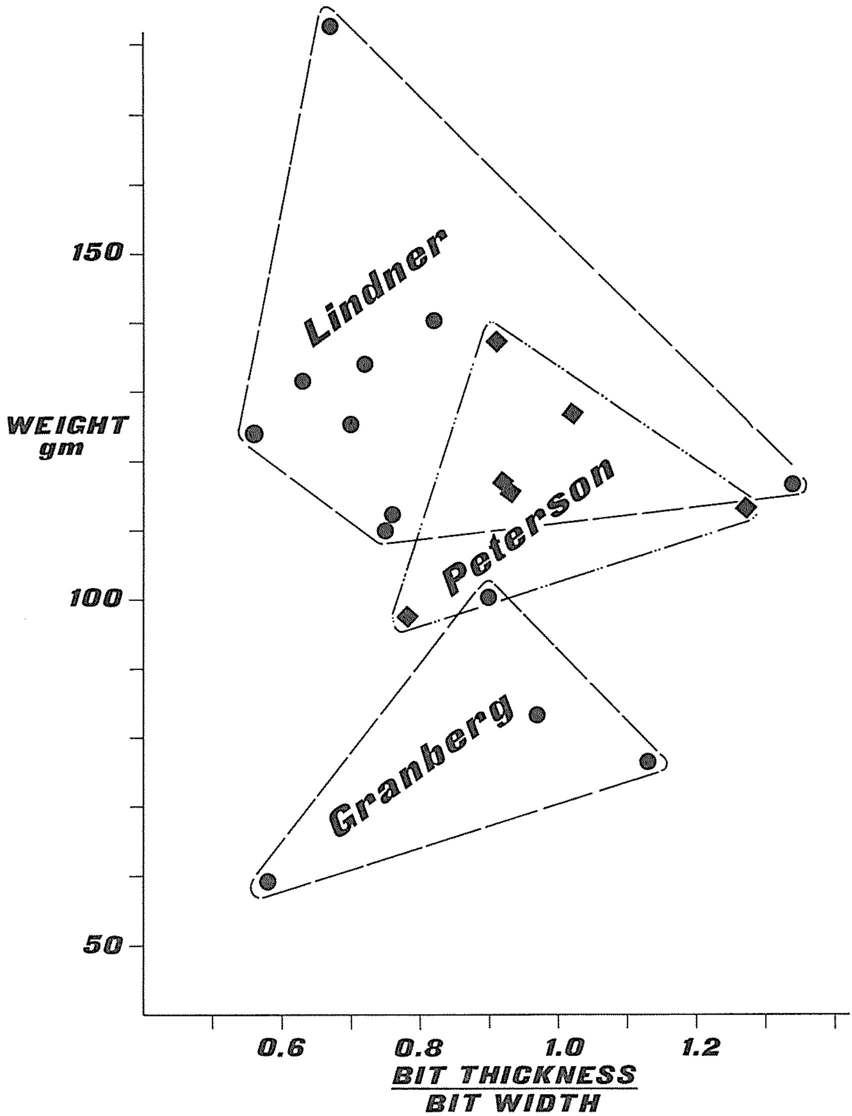


Figure 16. Scattergram showing relationship between weight and amount of bit "arch" (expressed as the ratio of bit thickness to bit width) for all 19 tools in the study. Weight is a variable related both to use and to availability of raw material. The amount of arching of the bit is probably largely stylistic, a matter of craft habits of the individual knapper. The scattergram shows that the Peterson cache is intermediate between the Lindner and Granberg caches, that there is limited overlap between caches, and that weight varies more than bit arch. The spread of points for each cache indicates how heterogeneous or homogeneous each cache is. Weight is measured in grams; bit arch is a dimensionless ratio.

APPENDIX: DESCRIPTION OF A CACHE OF CLEAR FORK TOOLS FROM THE J-2 RANCH SITE, VICTORIA COUNTY

It should be noted that a cache found at the J-2 Ranch site in Victoria County (Fox, Schmiedlin, and Mitchell 1978: 9) is erroneously reported as consisting of Guadalupe tools, but the specimens are more appropriately regarded as Clear Fork tools or protoforms. This classification has been perpetuated in subsequent literature. With the help of Shirley Van der Veer I have been able to examine both the specimens in question (lot 82A) and the relevant field notes. Three specimens were found clustered together near the east wall in the northeast quadrant of unit N100/E30 (= unit K) at depths of 62.5, 61.75, and 62.75 inches, respectively, below ground surface at the northwest corner datum. Judging from the level plan all were grouped within a diameter of about 25 cm. A fourth specimen was found in the northwest quadrant in the same level (60 to 66 inches) but evidently was not found in place since it does not appear on the level plan (field notes, October 17, 1976). Of the cached tools, one is an elongate-oval biface of yellow-brown chert 12.8 cm long, with a slightly ridged dorsal face, and the beginnings of a recognizable bit formed on the ventral side by a few heavy percussion scars at the distal end; in plan view the bit end is somewhat arched. This specimen is perhaps best regarded as a Clear Fork protoform. Another is a thick, markedly plano-convex biface of light brown chert 13.1 cm long, with a well developed bit formed on the ventral side by detachment of several heavy percussion flakes; in plan view the bit is roughly straight with rounded corners. This specimen seems to be a representative Clear Fork tool. The third specimen in the cache is a small elongate-oval biface of light chert with patches of cortex on the dorsal side. In section it is plano-convex only toward the proximal end. The presumed distal end has a slightly beveled effect created by the removal of many, fairly well-controlled flakes from the ventral face, driven off from around the periphery of the bit. In plan view the bit end is rounded. This specimen appears to be a small counterpart to the first one, and like it is presumed to be a protoform. The fourth specimen, found isolated from the others, is a short thick biface 5.9 cm long of yellow-brown chert, biconvex to plano-convex in section, with a steep, well-defined bit (rounded in plan view) formed on the ventral side. It may be a Clear Fork tool that has been shortened by repeated resharpening.

ACKNOWLEDGMENTS

I would like to thank Mr. O. R. Lindner for reporting his artifacts, for loaning them for study, and for allowing me to visit the site. Tom Hester and Shirley Van der Veer provided crucial information on the Granberg and J-2 Ranch sites and arranged for me to have access to the tools from both sites. Steve Black and Al McGraw let me borrow two specimens from the Panther Springs Creek site for study. Bobbie McGregor and Fred Valdez brought the Peterson cache to my attention and arranged for the Witte Museum to loan them for study. Kay Hindes assisted in tracking down the original find spot of the Peterson Cache, and Mr. Tobey Tomblin and Mr. J. W. Kenney provided access and answered questions about the find. Harry Shafer and Rick Holloway provided access to photomicrographic equipment.

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Episodes in the History of Texas Archeology: Excavations at Shumla and Eagle Caves, Witte Memorial Museum

Roberta McGregor

ABSTRACT

The Witte Museum of San Antonio was involved, during the 1930s, in early archeological research in the Lower Pecos region of Texas. These activities are summarized here and have been supplemented by interviews with Harding Black, a participant in the field work.

INTRODUCTION

This narrative is intended to give historical insight into the Witte Museum's expeditions into the Lower Pecos River area of Texas in the 1930s. These explorations provided important foundations toward our understanding of the archeology of that region. The objectives, methods, and techniques, although imprecise at best by our modern standards, were in keeping with their time and serve to illustrate how far we have come. In this paper, one member of the early expeditions, Harding Black, furnishes a personal glimpse of those historic moments in Texas archeology.

The involvement of San Antonio's Witte Museum in the archeology of the Lower Pecos River area began more than 50 years ago. In 1931 the Witte sent a small scouting expedition to investigate a number of prehistoric sites in West Texas including 10 rock-shelters near Langtry. A member of that early group, Mary Virginia Carson, sketched a series of pictographs painted on the walls of several shelters. The Witte now houses those first attempts to document the Lower Pecos area rock art. Later, in 1933, a museum expedition excavated the Shumla Caves (Martin 1934). The 1936 excavation of Eagle Cave (Davenport 1938) followed two testings of the shelter in 1935.

THE 1933 EXCAVATION

Concern about scouting expeditions in the Lower Pecos from other institutions—particularly from the north and east—expedited the decision to excavate the nine Shumla Caves. The San Antonio *Light* in 1933 quoted Mrs. Ellen Schultz Quillin, Witte Museum Director: "Material brought from this section to San Antonio will be invaluable, as all of the major outside institutions have their expeditions in the same field, and soon there will be nothing left for Texas unless the work of excavation is done now."

To finance the expedition, Mrs. Quillin solicited food and money from the citizens of San Antonio who responded with donations of beans and coffee and other food items and $90.00 in cash. The crew, all members of the newly-formed Southwest Texas Archaeological Society, consisted of George Martin, President of the Society and head of the expedition; Major Fletcher Gardener, Ret.; John S. Eross, crew chief; Jack W. Davenport, "expedition artist"; and Harding Black, now a well-known San Antonio potter. Other Society members who spent a varying amount of time at the site included Jack Specht, George C. Martin, Jr., Albert Maverick III, Everett Lehman, John Davis, George Nalle, Jr., John Ray, Gustave Bentrup, and Burton Waters. All of the crew members volunteered their services.

Harding Black's association with the Witte Museum dates back to the Depression years of the 1930s when Quillin hired him to conduct children's pottery classes. He recalls (personal communication 1985) the early days of Texas archeology:

> Sam Woolford decided to start an archeological society at the Witte Museum. He was editor of the San Antonio *Light*. The University of Texas was doing some digging out in the Big Bend area. Woolford was a good friend of George Martin—he was sort of an amateur archeologist and so they decided to have an expedition out to West Texas. I was selected to be one of the pick and shovel men. For some reason we started out at midnight and ended up at Shumla, Texas; it was just a railroad siding. We arrived there in the middle of the day—hot as blazes. We set up camp [May 28, 1933]. There was a little cave just down from the camp site where we set up the kitchen. It was a bare cave—no ash or anything in it. We had a spring right down below. To get to the spring we stretched a rope from the top and tied it to a bush and let ourselves down that steep slope. (Figure 1)

Black reminisces about some of his Shumla co-workers:

> Eross was a semi-professional. He worked in New Mexico and Arizona with some archeologists there. He knew where to dig so he came up usually with the best finds. We had George Nalle—the governor's (Ma Ferguson's) grandson at that time. Of course us guys were mostly poor people and they were very rich. So when we heard he was coming, think of the consternation it caused in the camp. During the first day of digging, someone threw a whole shovelful of ash right on top of his head. It's a

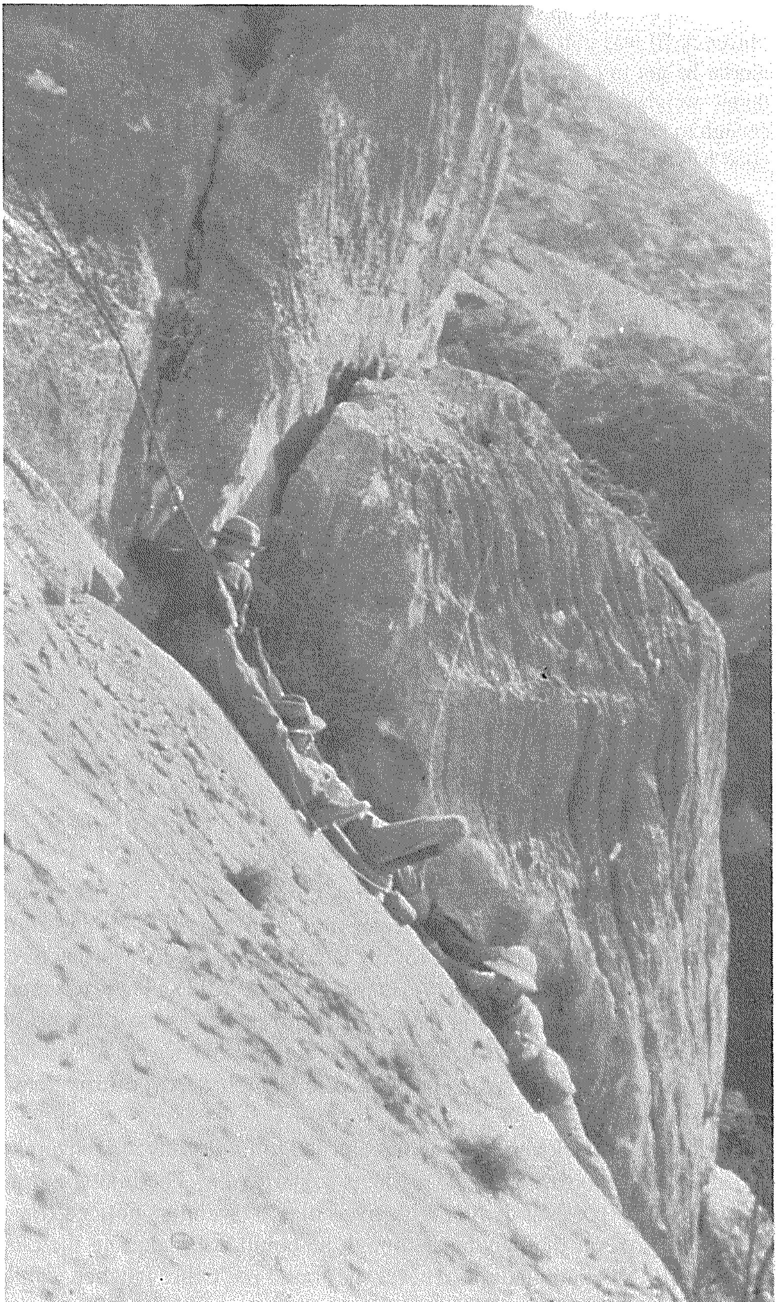

Figure 1. Descent to the Shumla Caves: The 1933 Excavation

> good thing he came up smiling or I'm afraid he would have been ostracized. Albert Maverick III was in training for football at school so whenever they found a heavy mortar he got to carry it out of the canyon, which was quite a job. Some of these things weighed 30–40 pounds. . . . Jack Davenport was an artist—that wasn't enough to keep him busy so Quillin hired him here at the museum because he was a good handyman, a good plumber, and electrician.

Davenport drew the illustrations in the Witte's *Big Bend Basket Maker Papers.*

Major Gardener returned to San Antonio before the actual digging began. George Martin followed in a little over three weeks. Ellen Quillin (in a letter to "Uncle Tom" dated July 12, 1933) writes: "Mr. Martin came in from the field about three weeks ago, both to get the material in and mounted for exhibition, and to rest. He was quite ill when he got back." John Eross remained as crew chief and kept a log of the daily activities from June 20th to his arrival back in San Antonio on August 25, 1933. During that time Martin, who returned to Shumla for one day in July and three days in August, received weekly progress reports from Eross. The crew spent long hours working in the shelters, usually excavating from 7:30 a.m. to 6:00 p.m., six days a week.

This early exploration in the dry shelters yielded an unsurpassed collection of perishable materials dating mainly to the Middle and Late Archaic. Eross and his crew recovered hundreds of mat fragments and such rare items as hafted knives and points, several complete baskets, woven headbands, a threaded bone awl and a skin pouch. In addition, the crew uncovered a number of burials including one of the most elaborate burials yet found in the Lower Pecos.

1935 SURVEYS

Elated by the Shumla excavations, Ellen Quillin sent two of the museum's employees back to the Lower Pecos River area. On March 8, 1935, Harding Black and J. Walker Davenport "left for the Big Bend region in a survey of caves located around the Langtry district" (Davenport 1935a: 1). They remained at Eagle Cave for four days "sinking test holes and trenches as cave far too big to work without additional help" (*ibid.*: 3). Davenport also wrote: "The eastern museums have been sending scouts through here [Langtry area] offering cash for information and artifacts."

In September, Black and Davenport returned to Eagle Cave for several days of excavation. Davenport noted two artifacts in particular. The first (Figure 2,a) was a painted slate pendant drilled with five holes. Davenport noticed traces of painting on the face of the pendant although he could not make out the design. When Mock (1984) examined the artifact she found red ochre patches visible on the edges. The second object (Figure 2,b) was "the largest painted stone I have ever seen," (Davenport 1935b:4). The same artist may have painted two other pebbles recovered at this time since they share a strong similarity in design and technique (Figure 3).

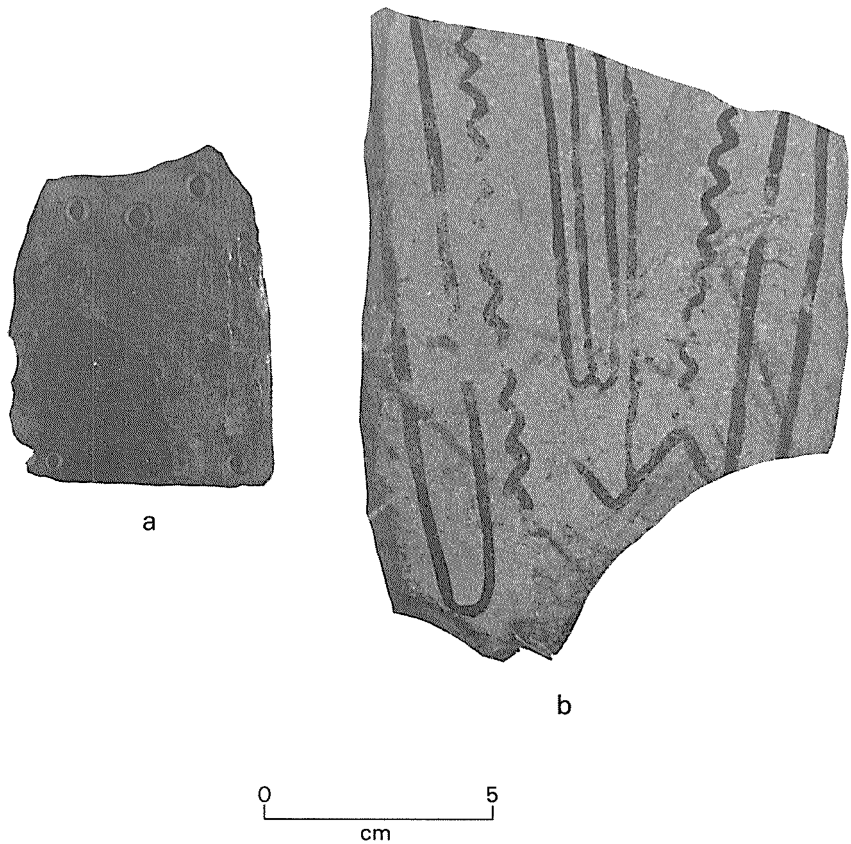

Figure 2. Artifacts from Eagle Cave, 1935. a, painted slate pendant drilled with five holes; b, fragment of a large painted pebble.

1936 EXCAVATION

As a result of the 1935 trips, Quillin successfully solicited money and food from the citizens of San Antonio to finance the excavation of Eagle Cave. Davenport and Black, accompanied by Edward Ritchey and Joe Bentz (Figure 4), returned "to work this rock-shelter to the bottom" in 1936 (Davenport 1936: 1).

In 1922, Sam Woolford had explored Eagle Cave with Herbert Dodd, the postmaster at Langtry. Woolford (Woolford and Quillin 1966: 198) describes the shelter: "There it was—a great yawning opening in the canyon wall. I do not think it had been disturbed at that time by 'pot-hunters.' The typical large, black arrowheads lay in clear view on the packed-down surface of the cave. When you stamped your boots on the floor of the cave it made a thumping sound." Unfortu-

Figure 3. Artifacts from Eagle Cave, 1935. Two painted pebbles.

nately, by 1935 the landowner was using the cave to shelter freshly-sheared sheep from inclement weather—as many as 5,000 at a time (*ibid.*). Later, in 1963, Ross (1965: 15) found "the uppermost stratum was a light gray soil composed of backdirt from potholes, burned rocks, sheep and goat dung and straw."

Access to Eagle Cave is possible through a cleft in the canyon walls near the site, or by coming upstream from the mouth of Mile Canyon. However, the Witte crew found a third way in 1936. They built a wooden ladder and braced it halfway down the slope by wooden scaffolding (Figure 5). Davenport (1936:3) wrote: "Ritchey had the doubtful honor of making the first trip down." They set up the screen and shaker—a motorized contraption built by Davenport "that shot that ash down a shoot to the canyon to get rid of it" (Black, personal communication 1985).

Davenport drew a floor plan of the shelter. He mentioned in his field notes that two boys named Lassiter were "doing some work in the cave—know of no way to stop them. However, don't think they will interfere with us" (Davenport 1936:2). In fact, Davenport (1938:4 ; Figure 6) mapped in the local boys' trench in his drawing. Black (personal communication) remembers: "Every day after school, three little boys of the neighbors there would come down to where we were digging. They were looking for painted stones because you could get about $10.00 for these painted stones."

Davenport began excavating Eagle Cave by digging a trench 106 feet from the south edge and about 18 feet in from the line of the two edges. The trench measured eight-feet wide and extended to the rear wall (Davenport 1938). In later excavations, the east-west trench was visible as an elongated depression (Ross 1965). Davenport (1936:3) described the top layer as consisting of "limestone dust, ashes and some burnt rock. Snail shells are thickly scattered through this layer. Bones of birds and animals are also in the layer which are being saved for future reference." Davenport (*ibid.*) wrote that Layer A was about two-feet deep towards the outside of the shelter and increased in depth to five feet at approximately 15 feet from the rear.

Davenport usually listed the daily finds in the margin of his notebook. In the first stratum he mentioned, in addition to the chipped stone artifacts, eight painted pebbles, miscellaneous bone and broken awls, a tubular stone pipe fragment (Schuetz 1961) and one gray stone bead.

Work began on Stratum B, which dates to the Middle Archaic, on February 24. On March 5, Davenport (1936:12) wrote: "Ritchey noticed a finger and fingernail mark on one of the cigar-shaped objects of which we have several. Several other objects, which we had collected today, upon examination prove to be clay. Believe this to be important as every piece that we can remember came out of B level." The crew uncovered two more clay figurines the following day.

Davenport (1938:10) later noted: "Scattered through layers A, B, and C were 12 objects of cigar-like shapes—these appear to have been moulded (*sic*) from clay." Later excavations at Eagle Cave (Ross 1965: Table 15) produced 22 additional clay objects including six clearly identified as clay figurines (Shafer 1975:150).

In addition to the figurines, Davenport (1936:13) described a painted pebble uncovered in stratum B: "Design on stone unusual—it is of spider web—have seen one other like it. It was in possession of Comstock mercantile store

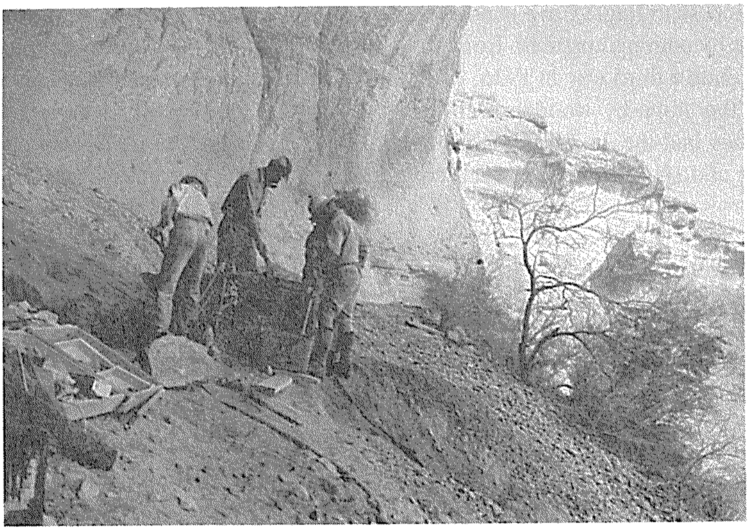

Figure 4. Excavations at Eagle Cave, 1936.

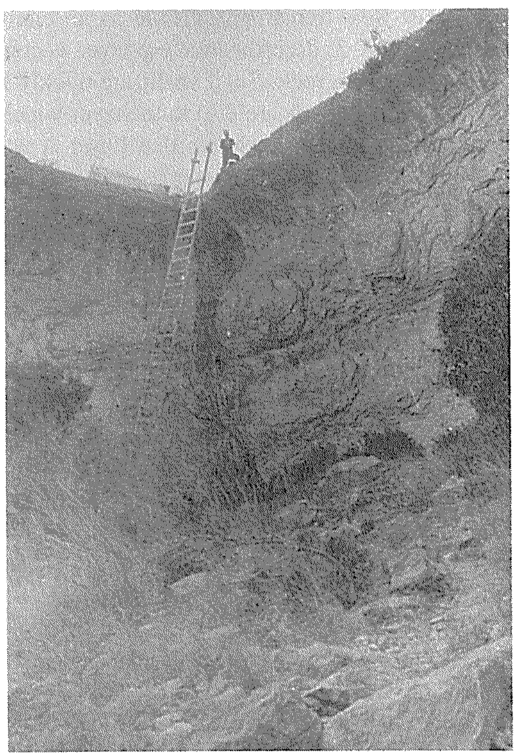

Figure 5. Excavations at Eagle Cave, 1936. View of ladder built for descent to the site.

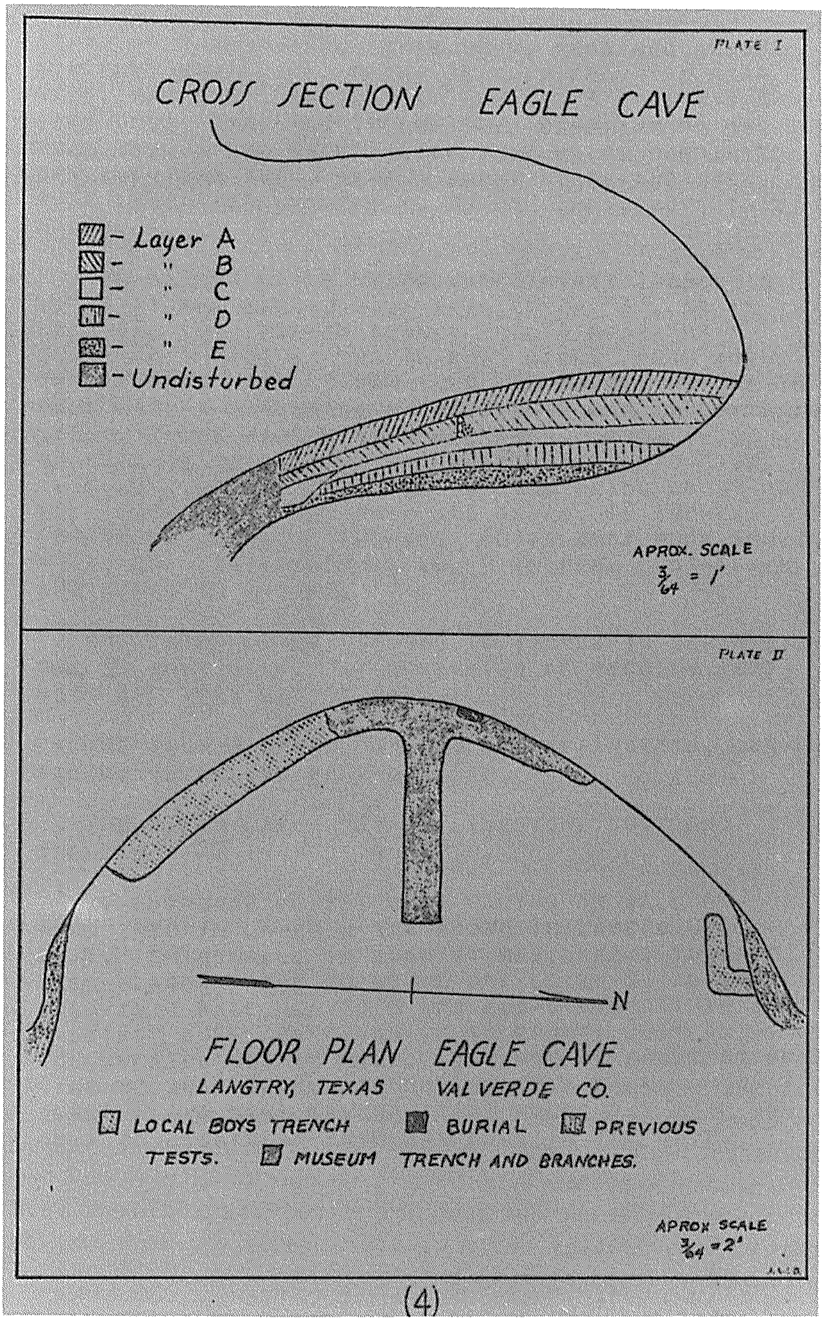

Figure 6. Plan of Eagle Cave. Drawn by J. Walker Davenport, the plan shows areas of the Witte excavations and earlier relic-collector trenches.

owner." Davenport completed recording section 4B by taking photographs and movie footage of the cross section.

Perishables recovered from Stratum B included three matting fragments, 13 knots, nine strings, 11 sandal fragments, two fiber rings and three basket centers. In addition, the crew excavated bone awl fragments, two perforated shells, 17 painted pebbles and eight clay figurines. Fifteen of the pebbles were found in the T-cut along the back wall.

The Witte crew excavated Strata C and D to a depth of 12 feet (Figures 7, 8). Before leaving Eagle Cave, Davenport (1936:12) wrote: "Dismantled ladder and after supper took lumber and wheelbarrow to Skiles. We had quite a little talk with them, shortly before we started to leave Guy said he sure would like to have the lumber from the ladder and when we told him it was outside on the truck and that we had brought it up to give him he was pleased and as a result he gave us a (prehistoric) Lower Pecos gee string. We feel that we got the better of that bargain." Thanks to Davenport and Black the leather "g-string" is now in the museum's collection.

While reminiscing about the lower Pecos, Black discussed his ideas as to how the prehistoric people cooked one of their staple foods:

> I can't remember which cave this was I found a fireless cooker. Most people didn't realize they didn't have pots to cook in—even to carry water. There was no clay out there—they didn't make any pots—and I found this fireless cooker. I was digging one day and I came to some rocks and I took the rocks off and I found some grass and I removed the grass and in that was a bunch of yucca hearts. Then below that I found some more grass and below that some more rocks. So they heated up the bottom rocks, put the wet grass on top of the hot rocks, put the hearts in, some more wet grass and some more hot rocks and covered the whole thing up and that's the way they cooked the yucca hearts to eat.

Hough gives an ethnographic example for a similar cooking technique in the American Southwest (1959:846): "Mescal pits are usually circular depressions in the ground, a foot to three feet in depth, and lined with coarse gravel. A fire was built in the pit, raked out after the stones became hot, and the mescal plants put in and covered with grass. After two days steaming the pile was opened and the mescal was ready for consumption."

Black (personal communication) also discovered how the Lower Pecos peoples improved their sleeping quarters: "Most of the fiber was found in the top levels where it hadn't been burned. They used grass for bedding. We'd find this bedding material because this ash wasn't very good to sleep on so they'd pull this grass and make beddings." Baker Cave (Brown 1984) and Hinds Cave (Shafer and Bryant 1977) yielded similar grass-like features.

Figure 7. Excavations at Eagle Cave, 1936.

Figure 8. Excavations at Eagle Cave, 1936. View of stratigraphy in trench.

FINAL COMMENTS

The main reason the Witte explored the Lower Pecos area was to collect objects for the museum. Mrs. Quillin chose two of her full-time museum employees for key positions in the excavations: Jack Davenport, an artist, carpenter and mechanic; and Harding Black, a potter. Both observant and hard working, they returned with more information than once thought. The Witte published Davenport's report in 1938. Davenport and Black brought back soil and charcoal samples, took photographs and filmed a portion of the excavation. The film, now restored, resides in the collection of the Witte Museum. Harding Black looks back to the early excavations:

> We used shovels. We had to move a lot of ash in order to find anything. We screened all the ash to make sure. Of course, at that time we weren't too professional. Now I realize we should have saved seeds, leaves—because they were just as important as some of the hard stone. We probably didn't do too good a professional job but I guess we got the stuff before the potholers got it, which is a good thing. At least we got it in the museum.

In September, 1963, a Texas Archeological Salvage Project crew left Austin to begin a three-month season in the Amistad Reservoir testing three sites: Bonfire Shelter; Fate Bell; and Eagle Cave. The cultural fill within Eagle Cave varied considerably, from 2–3 feet thick approximately 50 feet from the rear wall to 9–10 feet thick at 20–25 feet from the rear (Ross 1965).

Ross began the excavation by cleaning out and profiling the old Witte Museum trench (*ibid.*: E–W Profile along N90, p. 18) (Figure 9). He also excavated a 20 × 10 foot block of undisturbed soil adjacent to the north side of the trench, a pothole in the north end of the shelter, and a deep pit to the floor of the shelter.

Table II compares the stratigraphic distribution of selected dart points from the 1936 and 1963 excavations. If one disregards the unknown stratum and the disturbed stratum A, we find that Ross (1965) uncovered the majority of the Pandale points from levels IIc and IId, and Davenport from level B. Ross found Langtry and Val Verde points well represented in IIa and Davenport again in B. Most Shumla points came from the top level.

The Witte Museum's interest in Lower Pecos prehistory continues today. Funded by the Witte, the Center for Archaeological Research at The University of Texas at San Antonio conducted excavations at Baker Cave in 1984 and 1985. In January of 1987, the Witte opens a major exhibit that explores the lifeways of the people of the Lower Pecos. In addition, the Witte has supported the production of a book amply illustrated by color photographs of the rock art taken by Jim Zintgraff of San Antonio over the last 20 years. The author of the book, Dr. Harry Shafer of Texas A&M University details the ways of life of the ancient people who produced the art and lived in the shelters.

ACKNOWLEDGMENTS

I would like to thank Dr. Thomas R. Hester for his advice and for reading several versions of this paper. My thanks also to my friends and co-workers at the Witte Museum—Roger Fry for the excellent quality of the photography and Karen Branson for her fine typing. My special thanks to Harding Black for spending a morning with me reminiscing about the early days at the Witte.

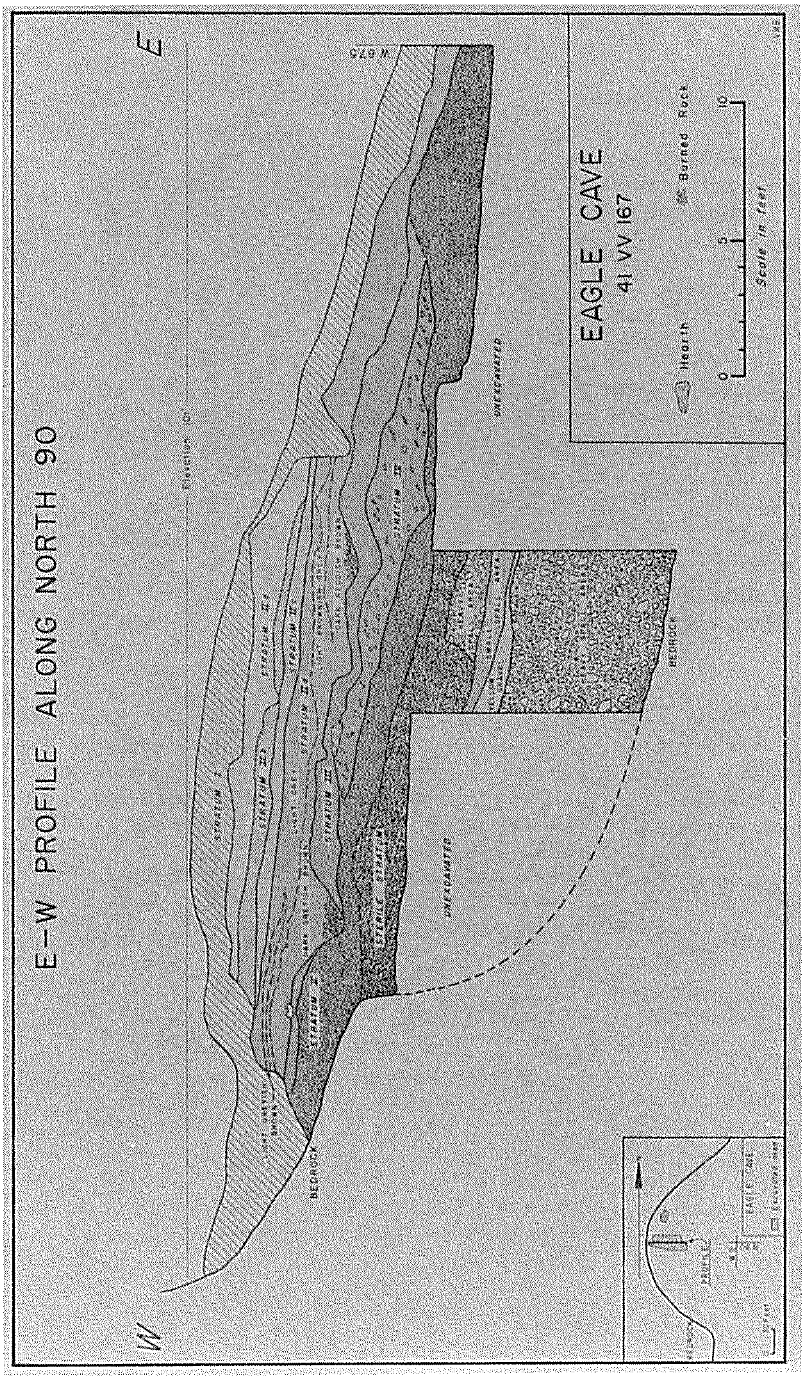

Figure 9. Profile of 1963 Excavations at Eagle Cave. From Ross (1965).

Table 1. Artifacts Recovered During Surveys of Eagle Cave

Artifacts	March 15–18, 1935	September 17–22, 1935
Stone, chipped		
Points, perfect or good	53	185
broken or bad	11	432
Scrapers	57	238
Knives	2	30
Drills	1	4
Fist axe		1
Stone, ground, pecked, smooth		
Manos	26	33
Metates	6	9
Stone		
Painted	7	41
Smooth		17
Miscellaneous		17
Pendant, slate		1
Bone		
Awl, whole	1	1
Awl, broken		31
Flakers		2
Miscellaneous		3
Bead	1	
Wood		
Point		1
Miscellaneous		23
Basketry		
Burnt		6
Sandal		1
Fiber ball	1	
Shell		
Clam		2

Table 2. Comparison of the Provenience of Selected Lower Pecos Dart Points Excavated at Eagle Cave: 1936 and 1963

Dart point	Pandale		Langtry		Val Verde		Shumla	
Excavator	Ross	Davenport	Ross	Davenport	Ross	Davenport	Ross	Davenport
Unknown	21	25	54	128	22	33	3	49
Stratum								
I	11	11-A	48	164-A	19	32-A	9	49-A
IIa	1		30	65-B	6	34-B		6-B
IIb			2		4			
IIc	9		1		1			
IId	8	16-B	2		3			
III	2		3	4-C				4-C

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Trace Element Analysis of an Obsidian Paleo-Indian Projectile Point From Kincaid Rockshelter, Texas

Thomas R. Hester, Glen L. Evans, Frank Asaro, Fred Stross, T. N. Campbell, and Helen Michel

ABSTRACT

Excavations in 1948 and 1953 exposed the basal cultural deposits at Kincaid Rockshelter, southcentral Texas, and led to the recovery of an obsidian projectile point fragment. The specimen is attributed to the Paleo-Indian period on the basis of stratigraphy (the basal deposits contained the remains of late Pleistocene fauna) and typological attributes. Problems with Paleo-Indian radiocarbon dates from the site are noted. Trace element analyses have shown that the obsidian is derived from a geologic source near Queretaro, Mexico, more than 1000 km from the Kincaid site.

INTRODUCTION

Kincaid Rockshelter is a rockshelter-river terrace occupation site on the Sabinal River on the edge of the Edwards Plateau in southcentral Texas (Figure 1). Excavations were conducted at the site by the Texas Memorial Museum and a University of Texas (Austin) field school in 1948 and 1953, after attention was drawn to the site by the discovery, by amateurs, of three Folsom points. The investigations failed to locate any additional Folsom materials, but they did reveal 2.5 meters of stratified deposits at the base of which were zones containing Pleistocene fauna and artifactual evidence of human occupation. The site has not yet been fully published; brief summaries can be found in Suhm (1960:98–99) and in Hester and Story (ms).

According to Glen L. Evans, then director of the excavations for the Texas Memorial Museum, the lowest stratigraphic units at Kincaid, Zones 1 and 2, were comprised of sterile alluvium. Zone 3 contained Pleistocene fauna, including juvenile horse, elephant, bison and large cat. At the top of this zone, at its contact with Zone 4, there was a cobble pavement formed by large stones brought into the shelter by the earliest human inhabitants. The paving apparently served to provide better footing around a travertine spring at the rear of the shelter. Atop the pavement, in Zone 4, were the earliest artifacts, along with late

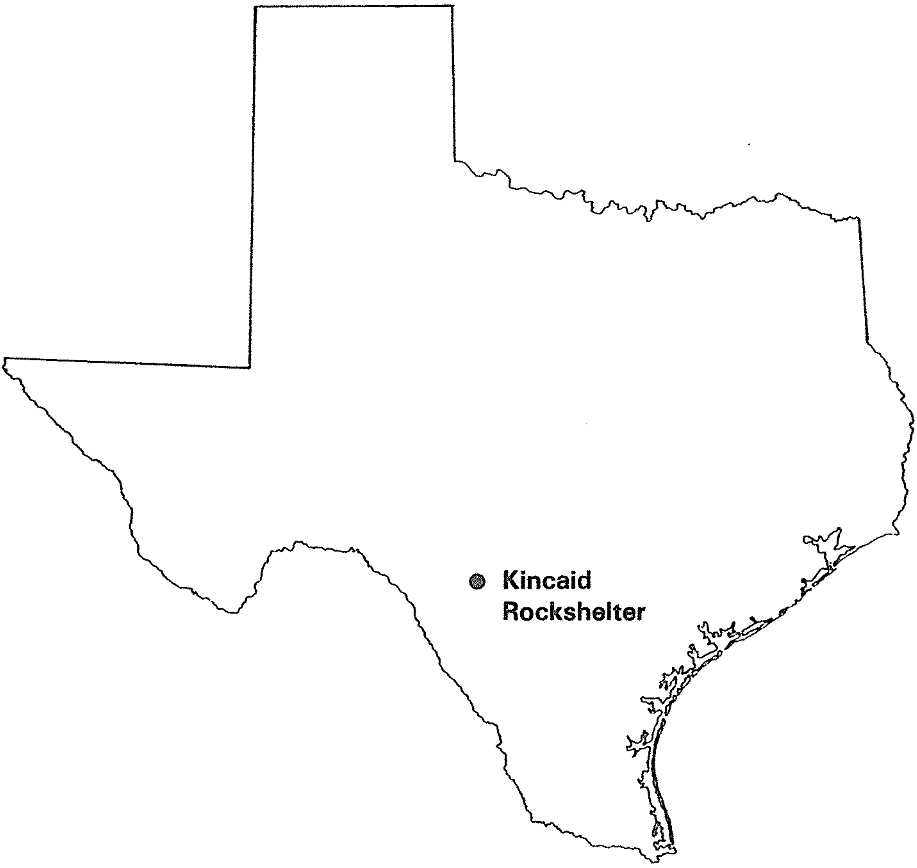

Figure 1. Location of Kincaid Rockshelter, Uvalde County, Texas.

Pleistocene vertebrate fossils, especially bison. Evans believes Zone 4 to have been the stratum from which the Folsom points were derived. However, no additional Folsom points were found and the other artifacts that came from the excavations within Zone 4 were generally undistinguished. The assemblage included four lanceolate bifaces, six flakes with single-edge retouch, one graver, several cores, and 52 pieces of debitage. Another artifact from Zone 4, the only specimen that apparently served as a projectile point, was the basal fragment of a thinned obsidian biface. Since the specimen was broken, Evans recalls wondering if it had been broken in manufacture, and he carefully searched for obsidian debitage, but found none.

In the overlying Zone 5, late Paleo-Indian artifacts were found although the cultural stratigraphy within the zone is unclear, as artifacts of the Edwards Plateau Archaic are also present. Hester's review of 19 Paleo-Indian projectile points from the zone reveal the following types: Plainview or Plainview-like (3), Golondrina (4), Angostura and Angostura-like (11) and a small reworked Paleo-Indian point.

Eighteen radiocarbon dates have been published for Kincaid Rockshelter (Stipp *et al.* 1962; Tamers *et al.* 1964). All are from Zone 5, primarily from deposits in the terrace fill in front of the shelter. Haynes (1967:270) published five dates from the site and attributed them, without any comment, to Zone 5. The dates cited by Haynes were TX-63, and TX-17 through TX-20, ranging from 7900 to 10,365 B.P. However, only one of these dates (TX-63; wood charcoal) can be accepted as accurate. The other four, TX-17 through TX-20, were all run on snail shells, materials that produced dates which Stipp *et al.* (1962:48) described as "older than expected." Moreover, they are from miscellaneous contexts in Zone 5, with no associated diagnostic artifacts. Indeed, TX-17 (on snail shells) yielded an age of 10,025 ± 185 B.P. Yet a date from a charcoal sample, TX-67, which was stratigraphically below TX-17 has an age of 1150 ± or ca. A.D. 800.

Only one of the dates listed by Haynes (and published originally by Tamers *et al.* 1964) from Kincaid is of interpretative value. As noted above, this is TX-63 at 7900 ± 800 B.P. or 5950 B.C. It came from the "lower levels of Zone 5", associated with a fragment of a point of "Angostura outline" (Tamers *et al.* 1964:147). This date fits with what we presently suspect in Central Texas in terms of the terminal part of the Paleo-Indian era. Two other dates on charcoal reported by Tamers *et al.* (1964:147–148) are of relevance. TX-59 (5890 ± 200 B.P.; 3940 B.C.) is linked to the "Early Archaic" on stratigraphic grounds. TX-58 (6020 ± 170; 4070 B.C.) comes from the "base of Zone 5."

Though the radiocarbon chronology for Zone 5 begins at ca. 6000 B.C., there are diagnostics within this zone which we know, from other sites in southern and southwestern Texas, date 1000–2000 years earlier. Golondrina points can be dated at ca. 7000 B.C. (Hester 1983), and Plainview, to ca. 8200 B.C. (Dibble 1970). On the basis of the Kincaid stratigraphy, we must assume that Zone 4, with its obsidian point and late Pleistocene fauna, dates sometime prior to 10,000 years ago.

DESCRIPTION OF THE OBSIDIAN ARTIFACT

The obsidian projectile point fragment from Kincaid Rockshelter has a lanceolate outline, with a slightly constricted base. The lateral edges near the base are heavily dulled, indicating that this is a finished point. Parallel flaking is present on both faces. The base is thinned by longitudinal scars on one side and short arc-shaped flakes on the other (see Figures 2, 3). The dimensions of this basal fragment are: length, 26 mm; maximum width, 25.5 mm; basal width, 20 mm, thickness (at the break), 9 mm; and weight, 8 grams.

Typologically, it is difficult to place the specimen into any specific niche. Illustrations of the artifact were sent to several experts in Paleo-Indian projectile point typology. Dennis Stanford (personal communication) does not think it fits the Clovis type, to which it was once assigned in a Texas Memorial Museum exhibit. Computer-assisted attribute analyses by T. C. Kelly (1983; personal communication) definitely exclude the specimen from the Plainview type, as well as from Angostura. In regard to the latter type, the broad morphological range of contracting-base lanceolate points called Angostura in Texas might include the Kincaid specimen (as M. B. Collins, personal communication, has observed: "It looks like Angostura more than anything else."). But, the same general statement might also be made for the Agate Basin type of the Plains (George Agogino, personal communication; cf., Shelley and Agogino 1983).

Such typological considerations from a North American perspective may be meaningless when we view the Kincaid specimen in terms of its temporal context and geographic derivation. For the present, then, we share Ruthann Knudson's view (personal communication) that no specific typological label should be applied to the Kincaid obsidian point.

TRACE ELEMENT ANALYSIS

Over the past two decades, geologic source analysis of obsidian has become a standard analytical technique. Mesoamerican obsidian sources have been particularly well defined (cf., Stross *et al.* 1976; Zeitlin and Heimbuch 1978, Stross *et al.* 1983), and studies have also taken place in volcanic areas of the western United States (e.g. California, Arizona, New Mexico; see Jack 1971; Hughes 1984; Baugh and Terrell 1982). While there are gaps in the data base in terms of the geochemical characterizations of some obsidian types, the universe of geologic sources has been very extensively sampled and analyzed.

The Kincaid specimen (Texas Memorial Museum No. 908-1698) was submitted for trace element analysis to the Lawrence Berkeley Laboratory (LBL), University of California, Berkeley, where it was studied by Asaro and Stross in 1978 (LBL No. TEX-11). Initially, X-ray fluorescence (XRF) techniques were utilized; the material was identified as a comendite (a peralkaline rhyolite), and it exhibited a number of trace elements similar to El Paraiso, Queretaro, type obsidian. Following consultation among the authors, it was decided that a small piece of the specimen would be detached (after the specimen had first been photographed in color and black and white) and a pill prepared for neutron activation analysis (NAA).

As indicated in Table 1, comparisons of the Kincaid specimen were made with obsidian deposits at El Paraiso, Cadereyta, and San Martin, all in the state of Queretaro. These deposits lie within 20–50 km east-northeast of the city of Queretaro. A concordance of the analytical techniques used in these studies and the sample designations is provided in Table 2.

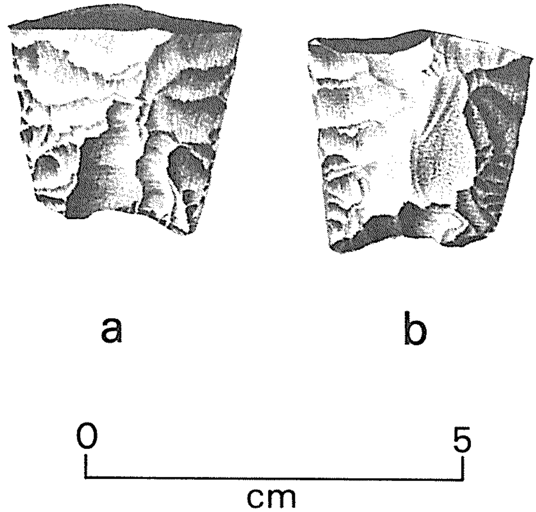

Figure 2. Obsidian Projectile Point Fragment from Kincaid Rockshelter. Both sides are shown; drawing by Hal Story.

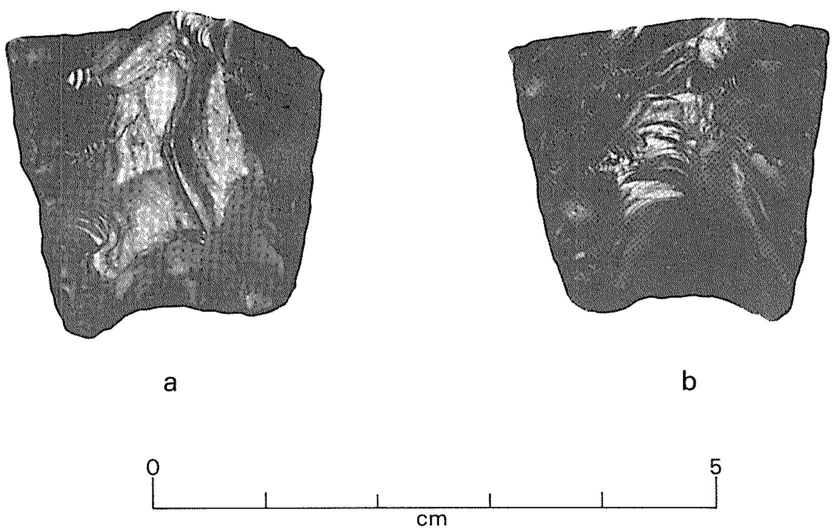

Figure 3. Obsidian Projectile Point Fragment from Kincaid Rockshelter. Both sides are shown. Photographs provided by the Lawrence Berkeley Laboratory (negative numbers BBC789-12547, BBC789-12549).

Table 1. Most Likely Provenience Assignments of Kincaid Rockshelter Obsidian Sample

	KINCAID SHELTER				EL PARAISO, Querétaro						CADEREYTA, Querétaro			SAN MARTIN, Querétaro				
Technique	Authors (NAA)		Giauque (XRF)		Authors (NAA)		Authors (XRF)		Zeitlin &[c] Heimbuch (rv) (XRF)	Ericson &[c] Kimberlin (rv) (NAA)	Authors (NAA)		Ericson &[c] Kimberlin (rev) (NAA)	Authors (NAA)		Authors (XRF)		Ericson &[c] Kimberlin (rev) (NAA)
No. of samples	1		1		1		5				1			1		4		
		+a		±a		±a		±a				±a			±a		±a	
Al	5.75	.17			5.58	.23					5.56	.09		5.87	.17			
Ce	145	2			158	2				146	144	2	147	145	2			140
Co	.20	.04			.23	.05					.22	.05		.32	.05			
Cs	3.27	.08			3.48	.08					3.34	.08	3.42	3.36	.08			3.25
Dy	28.1	.3			29.9	.3					30.5	.3		30.5	.3			
Eu	.483	.009			.525	.012					.511	.011	.458	.476	.011			.420
%Fe	2.01	.02			2.12	.02				1.98	1.92	.03	1.97	1.90	.03			1.90
Hf	31.5	.3			34.9	.4					32.2	.3	30.8	32.0	.3			29.2
%K	3.70	.22			3.79	.23					3.82	.24		3.88	.24			
La	59.4	1.5			64.4	2.0					57.1	1.1		57.6	.6			
Mn	224	4			238	5			224		229	5		227	5			
%Na	3.76	.08			3.73	.08					3.78	.08		3.79	.08			
Rb	246	8	258		248	8			226		214	7	238	209	7	225	31	223
Sb	.16	.03			.19	.03					.17	.03		.10	.03			
Sc	.223	.011			.261	.011					.282	.011		.236	.011			
Sm	22.2	.2			22.8	.2					21.8	.2		22.1	.2			
Ta	3.62	.04			3.68	.04					3.59	.04	3.50	3.59	.04			3.38
Th	32.68	.33			34.88	.35					31.91	.32	31.9	31.96	.32			30.54
U	6.03	.06			6.41	.08					5.81	.06		5.96	.06			
Yb[d]	18.0	.2			18.4	.2					18.3	.2		18.5	.2			
Zn	243	4			243	8				251	246	4		248	4			
Technique	(all XRF)																	
Sr	<13		<3		<2		<10		<13		<2					<12		
Zr	1309	131	1354				1399	12.5	1219		1427	19				1394	75	
Ba	<4						<6				<11					<6		
Nb	60	6					57	7			59	1				58	4	
Y	194	20	219				186	26	193		216	3				193	11	

a. The errors for single samples are the statistical uncertainties in counting gamma rays. For multiple samples the errors are the larger of the statistical uncertainties or the root mean square deviation.

b. These XRF measurements were kindly provided by Robert D. Giauque of the Lawrence Berkeley Laboratory.

c. See corresponding references in Stross *et al.* LBL 12252 January 1981. These measurements were revised as described in the above paper.

d. Because of a recalibration of the standard, the Ytterbium value was increased by 5.6% (Stross *et al.* 1983:324)

The obsidian specimens attributed to El Paraiso, Cadereyta, and San Martin were kindly made available to us by Dr. J. E. Ericson. The samples were collected along roadsides at the locations indicated. The three composition patterns, analyzed by Ericson and Kimberlin (1977) were similar to each other and collectively called by them the "El Paraiso Source". The average composition pattern is similar to that of El Paraiso obsidian found by Zeitlin and Heimbuch (1978), but different from that of the El Paraiso source described by Cobean (1971), which presumably represents a different flow deposited close to the outcrops sampled by the other authors (Ericson and Kimberlin 1977; Zeitlin and Heimbuch 1978).

While the NAA and XRF studies cannot precisely attribute the Kincaid specimen to any of the three Queretaran locations where obsidian was found by Ericson and Kimberlin (El Paraiso, Cadareyta, and San Martin), they established that the chemical composition of obsidian from these areas does indeed bracket the trace element composition of the Kincaid artifact. The three Queretaran locations are situated roughly 165 km northeast of Mexico City, and some 1000 km (635 miles) south of the Kincaid Rockshelter in southcentral Texas.

If one compares the abundances of the Kincaid artifact with those of the obsidian sources for all elements measured with precision of better than 3% (14 elements), then the composition patterns of the artifact differ by 2.2, 2.8 and 4.8% from the San Martin, Cadereyta and El Paraiso obsidian. This caliber agreement strongly suggests the artifact came from Queretaro, although it is not possible to distinguish conclusively the three source areas.

IMPLICATIONS OF THE DATA FROM KINCAID ROCKSHELTER

Obsidian artifacts are rare in Texas sites and no identified geologic sources for archeological obsidian are documented within the state (Hester *et al.* 1980). Over the past 15 years, the senior author has worked first with Robert N. Jack (then of the Department of Geosciences at the University of California, Berkeley) and subsequently with Asaro, Stross and Michel in conducting studies of

Table 2. Concordance of Obsidian Samples from Kincaid Rockshelter and Queretaro, Mexico

Sample designation	NAA run #	XRF run #
TEX 11	1062 O	
ELPAR 5	1062 P	
CAD 1	1061 F	8084 G
SAN 1	1061 J	
ELPAR 1, 1′, 2, 3, 4		8064 H, 8085 Q–T
SAN 2, 3, 4, 5		8085 U, V, W, X

more than 100 archeological obsidians from various spatial and temporal contexts throughout Texas (cf., Hester *et al.* 1975; Hester *et al.* 1980, 1982; Mitchell *et al.* 1981). Most of the specimens studied so far are of Late Archaic and Late Prehistoric date.

The Kincaid specimen represents the southernmost Paleo-Indian obsidian artifact from a known stratigraphic context. Indeed, obsidian projectile points are rarely found in Texas Paleo-Indian archeological assemblages. Two lanceolate specimens from surface sites in Val Verde County have been published by Carroll (1978; see Figure 4). Trace element analysis has failed to reveal their geologic source. At the Lubbock Lake site, an obsidian point perhaps attributable to the Plainview type has been analyzed as to geologic source and linked to the Valles Caldera obsidian outcrops in New Mexico (Johnson *et al.* 1985). It was associated with a bison kill/butchering locale nearly 10,000 years old. Johnson *et al.* (1985:51–52) also report that an obsidian Clovis point from Blackwater Draw Locality No. 1 has also proved to be from the Valles Caldera source. An obsidian biface from this site has also been analyzed, but the source could not be determined. The authors (*ibid.*: 52) suggest that the presence of these "exotic" obsidian points at Lubbock lake and Blackwater Draw ". . . indicates long distance trade, travel, or both and may be the beginnings of later well-established trade routes and relationships between the Southern Plains and the Puebloan Southwest."

However, with the Lubbock Lake and Blackwater Draw specimens, we are seeing obsidian material some 350 to 500 km from its geological source. As noted above, the distance from Kincaid to the Queretaro obsidian source is about 1000 km. Clearly, these cases provide specific instances of the long-distance movement, by whatever means, of Paleo-Indian artifacts. There have been a number of studies of Paleo-Indian settlement patterns, group mobility and exchange systems (Wheat 1971; J. Hester 1975:254–255). Additionally, the wide distribution of another raw material, Alibates dolomite, used for Paleo-Indian points and tools, has been documented for the Plains as far north as Wyoming (Wheat 1971; J. Hester 1975). These and other studies have focused on Plains Paleo-Indian cultures and comparatively little is known about coeval archeological complexes in central and northern Mexico. Given the geologic source of the Kincaid specimen, it is quite likely that we are dealing with a non-Plains, southern or Mexico-based Paleo-Indian pattern.

The Kincaid fragment is morphologically similar to the lanceolate projectile point found with the second mammoth of Santa Isabel Itzapan (Wormington 1957:95; Fig. 34, left). That specimen is, however, made of a dark red igneous material though other artifacts in the assemblage associated with the first mammoth are made of obsidian (the sources of which are, as far as we know, undetermined). One possibility is, then, that the Kincaid specimen reflects a southern cultural pattern that included within its boundaries part of what is now Mexico and southcentral Texas. One example of such a Mexico-oriented, non-Plains Paleo-Indian pattern has been published by Epstein (1980). His "Small Projectile

Point Tradition" is characterized by small bipointed bifaces as early as ca. 8600 B.C. Although we do not believe the Kincaid specimen to be linked to that construct, it may be indicative of another such complex, as yet undefined.

An alternative hypothesis is that the specimen is related to Plains Paleo-Indian traditions, but that its morphology is slightly aberrant and makes typological placement uncertain. If this is the case, long-range trade, exchange networks or trade contacts that involved groups over a considerable distance would be implied in the procurement of the Queretaro obsidian. With such meager data at present, it would be futile to speculate further on either of these alternatives. It is hoped that they can be tested by a variety of future investigations. One such test, obviously, would be the trace element analysis of other Paleo-Indian obsidian points from the region, perhaps extant in present collections.

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Paleo-Indian Occupations in Wharton County, Texas

L. W. Patterson and J. D. Hudgins

ABSTRACT

Several sites have been recorded in Wharton County, Texas with evidence of Paleo-Indian occupations. Much of the data is in the form of surface collections. However, excavations at site 41WH19 have demonstrated a well-stratified site with an occupation sequence from the Paleo-Indian period through the Late Prehistoric. Ongoing research by members of the Houston Archeological Society is contributing to a more detailed picture of early occupation sequences and technologies in southeastern Texas.

INTRODUCTION

This paper discusses evidence for Paleo-Indian occupations in Wharton County. This has become an important geographic area for Paleo-Indian research by the Houston Archeological Society. A number of surface collections from this area contain Paleo-Indian components and the first site in southeastern Texas with well-stratified Paleo-Indian occupations has been found here.

The Paleo-Indian period is of great interest in archeology, especially in relation to origins and early adaptations of early man in the New World. This time period is generally recognized as being a span of approximately 4,000 years in Texas (Story 1981: 142), from 10,000 to 6,000 B.C. It is viewed here as a chronological period rather than a term given to a specific prehistoric lifestyle. There appear to be regional differences in lifestyles throughout North America during this time period, perhaps due to adaptations to local resources. Data on this prehistoric period in southeastern Texas has been slow to accumulate (Hester 1980). However, in recent years a significant amount of new data (Patterson 1983) has become available on Paleo-Indian occupations in this region, mainly due to the efforts of serious amateur archeologists. The extent of the data base for each local area of this region seems to be directly proportional to the amount of survey work done. Harris County has the largest number (14) of reported sites in this region with Paleo-Indian components due to the large amount of survey work completed there.

Only one radiocarbon date is available for Paleo-Indian occupations in southeastern Texas. Most Paleo-Indian manifestations here have been identified by projectile point types. These include Clovis, Plainview, Dalton, San Patrice, Scottsbluff, Early Stemmed (Turner and Hester 1985:87), and Angostura types. Recent excavations at site 41WH19 in Wharton County have yielded Folsom, Plainview, San Patrice and Angostura-like points and some new types of notched and stemmed points from the Paleo-Indian period.

THE SETTING IN WHARTON COUNTY

Wharton County is located in a relatively flat section of the inland coastal plain (Figure 1), and contains a mixture of woodlands and prairie grasslands. This county is bisected by the Colorado River drainage system, and has other stream systems such as the West Bernard River. A large variety of natural floral and faunal resources occur here that could have provided a subsistence base for prehistoric foragers. The Holocene period geology here consists mainly of re-deposited Pleistocene sands and clays overlying the Pleistocene age Beaumont formation. Indian occupations here span the Paleo-Indian to the Historic period with sites found mostly on high points along stream banks.

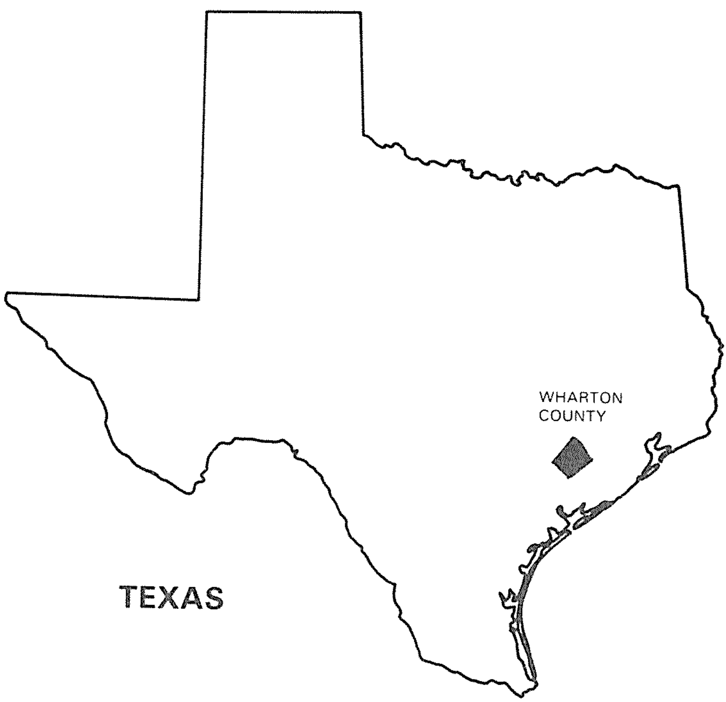

Figure 1. Location of Wharton County, Texas

SURFACE COLLECTIONS

Most survey work in Wharton County has been done east of the Colorado River. Surface collections from several sites in this area have revealed Paleo-Indian projectile points, usually together with point types covering a much longer time period. It is important to note that most finds of Paleo-Indian points in this area are not isolated finds, but come from surface collections of deflated sites that usually have evidence of very long occupation sequences, from the Paleo-Indian through the Late Prehistoric time periods.

Site 41WH2 (Patterson and Hudgins 1980a) has a collection with Plainview and San Patrice points. Two points from this site previously identified as Williams and Darl have recently been reclassified as Paleo-Indian side-notched types similar to ones excavated at site 41WH19. (Patterson and Hudgins 1980a: Figures 2,G and 4,G) It is common for early notched points to have ground basal edges.

Two Plainview points have been found at site 41WH7 (Patterson and Hudgins 1980a). Two Plainview points and one San Patrice point were found on site 41WH26 (Patterson and Hudgins 1982). A Scottsbluff point was found on site 41WH69 (J. D. Hudgin's field notes).

Several Paleo-Indian points have been found on the surface of site 41WH10 (Patterson and Hudgins 1980b, 1984a, 1985b). These specimens include Plainview, San Patrice, Early Stemmed (Turner and Hester 1985: 87) and miscellaneous lanceolate types. Site 41WH10 is a stratified site but test excavations to date have not located any Paleo-Indian points *in situ*.

A large surface collection has been obtained from site 41WH19 location "A" (Patterson and Hudgins 1981, 1983a, 1984b, 1985a; Hudgins and Patterson 1983). Paleo-Indian points in this collection include Plainview, Scottsbluff, San Patrice, Early Side Notched, Early Corner Notched, Meserve, and several forms of early straight-stemmed points. The Early Side Notched, Early Corner Notched and early straight-stemmed points are of the same types as described here from excavations at Location "B" of this site.

A total of six sites in Wharton County has now been reported with surface collections containing Paleo-Indian projectile points, mainly from the Late Paleo-Indian period of about 8,000 to 6,000 B.C. With the exception of site 41WH69, all of these sites have yielded data indicating very long occupation sequences, similar to a number of sites found about 50 miles east in Harris County (Patterson 1983). Also, Wharton County (Patterson and Hudgins 1983b) and Harris County (Patterson 1980) each have one excavated site with Paleo-Indian points found *in situ*.

An important point should be made here regarding surface collections, which represent significant archeological data that some investigators tend to ignore. Only when data from *both* surface collections and excavations are used can the maximum interpretive potential be realized. Syntheses derived without use of

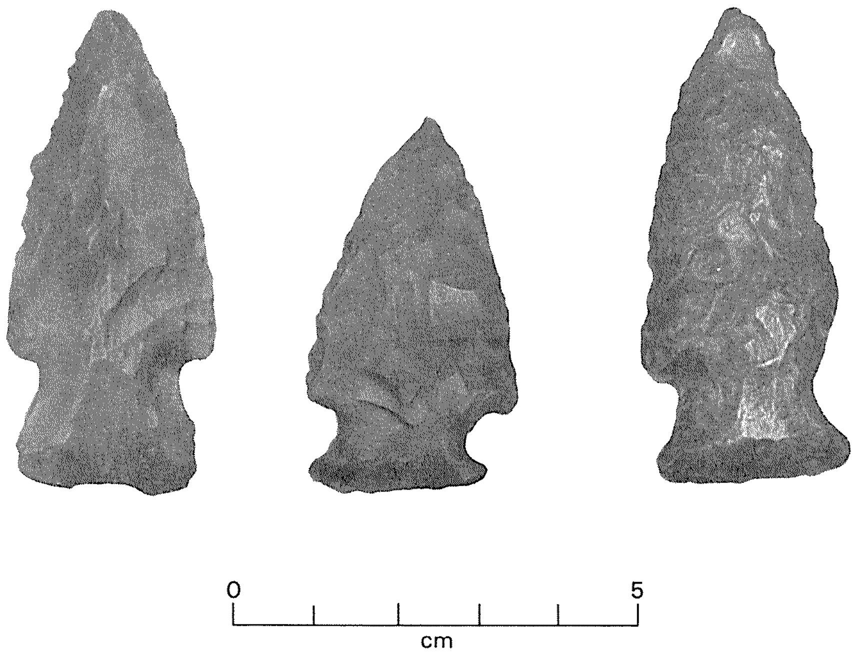

Figure 2. Early Side-Notched points, Stratum 3 upper half

the large number of published surface surveys in southeastern Texas cannot represent the full extent of this region.

SITE 41WH19 LOCATION "B"

Site 41WH19 Location "A" is a large eroded area on a steep river bank. Details on the location of this site have been recorded in the files of the Texas Archeological Research Laboratory in Austin. This area was thoroughly tested without finding any remaining intact cultural deposits. In the fall of 1982, tests were made downstream on a less eroded section of this river bank and intact cultural deposits were found. This was designated as site 41WH19 Location "B". A six-month excavation season was completed by the Houston Archeological Society in May 1983 and a preliminary summary has been published (Patterson and Hudgins 1983b). A second six-month excavation season was completed in May 1984. A detailed final report of this work is now being prepared. This project has required many hundreds of hours of labor. It is a good example of the type of contribution that can be made by serious amateur archeologists.

Site 41WH19 is the first site found in southeastern Texas with well-stratified

Paleo-Indian components. This site has an occupation sequence for the Early Paleo-Indian period through the Late Prehistoric. Stratified cultural deposits here have a total depth of 2.5 meters. The depth of stratified Paleo-Indian components appears to be slightly over 80 cm.

Stratum 1B is the top level of excavation, totally in the Late Prehistoric period. It consists of 35 to 40 cm of a uniform brown silty sand that is immediately above the uppermost "A" horizon buried paleosol that was encountered. Arrow points and ceramics were found in this stratum that are typical of the Late Prehistoric in this region. Stratum 1B, below 1A, consists of 35 to 40 cm of silty sand that includes three separate buried paleosols. The depth of this stratum was originally selected to include all visible "A" horizons, but later another "A" horizon was found in the top of Stratum 2. Stratum 1A is the transition between the Late Prehistoric and the Early Ceramic periods, with arrow points found only in the top half, but ceramics found throughout this stratum. A summary of projectile points from Strata 1A, B is given in Table 1.

Stratum 2, below 1A, consists of 80 to 100 cm of alternate light and dark brown layers. Variations in depths of the individual strata for various test pits are due to the fact that excavations were made according to natural stratigraphic levels, according to soil types. The top 20 cm of Stratum 2 represents the earliest portion of the Early Ceramic period. Below this level, Stratum 2 appears to be entirely in the preceramic Archaic period. A summary of projectile points from Stratum 2 is given in Table 2.

The bottom of stratum 2 appears to be the transitional point between the Late Paleo-Indian and Early Archaic periods, at a depth of about 1.7 meters. An Angostura-like point was found at this level. Based on estimates by other investigators (Prewitt 1981:Figure 3), Angostura and Angostura-like points occur in the period of 6,000 to 5,000 B.C.

Below stratum 2, in stratum 3, an abrupt soil change occurs, going from a clay-sand matrix to a completely sandy matrix with a depth of approximately 40 centimeters. Stratum 3 appears to represent the Late Paleo-Indian period. A surprising variety of side-notched and corner-notched points were found at this level (Figures 2, 3), all with ground basal edges. Except for San Patrice (Figure 3 upper left), these point styles were not previously known as being from the Late Paleo-Indian period in southeastern Texas. Some of these point types probably would be identified as Late Archaic types if found in surface collections. Some of these point types also occur at Location "A". In the Early Archaic period, notched points were displaced by straight stem point forms. Following the identification of these new kinds of notched points, more surface collections having Late Paleo-Indian components may now be classified in this region. Stratum 3 is judged as representing the Late Paleo-Indian period because it is bracketed by a Plainview point below and an Angostura-like point above, as well as having a San Patrice point in this stratum. A summary of projectile points from Stratum 3 is given in Table 3.

Below stratum 3, there is again a marked soil change in stratum 4 with a

Table 1. Site 41WH19 Projectile Points, Strata 1A, B

Type	Dimensions, mm L	W	T	Location Stratum	Depth, cm
Kent	51.5	21.6	10.9	1A	30
Ellis-like	43.0	26.5	7.0	1A	Btm
Yarbrough	51.3	28.9	8.0	1A	39
Kent	—	22.9	8.9	1A	0–20
Perdiz	39.0	18.2	3.3	1A	20
Edwards	31.8	18.4	4.3	1A	15
Travis-like	—	17.5	8.1	1A	15–30
Gary	—	23.6	8.2	1A	0–15
Scallorn	—	15.2	4.4	1B	0–20
Perdiz	23.5	11.6	2.7	1B	20–40
Perdiz	—	12.1	2.2	1B	0–20
Unifacial Arrow Point	—	18.1	4.2	1B	0–20
Gary(?) Preform	—	16.4	6.6	1B	20–40
Ensor	52.3	27.3	7.0	1B	15
Scallorn-like	17.5	11.4	3.0	1B	10

Table 2. Site 41WH19 Projectile Points, Stratum 2

Type	Dimensions, mm L	W	T	Location Stratum	Depth, cm
Bulverde-like	92.6	34.2	8.0	2	57
Angostura-like	—	29.4	8.8	2	71
Bulverde-like	98.3	36.5	8.3	2	50
Unclassified	—	—	8.5	2	Btm
Unclassified	—	46.1	8.5	2	70
Unclassified	49.9	27.0	6.9	2	61
Unclassified	27.0	16.5	5.3	2	50
Gary	34.0	21.0	7.7	2	5
Unclassified Stem	—	—	5.5	2	Btm
Unclassified Stem	—	—	6.9	2	40
Unclassified Stem	—	—	5.3	2	50–75
Misc. Lanceolate	38.7	18.6	8.2	2	0–25
Travis-like	—	22.4	9.8	2	41
Travis-like	—	21.5	10.2	2	30
Travis-like	—	22.1	7.4	2	25–50
Bulverde-like	—	36.2	8.6	2	80
Bulverde-like	44.7	29.3	8.1	2	45
Yarbrough	53.6	24.6	11.1	2	34
Gary	—	30.1	6.7	2	12

depth of about 40 centimeters overlying sterile Beaumont clay. A Plainview point, reworked as a scraper, and two side-notched points (Figure 4 lower right) were found just below the top of stratum 4. This level probably represents the earliest Late Paleo-Indian component at approximately 8,000 B.C. (Johnson and Holliday 1980:Table 3). Below this, at depths of 10 to 15 cm in stratum 4, other side-notched and unclassified points were found (Figure 4 upper row and lower left). At a depth of 20 cm, a Folsom point was found (Figure 5 second from left). This point is a manufacturing failure, apparently broken during removal of the second flute. Since this Folsom point is a manufacturing failure, it is not likely to be an item that was curated by later Indians. This split point type of manufacturing failure is common for Folsom points (Wilmsen and Roberts 1984:Figure 102). Because of the presence of a Folsom point, the lower portion of stratum 4 is judged to be in the earlier portion of the Paleo-Indian period that is usually represented by fluted points. This is now supported by a radiocarbon date of 9920±530 B.P. (AA-298) from a small piece of charcoal found during screening of soil from the lower half of Stratum 4. More radiocarbon dates from several excavation levels of this site are now being run. Many more small charcoal samples are available that could be dated by the atomic accelerator method if funds were available.

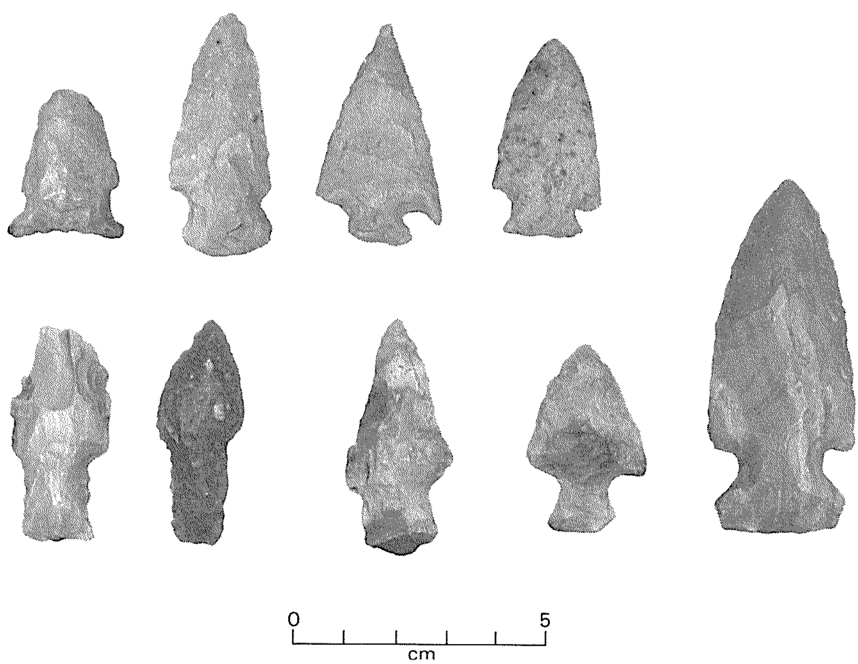

Figure 3. Late Paleo-Indian points, Stratum 3 lower half

Surprisingly, a large side-notched point (Figure 5 left) was found at a depth of 25 cm in stratum 4, somewhat below the Folsom point. The presence of a side-notched point this early may be very significant. This may explain why Folsom points have not been found previously on the upper Texas coast, because other point types were perhaps being made here, instead of Folsom, during this time period. A summary of projectile points from Stratum 4 is given in Table 4.

Some general comments on the lithic technology of this site can be made. The full range of typical Paleo-Indian lithic technology is not present here, as can be found elsewhere in Texas (Patterson 1977, 1981). Other than projectile point types, only large scrapers and a few combination scraper/gravers are similar to typical Plains-type Paleo-Indian tool kits. The absence of an industry for the manufacture of large prismatic blades should especially be noted. This may be explained by adaptation to use of local chert raw materials that are generally in the form of small cobbles that are not suitable for the manufacture of large blades. Paleo-Indian unifacial tool types seem to be discontinued altogether above stratum 3 in the Early Archaic. The simple utilized flake dominates the tool kit of the Archaic period, apparently casually taken from bifacial thinning debitage.

Preservation of faunal remains in the lower levels of site 41WH19, Location "B", is not good but some remains of deer and turtle have been identified. There is no data from this site to associate Paleo-Indians with the hunting of extinct megafauna, except for an unplaced elephant bone from Location "A". Based on limited data for faunal remains (McClure 1983), the Paleo-Indian subsistence pattern here does not appear to differ from that of the later Archaic period. Fired clay balls found here may be associated with cooking functions (Patterson 1976: 183). This is the first site in southeastern Texas where fired clay balls have been well identified at Paleo-Indian as well as Archaic levels. The use of fired clay balls would appear to be a very long technological tradition.

EXTERNAL RELATIONSHIPS

Wharton County, Texas appears to be in a geographic zone that may be an interface between Plains and eastern Paleo-Indian projectile-point traditions. At site 41WH19 and other sites in this county, the Plains tradition is represented by Folsom, Plainview, Scottsbluff, and Angostura-like points. The eastern tradition is represented by San Patrice, Big Sandy, and a variety of other side-notched and corner-notched points, all with ground basal edges. There seems to be a very early and widespread eastern notched-point tradition. For example, some of the side-notched points from site 41WH19 are similar to points found with San Patrice at a site in Louisiana (Webb, *et al.* 1971). Early notched points can be found throughout the southeastern U.S. (Goodyear 1982; Coe 1964; Gardner 1974) and on the eastern side of the Great Plains (Agogino and Frankforter

Table 3. Site 41WH19 Projectile Points, Stratum 3

Type	Dimensions, mm L	W	T	Location Stratum	Depth, cm
Early Corner Notched 1	48.4	27.2	7.1	3	38
Early Corner Notched 2	39.0	24.4	6.9	3	25
Early Corner Notched 3	43.7	22.5	6.6	3	30
Early Side Notched 5	53.3	21.2	9.3	3	37
Early Side Notched 5	59.2	25.5	11.9	3	5
Big Sandy	75.0	29.7	10.4	3	30
Early Side Notched 1	61.5	27.0	7.0	3	0–20
Early Side Notched 4	49.0	26.8	6.8	3	0–20
San Patrice	—	23.6	8.3	3	25
Early Triangular	32.5	—	7.7	3	25
Early Side Notched 5	—	—	9.5	3	25
Early Side Notched 5	—	—	8.4	3	0–20
Early Straight Stem	46.0	18.2	9.3	3	30–60
Early Straight Stem	—	20.4	7.6	3	Btm.–40
Early Straight Stem	48.2	22.0	8.1	3	20–40
Early Corner Notched 4	—	—	7.5	3	20–40
Bullet Shaped	33.5	12.2	9.5	3	0–20
Early Straight Stem	—	—	5.5	3	10
Early Side Notched 5	—	—	6.6	3	20–40
Early Side Notched 5	—	—	—	3	0–25

Table 4. Site 41WH19 Projectile Points, Stratum 4

Type	Dimensions, mm L	W	T	Location Stratum	Depth, cm
Early Side Notched 1	73.4	24.3	7.4	4	25
Plainview	—	26.4	7.0	4	1
Early Side Notched 5	69.7	31.4	11.0	4	1
Early Side Notched 4	49.9	23.7	7.0	4	2
Folsom	—	—	4.0	4	20
Unclassified Type 1	—	14.8	9.1	4	10
Unclassified Type 1	—	15.7	5.8	4	15
Early Side Notched 2	—	15.0	6.9	4	15
Unclassified Stem	—	—	6.5	4	20–40
Early Side Notched 3	—	17.9	8.8	4	7
Early Side Notched 3	—	—	5.1	4	0–20
Early Straight Stem	—	—	7.0	4	0–20
Early Straight Stem	—	—	5.8	4	0–20
Early Contracting Stem (A)	—	—	6.1	4	15–30
Unclassified Type 2	—	29.8	5.5	4	10
Dart Point Blade	—	21.8	6.0	4	0–20
Early Side Notched 3 Stem	—	—	—	4	0–20

A—or Lanceolate Base

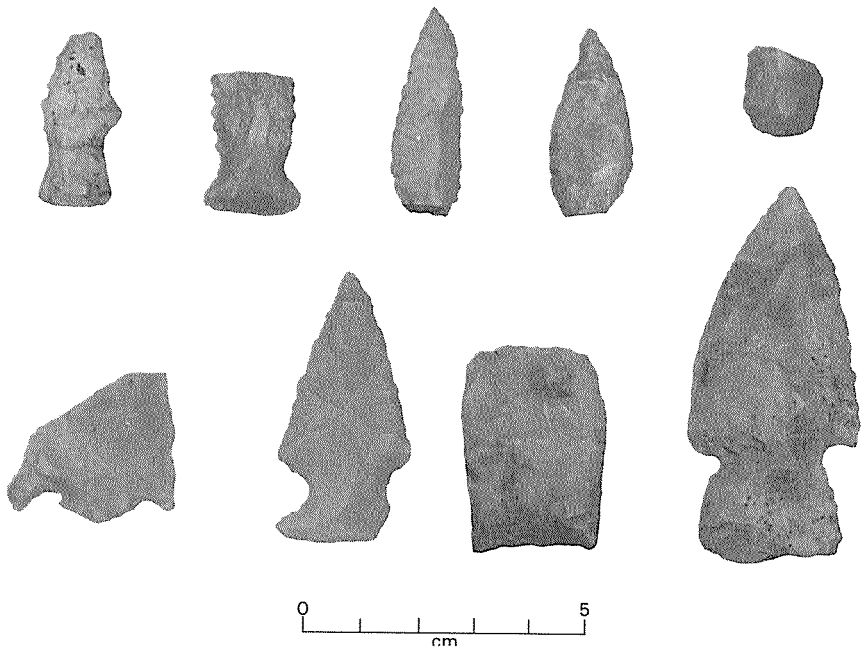

Figure 4. Paleo-Indian points, Stratum 4 upper half

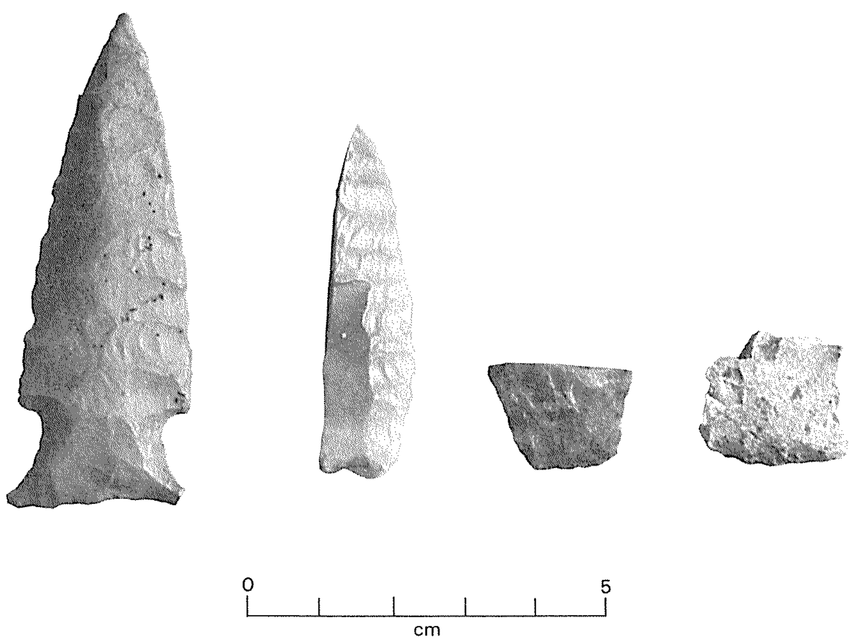

Figure 5. Paleo-Indian points, Stratum 4 lower half

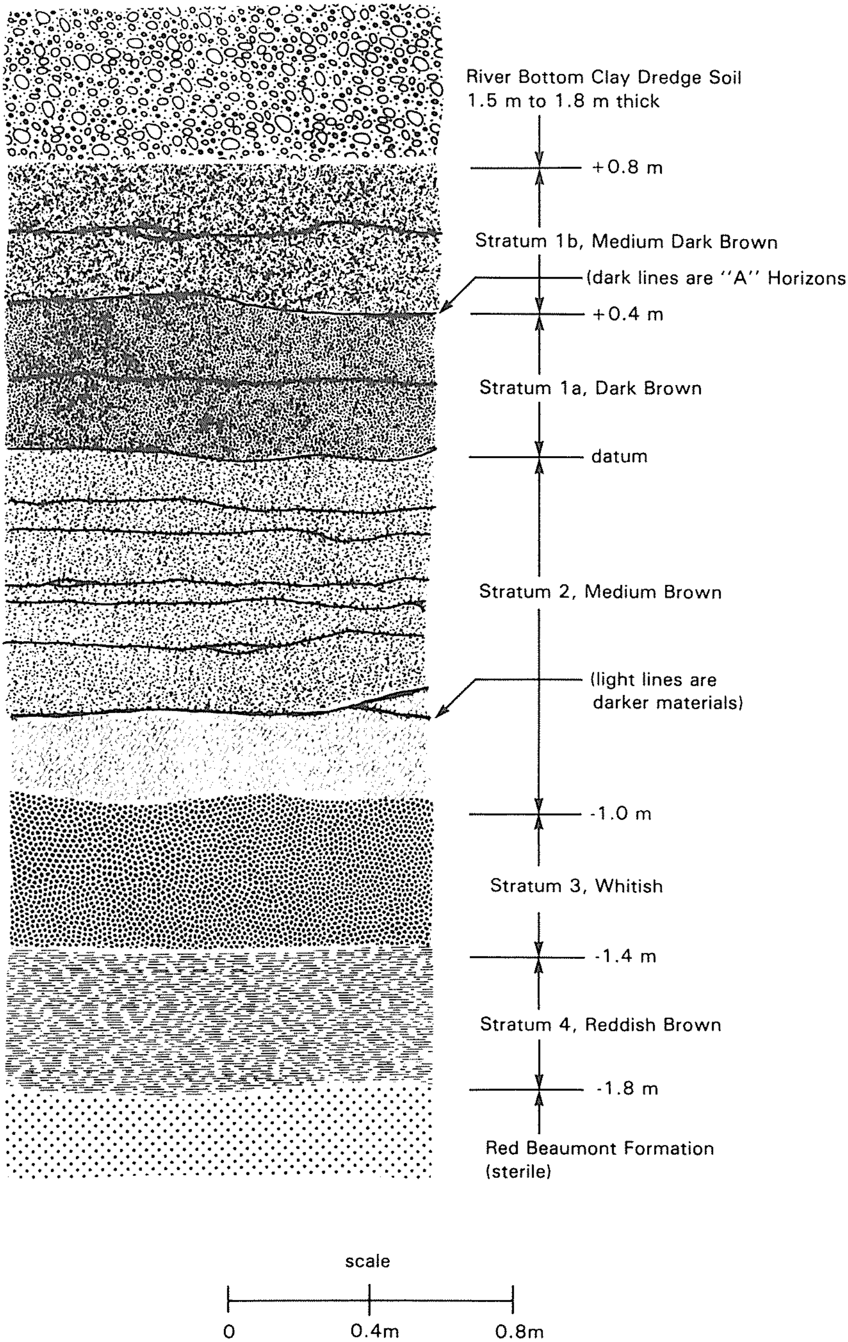

Figure 6. Typical stratigraphy at 41WH19.

1960), some dating as early as Folsom points in the period of 10,000 to 11,000 years ago.

It would appear that the development of a wide variety of projectile point styles may have been well underway during the Paleo-Indian time period, instead of starting in the Archaic period, as is so often cited. Some differences in projectile-point styles may be explained as adaptations to different regional environments. It should be noted, however, that technological innovation is not always related to environmental adaptations, as technological change can occur for a variety of reasons. The very early stemmed points at Site 41WH19 do seem to be related to a broad-based Archaic hunting and gathering lifestyle. This fits well with Shafer's (1977:187) hypothesis "that the early lithic adaptations of the area between the southern High Plains and the eastern woodlands was one of hunting and gathering and not which could be described as big game hunting." This should not be surprising. As Johnson (1977:65) notes, Paleo-Indians probably always did operate from a broad economic base. Also, it should be noted that hunting and gathering peoples must adapt readily to local resources in a new occupation area or perish.

A major question is how early did this nonfluted-point technological pattern begin in southeast Texas? Does this represent a technological tradition completely parallel to the fluted-point tradition, or is it a development from the Clovis early fluted-point tradition? Bryan (1977) notes the possibility of other projectile point traditions parallel to the fluted-point tradition. Very early stemmed points have been found in both western (Bryan 1980) and eastern (Fowler 1971; Peck and Painter 1984) portions of the United States.

Shafer (1977:Figure 3) has described an Early Lithic technological tradition without fluted points that is found throughout eastern Texas. This fits well into the concept of an eastern Paleo-Indian tradition that is distinct from the Plains Paleo-Indian tradition. The Obshner site (Crook and Harris 1955) near Dallas is a good example of this Early Lithic tradition in eastern Texas, where side-notched points were found together with Scottsbluff Paleo-Indian points. Several side-notched points from the Obshner Site are similar to Late Paleo-Indian specimens from site 41WH19.

Some of the early-notched points found in the central Mississippi Valley from a time period of 9,500 to 9,000 B.P. (Morse and Morse 1983:Figure 5.2) are similar to Late Paleo-Indian period points from site 41WH19. Morse and Morse (1983:71) place Dalton points earlier, however. They also seem to imply that the Dalton point may be a technological evolution from the Clovis point (Morse and Morse 1983:72). Not all of the early-notched points in this region are well dated. Unless the central Misssissippi Valley has a unique technological tradition, future research may find that some of the early-notched point types are as early as Dalton. In any event, the central Mississippi Valley is another example of the early start of an Archaic hunting and gathering lifeway (Morse and Morse 1983:71).

Aside from site 41WH19, there are now several sites in Texas with side-notched points earlier than Plainview. Watt (1978:Figure 7) has shown a San Patrice-like point earlier than Plainview in the central Brazos River Valley. The Wilson-Leonard site (Weir 1985), north of Austin, has a number of side-notched points earlier than Plainview (Frank Weir, personal communication). The Rex Rodgers site in the Texas Panhandle (Hughes and Willey 1978:Figure 12) has San Patrice-like points at least as old as Plainview, similar to Watt's specimen from central Texas. It should also be noted that there are some sites in Harris County, such as 41HR206 (Patterson 1976:Figure 1A, B, C), that have early-notched point types similar to those from site 41WH19 in Wharton County.

The presence of side-notched and straight and contracting-stem points as early or earlier than a Folsom fluted point gives more credence to the findings of Sellards (1940:1641) from a site in Bee County that is 100 miles west of site 41WH19. The side-notched point found by Sellards (1940:Plate 1–6) is very similar to the specimen from 41WH19 (Figure 5 left) that was found in a similar stratigraphic position. This type of point is well made and has an expanding stem with concave lateral edges. The straight and contracting stem point specimens from site 41WH19 and from the Bee County site are all fragments. It should also be noted that the coastal plain of southeast Texas is probably a poor place to search for pre-Clovis remains. It seems to be common for sites in this region to have Paleo-Indian remains of 11,000 years age or less directly overlying the Beaumont formation. Since the Beaumont formation has an estimated minimum age of at least 30,000 years (Aten 1983:108), there seems to be a gap in the geological stratigraphy of this region of roughly 20,000 years. This may represent a severe erosional episode at the end of the Pleistocene period.

SUMMARY

It has now become apparent that there are a significant number of sites in southeastern Texas with very long occupation sequences, indicating a longtime stable settlement pattern for the inland portion of the coastal plain (Patterson 1983). Excavations at site 41WH19 (Patterson and Hudgins 1983b), site 41HR315 (Patterson 1980), and site 41HR5 (Wheat 1953) have given details on this subject. Numerous surface surveys have also aided in establishing this widespread regional pattern. The long period of over 10,000 years for a foraging lifestyle in southeastern Texas might be compared to a similar longtime pattern for the Desert Culture of the eastern Great Basin (Jennings 1974:154–182).

Until recently, most of the data on the prehistory of southeastern Texas related to the Late Archaic and later time periods after 2,000 B.C. The earlier Paleo-Indian, Early Archaic, and Middle Archaic periods are now better known. Ongoing research by members of the Houston Archeological Society is continuing to contribute to a more detailed picture of the early time periods in southeastern Texas.

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A Burial From the Sour Mash Site (41HI34), Hill County, Texas

C. K. Chandler

ABSTRACT

A prehistoric human burial was recovered from the eroding bank of White Rock Creek in Hill County, Texas. A single dart point with broken stem was directly associated with the burial. It was embedded in the right tibia just below the knee. Two other dart points were recovered from the grave fill at the same level as the top of the burial and about 15 cm from the knees. Radiocarbon analysis of the human bones provided a radiocarbon date of 2060 ± 210 B.P.

INTRODUCTION

In November, 1964 a single human burial was found when the back of the skull was exposed by erosion of the vertical bank of White Rock Creek in north-central Texas near Milford (Figure 1). In addition to the natural erosional processes of creek bank collapse, the burial site area had evidence of extensive relic-collecting activity. The skull was covered with loose soil to mask and protect it until proper excavation could take place. The burial was subsequently excavated by C. K. Chandler, Bob Brannon and Henry Nichols on November 7, 1964.

BURIAL DESCRIPTION

The burial lay on its right side in a loosely-flexed position with both hands before the face. The head was oriented to the west facing south. The knees were drawn up almost to the elbows (Figure 2). The skull and most all of the remaining bones were fragmented. Most of the vertebrae and scapula were missing, apparently decomposed. Much of the ends of the ribs and long bones were decomposed. A dart point was embedded in the right tibia; it had a broken stem and is unclassifiable, but it has the appearance of a Gary. The other two dart points

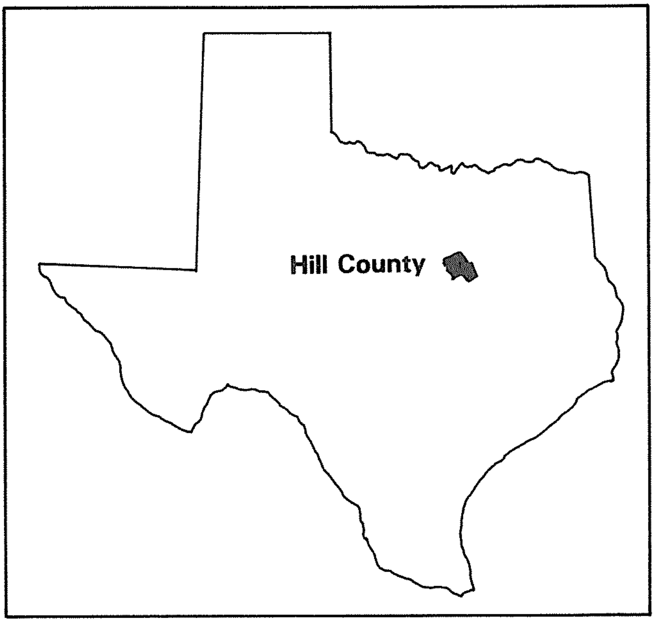

Figure 1. Location of Hill County, Texas and Site 41HI34.

found in the grave fill near the knees were Gary. Research of the literature reveals projectile points associated with burials are not uncommon but the vast majority of those reported have been arrow points. For more on projectile point wounds see Watt (1936) and Prewitt (1974).

STRATIGRAPHY

The top of the skull was 121 cm below the surface. An excavation area 210 cm x 120 cm was started from the surface. All material was passed through a ¼-inch screen. Four identifiable soil zones were encountered in the excavation. Zone I, from surface to 30 cm, was black clayey loam interlaced with tree roots, small particles of marl, a few flint flakes, one small pottery sherd, two flint artifacts, some animal bone refuse, and a deer ulna tool. Of the two flint artifacts, one was an Alba arrow point and one a bifacially-worked cutting tool on a medium-sized flake.

Zone II, 30 cm to 95 cm, was dark grayish-black clayey loam containing numerous pieces of marl, flint flakes, broken animal bone, charcoal flecks, large tree roots, one Gary dart point and one broken pointed biface.

Zone III, 95 cm to 125 cm, was a grayish-black clay interlaced with white streaks that appeared to be decomposed limestone that had leached into the soil. This zone was almost sterile of cultural debris in that there were no animal bones, no flint flakes, and only an occasional charcoal fleck. However, three artifacts were recovered from the bottom of this zone. Two were large Gary dart points and one a pointed biface made of petrified wood.

Zone IV began at 125 cm. It was a yellowish clay of an undetermined depth. The burial pit had been dug into this zone approximately 15 cm. This would place the lowest part of the burial at 140 cm below the existing surface.

The burial pit was not identified in Zone III, but the upper surface of three large limestone slabs was encountered at 105 cm to 112 cm below surface. The thickest of these slabs (12 cm) was placed over the upper torso and skull while the two thinner slabs (5 to 8 cm) were over the hips and legs (Figure 3).

Forty-five centimeters of the yellowish clay (Zone IV) was excavated below and immediately north of the burial and it was sterile of cultural debris. It appears the burial pit originated in Zone III and was dug into Zone IV.

PHYSICAL ANTHROPOLOGY

An osteological analysis of the skeleton from the Sour Mash site was carried out by Lawrence E. Aten in April 1967. The comments that follow are derived from his notes.

Sex Determination

The skeleton is almost certainly that of a female, based on small to medium features of the skull, a smooth occipital region, and a delicate mandible. This set of features is in contrast to the more rugged characteristics of the male cranium. (cf., Brothwell 1965:51, 53).

Age at Death

Aten's notes indicate a "rough guess" as the age of death of this individual. His estimate is 40–45 years of age, based on several factors. He notes excessive tooth wear, but was impressed by the "great abundance of sutures still evident." The cranial sutures were generally obliterated on the interior, however, and this condition had apparently not progressed very far towards the exterior cranial surface by the time of death. Brothwell (1965:38) notes that suture closure is not very useful for age determination although sutures begin to close at about 20 years of age.

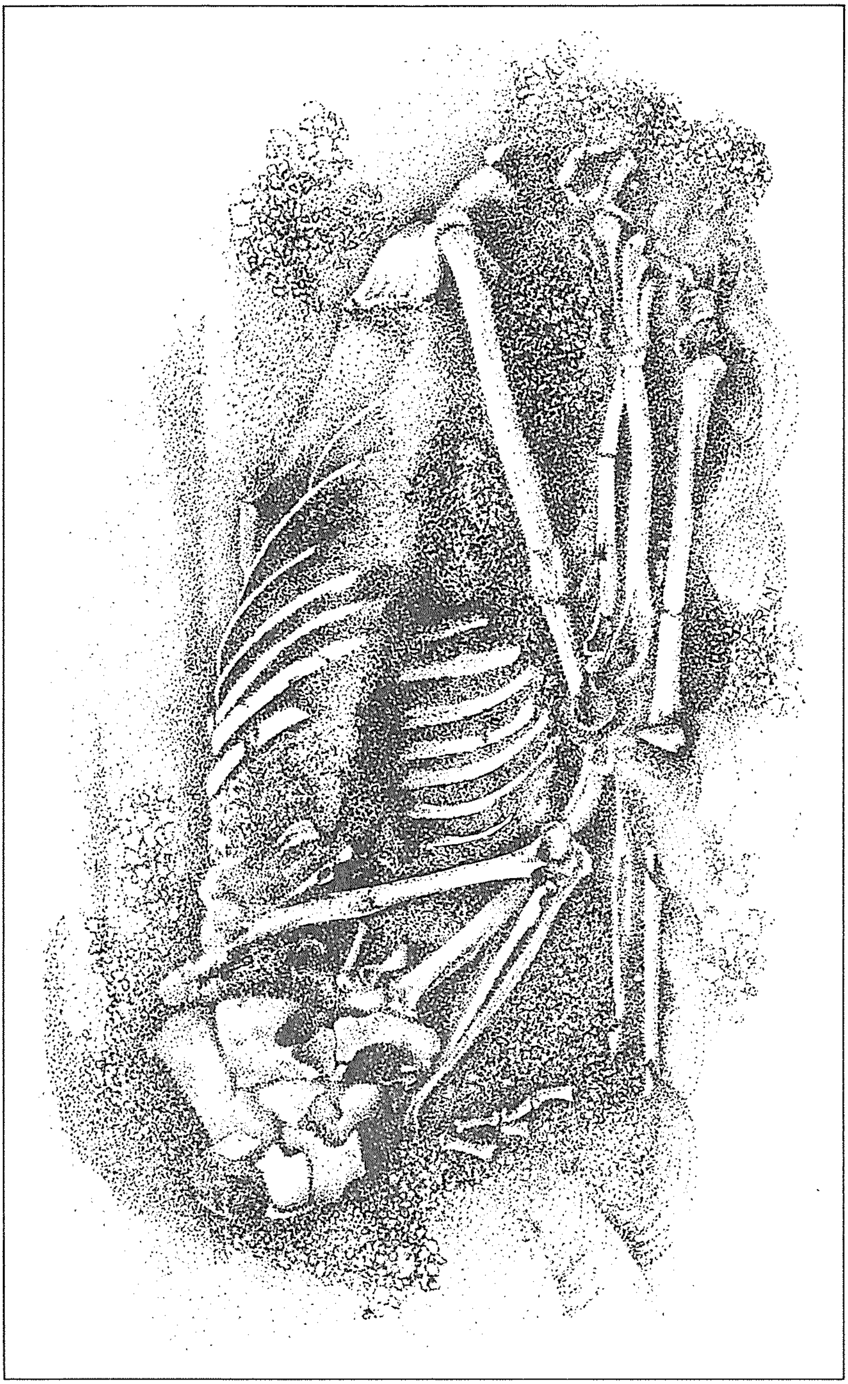

Figure 2. Burial after limestone slabs removed. Drawing by R. McReynolds.

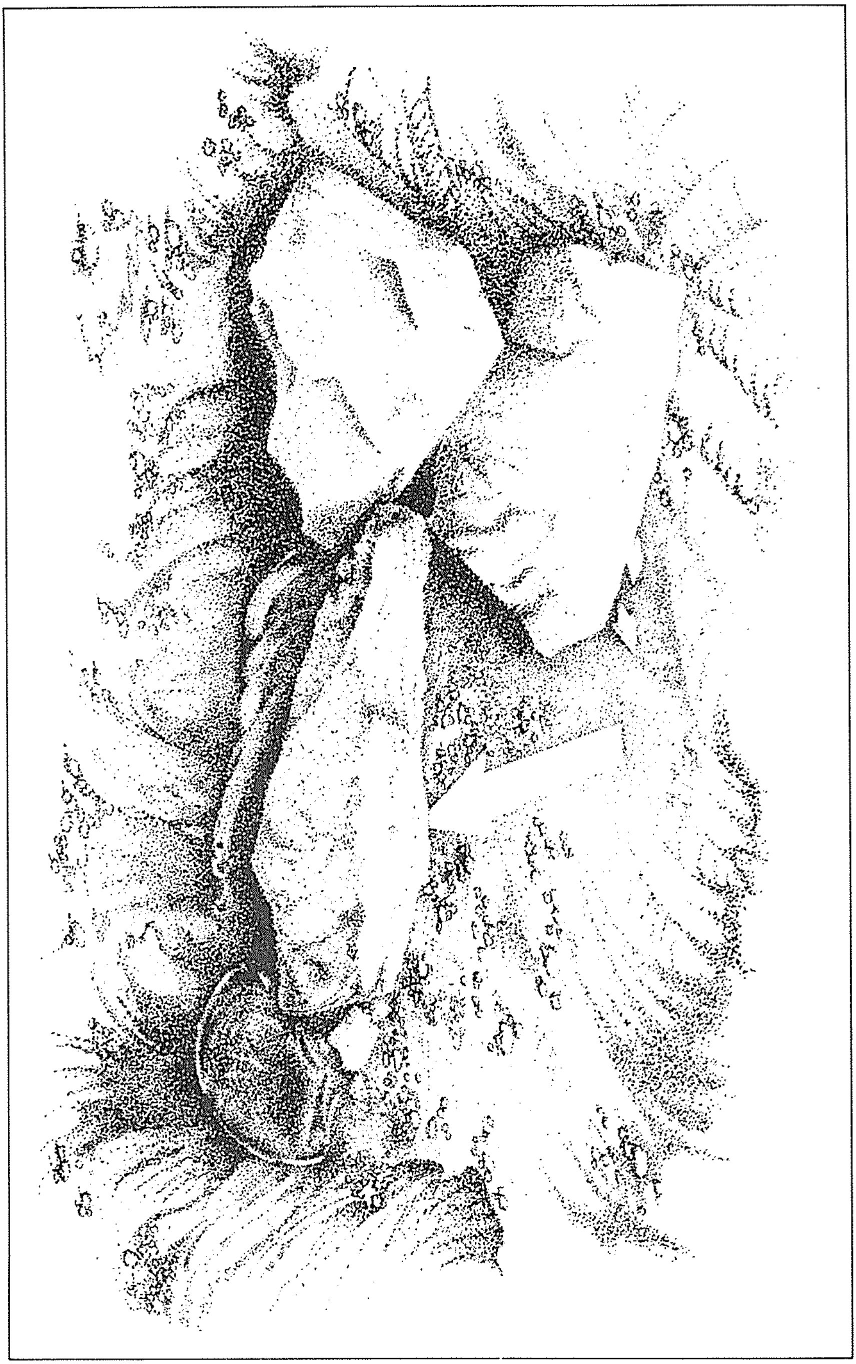

Figure 3. Burial covered with limestone slabs. Drawing by R. McReynolds.

Skeletal Elements Present

Much of the skull and a complete mandible are in the collection. Postcranial bones include: the center of two cervical vertebrae, showing marked lipping; fragments of the sacrum; rib fragments (6 right; 13 left; 8 indeterminate fragments); four fragments of the right and left innominates; the right humerus from just below the head to the distal end and the lower third of the left humerus to just below the coronoid fossa; a right ulna that is complete except for the distal extremity (the left ulna is present and in a similar condition); the right and left radii, both of which are fragmentary, extending from just below the head to near the distal end of the shaft.

Lower limbs from this skeleton include: the right femur (fragmentary and extending from just below the lesser trochanter to just above the patellar area); the left femur (fragmentary, in a similar condition as the right femur); five tibia shaft fragments, one of which exhibits a jagged osseous growth along the anterior border; the right fibula and the left fibula, both fragmentary and extending from just below the proximal end to near the lateral malleolus); outer extremities, including three metatarsals, four phalanges, and a fragmentary left (?) calcaneum. Finally, there were 20 unidentifiable fragments of the skeleton.

A series of cranial measurements were made by Aten. These detailed observations are on file at the Center for Archaeological Research, The University of Texas at San Antonio, and are available to interested colleagues.

Pathology

A couple of observations can be made here. First, the cervical vertebrae with marked lipping may be indicative of osteoarthritis (Brothwell 1965: 144; Ubelaker 1980: 10).

The jagged projections noted on the anterior surface of a tibia fragment may result from some type of osteitis, or inflammation of the bone. This fragment should probably be examined by a specialist for a more accurate assessment. The affected area is 28 mm long and the three bony projections range in length from 2–3 mm. There appears to be postmortem or postexcavation breakage of two of these projections.

Radiocarbon Dating of the Burial

The long bones from this burial were submitted to the Radiocarbon Laboratory, University of Texas, Austin. This radiocarbon assay yielded a date of 2060±210 B.P. This date was corrected through dendrochronology (see Klein *et al.* 1982), to 520 B.C. to A.D. 245 (Sam Valastro, personal communication).

TRACE ELEMENT AND GEOLOGIC SOURCE STUDY OF OBSIDIAN

The one small obsidian flake from 41 HI 34 was subjected to X-ray fluorescence analysis at Lawrence Berkeley Laboratory, University of California, Berkeley. This XRF analysis reveals a probable source of Malad, southeastern Idaho. Fred Stross (letter to T. R. Hester, June 20, 1985) notes that the specimen from 41 HI 34 actually ". . . fits the Malad profile quite well, but the thinness of the sample has tended to increase the values for the abundances of diagnostic elements." Hester *et al.* (1986) have noted the presence of Malad, Idaho obsidian at a number of Late Prehistoric and Late Archaic sites in Texas, primarily along the eastern and southern edges of the Edwards Plateau.

For future reference to interested scholars, the raw data provided through the XRF analysis is found in Table 1.

DISCUSSION

A review of two local collections from this site reveals Perdiz, Cliffton, Alba, Cuney, Scallorn and Young arrow points, Gary, Palmillas, Ensor, Wells, Marshall, Elam, Ellis, Yarbrough, Godley and Neches River dart points. Perdiz is the most common arrow point type constituting 50 percent of the identifiable arrow points and Gary the most common dart point type for 37 percent of the identifiable dart points. Classification of these artifacts is derived from Suhm and Jelks (1962) and Turner and Hester (1985). In addition to these identified types there were 20 unidentified dart points with rectangular to slightly expanding stems that have the general appearance of Darl or Godley. Seven of these have strongly beveled blades with stem edge smoothing, seven others have stem edge smoothing without beveled blades and the remaining six are somewhat smaller without beveling or smoothing. Some have lightly serrated blade edges and some have slightly flared shoulders. These appear to fit well within the Eliasville type proposed by Flinn and Flinn for similar points from the High Bluff site in northern Stephens County (Flinn and Flinn 1968:98, 99, 100).

Among the unidentified dart points is a corner-notched, expanding-stem point that is unusually long and made of a very light-gray grainy flint that is unlike any other material from this site. Dimensions are: L-9.7 cm; W-2.7 cm; T-.8 cm. This point greatly resembles an Ellis but is unusually long for this type.

Also included in the local collections from this site are several Erath Bifaces (Story 1965), serrated flakes, flake end and side scrapers, bifacial knife forms, scored hematite, bifacial drills, one canine tooth, one obsidian flake, one hammerstone, and one thin butterfly-shaped gorget made of Taylor shale (Prewitt, personal communication), deer-ulna bone tools and 99 potsherds. Sixty of these

Table 1. XRF Analysis of 41 HI 34 and Malad, Idaho Obsidians

Designation	LBL Run	Ba*	Zr	Rb/Zr	Sr/Zr
41 HI 34	8141-0	1493	117	1.21±.03	.74±.02
Malad, Idaho reference	8136-E (XRF)		101	1.28±.04	.71±.03
	8136-F Neutron activation analysis	1499			

Analysis performed by Lawrence Berkeley Laboratory (LBL) and data provided by F. Stross to T. Hester, June 20, 1985.
*The XRF Ba values have been calculated by a new approach and should be close to the true value (~±2%).

sherds are decorated with various incised, punctate, stamped, brushed or impressed designs of various unidentified Caddoan types. One sherd is Weches Fingernail Impressed. The one stamped sherd appears to be Pontchartrain Stamped (H. Shafer, personal communication). There appear to be at least twenty different vessels represented. Several of the sherds are shell-tempered. All of these materials reportedly came from the upper levels of the site and cannot be directly related to the burial, but it is of interest to note that the predominate dart point style of Gary is the same type as found in the grave-fill at the same level as the upper part of the skeleton beneath the covering limestone slabs.

SUMMARY AND CONCLUSIONS

Of the 13 sites listed in Table 2, eight report burials including cremations at two of these sites. The Stansbury site burials were historic and stone slabs were associated with only one of these. However, it is not stated that the burial was covered with stone slabs, but: ". . . Burial No. 2 was located in the midst of eight stone slabs. . ." (Stephenson 1970:64) One of the Strawn Creek burials had limestone slabs in association but was not defined as being covered with these slabs. None of the burials from the other sites listed in this table are reported to have had limestone slabs covering.

Earlier reports (Watt 1936:10, 11) reflect a number of burials covered over with limestone rocks and describe this as a usual feature of the 32 burials recovered from Aycock Shelter. Hughes (1942) also states Central Texas burials ". . . are ordinarily flexed and stone covered." Burials covered with limestone slabs are also reported from Horn Shelter No. 2 (Redder 1985:43) and from

Lehman Rock Shelter (Kelley 1947: 123).

An analysis of artifacts in private collections recovered from this site indicates it was intermittently occupied over a considerable span of time and that cultural changes occurred over this time period. The earliest occupation of the site, though intermittent, appears attributable to the Middle Archaic time period with increased use of the site toward Late and Transitional Archaic times. The predominant dart point styles of Gary, Yarbrough, and Palmillas indicate a strong bond with the Archaic LaHarpe Aspect in the eastern part of the state. There is evidence in the form of Elam points for ties with the Elam Focus of the Trinity Aspect to the north, and the Godley points indicate either Late Archaic occupation or other contact with early Austin Focus people from Central Texas. The presence of Scallorn points supports the continued presence of the Austin Focus people.

The predominant arrow point type of Perdiz with the minor occurrence of Cliffton are diagnostic of the Toyah Focus. These point types occur over most of the state and are well documented from the northcentral area to the Gulf Coast. Perdiz occurred in 10 of the 13 sites researched.

The occurrence of a wide variety of Caddoan style pottery, two sherds of Leon Plain and one sherd of Pontchartrain Stamped indicates an extensive trade network over much of the Caddoan areas of East Texas and possibly into Oklahoma and Louisiana. The Leon Plain ware may have been locally made but probably came from contact with Central Texas people.

Trace element analysis of the one obsidian flake from this site indicating a tentative source of Malad, Idaho and the identification of several other obsidian flakes and artifacts along the eastern edge of the Edwards Plateau as having their source as Malad, Idaho indicates a far-reaching trade network to the north and west.

The complete absence of European trade material indicates occupation of the site terminated prior to intensive trade between white men and Central Texas Indians.

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to Lawrence Aten, Tom Hester, Harry Shafer and Elton Prewitt for their help and guidance in the analysis of materials from this site and to Richard McReynolds for the drawings of the burial.

Aten did the osteological analysis and Hester later prepared the physical anthropology summary from those notes. Hester also arranged for the XRF analysis of the obsidian flake and provided additional information regarding previous work in this area. Shafer was helpful in the classification of the pottery sherds. Prewitt was very helpful in providing information on reference material and in the identification of the lithics. The radiocarbon analysis of the human bone was funded by the Friends of Archaeology program, The University of Texas at San Antonio.

Table 2. Common Attributes of Excavated Sites in This Area of North Central Texas

	Alba	Clifton	Cuney	Fresno	Granbury	Perdiz	Scallorn	Young	Darl	Elam	Ellis	Ensor	Gary	Godley	Kent	Marshall	Palmillas	Williams	Yarbrough	Bone Tools	Caddoan Pottery	Goose Creek Pottery	Leon Plain Pottery	Burials	Cremations	Gorget	Cultural Affiliations
Sour Mash	1	1	3	1		11	6	1		12	5	4	39	10		2	13		18	x	x		x	x		x	LaHarpe Edwards Austin Toyah
1 Pecan Springs	7	4	2	2	12	11	26		1	4			128	9	33	6		5		x				x	x		
2 Kyle Shelter	2	16			38	49	154	2	4					7			1		6		x		x	x	x		Toyah Austin
3 Blum Shelter	6	19		3		50	28													x	x	x					Central Aspect
8 Buzzard Cave	6	14	2	9		87	32	15					1				2		1	x	x	x	x				Toyah
8 Forrester Cave	8	2				2	14	5	2			1								x							Toyah

8	Little Buzzard Cave	5	8		5		44	38	12	1				1	1		15	1	11	x	x	x	x	x	Toyah Austin
4	High Bluff					9		8	1	33			4				1	2		x					Austin Edwards
6	Stansbury	2	2		4			1	2	5		4							3	x	x		x	x	Norteño Focus
6	Pictograph Shelter	15	16		18		25	52		7		15		1						x	x		x		Austin Toyah
* 5	Cedar Creek	6	7	2		17	25	10						191	4	4			3	x	x		x		LaHarpe
7	Strawn Creek	13	13	2	1				x		1			10					7	x	x		x		Archaic NeoAmer
6	Sheep Shelter	5	5		4		13	20		4		12					6		14	x	x				Edwards Austin Toyah

[1] Sorrow (1966); [2] Jelks (1962); [3] Jelks (1953); [4] Flinn (1968); [5] Story (1965); [6] Stephenson (1970); [7] Duffield (1963); [8] Long (1961)

*The materials listed for Cedar Creek represent materials from three sites: Wild Bull, Lacy and Gosset Bottoms. Materials from these three sites were grouped and treated as a single collection— ". . .an approach justified by the many traits each site shares with the other two" (Story 1965: 177).

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A Mimbres Potter's Grave: An Example of Mimbres Craft-Specialization?

Harry J. Shafer

ABSTRACT

Archeological excavations beneath the floor of a Late Pithouse period Three-Circle Phase Mimbres structure at LA 15049 in Grant County, New Mexico, led to the discovery of a burial accompanied by an assortment of artifacts suggesting that the female adult buried in the grave was a potter. Among the grave items was at least one and possibly two baskets, a Boldface Black-on-White bowl containing a red paint pigment, seven worked potsherds, two polished pebbles, and at least three unfired, red painted, Mimbres Boldface Black-on-White ollas. The archeological and cultural contexts of the burial and artifact assemblage are described. The find is significant because the potter was recognized for her craft skills by her own people suggesting that a level of craft specialization had been achieved in the Mimbres culture by the Late Pithouse Period.

INTRODUCTION

The Mimbres Mogollon of southwestern New Mexico are recognized mostly for their exquisitely painted Black-on-White pottery (Brody 1977). In fact, the commercial collecting of the Mimbres painted pottery, which is recovered mostly in mortuary context, has led to the total destruction of most Mimbres pueblo villages in the Mimbres heartland. This regrettable loss in archeological sites has promoted a fear among archeologists that we may never know the specifics about the people who painted the pottery. In an effort to expand our knowledge about this little known ancient Mogollon culture, the Department of Anthropology at Texas A&M University has been engaged in intensive, long-term archeological investigations in the middle Mimbres River Valley in Grant County, New Mexico. Among the objectives of this research are to gain information about the evolution of the Mimbres culture, and to study the human ecology and adaptive technology by examining all aspects of their material culture such as subsistence remains, architecture, mortuary data and skeletal remains, lithic and ceramic technology, and agricultural technology. In short, we are seeking to find out about them as a people, by looking beyond the pottery, in an effort to understand why they expressed their unique symbolism so vividly in the ceramic arts; and perhaps more importantly, we are seeking to determine what happened to their cultural adaptation and to the people who disappeared from the archeological record ca. A.D. 1130.

MIMBRES MOGOLLON SEQUENCE

The Mimbres Mogollon culture was an indigenous, agriculturally-oriented tradition that began ca. A.D. 200 (Cosgrove and Cosgrove 1932; LeBlanc 1983; Shafer and Taylor 1986). Geographically the Mimbres area is concentrated in, but not totally confined to, the landlocked Mimbres River drainage in southwestern New Mexico (LeBlanc 1983: Figures 1 and 2). The Mogollon sequence

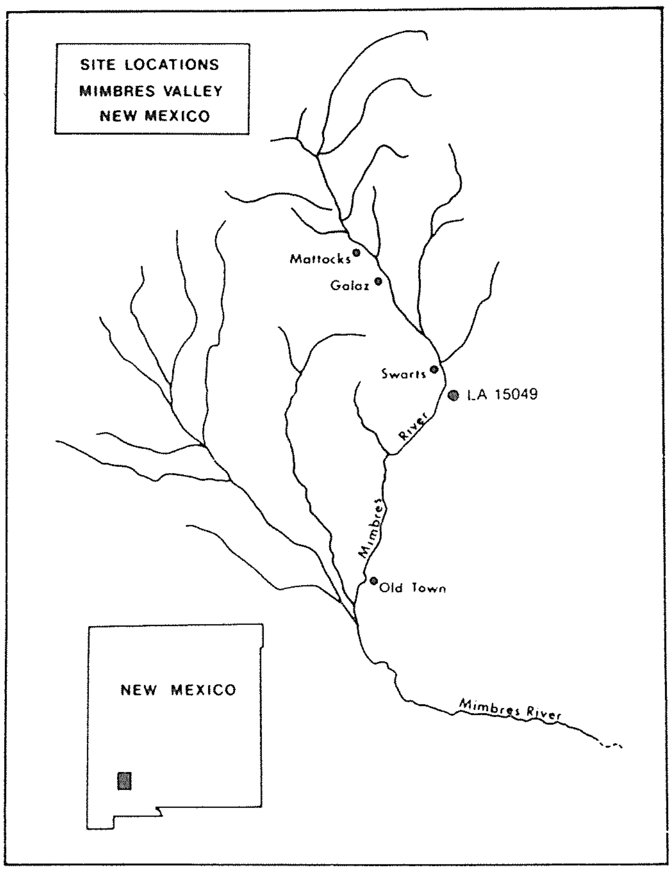


Figure 1. Map of the Mimbres Valley in southwestern New Mexico showing relative location of LA 15049.

began with the appearance of shallow, oval pithouses with extended entranceways that were usually constructed on high points of land overlooking the predominant streams. These early pithouses are associated with plain brownware pottery. This Early Pithouse period is referred to as the Cumbre phase (Anyon *et al.* 1981). About A.D. 550, oval pithouses began to be constructed in the lower elevations of the valleys. This shift, presumably tied to an increasing commitment to agriculture is marked by other changes as well, and signals the beginning of the Late Pithouse period (Anyon *et al.* 1981).

A general shift from oval to rectangular pithouse form can be traced throughout the Late Pithouse period. The appearance of decorated pottery, first the red-slipped San Francisco Red, followed sequentially by Mogollon Red-on-Brown, Three-Circle Red-on-White, Mimbres Boldface Black-on-White and the finer transitional style, which occurred between Boldface and Classic Black-on-White, provides the hallmarks of the Late Pithouse Period.

The ceramics and the general evolution in pithouse form and characteristics have been used to define three cultural phases within the Late Pithouse period (Anyon *et al.* 1981). These are Georgetown, San Francisco, and Three Circle. Surface rooms began to be constructed about A.D. 950 to 1000. These may have been surface storage rooms associated with the pithouses at first, but eventually contiguous-room pueblos replaced pithouses altogether and marked the onset of the Classic Mimbres period. Other changes occurred also; most notable are the appearance of Mimbres Classic Black-on-White and polychrome pottery and the mortuary patterns, which include numerous subfloor burials and the placement of "killed" bowls over or about the head of around half of the interments (Gilman 1980).

SITE LA 15049

Site LA 15049, known as the NAN Ruin (Cosgrove and Cosgrove 1932; Shafer 1982; Shafer and Taylor 1986), is located in the middle portion of the Mimbres River valley in Grant County, New Mexico (Figure 1). The site has been under investigation by Texas A&M University since 1978, It consists of a pithouse village of undetermined size overlain by a large Classic Mimbres pueblo ruin (Shafer 1982; Shafer and Taylor 1986). The Classic Mimbres ruin was first tested by the Cosgroves in 1926 (Shafer *et al.* 1979) and was extensively disturbed by pothunters prior to the Texas A&M University investigations.

The occupation at LA 15049 began sometime in the Late Pithouse period, probably about A.D. 700, based on the presence of Mogollon Red-on-Brown and Three Circle Red-on-White pottery found in the fill of some of the older pithouses. The settlement was occupied continuously throughout the remainder of the Late Pithouse period, through the Classic Mimbres phase, ending sometime between A.D. 1125 and 1150, at a time when the entire Mimbres Valley was abandoned and the Classic Mimbres period came to an end.

The emphasis of this report is on the Late Pithouse period village at LA

15049 represented by 10 pithouse structures, eight of which have been partly or wholly excavated. These include the floor remnant of Room 1, Rooms 14, 15, 17, 43, 52, 83, 86, 91, and 93. The "potter's grave" was located in Room 14.

Room 14

This east-facing Three-Circle Phase pithouse was discovered beneath the northern section of Room 12 (surface pueblo room of the Classic Mimbres Phase) in the 1981 season. The pit was dug 1.13 meters into the Pleistocene clay and gravel terrace underlying the cultural deposit at the site. Room 14 was not completely excavated, but was sufficiently investigated to accurately measure the interior size (Figure 2). The subsquare pitroom measured 3.2 meters east-west by 3.0 meters north-south, giving an overall floor space of about 9.5 square meters. The walls were once plastered with adobe and the floor was surfaced twice, once when the room was originally constructed and again later. Although not exposed by excavation, the entrance faced east as indicated by the firepit placement in the eastcentral portion of the room.

Floor features included a circular firepit in the eastcentral portion, a mano adjacent to the firepit, portions of a Three-Circle Neck Corrugated olla in the northwest corner and a post set into the floor along the south wall at a point where the wall expanded outward (Figure 2). A similar outer expansion occurred along the north wall as well.

Subfloor features included three burials; Burial 86 is the subject of this report and is described in more detail below. Burial 90 was a pit placed in the center of the north wall that contained two smashed vessels (an early Mimbres Transitional Black-on-White [Figure 6, a]), a brownware plate, a pot polishing stone, and two worked potsherds. No skeletal material was found in this pit, but its depth near the water table and composition (very loose large cobbles) may have contributed to total destruction of the skeletal material. Burial 93 was a child placed near the entranceway close to the east wall. It was accompanied by shell beads, turquoise and lead crystal inlays (part of an inlaid object), a smashed pallette, and three smashed pottery vessels, including a red-slipped seed jar (Figure 6, b), a small punctated jar, and a plain brownware boat-shaped bowl with tab handles (Figure 6, c).

Burial 86

Burial 86 was placed in an oval pit 52 cm deep beneath the second or uppermost floor in the northwest corner of the room. The poorly preserved skeleton was in a tightly flexed position with the head to the east (Figure 3, a; 3, b). The sex of the individual in the grave, determined by Suzanne W. Patrick (personal communication, 1986), a graduate student in human osteology at Texas A&M University, on the basis of sexually distinctive features on the skeleton, was a gracile female. The grave contained an assortment of artifacts associated with

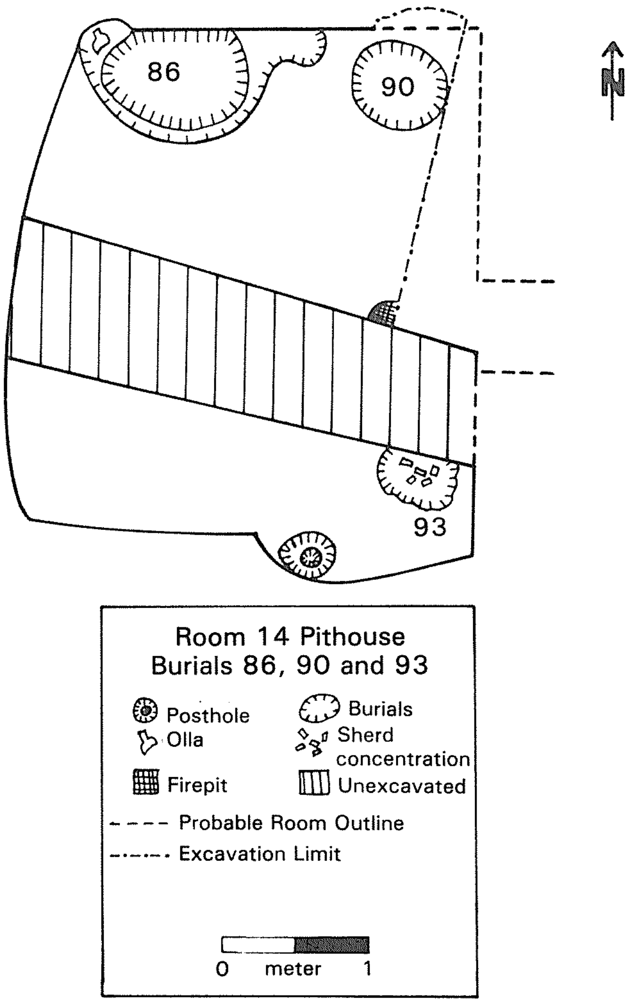
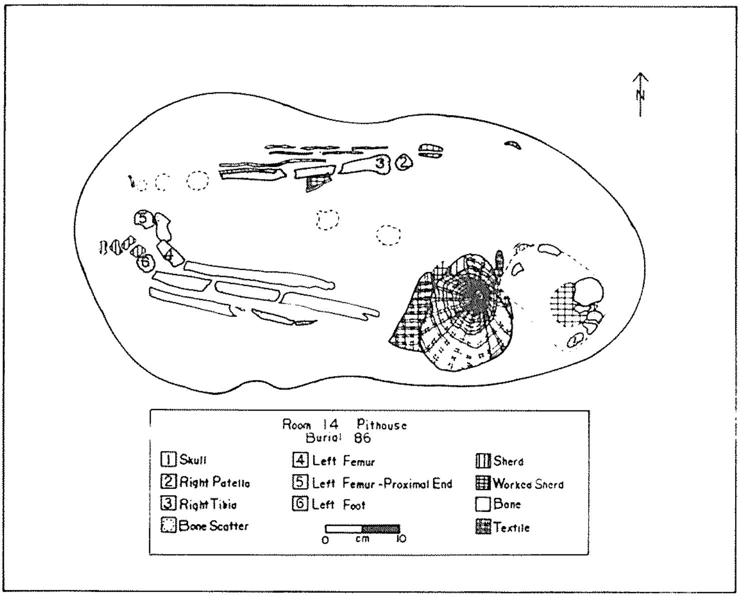


Figure 2. Schematic plan of Room 14, LA 15049.

pottery making; it is on the basis of these associated artifacts that the grave is interpreted to be that of a potter.

Associated Artifacts

Included in the grave was a coiled basket; it is possible that a twilled basket (Figure 5) was also included, but since the body was wrapped in a twilled mat, the fragments of which were scattered throughout the area of the corpse, it was not possible to conclusively determine if there were two separate twilled objects in the grave. The textiles, along with traces of other organic residue, were preserved by the damp condition due to the depth of the grave into the gravels. Also



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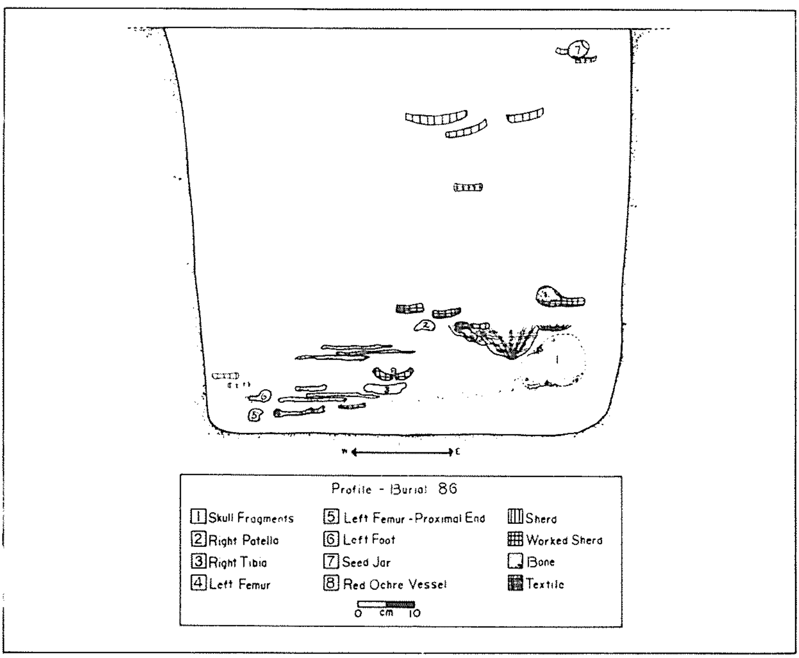

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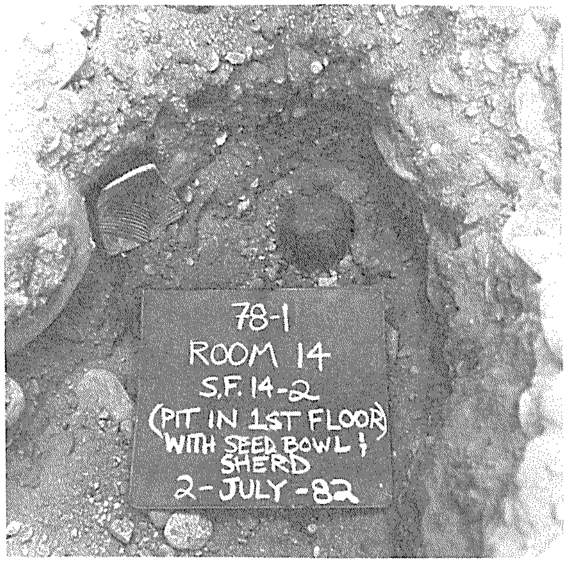
Figure 3. A, horizontal plan of Burial 86; B, profile of Burial 86.



a

b

Figure 4. Views of Burial 86 during excavation; A, upper portion of pit with seed jar and sherd of Boldface Black-on-White bowl; B, sherds of Boldface Black-on-White at middle level of pit.

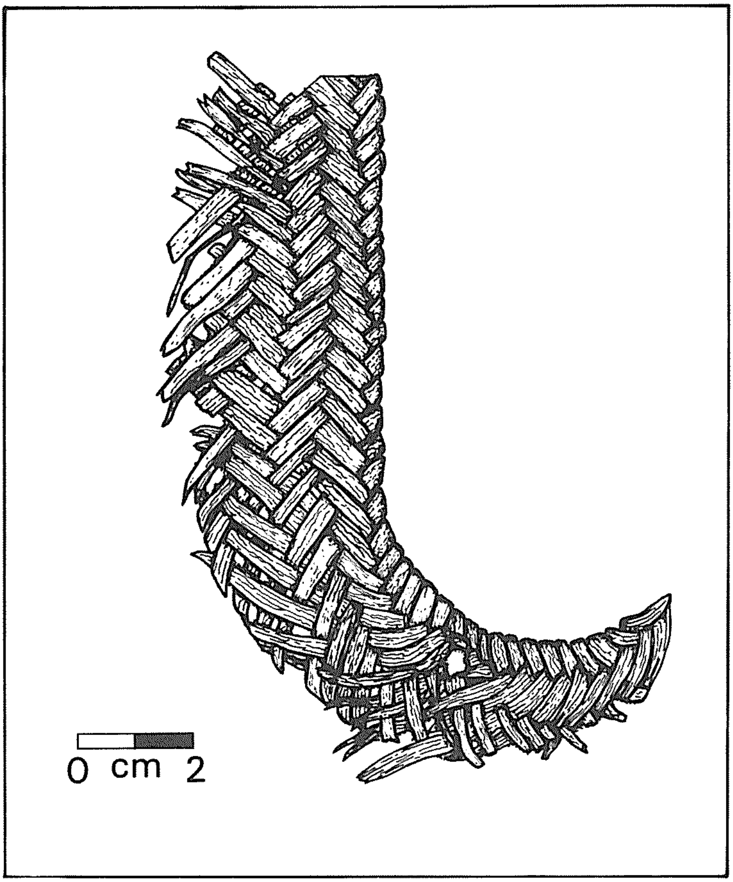


Figure 5. Selvage fragment of twilled mat or basket from chest area of Burial 86.

in the grave was a small Boldface Black-on-White seed jar (Figure 4,a 6,d), a smashed Boldface Black-on-White bowl (Figure 6, e), a small Boldface Black-on-White bowl containing red pigment (Figure 6, f), at least three unfired, white slipped, red painted Boldface Black-on-White ollas (Figures 7, 8), seven worked potsherds (Figures 9, a–d, g), and two polished pebbles which probably served as pot-polishing stones (Figure 9, f). Some of the pottery making tools may have been contained within a twilled basket. The worked sherds were presumably used in tooling the clay while shaping the pottery. The unfired ollas were severely crushed and because of their soft state, were extremely difficult to recover. Nevertheless, with the delicate conservation by Elaine Hughes, enough was restored to determine the vessel forms and general design layout for three (Figures 8, a–c). All artifacts are illustrated to scale.

Smashing of the Boldface bowl and scattering the sherds in the burial pit fill is a method of vessel-killing, characteristic of Three-Circle Phase burials. The smashing of vessels albeit ceases in the Classic Mimbres period when the characteristic method of killing is by knocking a hole in the bottom of a bowl.

The placement of the artifacts in the grave occurred at intervals. The unfired ollas were placed on either side of the body; the pebbles and worked sherds were placed over the body along with the bowl containing the pigment. The baskets, one of which may have contained the pottery-making tools, were placed over the head and chest. The coiled basket was over part of the face but it was not possible to determine if the basket had been inverted. Sherds of the smashed bowl were scattered in the fill after the body and other artifacts had been covered (Figure 4, b). The seed jar was the last item included. It was placed intact just beneath the floor (Figure 4, a).

DISCUSSION

In a recent study of status differentiation in Mimbres burials, Anyon and LeBlanc (1984: 183–186) concluded that there was no marked status differentiation evident in the burials from the Galaz and Swarts Ruins, both large Late Pithouse period-Classic Mimbres sites. They compared the Mimbres data to the Chaco Canyon and Casas Grandes areas where some indication of status differentiation and social ranking, which would be in the form of ascribed status, existed. In a ranked society, a person is born into a particular social class and retains that ranking throughout his or her life. Somewhat simpler tribal societies usually do not exhibit social ranking, but often do display some differentiation in the form of achieved status. Anyon and LeBlanc (*ibid.*) felt that the Mimbres fit the expectations of a tribal society although cited no specific examples of acquired status. A study of the social implications of the mortuary remains of the LA 15049 burials was conducted by Spreen (1983). She concluded that there was evidence for both ascribed and achieved status among the Mimbres and postulated a social structure somewhere between the tribal and chiefdom level.

The significance of the LA 15049 find may not be obvious at first glance. The importance lies in four things. One is that this is the first assemblage of pottery-making tools reported with a burial in the Mimbres area, an area which is known both archeologically and in the art world for its ancient painted pottery. (Note that Burial 90 also included artifacts associated with potmaking.)

Secondly, the individual in the grave was a female. Most archeologists have assumed that the Mimbres potters were women based on the early historic pattern among the southwestern Pueblo people where women were the potters. However, LeBlanc (1983: 138) has suggested that perhaps it was the men who painted the more exquisite Mimbres pottery. If the mortuary furniture in Burial 86 symbolized that this woman was indeed associated with ceramic production,

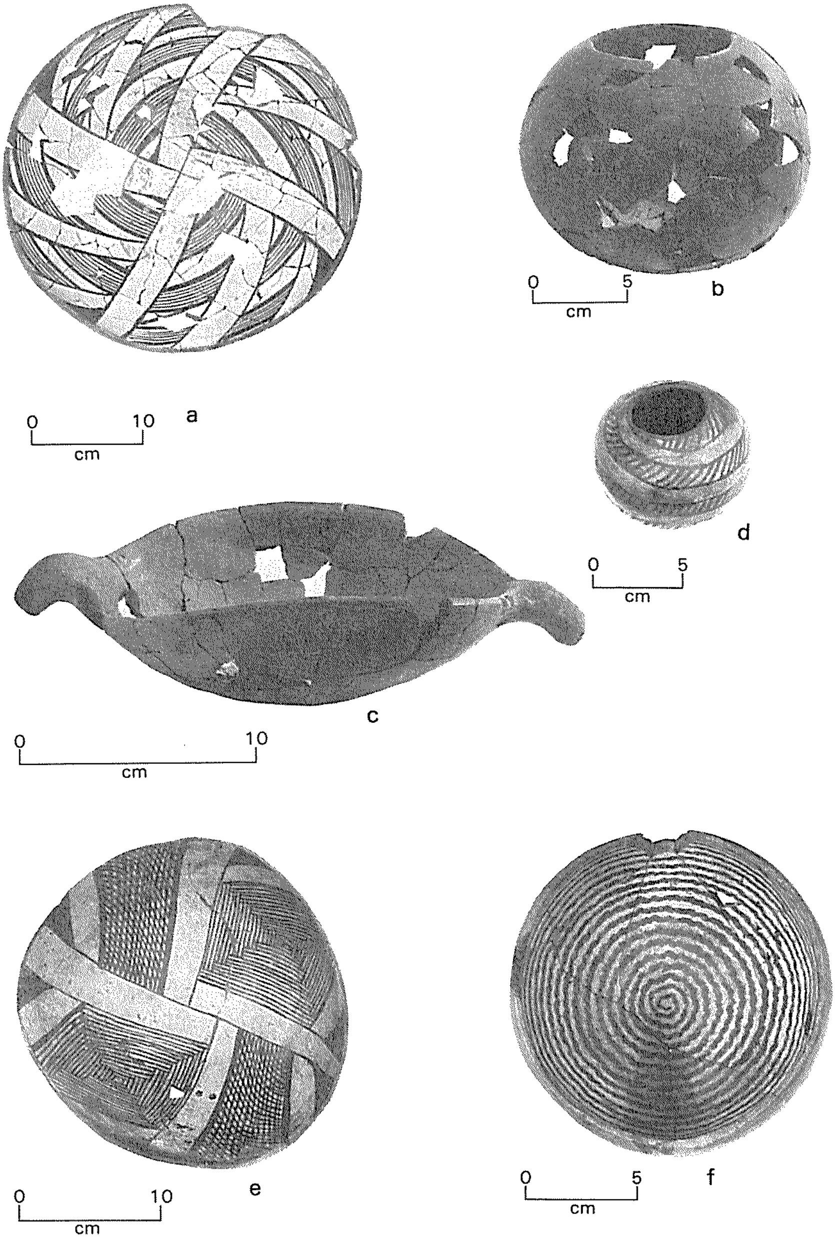


Figure 6. Mortuary vessels from Room 14. A, Mimbres transitional Black-on-White from Burial 90; B, red-slipped seed jar (San Francisco Red?) from Burial 93; C, boat-shaped brownware vessel with tabs from Burial 93; D–F, Mimbres Boldface Black-on-White vessels from Burial 86.

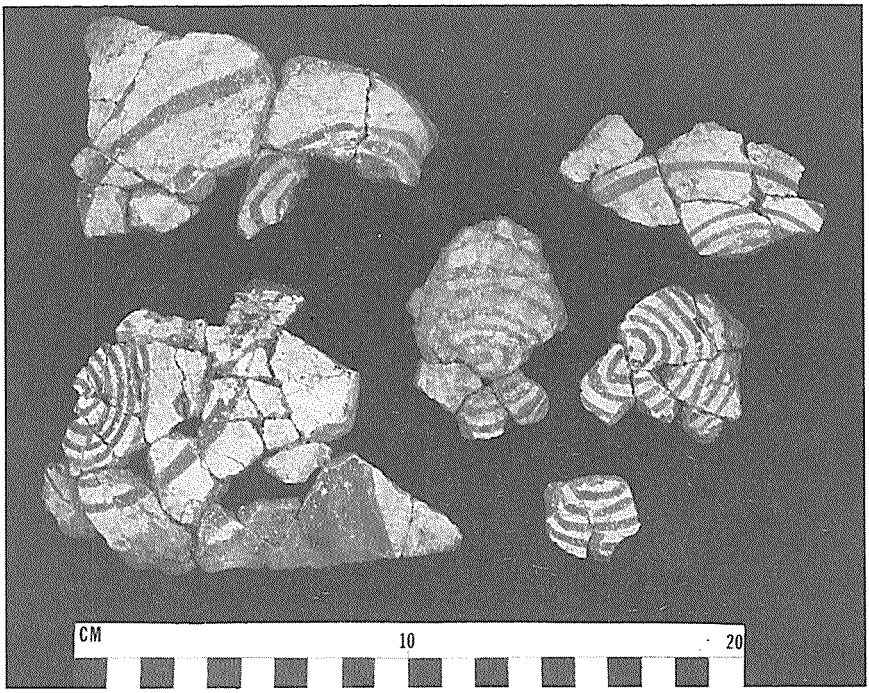


Figure 7. Sherds of unfired ollas from Burial 86.

then the burial provides the first instance of what might be interpreted as archeological proof of female potters among the Mimbres.

Thirdly, this is the first reported unmistakable evidence of baskets being included as mortuary vessels in a Mimbres grave. Traces of textiles had been found in other graves at LA 15049 (Shafer *et al.* 1979) including impressions of what may have been a basket over the head of a child. Bradfield (1931 Plates IV, 2) illustrates traces of a textile in a Cameron Creek grave which may have been a shroud. Poor preservation of textiles may have given a very biased impression of vessel inclusions with Mimbres burials. Many of those lacking pottery could have included baskets instead.

The fourth important aspect about this find is that if we can assume that status in life is preserved in death (Binford 1971), then this woman's status as a potter was recognized by others in her society. This would be an example of achieved status much like that of a shaman.

What processes can we look for in the Mimbres society that may have led to low-level craft specialization? For one thing, craft specialization does not necessarily indicate high levels of social complexity. Good craftsmen are often sought out for their skills, not only in primitive societies but in complex societies as

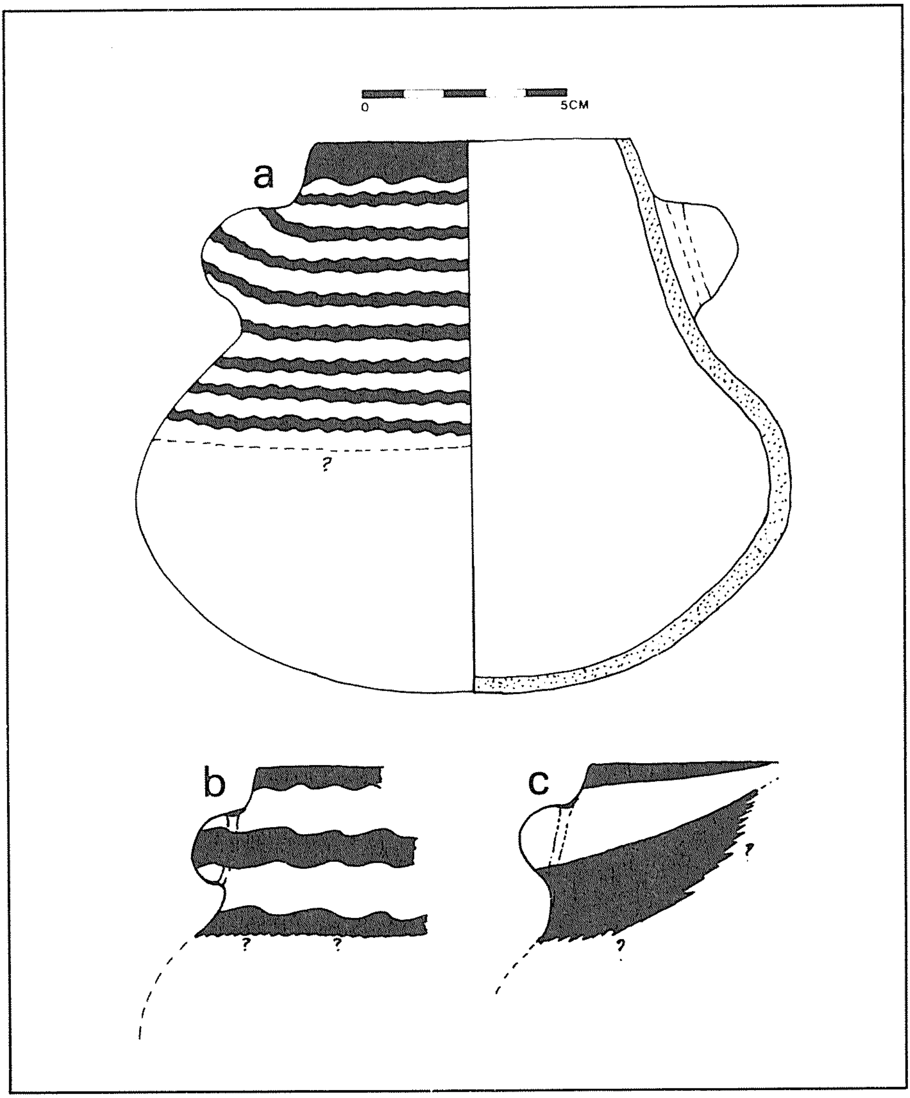


Figure 8. Reconstructed designs on three partially restorable unfired Mimbres Boldface Black-on-White ollas from Burial 86.

well. Presumably every woman in the Mimbres village could make pottery to suit their needs, but some were undoubtedly more skilled than others. Because of their recognized skill, some craftsmen may have been called upon to produce more of an item than they or their family would ordinarily need. When this happens in simple societies, the development of low-level craft specialization occurs. It usually begins as a cottage industry (Prentice 1983); that is, the crafts are

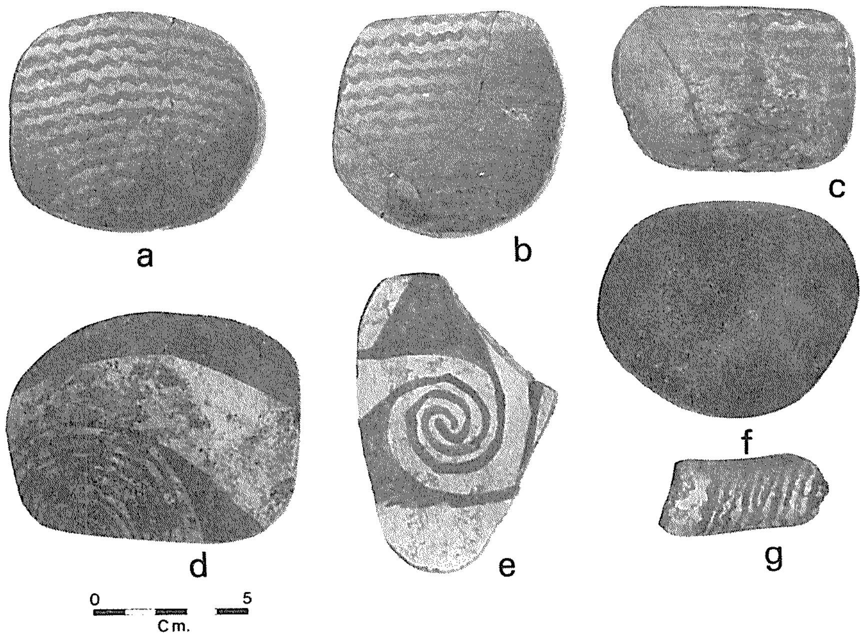


Figure 9. Worked sherds and pot polishing stone from Burial 86; A–E, G, worked sherds; F, pot polishing stone. Worked sherds A–C were from a Boldface Black-on-White bowl; Sherds D, E, and G, were from Boldface Black-on-White ollas.

made at the household level (Clark 1983), and, if the economic networks within the society continue to become more complex, then more intensive levels of craft specialization emerge (Shafer and Hester 1986).

Levels of intensity—that is, production output—among craft specialists may be associated with another process, that involving a "second class" citizen status. This scenario can be associated with land use and land tenure. For example, let's assume that the Three-Circle Phase represents the zenith of Mimbres Mogollon development (painted pottery aside). If the population had expanded to the point that all prime land was claimed and appropriately partitioned to those having jural access to it, what happened to those families who were late comers and had no legitimate claim to good farm land? Presumably they attempted to work less desirable land; one alternative was for them to produce a needed commodity, which they could exchange for products that they could not produce themselves. Low-level craft specialization can emerge in this fashion among second-class families. The burials in Room 14, however, do not suggest a second-class status when compared to other Three-Circle Phase burials (e.g. Anyon and LeBlanc 1984: 173–186), but since pottery-making artifacts were associated with Burial 90 as well, perhaps this particular household was engaging in pottery production above that of the normal households of this period.

During the Three-Circle Phase, the Mimbres people began to make more black-on-white pottery than they used locally. Much of this excess pottery was traded to people, whom we identify as the Jornada Mogollon, who occupied the desert region to the south and east of the Mimbres. The Jornada people did not make a Black-on-White pottery although Mimbres Boldface and Classic Black-on-White are common in Jornada sites that date before A.D. 1150 as far east as the Guadalupe Mountains in Texas (Phelps 1974; Smiley 1979). After the disappearance of the Mimbres about A.D. 1130, the desert area was supplied with Black-on-White pottery from the Salinas area in the form of Chupadero Black-on-White and later Tabira Black-on-White.

Another item, which may have been produced by incipient craft specialists in the Mimbres area, was the corrugated ware. LeBlanc (1983: 144–146) has reported the use of a distinctive temper in the production of some corrugated vessels distributed throughout the Mimbres Valley. The temper materials have a very localized distribution in the area. One of the scenarios that LeBlanc suggests to explain the pottery distribution is localized craft production.

Craft production beyond the household needs was by no means limited to ceramics. Cosgrove and Cosgrove (1932: Plate 69) illustrate a workshop assemblage of bead-making items including raw material, blanks, and finished products, recovered from Burial 904 at the Swarts Ruin. Anyon and LeBlanc (1984: 276–278) suggest that three-quarter grooved axes found throughout the Mimbres area were made at the Galaz and Mattocks sites of a green igneous rock that outcrops nearby. They noted that no workshops were found and that such specialization could not be demonstrated. This is not surprising since no debitage analysis was done to define workshop activity or workshop production. I have personally observed a noticeable amount of debitage of this distinctive green stone at both the Galaz and Mattocks ruins. Axes of the green igneous rock occur at LA 15049 in Classic Mimbres context but no debitage or production failures have been found to indicate localized manufacture. In a more dramatic example of Mimbres craft production, McCluney (1968) describes what seems to be a Classic Mimbres turquoise workshop at the West Baker site (although interpreted by him as a shrine). These examples of craft production, together with the recognized status of a potter by her own people as proposed for Burial 86, would suggest that some degree of low-level craft specialization—probably at the cottage industry level—indeed existed in the Mimbres culture beginning sometime during the Late Pithouse period. How these industries developed and how they were structured among kinship networks and villages is not known; pursuit of these questions will undoubtedly yield much new information about the structures of the ancient Mimbres society.

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Book Review

An Archeological Reconnaissance of the Upper Little River Basin in Cleveland County, Oklahoma, 1984. By Terry L. Steinacher.

The University of Oklahoma, Oklahoma Archeological Survey, Archeological Resource Survey Report Number 25. January 1986. xii + 150 pp., 28 figs., 14 tables, and appendices.

The Oklahoma Archeological Survey has just published Terry Steinacher's archeological assessment of the Upper Little River Basin of central Oklahoma (just southeast of Oklahoma City, just north of Norman). With a bright red cover, bold printing, and perfect binding, it is available for $6.00 postpaid from the OAS (1808 Newton Drive, Norman, OK 73019). The project itself was funded in part by the Oklahoma Office of Historic Preservation and the National Historic Preservation Fund Grant-In-Aid Program.

It is an extremely interesting study in that it samples the archeology of the headwaters of a "small" river basin (some 70,000 acres or 109 square miles) through systematic sampling. The archeological resources of the area are seriously threatened by the continued urban growth of cities and highways, as well as two major reservoirs.

This volume reports an innovative approach to the project in the sense of using modern sampling techniques to check a mosaic of patches which total six square miles (5% of the area). Crews examined representative units throughout the river basin (by "pedestrian survey"), and the report interprets the results of these tests in terms of Oklahoma's cultural resources plan. The study succeeded in its major objectives, and identified 49 new sites plus additional isolated finds, which are representative of the archeological potential of the region. The study more than doubled the number of recorded sites in the river basin, and recommended full National Register evaluation for six sites, content testing for 21, and resurvey of eight.

As with other Oklahoma Archeological Survey reports, this is a very professional volume, with comprehensive overviews of the geomorphology, climatology, flora, and fauna of the region. One finishes the introduction and background sections with a very good understanding of the study area and how it relates to the rest of the state and entire Southern Plains region.

A minor problem is the number of previously recorded sites in the study area; the Introduction (p. 1) notes there were 41 but the Survey Results section talks of revisiting "30 of the 39 previously recorded sites" (p. 39) and Figure 11 shows only 39 previous sites (p. 42). This is not a particularly significant discrepancy, but an irritating one.

Specific sites which were located or revisited were evaluated with a variety of information. For example, the slope orientation ("general direction of the slope") of each site was recorded and analyzed. Figure 27 presents the results in a graphic display, and the text notes that there is a predominance of a southerly orientation. Yet, the longest single line in Figure 27 appears to be that to the east. The schematic is unscaled but the length of the lines presumably represent proportions of occurrence. In any case, the author concludes, "it does not appear to be a significant variable" (p. 70). A more complete explanation of this graphic would have been helpful (or its elimination from the report).

The number of lithic, bone, and ceramic artifacts recovered during field work was very small (except for 1504 flakes). Thirty-four bifaces (including five projectile points) were documented. This sample was augmented by examination of local collections by avocational archeologists (variously called amateur collectors, local collectors, and finally in Appendix D, avocational archeologists). The use of such collections makes possible an extended number of analyses, including estimation of the chronological and cultural affiliation of the sites. Unfortunately, it is not always made clear when such surface collections are the data being reported; most titles of the tables and photos in the main body of the report include the phrase "in the Upper Little River Survey 1984" which erroneously infers (for Table 8 and Figure 23 at least) recovery during the survey.

Upon closer reading of the findings, a number of other errors become evident. The chronological assessment relies heavily on "diagnostic point types" for dating, yet there are some major problems with the chronological ranges given in Figure 22. The San Patrice is shown as 3000 B.C. to 0; Yarbrough is given as 500 B.C. to A.D. 1200; and Morhiss as 200 B.C. to A.D. 1200. In the Texas archeological literature, San Patrice is firmly accepted as a Paleo-Indian type dating about 8000 to 6000 B.C.; Yarbrough is thought to date in the Early Archaic; and Morhiss (a very southern Texas type) is Late Archaic (ca. 800 B.C.; see Turner and Hester 1985). This kind of error undermines one's confidence in Steinacher's analysis. It also makes it necessary to examine his references to evaluate his exposure to recent archeological progress in Texas. This is an important issue, since Steinacher reports many Texas types as occurring in the Upper Little River Basin, and bases much of his chronological analysis on their presence.

The reference list contains only two Texas publications in eight pages of references: the Suhm and Jelks *Handbook* (1962), and Lynott's *Bulletin* article on Bison in northcentral Texas (1979). One might conclude from the paucity of Texas typology references that the author is not familiar with the more recent Texas literature. Otherwise, he might have hesitated to classify (or report) the Little River specimens as Desmuke, Frio, Morhiss, and Uvalde since these are defined as localized types having distributions limited to South and southwestern Texas.

In fact, part of the reference list appears missing; perhaps a whole page of authors. Everyone between Gray and Keith is unlisted, yet Hall (1977a, 1977b, 1977c, 1978, 1982), Hall and Lintz (1984), and Hemish (1980) are all cited in

Figure 6 (page 17). Since the pages of the bibliography are all numbered serially, this appears to be an author and reviewer problem rather than a printer's mistake. Page 123 includes a printed pencil mark note, "9 in", which may be a printer's error.

Most of the information on local collections is in Appendices D and E, except for Table 8 and Figure 23 in the main report. Figure 23 includes photos of named points from three collections, yet photos from the same collections included as Figures D-3 through D-11 are not classified as to type. Many of these specimens must have been classified in order to build Table 8. In the Cox collection (Appendix E), the points are classified in the photos (Figures E-1 through E-6) and summarized in Table E-1. The author explains (p. 135) that the Cox collection was examined after the analysis was completed. This difference in treatment and lack of inclusion of the Cox collection in the analysis is regrettable, since it disguises some interesting and potentially significant data.

For example, if the data on Site 34CL76 are summarized across Tables 8 and E-1, the site appears to be highly significant. It included points ranging from a reworked Plainview (not noted in the main body of the report) through many Archaic types and even Late Prehistoric arrowpoints (Scallorn, Washita, Reed)—a total of at least 148 projectile points. This is a large enough sample to start to see some possible cultural contact (or trade) trends. Types with the highest frequencies are: Gary (20), Calf Creek (15), Ellis (14), and Darl (10).

Gary points are frequently found in East Texas and Louisiana (Turner and Hester 1985). They are also occasionally found in western Oklahoma (i.e., The Edwards I site, 34BK2; see Baugh 1982) where they may represent some type of contact from the Caddo of eastern Texas and Oklahoma (Lintz 1979).

Calf Creek are Pre- or Early Archaic points which are probably related to Texas Andice and Bell types (see Parker and Mitchell 1979; McKinney 1981; Prewitt 1983; Chandler 1983; Turner and Hester 1985). Indeed, the three forms intergrade and probably represent one technological series rather than distinct types (see Weber and Patterson 1985). The relatively large number of such points recovered from 34CL76 represent an important sample which needs further study, in terms of technology, attributes, and source of lithic materials. Examination of the photos of Little River Calf Creek specimens suggests that they vary to both the Andice and Bell ends of the series.

It is difficult to evaluate the lithic raw material data in the Little River report; it is tabulated by site but not by point type (see Tables E-1 and E-2). Thus, the data can not be used directly to test for possible relationships with other areas (such as Texas) at specific time periods. The lithic source data for flakes is so tabulated (Tables C-1 through C-5); however, flakes are more evidence of local workmanship and thus are a biased indicator of long range trade sources.

Steinacher concludes his report with recommendations for future research in the Upper Little River Basin. He includes site 34CL76 among the six sites recommended for "more extensive testing" (p. 83) and full National Register evaluation. Thus, he recognizes its rich potential for what he calls morphological, historical, and behavioral research.

This is an important report. It represents a substantial effort toward evaluating a threatened river basin, and the project was an excellent investment in the future archeology of central Oklahoma. While there are problems with the presentation and report, the project itself should stand as a model for professional and avocational cooperation. By analyzing both local collections and field data, it was possible to develop a fairly comprehensive picture of the threatened archeological resources of the area. Hopefully, this kind of cooperation can go forward to a more complete study of these important sites.

Jimmy L. Mitchell
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