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Texas Archaeological
Association

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The Southern Texas Archaeological Association

The Southern Texas Archaeological Association brings together persons interested in the prehistory of south-central and southern Texas. The organization has several major objectives: To further communication among avocational and professional archaeologists working in the region; To develop a coordinated program of site survey and site documentation; To preserve the archaeological record of the region through a concerted effort to reach all persons interested in the prehistory of the region; To initiate problem-oriented research activities which will help us to better understand the prehistoric inhabitants of this area; To conduct emergency surveys or salvage archaeology where it is necessary because of imminent site destruction; To publish a journal (*La Tierra*), newsletters, and special publications to meet the needs of the membership; and to assist those desiring to learn proper archaeological field and laboratory techniques for southern Texas.

STAA Officers and Staff 2004

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About the cover: Drawing of 41VV1971, core Motif 6.

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A Trade Blank from the Lower Rio Grande: Further Observations on Large Biface Exchange in Southern Texas

Thomas R. Hester and William Wilson

INTRODUCTION AND DESCRIPTION

Chance discoveries in southern Texas continue to provide examples of large bifaces made from Central Texas chert. The documentation of these artifacts provides a set of data with which archaeologists can begin to evaluate the chronology and circumstances of trade between the two regions.

The terms "trade blank" and "cache biface" have been used by Turner and Hester (2003:24-26) to refer to large, thick bifaces of a form that sometimes occur in caches (Miller 1993) or in mortuary contexts (Taylor and Highley 1995). "Trade blank" is particularly appropriate for the specimen described here, as it occurred as a single artifact, with no demonstrated link to a cache or burial.

In late 1956, the late Darrell Wilson was surface-collecting from a surface site south of the dam for Falcon Reservoir in Starr County, Texas. The lake had filled a couple of years earlier. The site appears to be 41SR47, located in the present-day Falcon State Park picnic and camping area. It was recorded in 1950 by Jack T. Hughes during the River Basin Survey reconnaissance at Falcon Reservoir. It was the only site in what is now the park that attracted Hughes' attention, doubtless because of lithic debris eroded over a wide area. Hughes collected four Tortugas points and one Refugio point. Also present at the site was a sandstone hearth, and numerous flakes and cores (site data from the Texas Archeological Site Atlas, Texas Historical Commission, accessed on July 20, 2004).

However, in 1956, the park had not been designated, let alone built. When Wilson found the large biface, only the basal portion was exposed. Aside from clearing off the rest of the artifact, no digging was done in the discovery area and it is unknown whether there were other bifaces or associated materials. It apparently had been eroded and exposed on the surface for a considerable period, since one face of the artifact is fully patinated, and the opposite face patinated along the lateral edges.

The artifact (Figure 1) is made of a brown Edwards Plateau chert. It is 19 cm long, 11.8 cm wide, and maximum thickness is 1.95 cm. Both faces are characterized by broad thinning flakes and occasional retouch along the lateral edges (these have an edge angle of 30 degrees). The basal edges are dulled and there is some visible polish along this edge, extending onto adjacent flake scars. As noted above, a white patina covers one face while the opposite face has patina on the edges.

COMPARATIVE NOTES

The biface discussed here is very similar to those from the Fairview Cache, found in Austin (Travis County) in the early 20th century (Miller 1993). It shares the flaking patterns and general outline of those specimens, although many of the Fairview Cache specimens have basal edges that are somewhat more convex. There is further similarity to some of the bifaces from the Hoerster site cache reported from Mason County by Lintz and Saner (2002). It resembles, in size and shape, their Specimen 1 (Lintz and Saner 2002: Figure 2), described as sub-triangular with bilateral symmetry.

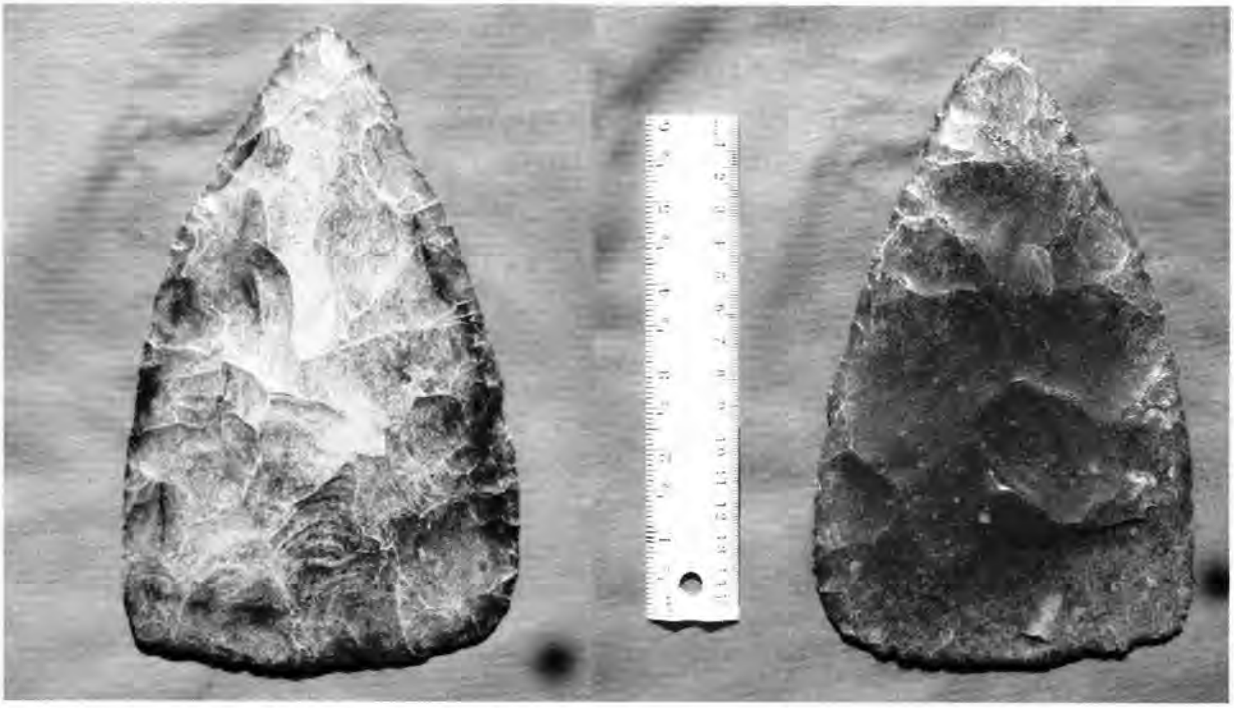

Figure 1. "Trade Blank" from the area south of Falcon Reservoir. Both sides are shown.

Other caches, such as Riley (from southern Medina County) and Goldapp (Fayette County), also have bifaces of similar shape and technology, but which are generally smaller in size. This is particularly true of the Riley Cache (Miller 1993; see also Hester 1995: Figure 21).

At Falcon Lake, a cache of 52 bifaces was found by collectors and associated with a burial near 41ZP7. Unfortunately, the cache was divided between two persons. With the assistance of James B. Boyd, half of the cache was documented. All but one of the bifaces were triangular, but were of "large preform" size, much smaller than the Wilson biface. Michael B. Collins conducted a short-wave fluorescence analysis of the available specimens, of which 17 were of Edwards Plateau chert (e.g., they fluoresced a distinctive yellowish hue). Interestingly, one of the specimens fashioned of Edwards Plateau chert was a stemmed biface of the so-called "San Saba" form (see Hester and Green 1972). The presence of this biface provides a general age for this cache, as these large, short-stemmed, and basal notched artifacts are of Late Archaic age (see Hester 1995:442-443 and Figure 20a-b).

GLIMPSES OF FUNCTION AND TRADE

A number of groups of large bifaces made of Edwards Plateau chert are reported in various parts of South Texas. These range from caches such as Riley (Miller 1993) to mortuary inclusions of the sort found at Loma Sandia (Taylor and Highley 1995) and the Silo site (Lovata 1997). The patterns of caching behavior have been reviewed by Miller (1993) and Lintz and Saner (2002:37-41). Miller (1993:132) suggests that caches could have been raw material stockpiles or "insurance" for further needs, as well as for ritual or status demands. Perhaps specimens from these caches were subsequently distributed, through trade, to other South Texas peoples, to be used as mortuary offerings. Lintz and Saner (2002:39) give this description of the role of caches: "Archaeologically recovered caches present static snap-shots of a dynamic prehistoric process of assembling, using, and dispersing a mass of goods that are regarded as useful. . ."

The temporal span of the South Texas caches and mortuary offerings involving large bifaces ranges from the Middle Archaic (Loma Sandia) into the Transitional Archaic (Silo). There are earlier biface caches, as noted by Hester and Calame (2003), perhaps as early as Paleoindian times. A recent discussion of cache chronology in Central, coastal, and East Texas is provided by Lintz and Saner (2002).

The quote cited above from Lintz and Saner (2002:39), regarding the processes represented by biface caches, would include the pattern of utilizing specimens from a cache to include use as cores or preforms; as mortuary items; use in ritual tasks, to perhaps symbolize status; and even for a specific function. An example of the latter is the large, thin biface from the Shrew site (Wilson County), reported by Labadie (1988) to have extensive use wear related to the cutting of grasses and plants.

The only ethnographic insights that we have for the use of large bifaces in southern Texas comes from Alvar Nunez Cabeza de Vaca in the mid-1530s. For example, the Avavares had a myth involving Mala Cosa ("the Badthing"), a strange little man who used a big flint knife up to two palms long and a hand wide (see Hester 1999:21), to cut the Avavares (sometimes removing their intestines, but then healing the wound). Large flint bifaces were given by the Cutalcuches as gifts to Cabeza de Vaca. He noted that this group considered such artifacts, up to a palm and a half long, prized belongings, yet they were also used for cutting tasks. The Avavares and the Cutalcuches shared a prickly pear harvesting area in Duval or Jim Hogg counties in summer 1535.

What is the length of a biface calculated at 1 or 2 palms? Sixteenth century Spanish measurements are inconsistent. A *palmo* is thought to have been about 20 cm (8 inches). However, this is the *palmo mayor*, while a *palmo menor* was about 7 cm (almost 3 inches). Neither of these measurements seem to relate to what we know about "trade" and "cache" bifaces in South Texas, however, and we are still uncertain what linear measurement equivalent might be applied to Cabeza de Vaca's "palm." For example, if we "size" the Wilson biface from Starr County, it would be almost a "palm" long and while "two palm" bifaces are known from Central and south central Texas (Lintz and Saner 2002; Hester and Calame 2003), they are extremely rare.

Finally, when we note the "trade" or "exchange" of lithic bifaces, we are assuming that it was this type of mechanism that brought the specimens, either as caches or perhaps singly, to South Texas. Miller (1993) has mapped the distribution of biface caches emanating from the Edwards Plateau, and extending into South Texas and East Texas in particular. We know that the movement of caches happened fairly frequently and we know the raw material is from the Edwards Plateau. Certainly, the South Texas peoples, used to working Uvalde or Rio Grande gravels, which are hard, flawed, and small, would have wanted to acquire bifaces of high quality chert. What could they have offered in exchange? From the perspective of south central Texas, north of the escarpment marking the southern edge of the Edwards Plateau, there are very few (if any) stone artifacts, or those of any other non-perishable material, that reflect items coming in "trade" from southern Texas. We have to assume that if such exchanges were made in acquiring these bifaces, the goods were of a perishable nature. Krieger's (2003) account of Cabeza de Vaca's interactions with South Texas Indian groups indicate that foodstuffs were commonly exchanged (e.g., prickly pear fruits [*tunas*], mesquite bean flour; meat), and that the Spaniard traded with the Indians by making them combs, bows and arrows, mats, and nets. During his life among coastal Texas groups, he served as a trader. He took "shells of sea snails and their cores, conches ("with which they cut. . ."), a fruit or bean (still unknown) that was both for cures and for dances and celebrations, and "sea beads." The fruits or beans were the items of greatest value (Krieger 2003:187-188). These were exchanged with interior Texas groups for hides, red ochre, flint for arrow points, glue, canes for arrow shafts, and tassels of deer hair that had been dyed red. This account serves as an example of an active trade network between the coast and the interior. Such a network between the Edwards Plateau and the interior could have involved chert of high quality from the Edwards Plateau (in large biface form). Whether the Edwards Plateau peoples would have been interested in hides, ochre, cane, and deer-hair tassels is hard to say, but there may have been some commodities among these (and other perishables) that were valued by them.

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Prehistoric Archaeological Site Types in the International Falcon Reservoir

James Bryan Boyd

ABSTRACT

I discuss 10 types of prehistoric archaeological sites documented during archaeological investigations in the Falcon Reservoir area. These consist of occupation sites, occupation zones, lithic procurement sites, plant processing sites, stone tool manufacturing sites (ateliers), river mussel harvesting/processing sites, burial and cemetery sites, bedrock mortar and metate sites, rockshelters, and rock art sites. Each site type is described, along with specific examples. The diversity of site types is examined in relation to their setting in this unique area on the lower Rio Grande, encompassing parts of South Texas and northeastern Mexico.

INTRODUCTION

From 1983 to the present, I have conducted nearly one thousand investigations of archaeological sites in the area of International Falcon Reservoir, located on the lower Rio Grande. The study area is a roughly parallelogram-shaped zone centered on Falcon Reservoir (Figure 1), approximately 50 km north to south and 35 km east to west. The reservoir was formed when Falcon Dam was built in the early 1950s. Subsequent flooding of the Rio Grande basin inundated countless archaeological sites, but periodic fluctuations of the water level often expose some of these sites for extended periods of time. Although many have been severely impacted by artificial processes caused by the lake, they have conversely been protected from the ravages of natural erosion and looting until low water levels expose them. Various types of archaeological sites have been extensively documented within the reservoir basin, which lies below the elevation of 301.2 feet amsl (IBWC 1975).

Figure 1. General area map showing South Texas and northeastern Mexico. Falcon Reservoir is located near the center of the map. The study area is delineated by the parallelogram drawn around the lake.

Salvage work performed in some of these sites prior to the construction of Falcon Dam, and the subsequent reservoir inundation, was limited in scope (cf. Cason 1952; Krieger and Hughes 1950; Hartle and Stephenson 1951). Work done in the 1980s and 1990s has also been limited (cf. Davis 1994; Kotter 1980; Saunders 1985; O'Neill et al. 1992), and none of these investigations have defined the multitude of site types in the reservoir area. Indeed, one of the most comprehensive surveys to date was an August

1996 multi-agency survey effort led by the National Park Service and the Texas Historical Commission (see Perttula et al. 1996), but time and budget constraints were prohibitive in the collection of the kinds of data that could provide the formulation of a general model of site typology in the reservoir area. More extensive archaeological surveys at Falcon Reservoir have been completed in the past two years (McCulloch et al. 2003; Parsons and Lopez Garcia Group 2002), along with excavations at several upland sites (Quigg and Cordova 1999, 2000).

The higher areas above the lake are not affected by the artificial conditions present in the reservoir basin, but are constantly affected by natural erosional processes and looting. Some of the archaeological sites in this area are remote enough, however, that they have escaped the hoards of relic collectors that frequent this general area. Salvage and/or survey work conducted by qualified individuals in these areas has been extremely limited in scope, other than the work performed by a few cultural resource management surveys and the efforts of a few dedicated avocational archaeologists. Archaeological work I have performed in these high landform areas on both sides of the reservoir have revealed a wealth of information regarding prehistoric settlement patterns and types of sites encountered there (cf. Boyd n.d.a, n.d.b).

The variety of site types, whether in the reservoir zone or the adjacent high areas on both sides of the Rio Grande, are indicative of a diversified use during prehistoric times. It is clearly apparent that the area was continuously inhabited from Paleoindian through Late Prehistoric periods, as indicated in the recorded artifact types documented from sites there (Boyd n.d.a). This diversity is probably at least partially an effect of the great length of time that the area was occupied and utilized by aboriginal populations. Certainly a considerable diversity in cultural traits must have existed during this 10,000 year period.

Other factors influenced the spatial distribution and character of sites in the region. One of these is that the Rio Grande and Rio Salado were the only reliable sources of water present in this now semi-arid region. The Rio Salado merges with the Rio Grande just west of Zapata, Texas (see Figure 1), and meanders generally southeastward from its source in Coahuila, Mexico, in the area of Cuatro Cienegas. There are presently no permanent or semi-permanent tributary streams that have water, and there is no conclusive evidence that they did in prehistoric times, although it is generally thought that conditions were wetter then. Another important factor is the confluence of two major rivers now near the center of the reservoir basin. In a region where low rainfall and persistent droughts are commonplace (Boyd and Perttula 2000a:6-21), it is no surprise that the confluence of these two rivers enticed the indigenous population to settle along their banks.

It is apparent from the projectile point types recorded in numerous prehistoric sites on the Rio Salado that the river may have served as a migratory route for the peoples that once inhabited the area. Projectile point types that are commonly found in prehistoric sites in the interior regions of Mexico are often found in sites located on the Rio Salado, but often are not found in areas of South Texas, just on the other side of Falcon Reservoir, a distance of only a few km (Boyd 1997a:44-48, n.d.b).

Therefore, the variability of site types in the Falcon Reservoir area is a product of lengthy prehistoric use, as well as the geographic setting of the region. The area may have been settled by large numbers of peoples over long periods of time, with cultural changes probably accounting for some of the variability in site types. The geographic setting of the area, specifically at the confluence of two major river systems, also provided unique ecological conditions that likely were of unprecedented importance in resource availability and density to the prehistoric foragers that lived on the lower Rio Grande/Salado.

THE SITE TYPES

Many prehistoric site types exist in the study area. Each type of site is discussed below, along with specific descriptions and examples of each. Combinations of site types sometimes occur. For example, most of the known cemetery sites occur within the confines of occupation sites. Bedrock mortar sites, rock art sites, etc., also *usually* occur in combination with other site types.

Occupation Sites

This is perhaps the most common site type, as hundreds or thousands of such sites occur within a few km of Falcon Reservoir. In fact, it is often difficult to distinguish where one occupation site ends and another begins. These sites represent the former campsites or "villages" of the prehistoric populations that lived in the region. Some appear to have been extensively utilized over great periods of time, while others appear to have been temporary, or short-term, encampments.

Occupation sites here typically exhibit significant amounts of burned rock and lithic debitage. Burned rock is usually comprised of sandstone cobbles, reddened by heat, and often found in hearths (Boyd n.d.a). The use of chert cobbles as hearthstones is infrequent; chert cobbles were more commonly used as hearthstones to the southeast, west, and north of the study area (Boyd n.d.a). Hearths and burned rock in Starr County, Texas, to the southeast (see Figure 1), had an abundance of chert cobble hearthstones, as they are in the vicinity of the confluence of the Rio Salado and the Rio Sabinas (Tamaulipas and Nuevo Leon, Mexico), an area approximately 40 km west of Falcon Reservoir. Furthermore, hearthstones in sites in Webb County, Texas, are often comprised of chert cobblestones (Boyd n.d.a).

Lithic debitage is usually present in great quantity, sometimes literally in "piles," and often consists of countless numbers of chert flakes of a great variety of colors. Lithic specimens typically are derived from the Rio Grande gravels, but examples of Edwards Plateau chert and other types, including some probably derived from Mexican sources, are often part of the assemblage (Dr. Michael B. Collins, 1996 personal communication). Also common on occupation sites are numerous chert cores and bifacial blanks, and a huge variety of stone tools.

Projectile point types found on occupation sites include both arrow and dart points. Dart point styles recorded include the following types: Abasolo, Almagre, Andice, Angostura, Bell, Bulverde, Carrizo, Castroville, Catan, Charcos-like, Clovis, Darl, Desmuke, Early Stemmed, Early Triangular, Ensor, Fairland, Folsom, Gary-like, Golondrina, Kinney, La Jita, Lange, Langtry, Lerma, Marcos, Marshall, Martindale, Matamoros, Meserve, Nolan, Palmillas, Pandale-like, Pandora, Plainview, Refugio, Scottsbluff, Shumla, Tortugas, Uvalde, Zorra, and several unidentified types (Boyd n.d.a).

Arrow point types found on occupation sites include Bonham-like, Caracara, Cliffton, Fresno, Garza-like, Guerrero, Livermore-like, Maud-like, Perdiz, Scallorn, Starr, Toyah, Young, and Zavala, There are also unidentified types (Boyd n.d.a).

In addition to projectile points, common stone tools found on occupation sites include Clear Fork, Dimmit, Nueces, Olmos, and other types of both bifacial and unifacial specimens. Edge-modified chert flakes, or trimmed flakes, are also extremely common (Boyd n.d.a). Ground stone artifacts, such as metates, manos, and pestles, are often found in these sites.

In the reservoir basin, occupation sites are usually located on terraces above the original riverbed of the Rio Grande, and they are often severely impacted by wave action from the reservoir as well as by the formation of cutbanks and general deflation of the archaeological deposits. Cyclic fluctuations of the reservoir compound these processes. The majority of the sites tend to be located near where tributary arroyos merge with the river (Boyd et al. 1997:389). This is within the conservation pool area of the lake, below the 301.2 feet amsl elevation (see Figure 2).

In the reservoir zone, the majority of occupation sites are located on (or buried in) the Zapata terrace, as described by Evans (1961:39-40), although some are located in the Rosita terrace and on the higher and older Reynosa formation (Evans 1961:38-41). These are remnant terraces of the Rio Grande formed during depositional events beginning several thousand years ago.

Occupation sites are not confined to the lower terrace system of the Rio Grande, but they occur well inland and often dot the landscape along what are now dry arroyos that flow into the river. These dry washes or arroyos can run for several kilometers, and sites are located along both banks, often on the outside curves or meanders of the stream (Boyd n.d.a). These sites may be hundreds of meters in diameter, while others are only a few meters across.

Occupation sites in the high areas overlooking Falcon Reservoir are often severely impacted by erosion (Figure 3). Those on moderate slopes, such as hillsides, are often subject to sheet erosion, exposing

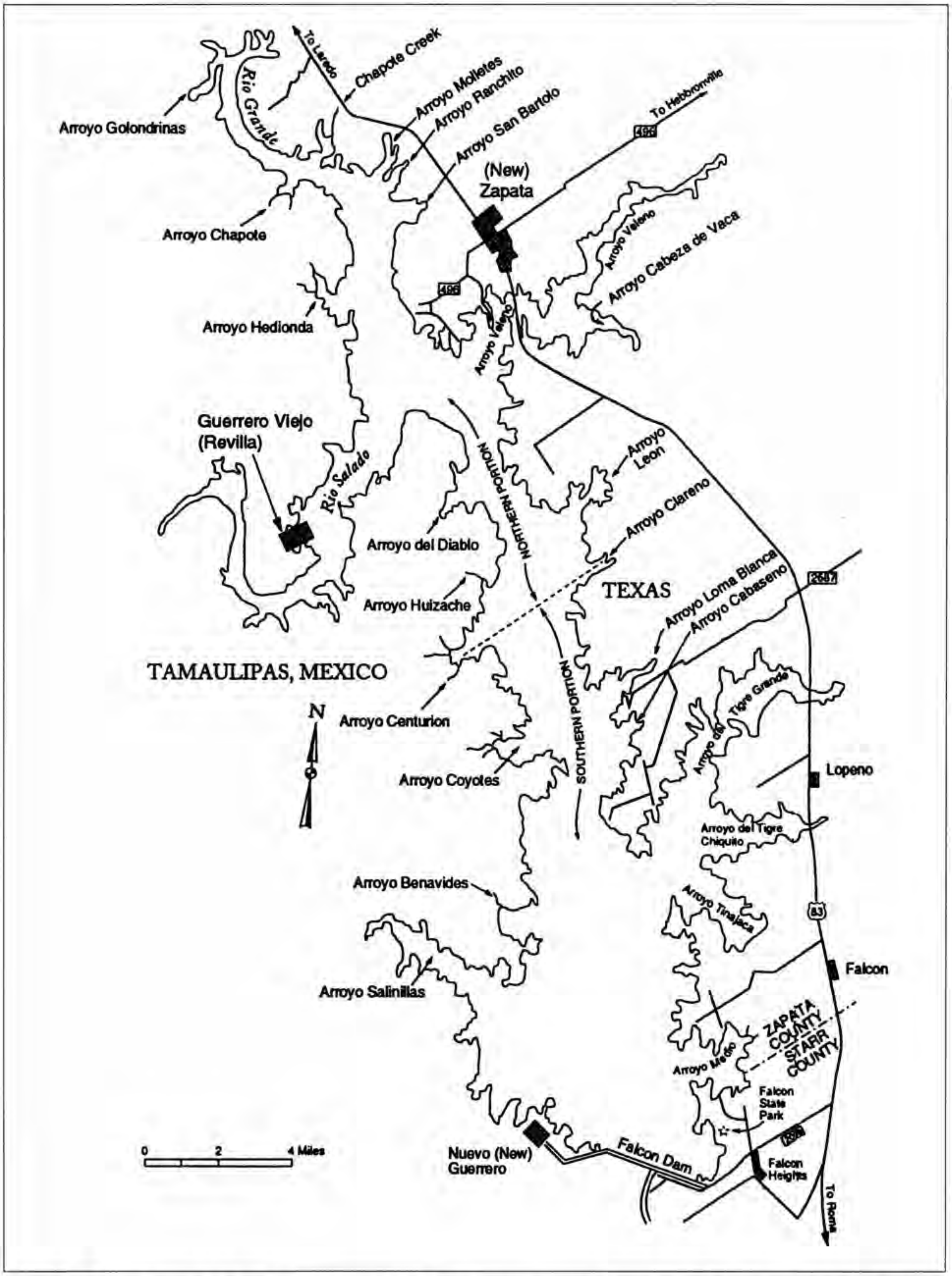

Figure 2. Detailed map of Falcon Reservoir. Most of the tributary arroyos referred to in the text are shown. The lake is shown at its conservation pool elevation, 301.2 feet amsl.

Figure 3. Typical eroding occupation site (SG4-70AG) located near the Arroyo Golondrinas in Tamaulipas, Mexico. Note the sparse nature of the brush and the lack of grasses. Erosion is exposing hearths and other artifacts. View east-northeast. Photo taken on October 19, 2003.

large numbers of artifacts (Boyd 1996a:43-47, 1997b:47-50). Sites located on the banks of arroyos are often exposed to severe erosion during infrequent flash-flooding events (Boyd n.d.a). During such floods, large portions of the arroyo banks often slump into the streambed from the forces of the flood. Thunderstorms in the area during the spring months can often become severe, significantly impacting archaeological sites.

In some areas, particularly near the northern end of Falcon Reservoir, distinctive occupation sites often occur in noticeable clusters or "complexes." These site complexes are usually located in the vicinity of major tributary valleys that merge with the Rio Grande, and are within 1-5 km of the river (Boyd n.d.a). One such site complex, located in the vicinity of the Arroyo Golondrinas (see Figure 2), on the Mexican side of the reservoir, has at least 230 distinctive occupation sites within a 35 square km area (Boyd n.d.a). This site complex, which I have extensively explored during the last 15 years, appears to have been occupied nearly continuously since Paleoindian times. Many of the sites are located along arroyos; others are on hillsides and hilltops, while still others are in the midst of vast, featureless flats. Also, numerous occupation sites are located around the many tinajas, or waterholes, that are found with some frequency in the area (Figure 4). This site complex lies outside of the reservoir, but is immediately adjacent to it, extending 5-6 km inland. This is one of the most extensively utilized areas I have identified during my intensive explorations in the region.

Some occupation sites, like Southern Island on the Mexican side of Falcon Reservoir, are very large in extent and exhibit artifacts spanning a great range of time (Boyd et al. 1997:390). Such long inhabited or continuously returned-to sites appear to have possessed attributes particularly attractive to aboriginal populations. In the case of Southern Island, the site is located on a peninsular-like landform, elevated well above the vega area of the Rio Grande, and was a good vantage point for views both up and downriver.

Figure 4. View of a tinaja, or waterhole at site SG4-20AG, near the Arroyo Golondrinas, Tamaulipas, Mexico. Note the sandstone bedrock floor of the arroyo. Prehistoric sites are often concentrated around such waterholes. Photo taken on October 30, 1988.

It is located at the north edge of the Arroyo Diablo (see Figure 2), a large tributary that merges with the Rio Grande just to the southeast.

Other sites, such as Toyah Hollow, located on the Rio Salado west of Falcon Reservoir, and Voladero Cliffs, on the Rio Grande north of San Ygnacio, Texas, appear to represent short-term occupation sites (Boyd n.d.a). Occupational debris is minimal, and the recorded projectile points indicate that such sites were settled only for relatively short periods of time. In addition to these sites, there are many other similar short-term occupation sites within the study area. However, sites exhibiting evidence that they were repeatedly used over great spans of time seem to be the rule rather than the exception in this area.

Occupation Zones

The term occupation zone was first defined by Hester (1976:85) to describe long, narrow strips (or zones) of occupational debris that occur in many areas of South Texas and northeastern Mexico. Occupation zones are normally located along dry arroyos or riverbanks, and usually denote areas that were favored and/or continuously returned to by prehistoric peoples over a protracted period of time. In such zones, distinctive campsites or components are often difficult to define, and different occupations overlap; sometimes these zones are kilometers in length.

Occupational debris in occupation zones in the area of Falcon Reservoir is very similar to that found in occupation sites. However, there is generally a lower artifact density in the zones as compared to the more easily defined (and often very rich) occupation sites. Generally, occupation zones in the region exhibit nearly sinuous bands of scattered burned rock and lithic debris along creek banks and terraces of many of the now dry arroyos. Occupation zones are also sometimes found along the high ridges and foothills that often parallel the Rio Grande and the Rio Salado.

One example of an occupation zone occurs on the Rio Salado a few km southwest of Zapata, Texas. This occupation zone is located along the top of a series of cliffs on the south bank of the Rio Salado; the zone is several km in length, and continues into the drainage system of a large tributary arroyo. This arroyo system is located directly across the river from the ruins of Guerrero Viejo, Tamaulipas, Mexico (see Figure 2). The density of occupational debris in this particular zone is relatively high; there is much burned rock and lithic debitage. Artifacts recorded in this zone span the period from the Early Archaic through the Late Prehistoric (Boyd n.d.a), and distinctive site boundaries are, in many instances, difficult to discern.

Occupation zones are relatively common occurrences along the Rio Salado, as well as the Rio Sabinas, located just west of the study area, but they also occur along the Rio Grande in the Falcon Reservoir. A good example is the Arroyo San Bartolo (see Figure 2), on the U.S. side of the reservoir, a few km northwest of Zapata, Texas. There is a nearly continuous band of occupational debris scattered along the terraces bordering this large drainage system (Boyd n.d.a).

Lithic Procurement Sites

Lithic procurement sites occur on both sides of the Rio Grande, as well as on the Rio Salado. They are usually on high ridges or the series of hills that usually lie a few km from the river(s), but sometimes they occur on rocky, isolated hillsides located closer to the river (Boyd n.d.a). These sites resemble similar ones located in many areas of Texas, with evidence of extensive testing of chert cobbles and the resultant lithic debitage. Usually no formal tools, such as projectile points, are found; crude bifaces or blanks are infrequent. In many cases there are no nearby occupation sites, although small isolated hearths have been observed in some of the procurement sites (Boyd n.d.a). These appear to represent temporary encampments, possibly overnight, for those who exploited the lithic resources.

Lithic procurement sites are more common along the Rio Grande than the Rio Salado (Boyd n.d.a). This is probably due to the higher amount of chert on gravel terraces and benches in the higher elevations along the Rio Grande. There are numerous procurement sites on the Texas side of Falcon Reservoir, but considerably fewer on the Mexican side. Again, this appears to be because of higher concentrations of lithic resources on the Texas side.

Examples of lithic procurement sites I have identified are located in the Arroyo Ranchito and Arroyo Molletes drainage systems in the northern portion of the reservoir, on the Texas side (see Figure 2). These sites are between 1-2 km from the Rio Grande, and occur on the gravelly hillsides overlooking the tributary valleys. There are numerous occupation sites within short distances of the procurement sites. The rocky hillsides have numerous tested cobbles and moderate amounts of lithic debitage; the hillsides may be part of the Reynosa formation described by Evans (1961:38-39). The procurement sites so far identified in the study area are considerably smaller in extent than procurement sites noted in Webb County, north of Laredo, Texas (Boyd n.d.a).

Another probable source of lithic materials in prehistoric times were gravel beds in the original riverbed of the Rio Grande (and probably the Rio Salado). However, the riverbeds are presently completely submerged by the waters of Falcon Reservoir, and have been artificially capped by thick layers of silt. The local chert sources mainly consist of Rio Grande gravels, although Edwards Plateau cherts are also represented. These Edwards Plateau cherts may have been transported down the Rio Grande by the river from sources in the Trans-Pecos region, but some of this material was probably imported into the area of Falcon Reservoir by prehistoric peoples (Dr. Michael B. Collins, 1996 personal communication).

Hester (1995:430) laments that adequate studies of lithic procurement sites in South Texas have yet to be performed, and that further research is recommended in terms of defining local lithic reduction sequences. Comparisons of these site types with others in adjacent regions will likely yield important data on the production and manufacture of lithic tools in prehistoric Texas and adjacent areas of Mexico.

Plant Processing Sites

There are a few sites, highly specialized in nature, as evidenced in the recorded artifacts. Such sites usually contain other occupational debris, such as burned rock and lithic debitage, but the stone tools present are the Clear Fork variety, although Nueces scrapers are sometimes found (Boyd n.d.a). Turner and Hester (1993:246) date the Clear Fork type as early as the Paleoindian and Early Archaic periods, through the Middle Archaic period. They further state that such tools were probably utilized in woodworking tasks. An earlier study (Hester et al. 1973) also indicated that the primary use of the tool type was probably for woodworking activities. Turner and Hester (1993:267) date the manufacture and use of Nueces biface to the Middle to Late Archaic periods. Although they do not specifically identify it as being used in the processing of plants, they do indicate that its primary use was probably in scraping and cutting activities.

Sites that appear to be primarily used as plant processing locales are rare here, but are found on both sides of the Rio Grande in the northern portions of the Falcon Reservoir area (Boyd n.d.a). The sites are usually small, sometimes only a few meters in diameter. One site in particular, located in the Arroyo San Bartolo drainage system (see Figure 2), a tributary of the Rio Grande in Zapata County, Texas, yielded numerous Clear Fork stone tools, and only a small number of dart points. Large numbers of the tools were found lying on the surface of a very small site located on a high terrace overlooking the drainage system. Other similar sites have been noted on the Mexican side of the reservoir.

The existence of these types of obviously specialized sites may hint at the presence of certain species of plants that were favored for processing in the vicinity of the sites. Micro-wear analysis of the recovered stone tool assemblages, as well as other specialized studies, may help determine what plant resources were worked by the Clear Fork tools.

Stone Tool Manufacturing Sites (*ateliers*)

These types of sites are fairly common, although more prevalent on the Mexican side of the Rio Grande, especially on the Rio Salado (Boyd n.d.a). Although "manufacturing" areas are frequently found in occupation sites (cf. Boyd 1997a:44-48, 1997c:5-10), they also occur singly or as isolates.

Stone tool manufacturing sites usually have large amounts of lithic debitage, and occasionally have numbers of unifacial and bifacial blanks and/or preforms (Boyd n.d.a). Some of these sites have chert flakes in the tens or hundreds of thousands, of a multitude of colors and varieties. The sites range from very small to medium in size, and often occur in small, isolated tributary valleys in the Lomeria zone (see Nunley 1989:195), although they are also present on hilltops and other vantage points overlooking the Rio Grande or Rio Salado drainage systems (Boyd n.d.a). Projectile points are sometimes found in these sites, but only in small numbers.

The largest number of stone tool manufacturing sites is found on the Tamaulipas side of Falcon Reservoir. The sites occur within a "complex" of other site types, and probably represent specialized activity areas by the inhabitants of nearby or adjacent occupation sites. Often these types of sites are distant from the nearest chert sources, or lithic procurement sites, and the raw materials for the manufacture of stone tools had to be transported as far as several km.

Ateliers, or workshop areas, are similar to stone tool manufacturing sites. However, small workshop areas are known on high terraces overlooking the Rio Salado and Rio Grande drainages (on the Mexican side), where the main activity appears to have been the manufacture of arrow points. This is based on both whole and unfinished arrow points that have been recovered from these workshops (Boyd 1997c:5-10, n.d.a). In some cases, the chert flakes in these sites are the same color as the projectile points, apparently being the debitage from the manufacture of the point(s).

River Mussel Harvesting/Processing Sites

This is a newly recognized type of site. Although I had noted this kind of site previously, it was recognized as distinctive during a large-scale survey of sites on the U.S. side of Falcon Reservoir in August 1996 (Dr. Timothy K. Perttula, 1998 personal communication).

These sites have small to large accumulations of discarded mussel shells, but little other occupational debris other than small clusters of burned rock as well as minimal amounts of lithic debitage. Their overall appearance and the minimal amounts of burned rock or lithic debitage hints at their transitory nature. They appear to represent locations where access to the mussel beds in the river or adjacent tributaries was available, and where the mussels were extracted as a food source. It is unknown whether they were consumed in these "processing" sites, or were taken in bulk to nearby occupation sites. The general paucity of occupational debris, when it is present, suggests that the harvesters of the mussels may have camped in those spots overnight, or otherwise for very short terms.

A notable number of such sites were encountered during the August 1996 survey in the Arroyo Clareño drainage system (see Figure 2), which had been exposed by record low water levels at Falcon Reservoir. This is on the Zapata County (Texas) side of the lake. According to Perttula (1998 personal communication), these types of sites were observed and recorded in significant numbers along the banks of the original Arroyo Clareño streambed.

Numerous similar sites have been observed in many areas on the Rio Salado, where tremendous accumulations of mussel shells sometimes occur (Figure 5). Occasionally, lithic debitage (in small amounts) is intermixed with the discarded mussel shells. In a few rare instances, small bifacial "scrapers" have been found in situ in the midst of the shells, apparently the implements utilized in the removal of the soft mussel from the shell(s). Most of the very few scrapers recorded in such contexts are rectangular in form (Boyd n.d.a).

The most common types of mussel shell species noted in these types of sites are Tampico pearlymussel (*Cyrtonaias tampicoensis*) and Washboard (*Megalonaias nervosa*) (see Howells et al. 1996:48-50, 80-83), although other types are infrequently encountered. Indeed, there are several other species of mussel

Figure 5. Eroding mussel shell heap at the Lluvia site on the Rio Salado, Tamaulipas, Mexico, west-southwest of Zapata, Texas. North arrow is visible at lower center. View southeast. Photo taken on December 6, 1992.

identified in the mussel shell harvesting sites, but the large accumulations in the processing sites are usually of the aforementioned two species.

Burial and Cemetery Sites

Prehistoric burials are frequent, and at least six prehistoric cemetery sites are now known in the Falcon Reservoir conservation pool area (Boyd and Wilson 1998:14-15; Boyd n.d.c). All the known prehistoric cemetery sites occur within major occupation sites, as do most isolated burials, although single burials sometimes occur away from the main portions of occupation sites. The burials and cemeteries in this area are probably the most studied category of site type, due to the presence of human remains and their associated grave goods.

Burials in the Falcon Reservoir area were first reported during salvage operations conducted prior to and during the construction of the dam and reservoir (cf. Cason 1952; Hester 1997:4-8). Many other burials have become exposed more recently in the reservoir conservation pool area during low water episodes (cf. Hester 1995:442 and Figure 20; Hester et al. 2000:1-5). To date, Perttula (2001:2-83) has published the most detailed synthesis of prehistoric burials in the South Texas region, as well as other areas of the state. It is likely that many other burials and prehistoric cemetery sites will become exposed at Falcon Reservoir in the future during cyclic fluctuations of the water level.

Isolated burials occur, for the most part, in (or in close proximity to) occupation sites. Most of the known burials have been discovered in terraces overlooking the original Rio Grande riverbed, on both sides of the river, and the majority have been found within the conservation pool area of Falcon Reservoir during low water episodes (cf. Boyd 1996b:42-45, 1997d:8-14, 2000:45-51; n.d.a, n.d.d; Boyd and Wilson 1996:13-17, 1998:11-15). Many of these burials contained burial goods, although a few have been encountered that did not (Boyd n.d.a; Wilson and Hester 1996).

Several other burials have been found in sites on the Rio Salado (Boyd n.d.a). All but one of those burials occurred on the north bank of the river. Furthermore, the Rio Salado burials were discovered as they eroded out of the site deposits. They were not disturbed, and no burial goods were visible at the surface. However, one arrow point distal fragment *was* found in apparent association with the eroding skeleton of one of the burials (Boyd 1997a:47).

Four categories of burials are known in the Falcon Reservoir area: (1) primary inhumations, (2) secondary inhumations ("bundle burials"), (3) cremation burials, and (4) cairn burials. It has yet to be determined whether both primary and secondary inhumations occur in the context of cairn burials.

Primary inhumations, often in the flexed position, are the most common type of burial. The orientation of these types of burials varies considerably, with the heads often pointed either north or south; the burials are often oriented so that they are facing the direction of the river (Boyd n.d.a). A well-known example of a primary inhumation is Burial #3 at the Southern Island Cemetery site, located on the Tamaulipas side of Falcon Reservoir (Boyd et al. 1997:407-409). A burial at the Scissors Island site, on the Tamaulipas side of Falcon Reservoir along the Arroyo Centurion (see Figure 2), was an unusual primary inhumation, because the cranium and leg bones were absent (Boyd and Wilson 1998:11-15).

Secondary burials usually consist of a cluster of bones haphazardly "piled." Often there are significant amounts of skeletal parts missing. Burials #1 and #2 from the Southern Island Cemetery (Boyd et al. 1997:392-407) exemplify the kinds of secondary burials found in the region. An unusual secondary inhumation was investigated in 1995 at the Gull Island site, also on the Mexican side of the lake in the Arroyo Centurion. That burial consisted of the nearly complete cranium and mandible placed on top of the long bones of the skeleton that was eroding out of a small, vertical pit. The long bones had been dropped in, then the skull placed on top (Boyd n.d.a). Another secondary burial I investigated in 1984 at the Toyah 1 site on the Mexican side of the lake south of the Arroyo La Hedionda (see Figure 2) consisted of only a cranium and mandible (Boyd and Wilson 2002:4-11). This burial was unique in that various portions of the cranium exhibited cut marks that were apparently made with chert flakes, possibly the result of a defleshing episode prior to the disposal of the remains.

Only one cremation burial has been documented (Boyd and Wilson 1999:4-7; Boyd and Perttula 2000b:8-9). This burial was discovered in 1986 at an exposed Falcon Reservoir site known as Shumla Camp. It is on the Arroyo Salinillas, on the Mexican side of the reservoir, and near its southern end (see Figure 2). The burial consisted of the charred and fragmentary remains of a single individual with an unusual Caracara arrow point (with a double-notched base) found in proximity to the remains. Cremation burials are rare in the Rio Grande Plains of South Texas (or adjacent northeastern Mexico), and only one has been previously reported (Hester 1984:4, 1989:2-4).

There have been several reported instances of burials in the region being accompanied with Late Prehistoric arrow points. In some instances, the arrow points were determined to have been the cause of death of the individual; in other cases this was not positively determined, but it appears likely to have been the case (Boyd and Perttula 2000b:5-14).

Cairn burials are relatively common. They usually consist of shallowly buried skeletal remains, covered with large sandstone rocks or slabs (Boyd n.d.a). I have recorded several such burials, including one on the Rio Salado. This burial was covered by several large sandstone slabs. It was located along the edge of a dry wash, and erosion had caused some of the slabs to slide or tumble down the embankment, leaving some of the skeletal remains protruding from the side of the wash. Another cairn burial at site IFR-N77, on the Tamaulipas side of Falcon Reservoir, consisted of fragmentary skeletal remains covered by sandstone rocks. A cairn burial at the Scissors Island site, also on the Mexican side of the lake, had skeletal remains covered with approximately 20 sandstone rocks (Boyd 2000:45-51). This burial also had a mortuary offering of over 80 perforated freshwater mussel shells of the Yellow sandshell (*Lampsilis teres*) variety (see Howells et al. 1996:69-71). Another larger cairn of sandstone rocks in the same site was left undisturbed, but it also presumably covers a burial(s). Still another cairn of sandstone rocks was found covering a burial in 2000 in the Arroyo Loma Blanca, on the U.S. side of the reservoir south of Zapata, Texas (Boyd n.d.a; see Figure 2). Additionally, at least two other cairns, comprised of piles of sandstone rocks, have been recorded in the Arroyo Golondrinas site complex near the north end of Falcon Reservoir. One of these was destroyed by looters in the early 1990s, and no other information is available. The other cairn, which may cover a burial(s), lies undisturbed in an isolated site (SG4-130) on an arroyo bank in the same site complex. This cairn was discovered by my young son, Jeremy. Still another cairn that I discovered in the early 1990s at the Antigua site, located on the lower Rio Salado, had been decimated by looters by 1999 (Boyd n.d.a). This site is located a few km north-northwest of Guerrero Viejo, Tamaulipas (see Figure 2). Davis (1994:27-29) reported a cairn comprised of sandstone rocks at 41SR207, a site in northwestern Starr County, Texas, and near the south end of Falcon Reservoir. Although the cairn was not probed, it is believed that it may cover a burial (Mike Davis, 1996 personal communication).

Other cairn-like features have also been recorded on the Rio Salado in Tamaulipas. One such feature consisted of several large sandstone rocks partially stacked to cover a crevice in a large sandstone formation. The rocks had been deliberately stacked to cover the crevice, but the "wall" had partially fallen, or had been knocked down, perhaps by looters. This cairn was possibly a burial place. A peculiar stone alignment in an isolated section of a remote site may be a burial, but this is undetermined (Boyd 1997e:32-36).

Although prehistoric cemetery sites were previously known to exist in South Texas (cf. Jackson 1933; Collins et al. 1969:118-146; Hester 1969:157-166; Taylor and Highley 1995; Lovata 1997), such sites were not known in the Falcon Reservoir area until the mid-1990s. There are at least six prehistoric cemetery sites in the conservation pool area of Falcon Reservoir (Boyd and Wilson 1998:14-15). Of these six sites, three lie on the U.S. side, and three are on the Tamaulipas, Mexico side. All the cemeteries are on terraces of the Rio Grande, and have been exposed by the fluctuating water levels of Falcon Reservoir. The erosional processes involved in the positioning and exposure of these cemeteries have been previously discussed in some detail (Boyd et al. 1997:387-425).

Erosion at the cemeteries has exposed several burials over a relatively short period of time. Many burials were accompanied by various mortuary inclusions; a few of the burials had none. The most complex prehistoric cemetery site, with a total of at least eight documented burials, is the Southern Island site, located just southwest of Zapata, Texas, on the Tamaulipas side of the lake. The burials here yielded a vast array of mortuary inclusions (Boyd et al. 1997:387-425). Evidence collected from this important site indicates that the cemetery dates from the Late Prehistoric period. The majority of the other recognized cemeteries also apparently date from this period, although Archaic period burials in cemeteries are also known. For example, a burial from the Toyah 1 site, on the Tamaulipas side of the lake north of the Rio Salado, had 50 large triangular bifaces (see Hester 1995:442 and Figure 20; Hester et al. 2000:1-5).

Many of the burials, including those from some of the prehistoric cemetery sites (most notably the Southern Island cemetery), were accompanied by artifacts, made from bone (both animal and human), chipped and ground stone, and shell (marine and river mussel). The marine shell ornament mortuary assemblage indicates that trade or transport of such artifacts (or at least the raw shell material) was ongoing between the aboriginal population of the Falcon Reservoir area and the peoples of the Brownsville complex of the Rio Grande Delta region of far southern Texas during the Late Prehistoric (Boyd 1998a:41-47, 1998b:8-13; n.d.e; Boyd et al. 1997:420-421).

Prehistoric cemeteries in settings away from the reservoir have yet to be identified. This may be due in part to differences in erosion and exposure. The cemeteries in the conservation pool area have been exposed more by lake erosion. Since such conditions do not exist in the upland regions, erosion is less pronounced. Erosion in the higher elevations occurs mainly from rainfall, of which there is little in this semi-arid region. Also, the reservoir provides an artificial cap over the resources of the lake, including the cemeteries, that may protect those resources when the water levels are high. Once a burial erodes out in a surface camp in the higher areas above the reservoir, the feature is subject to the ravages of natural forces, such as sunlight, scattering by wind and rain, and general rapid decay. Other artificial forces help to destroy burial features in the upland, including trampling by cattle and removal from the site(s) by looters. Therefore, prehistoric cemetery sites may occur in areas away from the lower terraces of the Rio Grande, but conditions are not generally conducive to their being located.

In the long term, it is likely that more prehistoric cemetery sites will become exposed in the Falcon Reservoir conservation pool area as the water level continues to fluctuate, slowly eroding or deflating site deposits. Prehistoric cemetery sites in the upland regions may eventually be identified, however, if proper conditions exist.

Bedrock Mortar and Metate Sites

Bedrock mortar and/or metate sites are infrequent, as only five are known. The main reason for their infrequency is probably that there are relatively few exposed bedrock surfaces in desirable locations. The function of these types of sites is obviously the processing of some type(s) of plant as a food resource, and stone pestles, implements used with bedrock mortars, are commonplace (Boyd n.d.a; Chandler and Kumpe 1996:24-35). Mano stones are even more common (Boyd n.d.a).

There are three bedrock mortar sites within the main conservation pool area of Falcon Reservoir, all on the Tamaulipas side. The northernmost site is located a few km northwest of the city of Zapata, Texas, just south of the Arroyo La Hedionda (see Figure 2). This site has 23 bedrock mortars and 17 bedrock metates (Boyd 1996c:17-23). This complex site is on an exposed sandstone bedrock surface a few hundred m west of the riverbed of the Rio Grande, and is exposed when the water level of Falcon Reservoir is very low. The bedrock surface also exhibits several deep abrading marks, and several large sandstone abrading stones have been recorded there (Boyd 1997f:30-33). Several very specialized types of activities were obviously carried out at this site.

The second complex bedrock mortar site in the reservoir is located on the south bank of the Rio Salado, in Tamaulipas, Mexico, a few km southwest of Zapata, Texas. This site has numerous mortars in a complex cluster of huge sandstone boulders (Figure 6) high above the original riverbed of the Rio Salado. The site is also exposed during low water episodes at Falcon Reservoir.

Figure 6. Bedrock mortars on top of enormous boulder exposed by dropping water levels at Falcon Reservoir, Rio Salado, Tamaulipas, Mexico. View south. Photo taken in 1989.

The third reservoir bedrock mortar site is located in a thick sandstone ledge on the south bank of the Arroyo Salinillas, near the south end of the reservoir (see Figure 2). Several deep mortars are exposed in the ledge during low water levels (Boyd n.d.a).

Another bedrock mortar site is several km upstream on the Rio Salado, and has only one mortar feature, located in the sandstone bedrock of the river channel of the Rio Salado. The feature is often submerged by the river, and is also exposed during low water levels. It is in the area of a low water crossing of the Rio Salado, and in close proximity to several major occupation sites (Boyd 1996d:87-90).

The fifth bedrock mortar site is near the junction of the Rio Salado and the Rio Sabinas, about 50 km west-southwest of Zapata, Texas (see Figure 1), in Nuevo Leon, Mexico. This places it just outside the study area. This site has several mortars at the top of a mesa-like hill. The hill is largely composed of sandstone and is surrounded by numerous occupation sites.

There are several exposed bedrock (sandstone) surfaces in the general area that would have made ideal surfaces for bedrock mortars and metates, but no such features were found. The absence of such features in these locales suggests that there were no desirable plants to be processed in proximity, and/or that such technology was not being utilized when the adjacent site(s) were being occupied. The five known bedrock mortar and metate sites are located within a few hundred meters, at most, from occupation sites.

Dating of the bedrock mortar sites is not presently possible. Components of nearby occupation sites indicate lengthy occupations, sometimes spanning thousands of years. Stone pestles, probable implements used in bedrock mortar sites, are, however, often found in those sites with significant Late Prehistoric components (Boyd n.d.a).

Rockshelters

My long-term explorations of archaeological sites have identified no rockshelters on the Texas side of the Rio Grande other than one small overhang at 41ZP8, although several have been found on the Tamaulipas, Mexico side. Several of these rockshelters were used during prehistoric times. In a few instances, some of these rockshelters exhibit rock art (see below). In most cases, the rockshelters are located within the confines of a larger occupation site.

The one small shelter or overhang at 41ZP8, just west of Zapata, Texas, consists of a very shallow overhang in a sandstone ridge high above the Rio Grande. The shelter is centrally located in what appears to be a "workshop" or special activity area where there are numerous abrading marks in the sandstone outcropping, as well as in large rocks and boulders. A large sandstone boulder immediately in front of the overhang has several wide and deep abrading marks (Figure 7). The adjacent main occupation area at 41ZP8 has yielded large numbers of artifacts dating from Paleoindian times to the Late Prehistoric (Boyd n.d.a; Jim and Cynthia Scott, 1985-1998 personal communication).

Figure 7. View of shallow rockshelter in upper level of 41ZP8, an extensive occupation site with deeply stratified terrace deposits in Zapata County, Texas. Arrow denotes large sandstone boulder with deep abrading marks. View east. Photo taken on December 12, 1998.

Some of the known rockshelters on the Mexican side are on the Rio Salado. Limited testing in one of them (Boyd 1999a:18-23) yielded numerous artifacts, including modified chert flakes, broken bifaces, and lithic tools. This shelter is actually an overhang underneath a sandstone ledge. The shelter is within the confines of a large prehistoric site occupied from the Early Archaic through the Late Prehistoric. A partially collapsed stacked-rock wall of unknown age is located along the north edge of the shelter.

Other rockshelters located on the Rio Salado include one large shelter or cave at the Vulture Hill site (Boyd 1999b:9-17), a few km to the west. This site is on a remote and desolate hilltop capped with huge boulders and sandstone ledges, in which there are several overhangs and rockshelters, some of which contain rock art (see below). The largest of these shelters is Vulture Cave, large enough to have housed several individuals and provide adequate shelter. A cursory examination of the cave showed chert debitage in the deposits, as well as abrading marks and faded rock art on the walls and ceiling.

Several small rockshelters have been located in the Arroyo Golondrinas archaeological site complex, located on the Tamaulipas side of Falcon Reservoir. Limited testing in one (SG4-73AG) recovered significant amounts of chert debitage and a small number of Late Prehistoric arrow points (Boyd n.d.a). Another larger, nearby shelter had already been dug by the time I discovered it in the early 1990s. According to a local informant, a small number of triangular dart points believed to be Tortugas points were recovered (by hand) from just under the surface of the original deposits during the early 1980s. It was apparently sometime after this that a large part of the remainder of the deposits was removed by unknown persons. This shelter also has several deteriorated pictographs and some eroded petroglyphs (Boyd n.d.a; see below for additional details on SG4-89AG).

There are also several small rockshelters and overhangs located along the course of the Arroyo El Salado. It is particularly rocky, and there are many sandstone outcroppings and cliffs that provide suitable conditions for rockshelters. This large arroyo is located on the Mexican side of Falcon Reservoir, between Zapata and San Ygnacio, Texas, and has yet to be fully explored.

Rock Art Sites

Until several rock art sites were discovered in the early 1990s (e.g., Boyd 1999b:9-17, n.d.a), such sites were unheard of in the Falcon Reservoir area. The nearest known rock art sites on the Texas side of the Rio Grande are 41WB56, a pictograph site located in extreme northwestern Webb County, Texas (Hester 1986:2-4), some 130 km to the north, and a petroglyph site at 41DM124 a few km to the east. My search for rock art sites on the Texas side of the Rio Grande found no rockshelters, and the few overhangs encountered were too shallow to have preserved rock art.

On the Mexican side of the Rio Grande, however, there are numerous rock art sites known in the Sierra Madre Oriental, a mountain range that lies 100-200 km west of the border, but on the Rio Grande Plain such sites were virtually unknown. One well documented site, El Fronton de Piedras Pintas, consists of numerous deeply carved petroglyphs on large sandstone boulders near the crest of a low hill on the Rio Sabinas (Morales 1983; Trevino 1996:83-85). The site also has some unusual pictographs in a small rockshelter that were first noted during a trip to the site in 1992 by Mike Krzywonski and I (Boyd n.d.a). The pictographs were briefly mentioned by Trevino (1996:85).

During the early 1990s, I began a large-scale search for rock art sites in the region on the Rio Grande Plains, particularly on the Mexican side of the river. The first site found was a small rockshelter in the Arroyo Golondrinas archaeological site complex

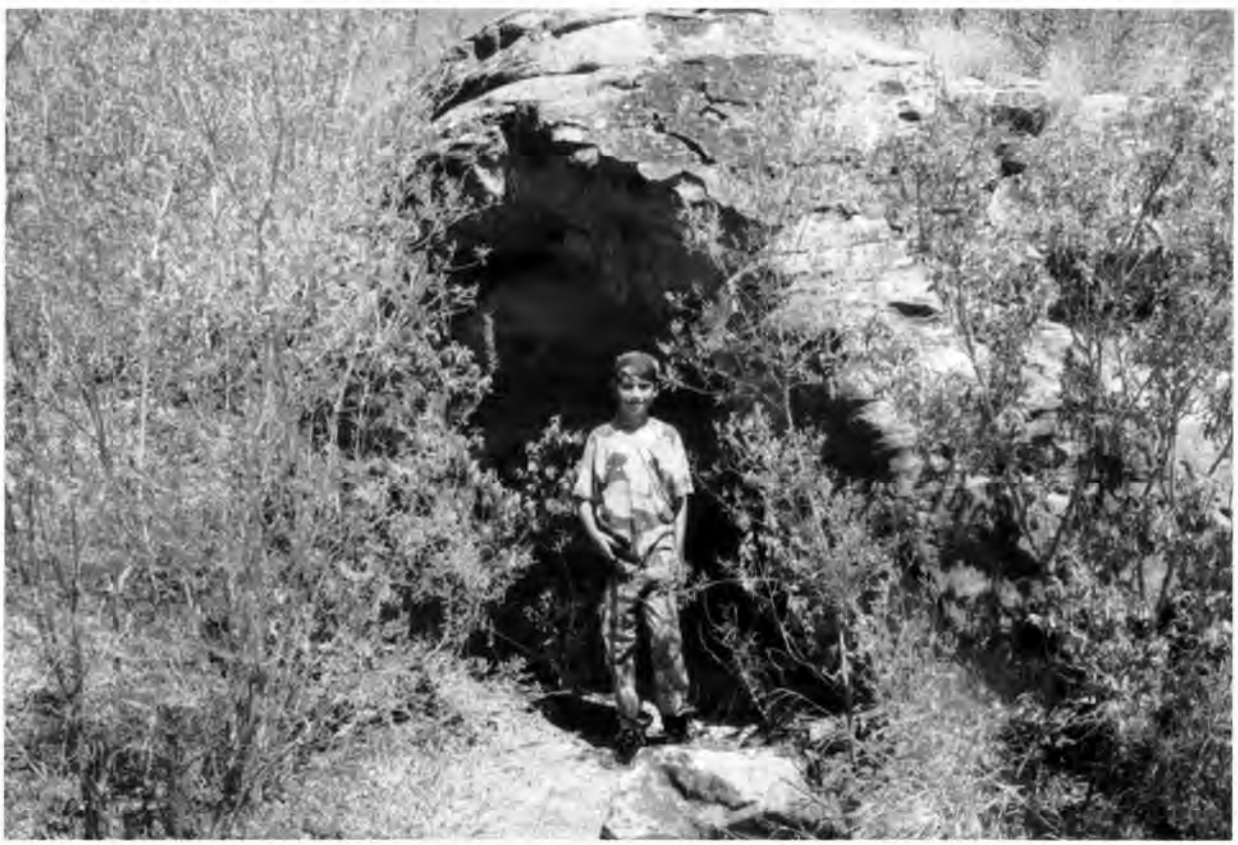

Figure 8. View (east) of the SG4-40AG rockshelter near the Arroyo Golondrinas in Tamaulipas, Mexico. Author's son is standing near the entrance to the cave. This site contains faded pictographs and abrading marks. Photo taken on August 12, 1999.

that had red pictographs on the ceiling (Boyd n.d.a). This site was designated SG4-40AG (Figure 8). The cave is located in a large site complex, approximately 3-4 km from the Rio Grande, and several km northwest of Zapata, Texas. The pictographs consist of a few geometric shapes and several lines, painted in red. There are also a few abrading marks on the sandstone walls of the shelter. The shelter has a bedrock floor and retains no signs of former occupation, although it is large enough to have provided temporary shelter for a small number of people.

As noted earlier, another larger, nearby cave was later found and designated SG4-89AG. This cave, still awaiting formal recordation, is remarkable for the fact that it has both pictographs and petroglyphs (Boyd n.d.a). The most striking pictographs are in a small panel on the rear wall, where three anthropomorphic figures, one wielding a bow and arrow, appear to be in pursuit of a bison (Figure 9). The other two anthropomorphs appear to be carrying spears. These pictographs are rendered in maroon, perhaps drawn with red ochre. Unfortunately, there is some graffiti on the walls of this cave in the form of names and initials scratched into the sandstone. The pictograph panel, which is quite fragile, has been slightly damaged by this graffiti. Several other apparently older pictographs are located on the ceiling of the cave. They resemble a "Maltese Cross," another cross, an arrow or dart point, and a small geometric motif. All of these are red in color, but there is also a very small, faded pictograph (unknown motif) rendered in black. Other even more deteriorated pictographs are present in the shelter. Several weathered petroglyphs, including carved lines, cross-hatching, and V-shaped designs are located on a large boulder at the mouth of the cave. Additionally, there is a chevron-like petroglyph on the ceiling.

Between 1991 and 1995, a total of four more rock art sites were found at a site on the Rio Salado, several km to the west-southwest of Zapata, Texas.

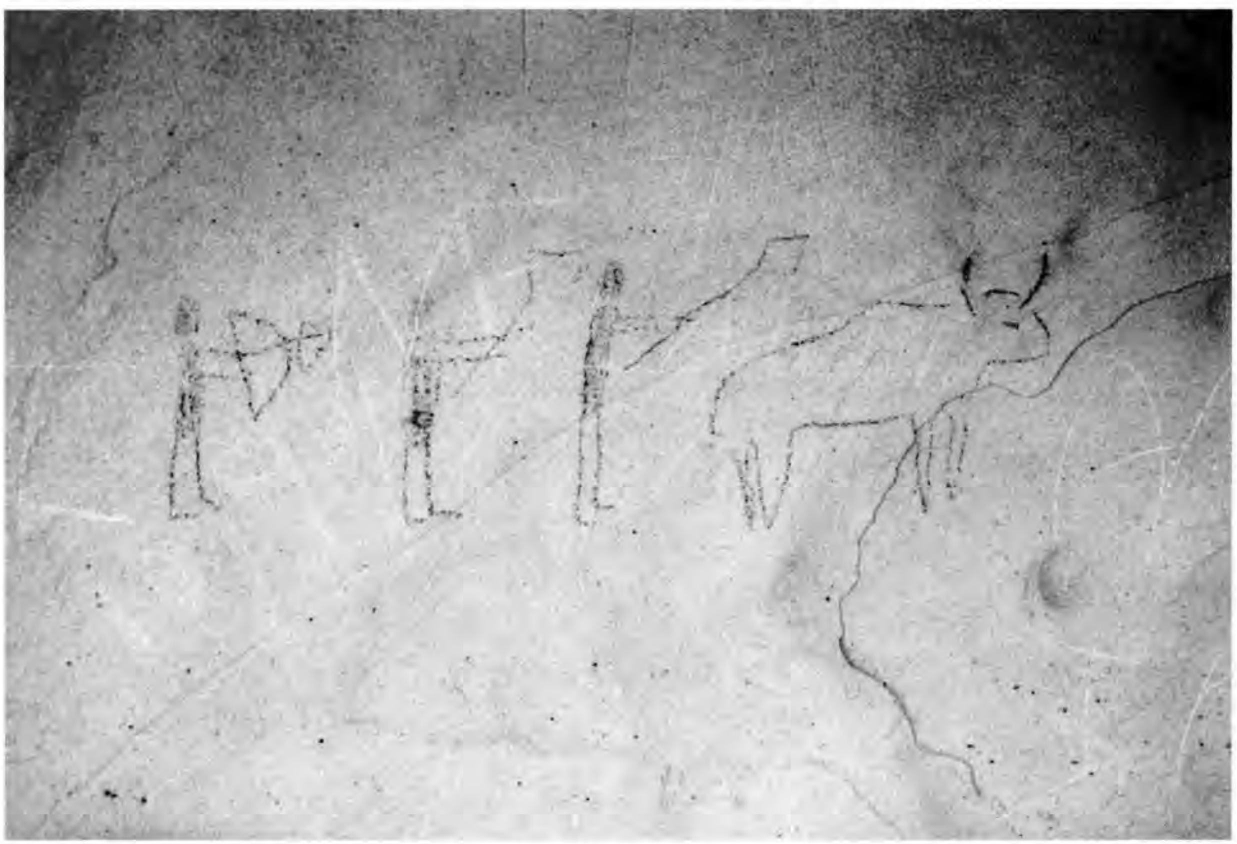

Figure 9. Photograph of pictograph panel at the SG4-89AG rockshelter near the Arroyo Golondrinas in Tamaulipas, Mexico. Panel measures 80 cm across and 29 cm high. Photo taken on March 2, 1999.

The site is known as Vulture Hill, and it consists of several overhangs, rockshelters, and crevices located in a complex of huge sandstone boulders and sandstone bedrock located along the top of an isolated ridge. Four of these small shelters contain rock art, namely pictographs rendered in red and black (Boyd 1999b:9-17).

The first shelter with rock art had an unusual pictograph: three red dots connected by a slightly curved line (Boyd 1999b:11-13 and Figure 4). There are also several red "X" marks and short, parallel red lines painted on the walls and ceiling of this small rockshelter, which could have provided temporary shelter only for two to three people for a very short time. All of the pictographs appear to have been *drawn* onto the walls and ceiling, with the exception of the unusual dotted motif, which appeared to have been *painted*.

The second Vulture Hill rock art site is in a large cave (Vulture Cave; see above), by regional standards, that exhibited definitive signs of former occupation. Although the roof of this cave was spalling badly, there were remnant, indistinct pictographs rendered in black. They consisted of a few lines and other indistinct shapes. The pictographs appeared to have been drawn, rather than painted, onto the rock surface. This cave also had abrading marks on the walls (Boyd 1999b:11-13 and Figure 5).

The third rock art site at Vulture Hill is a very small recess, or overhang, underneath a huge sandstone boulder. In this recess—that could have only provided very temporary shelter to a single person—there are numerous red "X" marks, mostly in rows, and short lines rendered in red (Boyd 1999b:12). They are reminiscent of those in the first rock art site found at Vulture Hill, but are much more numerous. Again, the pictographs appear to have been drawn onto the rock surface.

The final Vulture Hill rock art site is in a small crevice in a huge sandstone boulder. The opening is too small to serve as a shelter; it could have been only utilized as a rock art site. The rock art in this opening consists of outlined linear motifs of various shapes, including a chevron, rendered in red (Boyd 1999b:12-14 and Figure 6). The pictographs appear to have been drawn onto the rock walls, most probably with a red ochre crayon-like implement. Nodules of red ochre have been observed on Vulture Hill (Boyd n.d.a). The pictograph panel at this site is the most complex in the Vulture Hill rock art sites.

In 1999, while exploring an isolated outcropping of sandstone near the Arroyo Golondrinas (see Figure 2) on the Mexican side of Falcon Reservoir, my son Jeremy discovered another small petroglyph site (SG4-190AG). This petroglyph is comprised of 15 wide (greater than 0.5 inches) and deeply grooved lines carved in the sandstone wall of a tiny overhang (Boyd n.d.a). The overhang is too small to provide shelter other than for a single individual seeking refuge from the afternoon sun. Although there were no deposits on the solid bedrock floor, lithic artifacts were noted on the sandy terrace directly in front of the site.

SUMMARY AND CONCLUSIONS

The 10 site types within the Falcon Reservoir area, as defined herein, are quite diverse and complex. The function of occupation sites is clear, although they are variable in terms of the occurrence of burials, stone tool manufacturing areas, and rockshelters sometimes found within them. Indeed, determining what is an occupation site, versus an occupation zone or site complex is quite challenging, and will probably not be resolved until much more archaeological research is done in this region. Occupation zones or site complexes appear to be areas where a combination of plentiful natural resources and geography induced prehistoric peoples to return repeatedly to the same area. This repetitive use of the same geographic region often resulted in a clustering of occupation sites, sometimes in the overprinting of one occupation over part (or all) of another at the same sites.

Lithic procurement areas are found in quantity. Some of these are extensive, but detailed studies of them have not been performed to date. This is because these types of sites are overshadowed by the more visually spectacular classes of sites (e.g., occupation sites, burials, etc.) that are found in the area.

Few sites have been identified in the Falcon Reservoir area where plant processing seems to have been the primary function. This may be because such sites are easily lost or overlooked amongst the vast archaeological resources that have been encountered in the region. Further, detailed work in the area will most likely identify other similar kinds of sites.

Although stone tool manufacturing sites are often found as a component of occupation sites, they are also found as a distinctive site type. Such sites vary considerably in size, from very large to quite small workshop areas or ateliers, sometimes appearing to have been utilized by only one person during one manufacturing episode. The study of associated lithic technologies in these types of sites will be of great value in the interpretation and understanding of the other classes of sites in the general area.

River mussel harvesting/processing sites are the newest recognized site type in the Falcon Reservoir area. These functionally discrete sites appear to be relatively rare, but continued explorations may indicate otherwise. The use of river mussels as a major food source by prehistoric peoples in the Falcon Reservoir area is readily apparent, based on both the presence of these types of sites as well as the huge mussel shell middens in many nearby occupation sites.

Prehistoric burials are often found in occupation sites at Falcon Reservoir, although they are occasionally found as isolates. Most burials are single interments, although several prehistoric cemeteries have been tentatively identified. Numerous examples of both primary and secondary burials have been documented in the region, and a few unusual burials like the Toyah 1 burial (skull only) have also been recorded. Primary burials almost always consist of flexed skeletal remains. Cairn burials seem to be relatively common in the region, as demonstrated in numerous examples that have been documented, while only one cremation burial is known.

Included in the mortuary offerings found with Late Prehistoric burials in the area are marine shell artifacts exhibiting technologies affiliated with the Brownsville complex of the lower Rio Grande delta. The implication of this is that either trade or direct transport of the raw marine shell to the Falcon Reservoir area was occurring during the Late Prehistoric, or that the completed artifacts or ornaments, already fashioned, were traded or brought into the area. Still unanswered is who was doing the trading? This is likely a question that may be partially answered by the continued study of prehistoric burial sites and associated mortuary inclusions of the former prehistoric inhabitants of the area, and a general overview of their mortuary practices.

The occurrence of bedrock mortar and metate sites in the region is quite rare. Even though only five such sites are known in (and near) the study area, others may be found with further investigation. Although the function of these sites seems clear, the small number of them in a region where ground stone artifacts, namely mano stones and pestles, are common, is puzzling.

The utilization of rockshelters or caves, where they occur, seems to have been popular with the prehistoric population. While only one formerly utilized shelter has been recorded on the U.S. side of the border in the Falcon Reservoir area, several have been identified and tested on the Mexican side. The presence of more rockshelters on the Mexican side seems to be due, at least in part, to differences in geography and geology along the Rio Grande and Rio Salado. Perhaps future aerial surveys will reveal more rocky outcroppings where additional previously occupied rockshelters or shallow caves may be found.

The rock art in the region is sparse, and does not conform to any clearly established styles that have been defined in other areas of Texas or adjacent parts of Mexico. It is likely that there are more rock art sites still to be found, and when they are, perhaps a more comprehensive picture will emerge as to their origin and/or classification. It does appear to be the case that rock art was a common cultural trait of the aboriginal population of adjacent parts of Texas and Mexico, and that such art was rendered in virtually any place (although rare) where the medium to preserve it existed.

It is clear that at least two factors are responsible for the diversity of site types in the Falcon Reservoir area. One is that the region was inhabited more-or-less continuously since the dawn of human history in the area, a period of more than 10,000 years. Over such a long period, it is highly likely that the indigenous populations would have experienced periodic changes in their cultural traits and settlement/subsistence patterns, and these changes would have manifested themselves in the diversity of site types found here.

For the region to have sustained what appears to have been a continuous (or nearly so) aboriginal population, environmental factors must have been favorable over long periods of time. These must have included availability of water, game, and other natural resources necessary for the existence of the indigenous population, such as lithic and plant resources. Certainly the presence of the two major river systems, the Rio Grande and the Rio Salado, was an important consideration in the use of the area over the long-term. There is also evidence that the Rio Salado, originating far to the northwest, may have been a migratory route for the aboriginal populations of the area, and that lithic technologies, cultural traditions, and other material culture traits moved along the river's course with the peoples. With such a diversity of site types, it appears that the area around the confluence of the Rio Grande and Rio Salado was a hub of human activities during much of the prehistoric era.

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The Allison Site (41NU185): Limited Investigation Along the Bluff Line Above the Nueces River, Nueces County, Texas

Samuel D. McCulloch

ABSTRACT

Shovel testing in the northeast corner of the Allison site (41NU185) uncovered concentrations of several species of shellfish remains along with chert debitage, ceramics, bone, probable modified sandstone nodules, and baked soil. Correlation of shellfish habitats with reported changes in estuary levels during the Holocene are used to suggest several environmental periods represented at the site. Based on environmental conditions and archaeological remains, six occupation periods are suggested at the Allison site, four that are Archaic in age. A Late Prehistoric occupation is indicated by a Perdiz arrowpoint and Rockport ware ceramics. Another occupation dates to the late 19th century.

INTRODUCTION

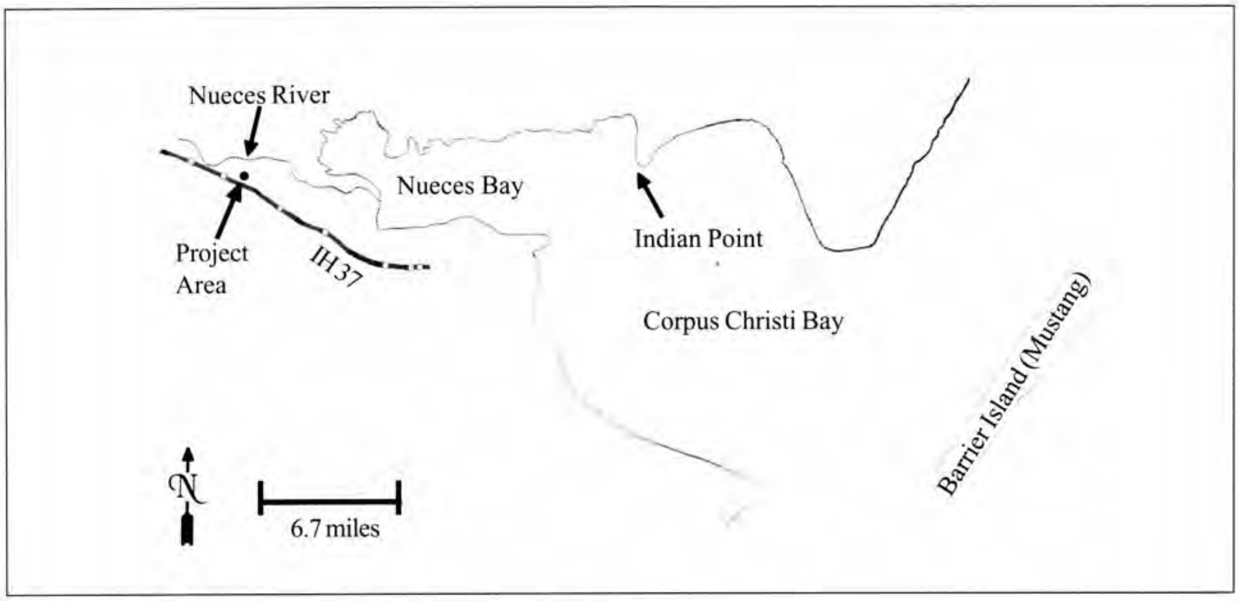
The City of Corpus Christi, Texas, manages the Allison Wastewater Treatment Plant, located about 16 km to the northwest at the edge of a terrace overlooking the Nueces River (Figure 1). The City planned in 2000 to double the Plant area along the terrace edge westward within the boundaries of a previously recorded site (41NU185). In accordance with the Antiquities Code of Texas, Urban Engineering, on behalf of the City of Corpus Christi, requested that Archaeology Consultants, Inc. (ACI) investigate this site and its archaeological deposits within the project area.

Primary fieldwork was conducted in April and May 2000. A considerable amount of archaeological materials were found despite relatively little excavations, and the State of Texas (Texas Historical Commission) determined that the fieldwork demonstrated that this part of the Allison site (41NU185) was eligible for listing in the National Register of Historic Places and for designation as a State Archeological Landmark. It was also recommended that the City of Corpus Christi should avoid expansion into this area, because continued expansion of the Treatment Plant as planned would necessitate a considerable amount of additional fieldwork to further investigate the site. Consequently, new plans were developed for expansion of the Plant toward the south as a separate project. This article is based on data derived from the investigation detailed in McCulloch and Warren (2002).

PROJECT AREA AND WORK ACCOMPLISHED IN 2002

The Allison Treatment Plant is situated at the north edge of the brush-covered uplands on a Pleistocene-age terrace above the Nueces River (Figure 2). The project area was about 122 x 122 m in size. A narrow grass-covered strip lays adjacent to the west fence of the treatment plant (Figure 3). The north edge of the project area consisted of the valley wall at the edge of the bluff line. Most of the project area was covered by dense vegetation, essentially impenetrable.

Although archaeological investigations in the past indicated that there are at least three cultural components within this part of the Allison site, those investigations were confined to a small part of the project area (Carlson et al. 1982; McCulloch and Warren 1996). Consequently, the ACI effort in 2002 was to involve a systematic survey of the entire plant expansion area, including surface reconnaissance, backhoe trenching, shovel testing, and, as appropriate, hand-excavated test units. It was intended that limited hand-excavated test units would be used to evaluate the character of the archaeological deposits found in the shovel tests and backhoe trenches; however, due to



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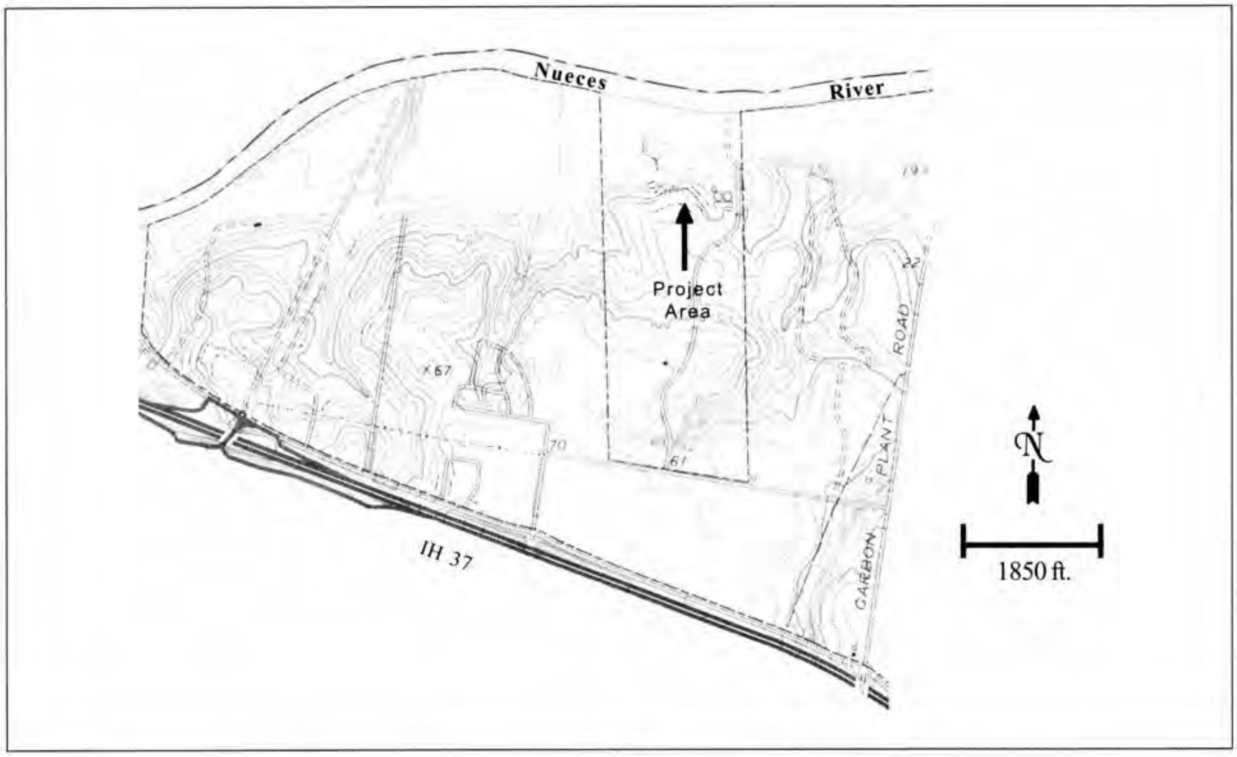

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Figure 1. Maps showing the location of the Allison site: a, map showing relationship between project area, the Nueces River, Nueces Bay, Corpus Christi Bay, and Mustang Island; b, map of the project area, along bluff line overlooking the Nueces River.

Figure 2. Northeast corner of project area, with Nueces River and floodplain in background. The Allison Treatment Plant is to the right of photograph.

Figure 3. Establishing grid lines in dense brush at the Allison site.

the change in expansion plans mentioned above, no further excavation work was done.

NATURAL ENVIRONMENT

The project area is within a part of the Texas coastal region described by Hatch et al. (1990:2, 11-12) as an inland prairie, originally a tall grass and oak savannah. The largest river in the region is the Nueces, which flows eastward just to the north of the site, emptying into Nueces Bay, beyond which is Corpus Christi Bay, Mustang Island, and the Gulf of Mexico. The Gulf of Mexico is about 45 km to the southeast, beyond the bays and Mustang Island (see Figure 1a).

Most of the project area lies about 10 m above the modern Nueces River floodplain on a dissected Pleistocene fluvial terrace. The geoarchaeological investigation conducted by Dr. Frank Huffman (Huffman 2002) concluded that the terrace is underlain at a shallow depth by Late Pleistocene strata, probably the Deweyville Formation, and did not contain archaeological materials. As shown by Figure 4, the east-central portion of the area has a slight north-south rise that slopes east-west and forms a gentle north-facing topographic nose. This suggests the original fluvial surface probably was more nearly horizontal, but was later modified by erosion and colluvial deposition. Erosion is clear in the west-central part of the area, where several north-draining gullies cut into the terrace.

The period of possible human habitation includes the last part of the Pleistocene epoch and all of the Holocene. It appears that the Holocene climate began to gradually change from the more mesic conditions at the end of the Pleistocene to the more xeric, semi-arid conditions that exist today. However, there have been numerous fluctuations in this general trend, including wet and dry periods and warm and cold periods. These may have lasted for up to several hundred years or more (cf. Antevs 1955; Baker and Penteado-Orellana 1977). The paleo-hydrology probably also fluctuated throughout the Late Pleistocene and Holocene. While the glaciers of the Late Pleistocene covered much of the northern United States, a pluvial period occurred to the south, with resulting heavier rainfall and greater stream flows (Antevs 1955:325-327). During the Early Holocene, in particular, as well as at other times, the Nueces River and its tributaries probably exhibited a more persistent flow and greater volume than in recent times. These massive stream flows, as well as dropping sea levels (Brown et al. 1976:19), gouged out wide valleys along rivers such as the Nueces, leaving older terraces at

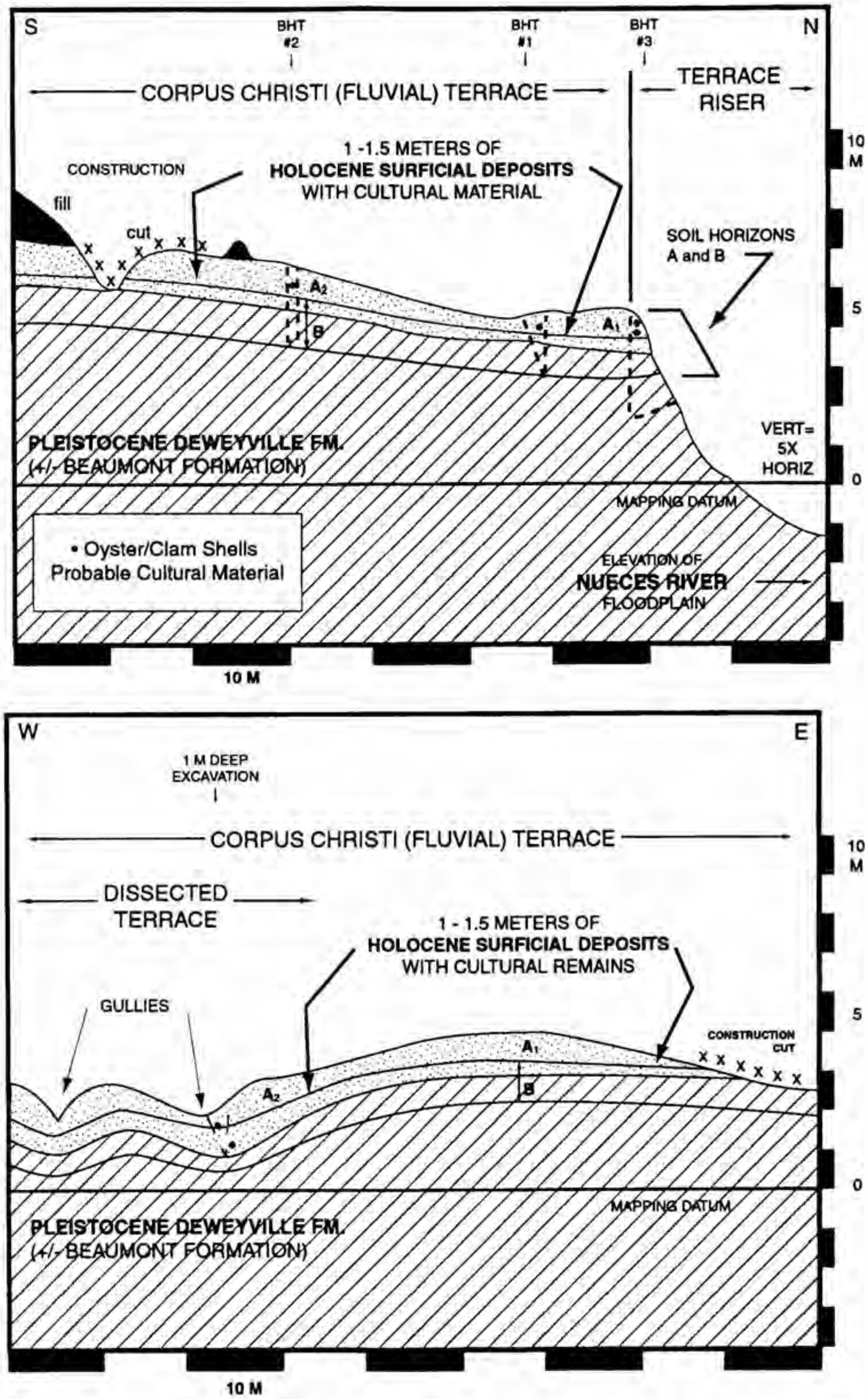

Figure 4. Geoarchaeological cross-sections of the project area. Vertical exaggeration is 5X. See Figure 5 for the location of cross-section lines.

some distance from the modern river channels when the waters receded.

As the glaciers melted, sea level rose, causing the Gulf of Mexico to cover current coastal areas. However, this sea level rise did not occur at a steady rate, and there were four periods of stillstand, the last occurring from 10,000 to 7500 years B.P. (Brown et al. 1976:21). The present configuration of the Central Texas coast, including the barrier islands and the protected bays and estuaries, was established approximately 2800-2500 B.P. As a result of the last stillstand, the Nueces valley contained estuarine waters several miles upstream from the Allison site. This relatively slow change in the salinity of the river would have resulted in very different habitats near the site at different times. This is reflected in concentrations of clam, mussel, and oyster shells found during the archaeological investigations, when brackish or even marine waters from the bays and estuaries moved further upstream from their present locations. The marine faunal species are typically replaced by freshwater forms when the transition occurs from high salinity marine waters to the freshwaters of the river (Smith 1990:884). Sediments from shallow, low-salinity estuary waters may contain the clam *Rangia* sp. (Smith 1990:885). Associated floral communities also vary with changes in adjacent waters (Smith 1990:886-891).

PREVIOUS INVESTIGATIONS

A number of sites have been recorded within the uplands south of the river near the Allison site. This site was recorded by archaeologists from the Texas Department of Water Resources in 1981, who observed two archaeological zones along the north wall of the terrace. Carlson et al. (1982) conducted limited test excavations at the site. The three test units and several posthole tests recovered shells of *Rangia* sp., oyster, and angel wing, fish otoliths, a small number of pottery sherds, a few chert flakes, burned clay balls, deer bone, and a probable bison bone (Carlson et al. 1982:23). Three cultural components were thought to be present: Archaic, Late Prehistoric, and a Historic component that dated to the middle to late 19th century. McCulloch and Warren (1996) conducted a second investigation in the same part of the site. Only one of three shovel tests contained any artifacts, including lithic debitage, a few sherds of Rockport ware, shell, and bone.

Of particular importance to our understanding of the Allison site is the McKinzie site (41NU221), situated on the same upland terrace formation but east of the treatment plant. Robert A. Ricklis recorded the site in 1984. He later directed excavations there, finding archaeological materials from three cultural zones within the upper 55 cm (Ricklis 1988). The upper Zone I contained Perdiz arrow points; an end scraper; several utilized chert flakes; a relatively large amount of lithic debitage; two sandstone fragments identified as parts of milling stones; two modified *Rangia cuneata* shells (probably scraping or cutting tools); three possible bone awls; a number of ceramic sherds; bison and deer bones, turtle carapace fragments, and a few bones from other faunal species; a large number of *R. cuneata* and *R. flexuosa* clam shells, several oyster shells; two fragments of the Sunray venus; and two marine fish otoliths (Ricklis 1988:15-33).

Materials from Zone II included several pieces of chert debitage; a fragment of a conch shell adze and a modified fragment of Sunray venus (with edge flaking); a few unidentified bone fragments; a scattering of *Rabdotus* and other snail species; and both *R. flexuosa* and *R. cuneata* clams. The lower Zone III contained four dart points, one a Bell type, two similar to Catán, and one similar to a Tortugas, but reworked to have a "gougelike" edge; two scrapers; a probable Clear Fork tool fragment; several utilized flakes; an obsidian flake; a considerable amount of lithic debitage; a perforated oyster shell; an oyster shell fragment modified into a square shape; shells from several snail species; *R. flexuosa* clam shells; oyster shells; and several fish otoliths. It is interesting to note that both species of *Rangia* shells occurred in Zones I and II, with about three times as many *R. cuneata* as *R. flexuosa* in Zone I, but fewer *R. cuneata* in Zone II than in Zone I. Only *R. flexuosa* shells occurred in Zone III. Zone I also had 45 oyster shell fragments, while Zone III contained 293 (Ricklis 1988:28, 30). Cultural features in the excavations included several hearths, concentrations of ash, and possible pits and post molds in Zone I, and a concentration of ash and burned soil in Zone III (Ricklis 1988:33-39). The hearths were mostly irregular patches of reddish-orange burned loam, grayish-white ash, and dark brown loam and ash (Ricklis 1988:34-35).

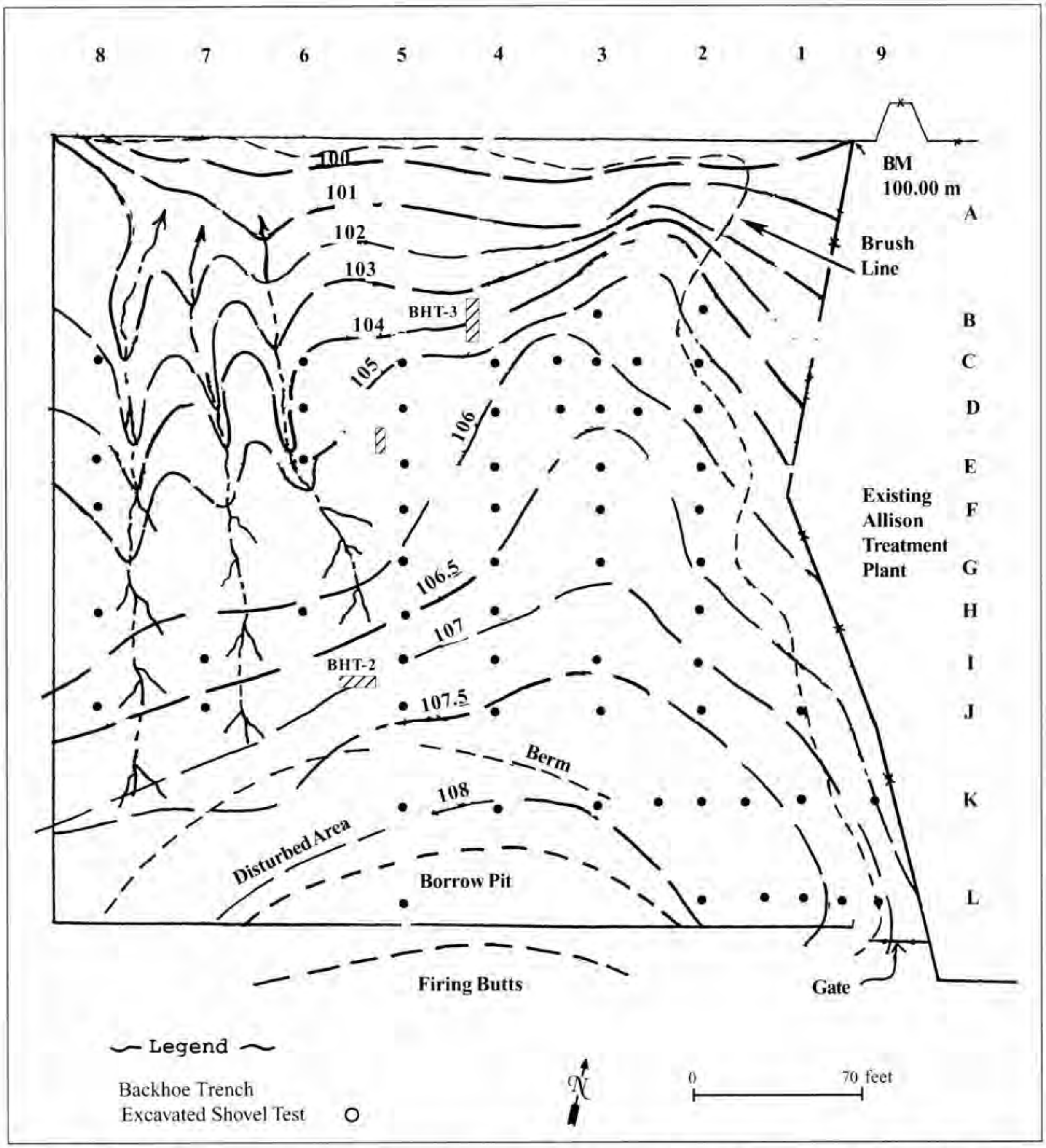

Figure 5. Map of the Allison site showing elevation contours (in meters), the grid system, backhoe trench locations, excavated shovel tests, and the approximate bluff line. Geomorphic cross-section lines are indicated (see Figure 4).

FIELD METHODS

Prior to beginning fieldwork, an area-wide grid system was developed to provide for systematic shovel testing in areas with dense vegetation (see Figure 3). We used a transit and tape to establish the grid lines for locating shovel tests. Using chainsaws and other implements, the grid lines were cleared of brush just above ground level, and the shovel test locations were staked by transit and tape. The grid lines and the locations of excavated shovel tests and backhoe trenches are shown in Figure 5. Largely due to ground disturbances, some of the planned shovel tests were not excavated, while others were added to

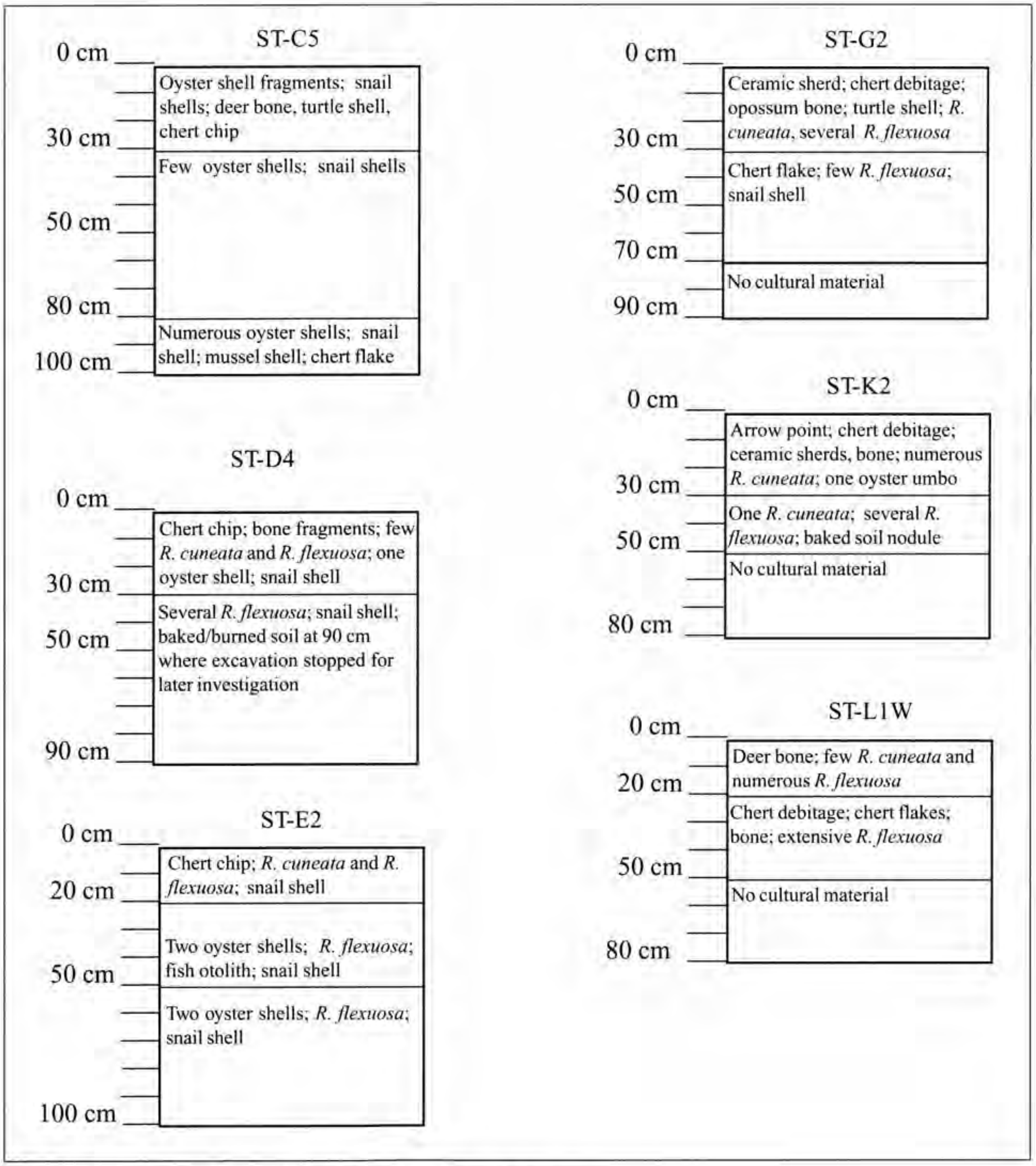

Figure 6. Archaeological materials found in selected shovel tests.

help determine the extent of archaeological materials found in the initial shovel tests. As fieldwork continued, more of the ground surface between the lines became visible as a result of field crew movements and other activity throughout the area. As a result, more than 90% of the ground surface eventually was inspected for artifacts.

Three backhoe trenches were excavated; one was a vertical cut made in the bluff face (see Figure 5). Sixty-one shovel tests (50 x 50 cm in size) were excavated in 10 cm levels with depths ranging from 60 cm to 100 cm below the surface (bs). Soils from BHT-1 and BHT-2 were sample screened, but all of the soil from the shovel tests was screened and archaeological materials collected, including snail, clam, oyster, and mussel shells. However, the substantial amount of clay in the soils made screening difficult, and some of the finer cultural materials may have been inadvertently discarded. Nevertheless, there were a number of small objects recovered in spite of the screening problems, including one fish otolith.

RESULTS

The surface survey showed concentrations of *Rangia* sp. shells in two areas, possibly historic materials in one location, and modern debris at several locations. A few lithic artifacts, *Rangia cuneata* and *R. flexuosa* shells, a few bone fragments, whiteware sherds, and a plowshare were found in BHT-1 and BHT-2. The vertical cut in the bluff face was excavated to examine the stratigraphy of the terrace soils. Three shell zones were observed, including a scattering of oyster and snail shells at about 40 cm bs, a zone of clam, oyster, and snail shells at 60 to 80 cm, and two clusters of oyster shells along a 1.5 m long segment of the south end wall (bluff face) and the west wall of the trench at 90 cm bs (Huffman 2002).

Archaeological materials from the shovel test and backhoe excavations are discussed here in terms of artifact categories and their general provenience within the project area. The vertical provenience of artifacts is depicted in Figure 6 for several shovel tests, while the horizontal provenience for several artifact categories is illustrated in Figures 7 and 8.

Shell

The occurrence of clam, oyster, and mussel shells at the Allison site is considered to be the result of human activities because of its location on a high bluff overlooking the river, as well as their association with prehistoric artifacts. The shells were often found in concentrations (see Figure 7). In some cases, where the concentration was in a relatively confined depth and the large numbers of shells appeared to form a dense lens, they are identified here as a "midden." In other cases, the numbers of shells from a shovel test may be rather high but the shells occur over a somewhat greater depth and are called a "concentration." These middens and concentrations could represent either single or multiple human occupations.

Two oyster middens were found in two shovel tests toward the north-central edge of the site close to the bluff line (see Figure 7), one at 80-100 cm bs and the other at 55-75 cm bs. Most of the oysters are *Crassostrea virginica*, with several *Ostrea equestris*. There were also a few *Ischadium recurvum* mussel shells. A few *R. flexuosa* shells were found in the upper part of one of these units, extending into and below the oyster midden. A third shovel test, situated a short distance to the southeast (see Figure 7), was also in a midden (60-100 cm bs) consisting of both clam and oyster shells. The clamshells were *R. flexuosa* and the oyster shells were primarily *C. virginica* with a few *O. equestris*.

The majority of shells recovered from shovel tests were either *R. cuneata* or *R. flexuosa* clams. Tests in the north-central, central, and extreme southeastern parts of the project area (see Figure 7) encountered middens of *R. flexuosa*. Those shovel tests in the southeast contained especially dense concentrations, as noted below. A shell midden, consisting of *R. flexuosa*, extended from 50-90 cm bs in the northeast part, with substantial numbers of these shells above and below, and a number of *R. cuneata* shells were found in the upper 20 cm. In the east-central part, there were several middens from 10-45 cm bs, all *R. flexuosa*. One location had numerous *R. cuneata* shells in the upper 10 cm. Just to the south, two shovel tests encountered middens of *R. cuneata* in the upper 30 cm; one shovel test also contained a midden of *R. flexuosa* between 50-60 cm bs; and several shells from both species were found between these lenses. In the southeast corner, there were six middens (see Figure 7). Three, in the upper 30 cm, contained shells of *R. cuneata*; and from 15-60 cm bs, three contained *R. flexuosa*. Two of the southeastern *R. flexuosa* middens were extremely dense, with nearly 1500 shells in a 30 cm thick range at one location and well over 1000 within a 15 cm thick lens in the other. Smaller concentrations of *R. flexuosa* clamshells were found in several shovel tests. Most were encountered in the highest elevations along a north-south line coinciding with Grid Line 3 (see Figure 7).

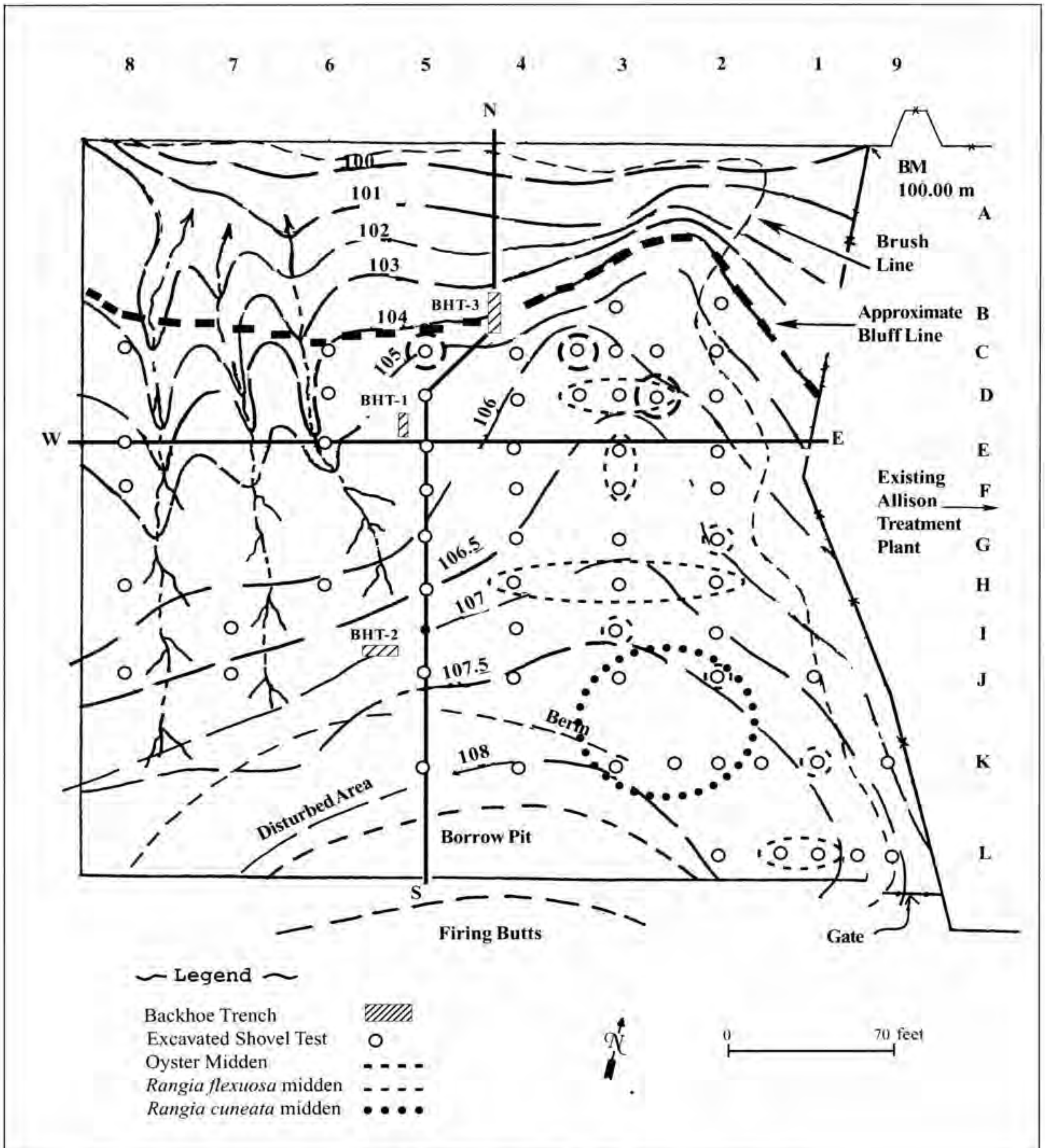

Figure 7. The horizontal distribution of clam and oyster shell "middens" found in shovel tests.

R. cuneata was found most often in the upper 30 cm but in places extended down to 40-50 cm bs and occasionally as low as 70-80 cm bs. *R. cuneata* clam shells appeared as middens in one area as well as in concentrations elsewhere on the site. The deeper concentrations were mostly in the northern part. The *R. flexuosa* shells were generally found in the upper 60 cm to the south and from near surface to 100 cm bs in the north. Both species occur together frequently, but *R. cuneata* was never found below *R. flexuosa*. Oyster shell middens and concentrations are generally at depths below, or found in conjunction with, *R. flexuosa* clamshells.

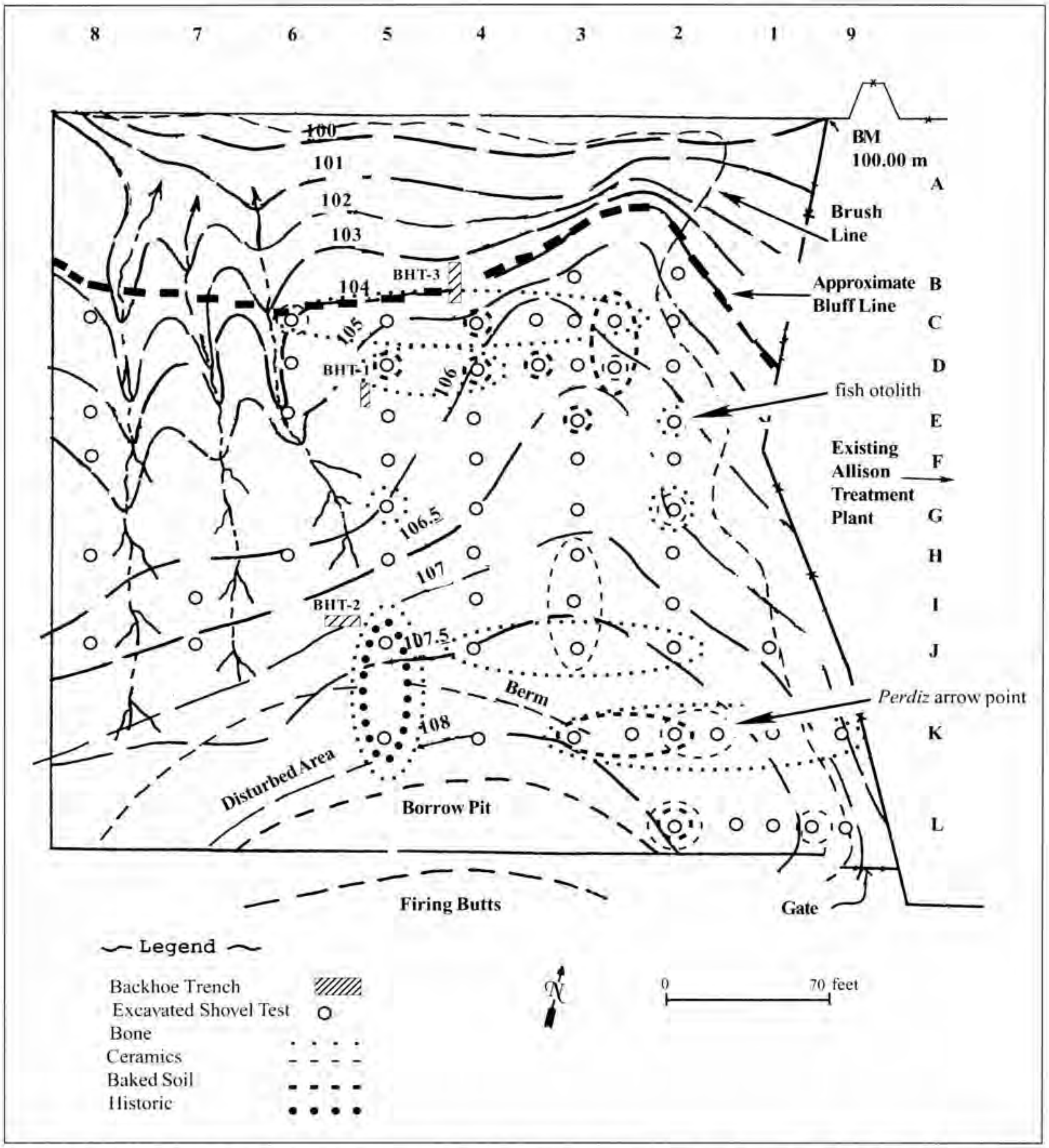

Figure 8. The horizontal distribution of artifact and ecofact categories found in shovel tests. The locations of shovel tests with a Perdiz arrow point and a fish otolith are also shown here.

An unidentified species of barnacle, a crustacean, was recovered from 70-80 cm bs in a shovel test in the northern oyster midden area, along with several shells of *C. virginica*, *O. equestris*, and *R. flexuosa*. As an example of barnacle habitat, one species found along the eastern Gulf Coast is the Ivory Barnacle, *Balanus eburneus*. These barnacles are found in estuaries, usually attached to rocks (Wernert 1982:283). It seems likely they could have attached to mollusk shells as well.

Snail shells were found throughout the project area, sometimes in fairly large numbers and as deep as 100 cm bs. Most frequently encountered were *Rabdotus* sp., probably *R. alternatus mariae* (see

Allen and Cheatum 1961:301). Two other species represented were *Polygyra texasiana* and *Helicina orbiculata tropica* (Allen and Cheatum 1961:309-310). All these land snails lived in open fields or wooded areas and appear to be associated with semi-arid climates.

Baked Soil

Nodules of baked soil were recovered from several shovel tests, and they possibly represent hearth remains. They were found mostly in two groups, one in the north-central part of the project area and the other in the southeast corner (see Figure 8). The northern group tended to be deeper (60-90 cm bs), while those to the south were in the upper 50 cm. In one unit, located in the north-central area, excavation was stopped at a depth of 90 cm when a surface of probable baked soil was encountered that may have been part of a hearth or an occupation surface (see Figures 6 and 8, ST-D4).

Ceramics

The ceramics were associated with Historic period and Late Prehistoric to Early Historic period components. The Historic period ceramics included a large number of earthenware fragments, apparently from a single salt-glazed and coil-made stoneware jug. These were from the south-central part of the project area (see Figure 8).

Forty-seven aboriginal sherds were recovered from the southeastern area (see Figure 8), possibly from two sub-periods within the Late Prehistoric, as defined by Ricklis (1995a:284-287). One sub-period extends from A.D. 1000-1250/1300, and the other from A.D. 1250/1300-1700. Earlier ceramics include a plain, sandy paste ware that may have been made before the asphaltum-coated or asphaltum-decorated ceramics of the Rockport phase. Most of the sherds appear to be from the second sub-period; but one shovel test in the south-central part had three sandy paste sherds with no asphaltum from 10-40 cm, below another sherd probably from the second sub-period. Ceramics in the second sub-period are Rockport ware, usually containing asphaltum in the coating or decoration. These were often decorated with geometric, incised designs below the outer rim or had a vessel lip modified to form a crenelated effect (Ricklis 1995a:284-285). Rockport ware has been linked to the Karankawa Indians (Ricklis 1996:26-29). In reassessing ceramic types associated with the Rockport phase, as defined by Suhm and Jelks (1962:131-136), Ricklis (1995b:198-199) suggests five types: Rockport Plain, Rockport Crenelated, Rockport Incised, Rockport Black-on-Gray I, and Rockport Black-on-Gray II.

Sherds found by ACI at the Allison site differ from the identified classes for this sub-period in the frequency of sand in the sherds rather than having bone tempering or other tempers. Type assignment of sherds was often difficult due to their small size. The longest dimension of each was as follows: three were 25-35 mm; three were 15-25 mm; six were 10-15 mm; and 35 were 5-10 mm in size. Nevertheless, sufficient identifying characteristics exist on several sherds to allow their identification according to the types proposed by Ricklis (1995b).

Asphaltum observed on the sherds covered the entire interior and/or exterior surface and, because of the small sherd size, did not allow detection of a decorative pattern. It is possible the lack of asphaltum on a sherd simply represented an area not receiving an asphaltum coating. Although the asphaltum was highly eroded in some cases, it covered enough of the sherd to suggest total coverage originally.

Primarily because of the asphaltum on the interior sherd surfaces, and the lack of bone temper, the following appear representative of Rockport Black-on-Gray II: one sherd each from the upper 10 cm of one shovel test and from the surface of another, and six from 10-20 cm in a third (five of the six include part of the rim). The interior of one rim sherd is punctated in addition to being coated with asphaltum (Figure 9). The following may represent Rockport Black-on-Gray I because of the application of asphaltum on the exterior only: a sherd from 10-20 cm in one shovel test and a sherd from 20-30 cm bs in another. It is possible one sherd from the upper 10 cm of a shovel test represents Rockport Incised due to lack of asphaltum, no added temper, and the appearance of "incised" lines or deep striations on the exterior (see Figure 9). No other sherds contained asphaltum, but most had a bone temper. These could be from vessels of Rockport Plain or Rockport Crenelated. Several had no temper

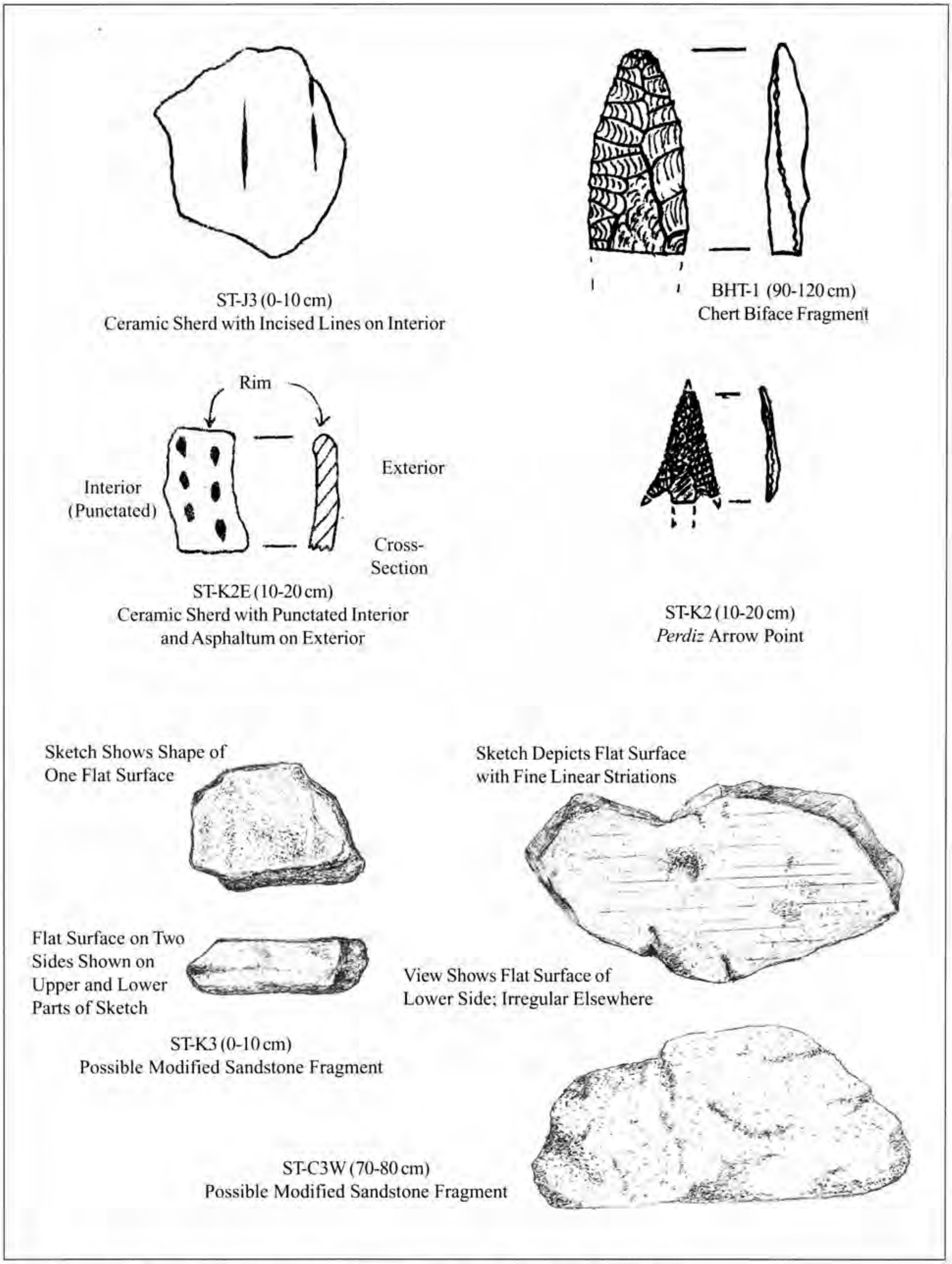

Figure 9. Selected artifacts from the Allison site. Artifacts are depicted at original size.

and may be Rockport Incised. Of the 26 sherds recovered from 10-20 cm in a shovel test in the southeast corner, 20 contained bone temper, while the remainder did not. This indicates the probable remains of two different vessels.

Although the interior and exterior surfaces and paste of some sherds were black or various shades of gray (probably due to being unwashed), the underlying surface was sufficiently exposed to suggest a light red or buff color. Exterior surface colors included black, gray, dark gray, light gray, red, light red, buff, or light buff. Interior surfaces were gray, light gray, red, buff, or light buff.

Except for the Historic period jug and a single sherd found 10-20 cm bs in a northwest shovel test, all ceramic artifacts were from units in the east-central part and in the southeastern corner (see Figure 8). Most of these were found within the upper 20 cm, but in two shovel tests were slightly deeper, with those in one unit extending to a depth of 40 cm bs. The sherd found in the northwest corner, adjacent to the area with extensive gullies, may be Rockport Black-on-Gray I, although it had a sandy paste. Another sherd of this type occurred in the central part on the crest of the north-south rise. It is possible the sherd found in the northwest corner was discarded elsewhere originally, or it may be that continuing erosion removed other sherds. All other sherd types laid along the crest or eastern slope of the rise, in the southeast part of the investigated area.

The work by Carlson et al. (1982) uncovered ceramic sherds in two test units: the central project area, 10-60 cm bs, and the south-central area in the upper 40 cm. Their description suggests Rockport Plain and Rockport Black-on-Gray, according to definitions by Suhm and Jelks (1962:131-135). No Rockport ware ceramics were recovered from nearby units during the current investigation. The project conducted by McCulloch and Warren (1996) recovered a ceramic sherd from the upper 20 cm of one test unit in the east-central part of the project area. This appears to be Rockport Black-on-Gray II (cf. Ricklis 1995b:198-199) due to asphaltum on the interior. The current investigation recovered a single sherd, lacking asphaltum, near that test unit.

Bone

Bones and bone fragments were uncovered in a number of shovel tests, mostly along the north edge and south end of the project area, with a few in the central part. The units were situated primarily along the slopes of the north-south rise. Most bone from the northern units was found in the upper 30 cm, but several occurred as deep as 50-60 cm bs. Those from the southern area were recovered mostly in the upper 30 cm but, again, some were between 40-60 cm bs.

A fish otolith from a spotted seatrout (*Cynoscion nebulosus*) was recovered from a shovel test in the east-central part between 40-50 cm (see Figure 6, ST-E2). During their first year, young spotted seatrout typically swim in or near available grass flats (Zimmerman et al. 1987:187; Hoese and Moore 1998:242, 322). Adults occupy deeper waters, occasionally above oyster reefs. Spawning takes place in bays during summer. It is believed larger specimens fed almost entirely on other fish, usually mullet (Hoese and Moore 1998:242). Mullets are usually found in fresh waters and may spend much of their lives in inland lakes or rivers (Hoese and Moore 1998:171).

A few deer bones (*Odocoileus virginianus*) were recovered from the upper 30 cm of shovel tests located predominantly in the far south-eastern corner, and from one other shovel test in the north-central part. White-tailed deer typically occupy wooded areas where they feed on a variety of plant species, including grasses, forbs, shrubs, acorns, mesquite beans, and persimmons (Davis and Schmidly 1994:281-282).

In the southeastern part, a bone from an unidentified species of turtle was found from 40-50 cm bs, and a burned turtle shell fragment from an unidentified species was recovered from the upper 10 cm of another shovel test. Fragments of turtle carapace identified as *Gopherus berlandieri*, the Texas tortoise (Garrett and Barker 1987:115-116), were found in several shovel tests, including the upper 30 cm of two shovel tests in the north-central part and the upper 10 cm of two shovel tests in the central part. A terrestrial turtle, the Texas tortoise is most active in early morning and late afternoon, and burrows into the soil or uses the dens of other animals (Garrett and Barker 1987:115). It is mostly vegetarian, preferring flowers, fruit, and pads of the prickly pear but sometimes eating grass and the leaves and stems of low-growing plants. They can exist without water for considerable periods.

An opossum vertebra *(Didelphis virginiana)* was recovered from the upper 10 cm of a shovel test in the east-central part (see Figure 6, ST-G2). Davis and Schmidly (1994:16) state that this nocturnal mammal mostly inhabits deciduous woodlands but may occupy prairies and marshes, feeding on a variety of small animals, fruits, and plants.

A few bones from bison (*Bos bison*) or cow (*Bos taurus*) were recovered from several shovel tests, including two in the southeast corner, in the upper 10 cm of one and from 30-40 cm in the other. A shovel test in the north-central part contained bison or cow bone from 10-20 cm bs and another from 60-90 cm in a backhoe trench located in the south-central part of the area. Although not identified, a large mammal bone was recovered from the upper 10 cm of a shovel test in the southeast part and one from 60-90 cm in the central area that may have been bison or cow.

Bison could have been found in the grasslands in the vicinity of the Allison site beginning about A.D. 1200 (Huebner 1991:353-355), and lasting until at least the early 1800s, according to reports reviewed by Weniger (1997:10-19). Seasonal distribution of bison, as indicated in these reports, show sightings in counties along the Texas coast occurred in September and October (Weniger 1997:23). Because of probable late 19th century to early 20th century human occupation of the area, the bone in the upper 30 cm of a shovel test where Historic period artifacts were found may be from a domesticated cow. Those in deeper levels of the backhoe trench and the other shovel tests could be from either cow or bison, but seem more likely to have been bison. The earlier investigation by Carlson et al. (1982:66) recovered a bone from a young animal, either bison or domesticated cow. This was located at a depth of 25 cm in the west-central part of the project area. During the 1996 investigation, a bison or cow tooth was found in the upper 20 cm of a shovel test located in the east-central part of the site (McCulloch and Warren 1996:28).

An unidentified pit viper vertebra was recovered from 20-30 cm bs in the north-central part of the site. Two medium-sized bird bones were found from 10-20 cm in the southwestern site area. Historic materials were recovered from this unit, so these may have been from a domestic bird. Several bones were recovered that were identifiable only as large, medium, or small mammals; unidentified bones and bone fragments were recovered from several units. During the investigation by Carlson et al. (1982:Table 6), bones from both cottontail rabbit and jackrabbit were also recovered.

Chert

The relatively few chert artifacts were mostly flakes and flake fragments, together with a number of chips and chunks, two expended cores, and one tested cobble. These were distributed among shovel tests in the eastern half of the project area, with fewer in the central part. Those found in the northern area occurred in two levels, from 10-30 cm bs and 60-100 cm bs, while those to the south were mostly in the upper 30 cm.

A biface fragment was recovered from a backhoe trench in the north-central part of the area at a depth of 90-120 cm bs (see Figure 9). A Perdiz arrow point (see Figure 9) was recovered between 10-20 cm bs in the southeast part (see Figure 6, ST-K2, and Figure 8). These date to the final Late Prehistoric period (A.D. 1250 or 1300 to 1700), according to Ricklis (1995a:284-285). The tested cobble was recovered from the upper 10 cm of a shovel test in the north-central project area. Expended chert cores came from 40-50 cm bs in the west-central part and in the upper 10 cm of a shovel test in the south-central part.

Stone

Fifteen small sandstone nodules were recovered from five shovel tests. The nodules are fairly soft and friable, and seven had flattened and possibly smoothed surfaces that appear to be the result of use as grinding or polishing stones. Some may be fragments of larger milling stones, but the size and shape of the apparently unmodified fragments suggest these were obtained and used in about their current size.

The one stone from the upper 10 cm of a shovel test in the southeast corner, measuring about 20 x 30 mm, was flattened on two opposite surfaces, and appears to be partly smoothed on one flat surface and part of one edge (see Figure 9). A shovel test in the north-central part contained a single nodule, between 70-80 cm bs, measuring 40 x 70 mm. This nodule has an elongated, ovoid shape, flattened on one surface, with numerous longitudinal striations, but is not otherwise smoothed (see Figure 9). The striations may be natural but are more likely the result of use as an abrader. All the other surfaces of this nodule are irregular. One shovel test in the north-central part contained 10 nodules, five with one flattened surface each. All were found between 70-80 cm bs. The remaining surfaces on these, and all surfaces on the other five, were irregular. Sizes of the five nodules without flattened surfaces ranged from 25 x 30 mm to 60 x 100 mm. Those stones with flat surfaces may have been used for polishing and grinding, and weathering at this deeper level may have obscured the originally smooth surface, unlike the fragment found at the upper level in the southeast corner, where the smoothing is more obvious.

The sandstone nodule from between 70-80 cm in a shovel test in the north-central area measured about 25 x 35 mm while the two measuring 220 x 30 mm were from 20-30 cm bs. These three were ovoid to irregular with no flattened surfaces and no indication of smoothing, probably reflecting the original condition of the other sandstone nodules prior to use. The source of the sandstone materials could have been the underlying geologic formation (Deweyville or Beaumont), as it contains sandstone pebbles between 2-3 m bs (Huffman 2002). An example of this section of the formation was observed in the backhoe trench in the bluff face (see Figure 5) and was identified as "pebbly sandstone." Exposures of this sandstone component could have occurred along the bluff line or at locations to the south of the project area.

Glass

A single glass bottle fragment was recovered from the upper 10 cm of a shovel test in the southwest part of the area, just north of a shovel test where other Historic-period materials were found (ceramics, a button, and a square nail, see Figure 8). In the same area, Carlson et al. (1982) observed Historic materials in surface and subsurface contexts during their earlier investigation. This area is north of a Historic period homestead (outside the project area) seen on 1938 air photos.

Metal

Square or machine-cut nails were found in the same area where other Historic period materials were recovered. According to Donald and Thoms (2000:144), machine-cut nails were cut or stamped from sheet iron and had rectangular cross-sections. The method was perfected by the 1820s. A patent for producing less expensive nails from wire-stock was issued by 1850 in the U.S., and their use became predominant by the 1890s (Donald and Thoms 2000).

Numerous lead bullets were found in shovel tests throughout the project area, mostly in the upper 20 cm. Analysis indicated they were probably from a firing range just to the south (see Figure 8), apparently in use since at least the 1930s.

INTERPRETATION OF CULTURAL RESOURCES

The planned expansion of the Allison Wastewater Treatment Plant was abandoned before completion of the initial investigation recommended by McCulloch and Warren (2002). Nevertheless, a considerable amount of archaeological data resulted from fieldwork in this part of the Allison site. This and other investigations, and recent studies from the Coastal Bend area, provide a context for the archaeological materials recovered from the Allison site. The natural environment can be inferred from geological and archaeological investigations and from habitat information appropriate to shellfish deposits found in the site. Although few datable items were recovered, various studies have assigned periodic changes in the natural environment to broad temporal periods. When correlated to shellfish habitat requirements and datable artifacts, several occupation periods can be suggested for that part of the Allison site investigated by McCulloch and Warren (2002).

The Natural Environment and Resources

The investigation conducted within the Allison Site provided only limited opportunity to assess the horizontal extent of archaeological remains from backhoe trenches and shovel tests, or to clearly document the existence of cultural features. However, from the artifacts and ecofacts collected, and considering their vertical and horizontal distribution, at least six relatively distinct occupation periods seem to be present at the Allison site.

The associated natural environment for each period is derived from various archaeological and geological studies undertaken in the region. The natural habitat of shellfish species is especially important in suggesting estuarine conditions. The remains of shellfish species in the archaeological deposits are those that inhabit coastal bays and estuaries. Given the location of the Allison site, therefore, shellfish concentrations appear to result from cultural activities rather than natural shell beds. Thus, it may be assumed that (1) shellfish remains were deposited by humans; (2) the shells were procured in the vicinity of the site; and (3) the waters of the estuary (now the Nueces Bay-Corpus Christi Bay system) were probably adjacent to or very near the present bluff line at various times in the past. No distinction is made between the two bays since, according to Brown et al. (1976:22), Nueces Bay was only separated from the Nueces Bay estuary by spit accretion (Indian Point Peninsula, see Figure 1) during approximately the last 2500 years.

Sea Level Changes

Sea levels rose and fell during the Pleistocene glacial-interglacial period, with levels approximating those of the present in interglacial periods (Brown et al. 1976:16). During the final glacial episodes, with sea level fall, rivers along the Texas coast and elsewhere cut deeply into older sediments, since streams could no longer wander from their courses (Brown et al. 1976:19). As the last glacial period was coming to a close, sea level began rising, but fluctuations in glacial activity often caused interruptions, with stillstands and occasionally even reversals occurring (Brown et al. 1976:14, 21 and Figure 5B). The sea level rise in this region between about 18,000 and 4500 B.P. was interrupted by four periods of stillstand (Brown et al. 1976:19-21 and Figure 5C). The last of these was between 10,000 and 7500 B.P., when Gulf waters extended many miles up the deep rivers and estuaries from the present Gulf shoreline.

Based on geological data, the Nueces River valley contained estuarine waters at least 50 km upstream from the modern Gulf shoreline at about 4500 B.P (Brown et al. 1976:21). This places the upper limit of the estuary about 5 km or more beyond the Allison site, based on 7.5' topographic map measurements along the present river channel. Current sea level was reached about 2800-2500 B.P. At that time, the lower Nueces River valley was an estuary for a distance of about 16 km upstream from the river mouth (Brown et al. 1976:22)—well above the Allison site. Later, fresh waters of the Nueces River would lie adjacent to the site.

Using data for the central Texas coast from Ricklis (1993), Cox (1994:221) hypothesized a series of rapid rises in sea level interspersed with periods of stillstand throughout the Holocene period, including: a stillstand from ca. 9000-7000 B.P. (Early to Middle Holocene, and Early Archaic period); a rapid rise in sea level from ca. 7000-5900 BP (Early to Middle Holocene, and Early Archaic); a second stillstand from ca. 5900-4200 B.P. (Middle Holocene, and Early to Middle Archaic transition); another rapid rise in sea level from ca. 4200-3000 B.P. (Middle to Late Holocene, and Middle Archaic period); and, finally, a stillstand from ca. 3000 B.P. to the present time (Late Holocene, and encompassing Late Archaic, Late Prehistoric, Protohistoric, and Historic periods).

Salinity Changes

Ricklis and Cox (1991:25-28; see also Ricklis [1993:60-63]) suggest that the primary periods for human use of estuarine resources correlate with periods of stillstand. On the other hand, periods of rising sea level saw reduced human exploitation of estuarine resources (Ricklis and Cox 1991:25-28; Ricklis 1993:64-71; Cox 1994:220). One of the effects of rising sea level on estuarine waters downstream would be an increase in salinity as they mixed with the rising marine waters. Salinity conditions would thus tend to stabilize during periods of stillstand, so that types and locations of exploitable aquatic resources should be reasonably predictable. However, as fresh water from the river flowed downstream toward the estuary, the salinity would have gradually decreased where mixing occurred. This flow of freshwater probably would diminish during xeric periods. During mesic periods, it seems likely that freshwater flow would increase, especially during periods of stillstand, when the rise of more saline waters from downstream had generally ceased while the flow of upstream freshwaters continued. Changes in salinity would have altered the habitat for various shellfish species. Thus, to the extent that shellfish habitat varied for species exploited by humans, the locations of these species would vary as estuarine conditions changed.

According to the model of estuarine ecology and associated human adaptations presented by Cox (1994:239-240; see also Ricklis and Cox [1991:25-28]), increasing xeric, and probably warmer, conditions during the Middle Holocene accompanied increased salinity in the Nueces Bay estuary. With the formation of barrier islands, estuary salinity subsided to a brackish condition, and the climate became more mesic as sea level reached its modern level about 3000 B.P (Cox 1994:239). The higher salinity levels were detrimental to oysters but, as salinity decreased, estuary waters became favorable. Further reduction in salinity during the Late Holocene resulted in reduced oyster exploitation and increased exploitation of *Rangia* clams.

Shellfish Habitat Requirements

The habitat for *Crassostrea virginica* is brackish bays and estuaries (Andrews 1992:99); for *O. equestris*, the Horse Oyster, it is high salinity oyster reefs, more saline than that of *C. virginica* (Andrews 1992:100); and for *I. recurvum* oyster reefs it is low-salinity bays (Andrews 1992:88). These are replaced by *Brachidontes exustus*, the Scorched Mussel, and *Ostrea equestris*, during drought periods. The habitat for both *Rangia flexuosa* and *R. cuneata* is "river influenced areas" (Andrews 1992:112), with *R. flexuosa* able to occupy somewhat higher salinity levels than *R. cuneata*.

According to Howells et al. (1996:161), the habitat for *R. cuneata* is "coastal fresh and brackish waters in river-influenced areas." While *R. flexuosa* can occur in waters with low salinity, it is considered a high-salinity species (Andrews 1992:112). Thus, salinity requirements of the three most frequently occurring shellfish found at the Allison site decrease from the oyster, *Crassostrea virginica*, to the clam, *R. flexuosa*, to *R. cuneata* (Andrews 1992:112; Cox 1994:233-234; Howells et al. 1996:161).

If concentrations of these oysters and clams actually represent intensive use as resources, their exploitation may correspond to periods of stillstand when the waters in the estuary (now the Nueces River) near the site contained relatively stable salinity levels, but with potentially different levels at different times. Most of the shellfish with somewhat higher salinity habitats were recovered from deeper excavation levels, and progressively lower salinity habitats at higher levels. It appears the waters adjacent to the site decreased in salinity over time, with marine waters of the Gulf eventually blocked by barrier islands and the continued flow of freshwater from upstream.

Recovered shellfish remains provide an indication of the estuarine environment for the time these materials were deposited. Together with the habitat and other environmental information, they also can be used to suggest times when the four earliest periods of site occupation may have occurred. The one arrow point and several ceramic sherds provide dates associated with the two later periods of occupation at the Allison site. Examples of shovel tests showing these changes in the shellfish habitat are presented in Table 1.

Other Environmental Factors

The site excavations yielded snail shells of *Rabdotus* sp. from virtually every excavation level. According to Allen and Cheatum (1960:299-301), the species of this land snail exist in semi-arid climates in Texas. The recovered snail shells were tentatively identified as *Rabdotus alternatus mariae* (Allen and Cheatum 1960:301). In addition, shells of *Helicina orbiculata tropica* and *Polygyra texasiana*, both land snails, were recovered throughout the project area, almost all from upper levels. However, shells of *H. orbiculata tropica* were recovered at deeper levels as well, including one shovel test that included a concentration of oyster shells. The habitat for this snail is usually woodlands, but it can be found in open fields, and it is considered somewhat resistant to drought (Allen and Cheatum 1960:309). Shells of *P. texasiana* also were recovered from middle to lower archaeological deposit levels.

Table 1. Examples of suggested changes in estuarine environments.

ST	Level No./ Depth (cm)	Number	Description
C5	2/10-20	2	Oyster; fragment; unidentified
	5/40-50	1	Oyster; *Crassostrea virginica*
	8/70-80	2	Oyster; fragment; *Crassostrea virginica*
	9/80-90	14	Oyster; umbo; *Crassostrea virginica*
		13	Oyster; fragment; *Crassostrea virginica*
	10/90-100	10	Oyster; umbo; *Crassostrea virginica*
		19	Oyster fragment; *Crassostrea virginica*
		1	Mussel; *Ischadium recurvum*
ST-E3			
	1/0-10	1	Clam; *Rangia cuneata*
		7	Clam; *Rangia flexuosa*
	2/10-20	1	Clam; *Rangia cuneata*
		12	Clam; *Rangia flexuosa*
	3/20-30	13	Clam; *Rangia flexuosa*
	4/30-40	1	Clam; *Rangia cuneata*
		21	Clam; *Rangia flexuosa*
	5/40-50	16	Clam; *Rangia flexuosa*
	6/50-60	1	Clam; *Rangia cuneata*
		11	Clam; *Rangia flexuosa*
	7/60-70	1	Clam; *Rangia cuneata*
		30	Clam; *Rangia flexuosa*
	8/70-80	107	Clam; *Rangia flexuosa*
		1	Oyster; umbo; *Crassostrea virginica*
		3	Oyster; fragment; *Crassostrea virginica*
	9/80-90	35	Clam; *Rangia flexuosa*
	10/90-100	7	Clam; *Rangia flexuosa*
ST-K2			
	1/0-10	31	Clam; *Rangia cuneata*
	2/10-20	118	Clam; *Rangia cuneata*
		1	Oyster; umbo; unidentified
	3/20-30	8	Clam; *Rangia cuneata*
	4/30-40	1	Clam; *Rangia cuneata*
		3	Clam; *Rangia flexuosa*
	5/40-50	16	Clam; *Rangia flexuosa*
ST-L1W			
	1/0-10	1	Clam; *Rangia cuneata*
		9	Clam; *Rangia flexuosa*
	2/10-20	1	Clam; *Rangia cuneata*
		77	Clam; *Rangia flexuosa*

Table 1. *(Continued)*

ST	Level No./ Depth (cm)	Number	Description
	3/20-30	594	Clam; *Rangia flexuosa*
	4/30-40	827	Clam; *Rangia flexuosa*
	5/40-50	45	Clam; *Rangia flexuosa*
ST-J2			
	1/0-10	13	Clam; *Rangia cuneata*
		1	Clam; *Rangia flexuosa*
	2/10-20	54	Clam; *Rangia cuneata*
		5	Clam; *Rangia flexuosa*
		1	Oyster; fragment; *Crassostrea virginica*
	3/20-30	47	Clam; *Rangia cuneata*
	4/30-40	18	Clam; *Rangia cuneata*
		25	Clam; *Rangia flexuosa*
		1	Mussel; *Ischadium recurvum*
	5/40-50	6	Clam; *Rangia cuneata*
		24	Clam; *Rangia flexuosa*
	6/50-60	120	Clam; *Rangia flexuosa*
		9	Oyster; *Crassostrea virginica*
	7/60-70	1	Clam; *Rangia flexuosa*
	8/70-80	12	Clam; *Rangia flexuosa*
		1	Oyster; *Crassostrea virginica*

Note: Vertical distribution of shellfish from selected shovel tests showing examples of middens. Snail shells and artifacts have been omitted. ST-C5=oyster midden; ST-L1W= high *Rangia flexuosa* midden; ST-E3 = low *R. flexuosa* midden; ST-K2 = *R. cuneata* midden; ST-J2 = mix of *R. flexuosa* and *R. cuneata*.

Therefore, the snail population from the Allison site suggests a prairie savannah environment.

The Cultural Periods

In his chronology of human occupations along the central Texas coast, Ricklis (1995a:266) includes both the shoreline zone and the coastal plain for 40-50 km inland from the mainland strandline. He suggests several cultural periods based on radiocarbon dating and associated materials from various investigations (Ricklis 1995a:268-287). Two periods within the Early Archaic date from approximately 7500-6800 B.P. and 5800-4200 B.P. (Ricklis 1995a:269). The few sites dating to the earlier period occur both in the plains and along the shore. Within these sites were mostly thin, dense strata of *Crassostrea virginica* oyster shells, edge-flaked sunray venus clamshell knives/scrapers, one fish otolith, a chert core, and a small amount of lithic debitage from one site, utilized flakes from another site, and several surface finds of dart points (Ricklis 1995a:269).

A greater number of sites date from the later period and contain mostly thin oyster shell deposits, although *R. flexuosa* clamshells are predominant in the river-influenced areas (brackish waters), with dense deposits of these clamshells at some sites. Artifacts are few, with some sites containing only a small number of chert flakes and fish otoliths (Ricklis 1995a:276), but dart points, chert end-scrapers, and large numbers of chert flakes were found at two upland sites (41NU184 and 41NU221), along with dense deposits of *R. flexuosa*. Both sites are located in the area of the Allison site. Various animal bones have been recovered from one site, and fish otoliths have been obtained from several sites dating to this period (Ricklis 1995a:277-278). The early part of the first Early Archaic period coincides notably with the latter years of a stillstand that occurred from ca. 9000-7000 B.P., while the remainder coincides with part of the suggested rapid sea level rise ca. 7000-5900 B.P. The second Early Archaic period essentially coincides with a stillstand from ca. 5900-4200 B.P.

This chronology suggests a Middle Archaic period from approximately 4200-3100 B.P. (Ricklis 1995a: 278) for which available data implies little use of the shoreline. A single site dated to this period contains a thin scattering of oyster shell during a period of apparently rapid sea level rise (Ricklis 1995a:277 and Figure 7). A Late Archaic period, from approximately 3100-950 B.P., begins around the time sea level stabilized at about its present level. Sites are larger than those of the Early Archaic period and frequently contain dense middens of various high-salinity mollusks, including oysters, scallops, sunray venus, quahog, and lightning whelk (Ricklis 1995a:278-280); bones of deer and other mammals; bird bones, fish bones, and otoliths; artifacts, including dart points and tools made of shell and bone, burned clay nodules, fragments of asphaltum showing basket impressions; and cemeteries (Ricklis 1995a:280-283).

The later part of the chronology along the central Texas coastline includes a Late Prehistoric period with two sub-periods (Ricklis 1995a:284): an initial sub-period from A.D. 1000-1250/1300 and a later one from A.D. 1250/1300-1700. The initial sub-period includes Scallorn and Fresno arrow points; plain, sandy paste pottery; deer bone; and numerous fish bones and otoliths. The late sub-period, the Rockport phase, has yielded Perdiz arrow points, thin bifacial knives, small unifacial end scrapers, elongate chert drills, and a prismatic blade-core technology (Ricklis 1995a:284-285). This sub-period is associated with Rockport pottery, and cylindrical ceramic smoking pipes, bone artifacts, bird bone beads, bison and deer bones, and fish remains (Ricklis 1995a:285-286). It is noted "that no major, dense shell middens have yet to be reported for discrete Rockport phase components" (Ricklis 1995a:286).

From his work at the McKinzie site, Ricklis (1988:43) found that *R. flexuosa* clamshell deposits appeared to correlate with a relatively early human occupation (including the Early Archaic, as noted above), while *R. cuneata* is predominantly or exclusively associated with Late Prehistoric cultural remains. The three zones in the excavations had *R. flexuosa* and dart points in Zone III, from 37-40 to 50-55 cm bs, dating to about 5200 B.P. *R. flexuosa* and *R. cuneata* shells were found from 10 to 37-40 cm bs in Zone II; and mostly *R. cuneata* shells, along with Rockport ware and Perdiz arrow points, dating to about A.D. 1300/1400, in Zone I. Thus, it would seem that Zone I is probably representative of the final sub-period of the Late Prehistoric, with substantial numbers of *R. cuneata* shells recovered from that site.

Excavations at the Allison site suggest a pattern similar to that at the McKinzie site, with an oyster shell zone below the clamshell levels. Distribution of various categories of artifacts and ecofacts (see Figures 7 and 8), together with materials from previous investigations, provide information on six possible cultural occupation periods. These include Historic and Late Prehistoric components containing datable materials, and possibly four or more Archaic components (cf. Ricklis 1995a:269). Although no direct dating of deposits below the Late Prehistoric level was obtained, suggestions for possible occupation periods can be inferred from changes in shellfish species at various levels based on their respective habitats and associated environments.

Each of these broad periods at the Allison site very likely includes multiple occupations. Although the concentrations of archaeological materials and associated environmental information seem to indicate several distinctive occupation periods, the timing of the earlier four is at best tentatively suggested. Considerably more effort is needed to define specific periods of occupation, even for the latter two where datable artifacts were recovered.

Occupation Period 1

Located along the north edge of the project area near the bluff line, the earliest occupation period consists of oyster middens and concentrations (see Figure 6, ST-C5). Shells are mostly *Crassostrea virginica* along with a few higher salinity species. Although indicating brackish waters, salinity is higher than that acceptable for *Rangia* clam species (see ST-C5 in Table 1). With the estuary adjacent to the site, inhabitants would have had easy access to oyster banks or reefs. A small amount of chert debitage and an apparently modified sandstone nodule (see Figure 9) were recovered from the deeper levels. In addition, baked soil nodules found in the area may be associated with some of these deeper middens. As noted above, Ricklis (1995a:269) suggests two periods of occupation on the central coast during the Early Archaic: from about 7500-6800 B.P. and from about 5800-4200 B.P. Considering oyster habitat requirements, these materials may have been deposited during the 9000-7000 B.P. stillstand or during the early sea level rise from ca. 7000-5900 B.P., when moderately saline estuarine waters would have been adjacent to the Allison site. These conditions would be similar to the brackish waters of modern bays protected by barrier islands, with some input from both marine and fresh waters. Remains recovered from the Allison site are similar to other occupied sites on the Central Texas coast during the earlier Early Archaic period (7500-6800 B.P.), considering the concentrations of oyster shells, the few chert artifacts, and the possible modified sandstone nodule.

Occupation Period 2

Several moderately dense middens of *R. flexuosa* shells were found in lower levels of the northern project area (50-100 cm). These generally occurred above the oyster middens, indicating a slight decrease in salinity over the previous period (see ST-E3 in Table 1); however, in one case, both oyster and *R. flexuosa* shells were found together in a midden. No *R. cuneata* middens occur in this area, although sometimes several of these shells appeared in the upper levels. If the site's period of fairly intense oyster exploitation was during the stillstand from ca. 9000 to 7000 B.P., and given the lower salinity requirements of *R. flexuosa*, then the stratigraphically higher occupation containing concentrations of this shellfish imply a period of high estuarine salinity, possibly following the sea level rise from about 7000-5900 B.P. This would represent the years of the Middle Holocene stillstand, from ca. 5900-4200 B.P, possibly the earlier part, considering the second set of *R. flexuosa* middens found at an even higher level in the site's deposits.

Other archaeological materials from this occupation period include a small amount of chert debitage and several baked soil nodules. During this stillstand, marine waters may have extended up the Nueces River, allowing moderate salinity adjacent to or beyond the site. This occupation period would be associated with the later part of the Early Archaic, from around 5800-4200 B.P. The natural environment at the time these shellfish were gathered would have been a period of increasing xeric, and presumably warmer, conditions.

Occupation Period 3

The very dense *R. flexuosa* midden found at the upper to middle levels of the southeastern project area (10-60 cm) occurred along the extreme eastern slope (see Figure 6, ST-L1W, and Figure 8). This was the densest concentration of *Rangia* sp. shellfish found in any shovel tests (see ST-L1W in Table 1). Other artifacts included a small amount of chert debitage and a single bone fragment. Upper soil levels may have been eroded away, and the middens may have originally existed at lower depths. However, other *R. flexuosa* middens along the crest are at about the same levels. These were discovered in the central project area, again in the upper to middle levels (0-50 cm). They occurred along the crest and east slope of the north-south rise. Associated archaeological materials included a small amount of chert debitage and a baked soil nodule. The higher levels at which these artifacts were found suggest a late occupation, perhaps toward the end of the ca. 5900-4200 B.P. stillstand, or possibly the beginning of the subsequent rise in sea level, at a time of transition from the Early to the Middle Archaic.

Occupation Period 4

This suggested period is the most difficult to support from the available archaeological data. Some shovel tests offered no clear separation between occurrences of the two *Rangia* clamshell species. A transition in salinity seems indicated, based on the mix of *R. flexuosa* and *R. cuneata* shells. The change may have resulted from transitional conditions toward the end of a sea level rise and during the onset of a following stillstand. This was likely a period of greater downstream freshwater flow during increasingly more mesic conditions, creating a habitat somewhat more suitable for *R. cuneata* clams, but also for *R. flexuosa*. Both species were found commingled in several shovel tests (i.e., ST-J2 in Table 1). Apparent changes in habitat during Occupation periods 3, 4, and 5 are exemplified in that shovel test on the eastern edge of the topographic rise toward the south part of the project area. Here 10 shells of the oyster were recovered from 50-80 cm bs, together with 133 *R. flexuosa* shells, but with no *R. cuneata* at those depths. From 30-50 cm, there was a combination of both *Rangia* species in moderate numbers. From 0-30 cm bs, a large majority of the shells were *R. cuneata*. In another instance, in the southeastern part, the two middens overlap slightly between 30 and 40 cm bs.

The depths of these shells vary over the project area but generally extend from 30 to 50 cm bs. Various other materials found at these levels include a small amount of chert debitage and a fish otolith in the northern area, and baked soil and small mammal bones in the southern area. Less saline waters may have developed near the site by the end of the previous stillstand, creating a habitat more suitable to *R. cuneata*. However, this was followed by sea level rise from 4200-3000 B.P., which could have increased salinity in the area. Also, a dry period may have reduced freshwater flow adjacent to the site and temporarily increased salinity, thereby continuing to support *R. flexuosa*. The last proposed stillstand began ca. 3000 B.P., and extends to the present. Mixed conditions could have occurred within the more xeric Middle Archaic, about 4200-3100 B.P., which has yielded very few cultural remains (see Ricklis 1995a:278). This occupation period at the Allison site may be part of the Late Archaic, dating ca. 3100-950 B.P.

Occupation Period 5

The environment for this period is based on concentrations of *R. cuneata* shells found in higher shovel tests (see ST-K2 in Table 1). The period includes the last major stillstand in sea level, beginning ca. 3000 B.P. (Cox 1994:221) and ending at approximately A.D. 1550. According to Ricklis (1996:34), *R. cuneata* can exist at some distance upstream from the coast, where salinity is low or absent. There, they would have been exploited by humans who could simultaneously exploit other more inland types of resources. This period would include the years when sea level approached modern levels, and waters adjacent to the site, although still brackish, were becoming the fresh waters found there today. Recovery of a Perdiz arrow point and several ceramic sherds indicates a Late Prehistoric component in the southeastern part of the project area (see Figure 8). The arrow point indicates a date range of ca. A.D. 1200 to A.D. 1500 (Turner and Hester 1999:227), if not later. It is possible that sherds (with a plain, sandy paste and lack of asphaltum) from the earlier part of the Late Prehistoric period may be included, but the majority of identifiable ceramics appear to be Rockport ware, from the Rockport phase, associated with the Karankawas who lived along the Texas Coast until sometime after 1830 (Ricklis 1996:27, 170). These materials date from A.D. 1250/1300-1700 (Ricklis 1995a:284-287). The climate during this period would have continued approaching that of modern times.

The ceramics occur mostly within the upper two levels of shovel tests in the southeast corner, but several sherds were found slightly deeper. Other artifacts include chert debitage and deer bone. Several of the baked soil nodules were found in southeastern shovel tests. Two of these also contained ceramics. The baked soil is situated just below the ceramic sherds and may be part of associated hearths. Furthermore, there is an apparent correlation between the occurrence of ceramic sherds, the arrow point, and *R. cuneata* shell middens, with the middens occurring in the southeastern area in the upper three excavation levels. The river environment from ca. 3000 B.P. to some time before the present could have provided habitat for *R. cuneata*, as well as for some *R. flexuosa*.

The Allison site appears to be a Group 2 site as defined by Ricklis (1996:101-104). These are prairie-riverine campsites occupied during the spring and summer to take advantage of resources available in the adjacent prairies, including deer and bison;

resources in the woodlands along the bluff line; as well as those in the river and floodplain. Inhabitants would have returned to the larger coastal Group 1 locations during the fall and winter to exploit bay and estuary resources.

Occupation Period 6

This period is characterized by the modern semi-arid climate. However, from the middle 1500s or earlier, to the middle 1800s, the climate apparently was cooler and more mesic than before or after, due to the Little Ice Age (Norwine 1978:12; Schneider and Londer 1984:114-117; Foster 1995:10, 228). In addition, changes in flora and fauna have occurred within the past 200 years resulting from human occupation of the region. Bones, including deer, opossum, cottontail, jackrabbit, pit viper, the Texas tortoise, and possibly bison were recovered from the upper 30 cm during the current and previous investigations. These bones likely were deposited during both this period and Occupation Period 5. Habitat requirements for these animals suggest that the part of the Allison site investigated was then situated within a woodland environment with grassland in the vicinity. This is consistent with a savannah type of landscape; descriptions in several historic accounts of a prairie grassland indicate they had a thin scatter of mesquite and prickly pear, and a more dense growth of shrubs along the streams (Johnston 1963:457).

An historic component was found in the south-central part of the area. Materials recovered earlier by Carlson et al. (1982) were considered part of a trash disposal area dating to the mid- and late 19th century (e.g., blue-sponged whiteware sherd, window pane glass, and cut nails). Historic artifacts found during the current investigation included a glass fragment and numerous sherds from a stoneware jug, coil-manufactured and salt-glazed on the exterior. This combination of historic materials also suggests a trash disposal area

Lebo (1987:129-132) indicates that salt glaze was most commonly used for utilitarian stoneware during the 19th century. Exterior salt glaze with a dry interior was most often used on jugs. Those produced in the Richland Creek area in north-central Texas dated to the mid-19th century, and jugs were associated with farmsteads. The square nail also indicates use of the disposal area prior to the 1890s. Finally, 1938 aerial photos show a farmstead just outside the project area.

SUMMARY

The Allison site (41NU185) is situated along the bluff line overlooking the Nueces River a few miles upstream from the Corpus Christi/Nueces Bay complex and the Gulf of Mexico beyond. A limited archaeological investigation in the northeast corner of the site recovered a number of artifacts and ecofacts from shovel tests and backhoe trenches, including shells of several mollusk species, bone, lithics, and ceramics.

Previous geological and archaeological studies of the Late Pleistocene and Holocene environment indicate a series of changes in sea level resulting in more saline bay and estuary waters that are currently located some distance downstream from the site. This saline condition would have periodically moved upstream. The altered salinity of the waters would have in turn affected the habitat of shellfish, and a number of periods are suggested from these long-term changes in the environment. Although the climate undoubtedly varied during these periods, the trend appears to have been toward increasingly warmer and drier conditions. The resources available to human inhabitants of the site would have also varied. Using estimated dates for periods of rising sea level interspersed with stillstands, salinity changes adjacent to the Allison site, and datable artifacts, six cultural periods can be defined here. The first four periods are suggested to date to various parts of the Archaic period, while the fifth is Late Prehistoric, and the sixth period dates to recent Historic times.

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Instrumental Neutron Activation Analysis of Tejano and Mexican Ceramics from Colonial Sites at Falcon Reservoir, Zapata County, Texas

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ABSTRACT

Instrumental neutron activation analysis of Tejano and Mexican ceramics from five late 18th-mid-19th century sites at Falcon Reservoir indicates that much of the hand-made and wheel-made coarse earthenwares were made by local Tejano groups. The analyzed Galera Polychrome and majolica from these sites were apparently made in Mexico.

INTRODUCTION AND GOALS OF THE STUDY

Instrumental neutron activation analysis (INAA) has been completed on a sample of 39 Spanish Colonial ceramics from five late 18th to mid-19th century sites at Falcon Reservoir, on the Rio Grande in southern Texas (Figure 1). The analyses were undertaken at the University of Missouri Research Reactor Center (MURR) (Neff and Glascock 2000).

The goals of the INAA study were to determine whether any of the Spanish Colonial ceramics found on historic ranching sites at Falcon Reservoir were made locally from Rio Grande clays, or were obtained from non-local sources in Mexico or elsewhere. We suspected that the hand-made and wheel-made coarse earthenwares were made locally by Tejano and Mexican potters for local domestic consumption. The fact that the coarse earthenwares are quite common in late 18th to mid-19th century contexts at Falcon Reservoir sites suggested that there was a limited supply of affordable and good quality ceramics (i.e., such as the majolica, lead-glazed Galera Polychrome *chocolateras*, and bean pots) available through long-distance traffic (i.e., transported overland by wagon) with central Mexico, and that the early settlers along the lower Rio Grande needed to also manufacture ceramics for themselves. Opening of the port of Matamoros, near the mouth of the Rio Grande, in 1824 to international trade (see Alonzo 1998:70-73) greatly increased the foreign trade along the lower Rio Grande through the mid-1840s, as manufactured goods made their way to the river villas at Mier, Camargo, Revilla (Guerrero), and Laredo.

Analyses of the material culture of late 18th-mid-19th century ranchos along the lower Rio Grande indicate that majolica, thin lead-glazed wares from bean pots and Galera Polychrome, and English ceramics are usually proportionally more common on sites dating after 1830, while the coarse earthenwares—both hand-made and wheel-made and frequently with interior and/or exterior lead glazes—are predominant in pre-1800 contexts (Perttula et al. 1998:Table 2). Certainly the decorated English whitewares are common only in post-1830 contexts at the ranchos, as are sherds of *molcajaetes* (Mexican lead-glazed thick shallow tripod bowls). Non-local goods became more accessible along the lower Rio Grande ca. 1830-1860 and then even more so in later times, and the available ceramic evidence from Falcon Reservoir sites suggests that changes in the importance of trade—especially maritime as opposed to overland wagon transportation—played a large role in defining the material culture record of the Tejano and Mexican populations along the lower Rio Grande. The continued use of majolica, thin lead-glazed wares, and coarse earthenwares by Tejanos even after the introduction of imported British ceramics also suggests that traditional means of serving and cooking foods were maintained on these ranchos after the popularity of whitewares supplanted majolica bowls and plates. The results of the INAA will hopefully better define which ceramic wares

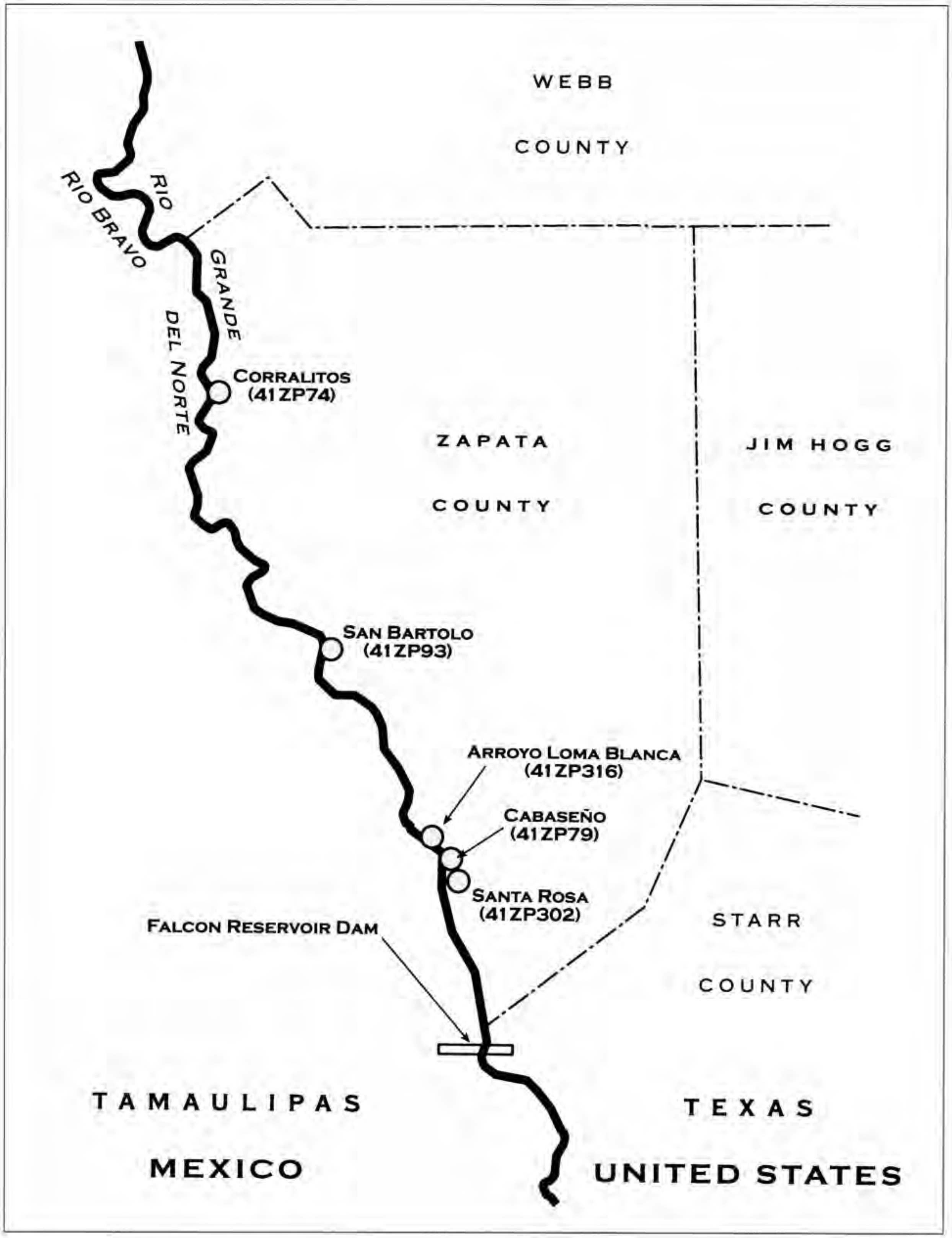

Figure 1. Falcon Reservoir, and sites mentioned in the text.

are of local manufacture, and which were obtained in long-distance trade, and also will provide supporting evidence concerning trends in local vs. non-local ceramic importation and use.

In this article, we first discuss the five Falcon Reservoir sites and the kinds of historic ceramics found on them that were selected for INAA. This is followed by a summary of the INAA methods, sample preparation procedures, and analytical techniques used at MURR. We then present a discussion of the results of INAA comparisons between the Falcon Reservoir historic sites and other Colonial and Native American ceramics from the general region (Neff and Glascock 2001, 2002a, 2002b).

FALCON RESERVOIR SITES AND COLONIAL CERAMICS

The Falcon Reservoir sites included in this study are located along the lower Rio Grande, in Zapata County, Texas, about 20-40 miles downstream from Laredo, Texas (see Figure 1). They include San Jose de Corralitos (41ZP74), Cabaseño Ranch (41ZP79), Rancho San Bartolo (41ZP93), Santa Rosa Ford (41ZP302), and Arroyo Loma Blanca (41ZP316). Archaeological survey investigations were conducted at four of the five sites in 1996 and 1998 as part of the effort to document the 18th and 19th century Mexican and Tejano ranchos exposed along the shoreline at the reservoir during record low-water levels (Perttula 2004; see also Perttula et al. 1996, 1998). Work at San Jose de Corralitos by Fleming and Perttula (1999) was intended to confirm the late 18th century construction of a ranch building there, "the earliest known house or ranch building still standing in Texas" (Fleming and Perttula 1999:395).

San Jose de Corralitos has late 18th century archaeological deposits in one area (Area B) that are associated with the 1786 construction of a stone *fortaleza* (fort) on a Rio Grande terrace. Ceramics in these deposits include a variety of majolica, including Aranama Polychrome and Puebla Green on White, as well as burnished redware, lead-glazed earthenware, and hand-made coarse earthenware.

There are extensive 18th, 19th, and 20th century archaeological deposits at the Cabaseño Ranch, including the ruins of at least three stone structures (probably the foundations to adobe-covered wood walled and thatched roof houses similar to wood post *jacales*), rubble piles, and midden deposits. The sherds included in the INAA study were collected from Area I, a ca. 1775-1800 occupation with three rectangular stone foundations built of 1-2 courses of undressed sandstone, trash midden deposits, and bone-filled pits (Perttula et al. 1999). More than 83% of the collected sherds from Area I consist of coarse earthenwares, and about 60% of these are from hand-made ceramic vessels, primarily ollas and bowls. Majolica comprises only 6.8% of the ceramic assemblage, and there are also olive jar sherds (1.8%) and thin lead-glazed sherds (7.1%).

Rancho San Bartolo (41ZP93) is one of the larger historic archaeological and architectural sites at Falcon Reservoir. The ranch appears to have been occupied between ca. 1840-1880. There are nine stone structural ruins on the ranch, built of unmodified sandstone *lajas;* two of the structures have multiple rooms. Extensive trash deposits with many broken ceramic vessels are present along the downwind and terrace edge in Areas A and B (Perttula 2004: Figure 18). Coarse earthenwares account for almost 41% of the more than 400 sherds from the site, followed by lead-glazed wares (32.2%), decorated English whitewares (16.9%), and Guanajuato Polychrome majolica (5.7%).

The Santa Rosa Ford site (41ZP302) was occupied during the early to mid-19th century. The archaeological deposits are marked by the remnants of four (F. 6-8 and F. 10) 1-2 course rectangular stone foundations, five middens filled with animal bones and discarded ceramic vessel fragments, and two stone *hornos* or cooking ovens (Perttula 2004: Figure 8). The ceramics from the site collected for INAA came from the extensive midden deposits, and most of the ceramic sherds on the site are either coarse earthenwares (45%; see Perttula 2004:Figure 9) or thin lead-glazed vessel sherds (41%). Guanajuato Polychrome majolica and English whiteware sherds each comprise about 6.6% of the sherd assemblage from the Santa Rosa Ford site (Perttula et al. 1998:Table 1).

At Arroyo Loma Blanca (41ZP316), there are four stone structures built with *lajas*. The ranch also had a single horno, two rock piles (probable remnants of outdoor kitchens), and a large lime kiln (F. 1). The stone structures are oriented in the same direction and are roughly equally-spaced, suggesting they were planned and built at the same time, and may have been occupied by several related families (see Perttula 2004: Figure 16). Ceramic sherds are abundant on the surface in and around the structures and rock piles, and the majolica and decorated English whitewares indicate that the Arroyo Loma Blanca ranch was occupied from ca. 1830-1860. Coarse earthenwares (45.9%) are the most abundant kind of vessel sherd, followed by decorated whiteware (21.7%), thin lead-glazed sherds (17.1%), and Guanajuato Polychrome majolica (10.5%).

The analyzed Colonial ceramics from the Falcon Reservoir sites include a variety of glazed and unglazed coarse earthenwares (see Perttula 2004: Figure 7a-b) together with two majolica sherds, several sherds of Galera polychrome, and one olive jar sherd. The coarse earthenwares include both hand-made and wheel-made vessel sherds from the Cabaseño Ranch, Santa Rosa Ford, Arroyo Loma Blanca, and Rancho San Bartolo, as well as one wheel-made *molcajaete* green lead-glazed tripod bowl from Rancho San Bartolo.

The hand-made coarse earthenware sherds are from medium-sized to large jars and bowls, as well as ollas, tempered with shell, bone, or crushed rock. This kind of earthenware is a distinctive part of the Spanish Colonial and Tejano material culture along the lower Rio Grande. Examples have been found in numerous historic archaeological sites at Falcon Reservoir (Perttula 2004; Perttula et al. 1996, 1998, 1999) dating from the late 18th century to the early 20th century.

The coarse hand-made earthenwares have thick body walls and bases, with rounded or flat lips and direct to strongly everted rims (Perttula et al. 1999:Figure 9a-e; Perttula 2004: Figure 7a). Many of the hand-made earthenwares do have a lead glaze, usually on the vessel interior. Both green and brown glazes were used in roughly equal proportions, and the glaze was applied in globs, splotches, streaks, and lines across the vessel surface. A few sherds also have exterior wiping, brushing, and fingernail marks, along with smudged and sooted areas, indicating they are from vessels used over a fire during cooking activities.

The wheel-made coarse earthenware sherds are from large jars, bowls, and ollas, and have a sandy paste that is tempered with crushed rocks. Vessel walls are thick, and rims are everted to strongly everted (Perttula et al. 1999:Figure 9f-k). The majority of these sherds have a lead glaze, usually on the interior and/or exterior vessel surfaces (see Perttula 2004: Figure 7b); few of these coarse earthenware sherds have a glaze only on the exterior. A green glaze was preferred, but brown, yellow, or clear glazes are also present, but about 3-4 times less common. The majority of the wheel-made sherds are from vessels fired in an oxidizing environment, probably a kiln.

The majolica sherds from Cabaseño Ranch (41ZP79) used in the INAA study have a grayish-white paste, sometimes referred to as the Puebla (Mexico) paste (cf. Fournier 1997). They have a tin glaze. They have blue and black or green painted decorations along the rim, either from San Elizario Polychrome (1750-1850) or Huejotzingo Green on white or Huejotzingo Green Banded (1780-1850) types.

The Galera Polychrome sherds (see Perttula et al. 1999:Figure 6a-g, i) are *chocolateras* from Cabaseño Ranch and Rancho San Bartolo. These sherds have a very fine paste, lead glazes on interior and exterior surfaces, and several different kinds of decorations; they have a characteristic orange vessel surface color. The Galera sherds have cream-colored bands and dots, black lines and swirls, as well as green and cream-colored lines and dots.

The single olive jar sherd is from Cabaseño Ranch. It is from a late style jar, dating from 1780-1800 (see Deagan 1987:34-35). It has a compact fine paste, lacks the exterior white slip seen more commonly on earlier jars, and has thick vessel walls (> 10 mm).

The most important comparative data in the MURR databank are analyzed Galera polychrome and other glazed types from Mission Refugio (41RF1) (Neff and Glascock 2002a), which lies about 300 km northeast of Falcon Reservoir. Other comparative data on Texas Colonial ceramics were produced at Texas A&M University; Shawn Carlson and W. Dennis James have generously allowed us to use these data (Carlson and James 1995) for comparative purposes. Finally, over 3000 INAA analyses of ceramics from Mexico provide a large database relevant to the possibility that some of the Texas Colonial sherds at Falcon Reservoir originated in Mexico.

INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS METHODS AND PROCEDURES

Sample Preparation

Samples from the Falcon Reservoir sites were prepared for INAA using standard MURR procedures, briefly described as follows. First, the clay sample was fired to 700 degrees for one hour in air before being prepared for analysis. Pieces of each sherd were burred with a silicon carbide tool to remove painted or slipped surfaces and adhering soil. The burred sherd samples and the clay test tile were then washed with de-ionized water and allowed to dry in air. These were then crushed in an agate mortar to yield a fine powder. Part of each specimen was retained, unpowdered, for the MURR archive of analyzed ceramic fabrics.

The powder samples were oven-dried at 100 degrees C for 24 hours. Portions of approximately 150 mg were weighed and placed in small polyvials used for short irradiations. At the same time, 200 mg of each sample were weighed into high-purity quartz vials used for long irradiations. Along with the unknown samples, reference standards of SRM-1633a (coal fly ash) and SRM-688 (basalt rock) were similarly prepared, as were quality control samples (i.e., standards treated as unknowns) of SRM-278 (obsidian rock) and Ohio Red Clay.

Irradiation and Gamma-Ray Spectroscopy

Neutron activation analysis of ceramics at MURR, which consists of two irradiations and a total of three gamma counts, constitutes a superset of the procedures used at most other laboratories (Glascock 1992; Neff 1992). As discussed in detail by Glascock (1992), a short irradiation is carried out through the pneumatic tube irradiation system. Samples in the polyvials are sequentially irradiated, two at a time, for five seconds at a neutron flux of 8×10^{13} n/cm^2/s. The 720-second count yields gamma spectra containing peaks for the short-lived elements aluminum (Al), barium (Ba), calcium (Ca), dysprosium (Dy), potassium (K), manganese (Mn), sodium (Na), titanium (Ti), and vanadium (V). The samples encapsulated in quartz vials are subjected to a 24-hour irradiation at a neutron flux of 5×10^{13} n/cm^2/s. This long irradiation is analogous to the single irradiation utilized at most other laboratories.

After the long irradiation, samples decay for seven days, then are counted for 2,000 seconds (the "middle count") on a high-resolution germanium detector coupled to an automatic sample changer. The middle count yields determinations of seven medium half-life elements, namely arsenic (As), lanthanum (La), lutetium (Lu), neodymium (Nd), samarium (Sm), uranium (U), and ytterbium (Yb). After an additional three or four week decay, a final count of 9,000 seconds is carried out on each sample. The latter measurement yields the following 17 long half-life elements: cerium (Ce), cobalt (Co), chromium (Cr), cesium (Cs), europium (Eu), iron (Fe), hafnium (Hf), nickel (Ni), rubidium (Rb), antimony (Sb), scandium (Sc), strontium (Sr), tantalum (Ta), terbium (Tb), thorium (Th), zinc (Zn), and zirconium (Zr).

Elemental concentration data from the two irradiations and three counts—a total of 33 elements—are assembled into a single tabulation and stored in a dBASE III file along with descriptive information available for each sample.

Quantitative Analysis of the Chemical Data

The analyses at MURR described above produced elemental concentration values for 32 or 33 elements in most of the analyzed samples (some elements, especially nickel, were below detection in some samples). Quantitative analysis was subsequently carried out on base 10 logarithms of concentrations for these data. Use of log concentrations instead of raw data compensates for differences in magnitude between major elements, such as iron, on one hand, and trace elements, such as the rare earth or lanthanide elements, on the other hand. Transformation to base 10 logarithms also yields a more nearly normal distribution for many trace elements.

In the present case, an additional transformation was necessary for comparative purposes because many of the analyzed Native American pottery samples from Mission Refugio (Neff and Glascock 2002b; Perttula 2002) contain large amounts of bone temper. As bone is composed mainly of hydroxyapatite, a correction similar to that developed for shell-tempered pottery by Blackman (Steponaitis et al. 1996; Cogswell et al. 1998) removes the temper effect from heavily-tempered ceramics. The correction is:

$$e' = (10^6 e)/(10^6 - 2.05c) \qquad (1)$$

where e' is the corrected concentration of any element in parts per million (ppm), e is the measured concentration of that element in ppm, and c is the amount of calcium in ppm. This correction obviously does not apply to elements that are present in high concentrations in bone, including strontium and barium. In the present case, calcium, strontium, and barium were excluded from the quantitative data analysis after correcting the other data for the addition of temper. It is also worth noting that this transformation will always over-correct because some calcium is naturally present in all clay. Nonetheless, experiments by Cogswell et al. (1998) demonstrate that the true clay chemical similarities of calcium carbonate-tempered ceramics can be recovered very confidently after applying the correction for shell temper, and we can extrapolate these findings to the bone-tempered case.

The goal of quantitative analysis of the chemical data is to recognize compositionally homogeneous groups within the analytical database, in this case colonial ceramics. Based on the "provenance postulate" (Weigand et al. 1977), such groups are assumed to represent geographically restricted sources or source zones. The location of sources or source zones may be inferred by comparing the unknown groups to knowns (i.e., source raw materials) or by indirect means. Such indirect means include the "criterion of abundance" (Bishop et al. 1982) or arguments based on geological and sedimentological characteristics (e.g., Steponaitis et al. 1996).

An additional approach to establishing provenance that is especially useful in the present case involves comparison with other INAA databases and to reference groups defined in those databases. The colonial ceramics from Falcon Reservoir can be compared to other groups by several means. For instance, certain production regions can be ruled out if one or more projections of the data clearly differentiate the Falcon Reservoir samples from the comparative groups.

Positive determinations of provenance—as opposed to merely ruling out provenances—have to be approached more carefully. If the reference groups in the comparative databases are large enough, Mahalanobis distance (or generalized distance) from the group centroids can be calculated, and, if the data points lie closer than some acceptable p-value cutoff, a compositional affiliation (and common provenance) may be inferred. The Mahalanobis distance of a specimen from a group centroid (Bieber et al. 1976; Bishop and Neff 1989; Harbottle 1976; Sayre 1975) is:

$$D^2_{yx} = [y - X]^t \, I_x \, [y - X] \qquad (2)$$

where y is 1 x m array of logged elemental concentrations for the individual point of interest, X is the n x m data matrix of logged concentrations for the group in which the point is being compared with X being its 1 x m centroid, and I_x is the inverse of the m x m variance-covariance matrix of group X. Because Mahalanobis distance takes into account variances and covariances in the multivariate group, it is analogous to expressing distance from a univariate mean in standard deviation units. Like standard deviation units, Mahalanobis distances can be converted into probabilities of group membership for each individual specimen (e.g., Bieber et al. 1976; Bishop and Neff 1989; Harbottle 1976). For relatively small sample sizes, it is appropriate to base probabilities on Hotelling's T^2, which is a multivariate extension of the univariate Student's t.

With small groups, Mahalanobis distance-based probabilities of group membership may fluctuate dramatically depending on whether or not each specimen is assumed to be a member of the group to which it is being compared. Harbottle (1976) calls this phenomenon "stretchability" in reference to the tendency of an included specimen to stretch the group in the direction of its own location in the elemental concentration space. This problem can be circumvented by cross-validation (or "jackknifing"); that is, by removing each specimen from its presumed group before calculating its own probability of membership (Baxter 1994; Leese and Main 1994). This is a conservative approach to group evaluation that may sometimes exclude true group members. All probabilities discussed below are cross-validated.

Another tactic that sometimes proves useful for assessing provenance is to scan a comparison databank in order to identify individual specimens that are compositionally similar to the individual specimens in the data set of interest. The technique is straightforward: Euclidean (straight-line) distances are calculated between a given individual specimen and all specimens in the comparison databank, and the top 10 specimens are extracted for comparison. Actually, the distance measure for which minima are sought is the average Euclidean distance:

$$ED_{a,b} = \frac{\sqrt{\sum_{i=1}^{m}\left(a_i - b_i\right)^2}}{m} \qquad (3)$$

where a and b are vectors containing m elemental concentrations for the two individual specimens being compared.

RESULTS OF THE ANALYSIS

The Colonial and Tejano ceramic samples from the five Falcon Reservoir sites appear to fall into five compositional groups: Galera, Main Glaze, Rio Grande 1, Rio Grande 2, and Mexican majolica. Two specimens from the Cabaseño Ranch and one specimen from Rancho San Bartolo are left unassigned (Table 1). This structure is depicted in a biplot of the first two principal components derived from a principal components analysis of the Colonial ceramics correlation matrix (Figure 2). A bivariate plot of tantalum and chromium (Figure 3), which contribute strongly to the pattern shown on the first two principal components, also illustrates the sub-group structure in the colonial data. The composition of the Mexican majolica sherds (TKP105 and TKP106, see Table 1) fall outside the other four chemical compositional groups.

A total of seven specimens, including four identified as Galera Polychrome (TKP107-108, TKP391, and TKP415) from Cabaseño Ranch and Rancho San Bartolo, fall in with a larger compositional group (the Galera group) that includes Galera polychromes from Refugio mission (Neff and Glascock 2002a) and a number of colonial Texas ceramics analyzed at Texas A&M University (Carlson and James 1995). Mahalanobis distance calculations (not shown) assign all but one of these seven specimens to the Galera Group at > 1.0% probability. TKP 412—a hand-made coarse earthenware with a clear glaze from San Jose de Corralitos—the one specimen showing less than 1% probability of membership in the group, is included with it because it has the highly distinctive enriched tantalum concentrations that distinguish this group from other southern Texas ceramics (see Figure 3 and Table 1). The high tantalum concentrations in members of this group also refute the hypothesis that they might be Mexican imports (Figure 4). One of the Texas A&M University specimens included in the group is designated "modern," which may suggest that it originates from somewhere other than Texas, probably western Mexico, where this ware is still made today (Fox 2002:207). As yet, however, we know of no region, in Texas or elsewhere, where the distinctive high-tantalum compositional profile might originate.

The 13 specimens in the Main Glaze group (see Table 1) form a tight cluster on virtually every projection of the data (see Figures 2-3), and it includes only coarse earthenwares. This group clearly differs from the southern Texas reference group defined from Refugio mission (see Figure 2) (Neff and Glascock 2002a, 2002b) and from two other, small Colonial ceramic chemical groups recognized in the Falcon Reservoir sample. None of the Texas A&M University analyses can be linked to this group either. The ceramic vessels in the group do not seem to be Mexican imports, since various projections of the data show the group to be chemically different from Mexican ceramics in MURR's database (see Figure 4). Samples from Cabaseño Ranch (41ZP79) dominate the group, and it is certainly plausible to suggest that the chemical group represents local production of glazed (and some nonglazed) ceramics in the vicinity of the Cabaseño Ranch; the other Main Glaze sherd is from the Santa Rosa Ford site (41ZP302), only a short distance south and across Arroyo Cabaseño from the Cabaseño Ranch site.

Eleven of the 13 Main Glaze sherds (85%) in the INAA sample have a lead glaze, and the two sherds of wheel-made and hand-made earthenwares

Table 1. Chemical group assignments for Falcon Reservoir Colonial pottery.

Analytical I.D.	Site	Description	Chemical Group
TKP107	41ZP79	Galera Polychrome	Galera
TKP108	41ZP79	Galera Polychrome	Galera
TKP391	41ZP79	Galera Polychrome	Galera
TKP409	41ZP302	brown glaze, wheel-made	Galera
TKP411	41ZP74	clear glaze, hand-made	Galera
TKP412	41ZP74	clear glaze, hand-made	Galera
TKP415	41ZP93	Galera Polychrome	Galera
TKP097	41ZP79	wheel-made coarse earthenware, no glaze (Group B)	Main Glaze
TKP098	41ZP79	wheel-made coarse earthenware, int. green glaze (Group W)	Main Glaze
TKP099	41ZP79	wheel-made coarse earthenware, int./ext. green glaze (Group O)	Main Glaze
TKP100	41ZP79	hand-made coarse earthenware, int./ext. green glaze (Group F)	Main Glaze
TKP101	41ZP79	hand-made coarse earthenware, int. green glaze (Group Z)	Main Glaze
TKP102	41ZP79	hand-made coarse earthenware, int. brown glaze (Group H)	Main Glaze
TKP392	41ZP79	hand-made coarse earthenware, brown glaze (Group E)	Main Glaze
TKP393	41ZP79	hand-made coarse earthenware, clear glaze (Group G)	Main Glaze
TKP397	41ZP79	hand-made coarse earthenware, green glaze (Group Z)	Main Glaze
TKP398	41ZP79	hand-made coarse earthenware, brushed, no glaze (Group X)	Main Glaze
TKP401	41ZP79	wheel-made coarse earthenware, clear glaze (Group C)	Main Glaze
TKP402	41ZP79	wheel-made coarse earthenware, green glaze (Group P)	Main Glaze
TKP410	41ZP302	hand-made coarse earthenware, brushed, clear glaze	Main Glaze
TKP104	41ZP79	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 1
TKP394	41ZP79	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 1
TKP395	41ZP79	hand-made coarse earthenware, no glaze (Group Y)	Rio Grande 1
TKP396	41ZP79	hand-made coarse earthenware, green glaze (Group Z)	Rio Grande 1
TKP399	41ZP79	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 1
TKP400	41ZP79	wheel-made coarse earthenware, green glaze (Group W)	Rio Grande 1
TKP404	41ZP316	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 1
TKP407	41ZP302	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 1
TKP408	41ZP302	wheel-made coarse earthenware, brown glaze	Rio Grande 1
TKP103	41ZP79	hand-made coarse earthenware, no glaze (Group X)	Rio Grande 2
TKP403	41ZP316	wheel-made coarse earthenware, green glaze	Rio Grande 2
TKP405	41ZP316	wheel-made coarse earthenware, green glaze	Rio Grande 2

Table 1. *(Continued)*

Analytical I.D.	Site	Description	Chemical Group
TKP406	41ZP316	hand-made coarse earthenware, no glaze	Rio Grande 2
TKP413	41ZP93	hand-made coarse earthenware, no glaze	Rio Grande 2
TKP105	41ZP79	Majolica, San Elizario Polychrome (Puebla type)	Mexican majolica
TKP106	41ZP79	Majolica, Huejotzingo Green-on-white (Puebla type)	Mexican majolica
TKP095	41ZP79	Olive jar (Group M)	Unassigned
TKP096	41ZP79	green glaze, wheel-made coarse earthenware (Group D)	Unassigned
TKP414	41ZP93	green glaze, wheel-made, molcajaete	Unassigned

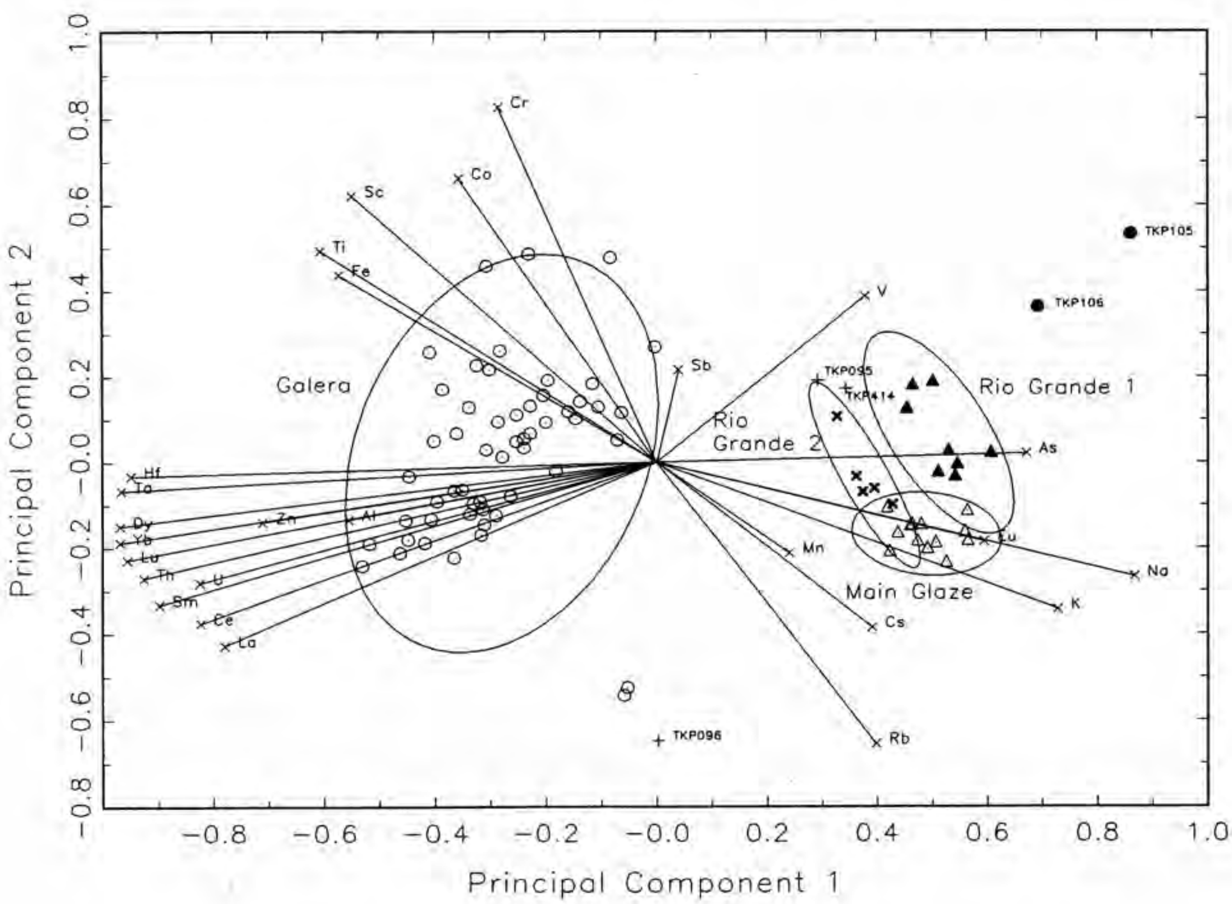

Figure 2. Biplot derived from PCA of the correlation matrix of the southern Texas colonial data, including Texas A&M University and MURR Mission Refugio analyses in the Galera Group. Vectors connect the origin with element coordinates. Ellipses represent 90% confidence level for membership in the groups. Mexican majolica (solid circles) and unassigned specimens (pluses) are labeled.

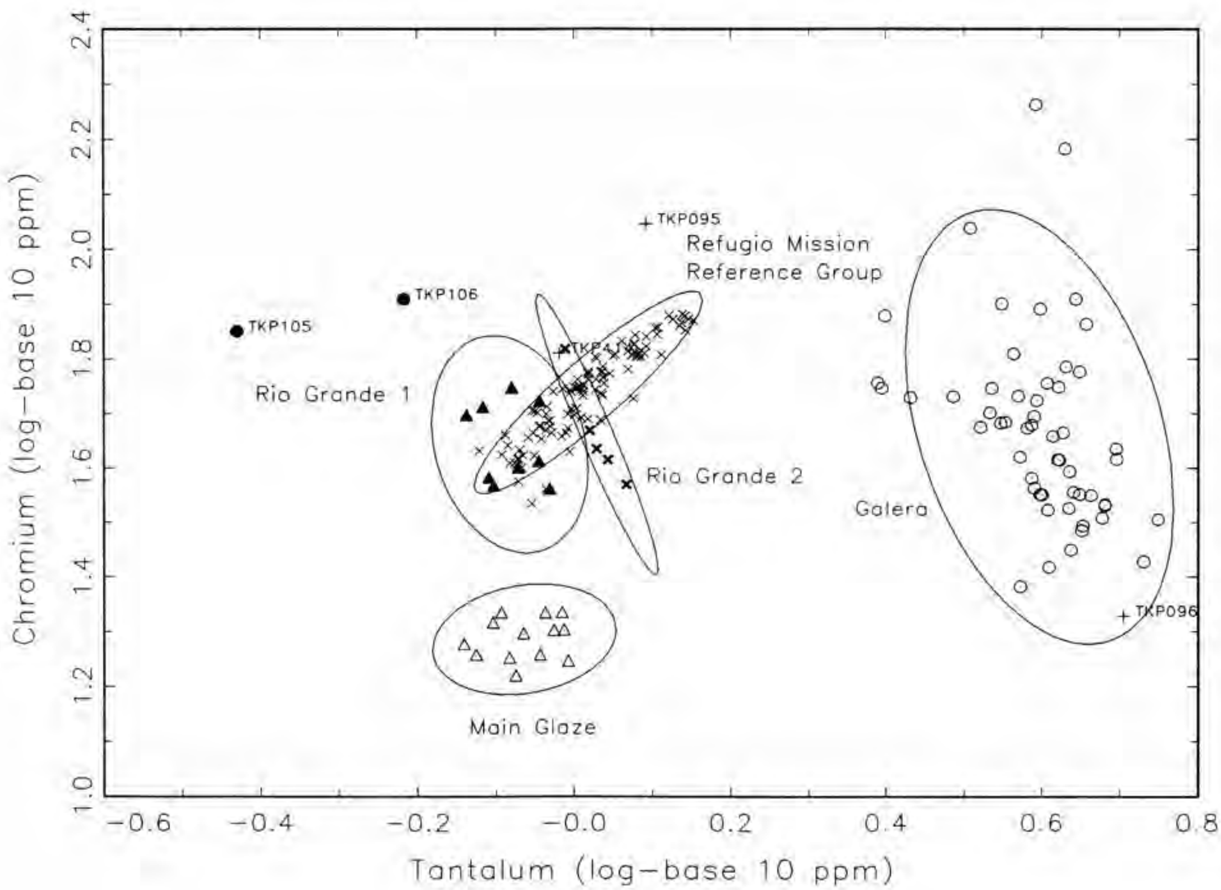

Figure 3. Bivariate plot of tantalum and chromium concentrations in the southern Texas Colonial sample, including the Mission Refugio reference group. Ellipses represent 90% confidence level for membership in the groups.

that do not have a glaze (see Table 1) probably are from vessels that were glazed on some interior or exterior surface areas. By way of comparison, only 36% of the sherds in the Rio Grande 1 and Rio Grande 2 groups have a lead glaze, and the majority of these sherds (i.e., 80% of the Rio Grande 1 and Rio Grande 2 sherds with a glaze) are from wheel-made coarse earthenwares. It seems reasonable to suggest that the Main Glaze, Rio Grande 1, and Rio Grande 2 chemical groups represent vessels made to be used in different ways from each other, and made from a different clay source(s) than the Main Glaze ceramic wares.

Euclidean searches of MURR's databank also suggest a southern/western Texas source zone for possibly a few Main Glaze sherds: two unassigned specimens from a southern Texas 18th century Native American site (41KA26) (Neff and Glascock 2001), and Native American ceramics from the El Paso and Four Corners areas were identified as chemically closest of all 25,000 analyzed specimens in the MURR databank. Perttula (2001:56) has suggested that one of the two sherds (a bone-tempered ware) may have been from a vessel imported into or brought to 41KA26, possibly from a source along the lower Rio Grande. The other sherd, which has a sandy paste, also appears to have been an import at 41KA26, as the sediments comprising the paste are derived from a granitic source, perhaps from an unknown Mexican clay source (see Hill 2001).

Two small groups designated Rio Grande 1 and Rio Grande 2 subsume the majority of the hand-made and wheel-made coarse earthenwares in the Falcon Reservoir samples. These include both glazed and non-glazed vessel sherds (see Table 1) from Cabaseño Ranch, Rancho San Bartolo, Santa Rosa Ford, and the Arroyo Loma Blanca sites. Although the groups can be discriminated on some projections of the chemical

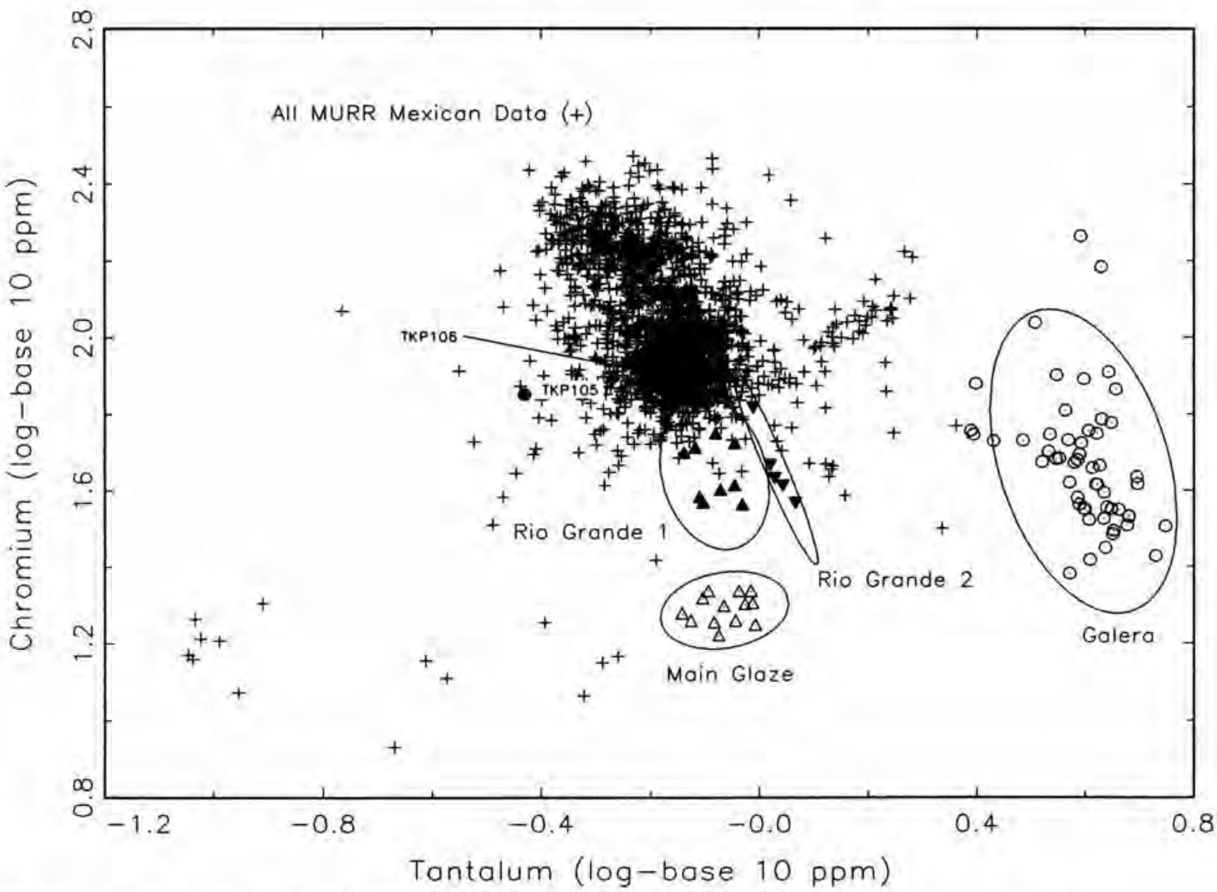

Figure 4. Same plot as Figure 3, but with all data in the MURR Mexican databank (n=3227) plotted for comparison. TKP106 (majolica) is obscured by the dense cluster of Mexican specimens with similar tantalum and chromium concentrations. Ellipses represent 90% confidence level for membership in the groups.

data (see Figures 2 and 3), most projections show them as overlapping. It is possible that additional sampling would either partition the non-glazed sherd data differently or show that there is really just a single group that has been arbitrarily subdivided. A local origin would seem plausible for these coarse earthenwares, especially since their composition is generally consistent with other chemical compositions known from southern Texas, such as the Refugio mission reference group (see Figure 3). Statistically, however, none of the vessel sherds in either of these groups would be assigned to the Mission Refugio Group.

The two analyzed majolica specimens, TKP105 and TKP106, are presumed to originate in the Colonial Mexican majolica production centers of Puebla (see Table 1). They are both obviously outside the range of variation of Colonial Texas ceramics (see Figures 2-4), and both fall within or close to the scatter of Mexican data points on virtually all projections of the data (see Figure 4).

Although neither of the majolica sherds from Falcon Reservoir could be matched to a MURR Puebla reference group or another specific Mexican reference group, Euclidean searches identified several Mexico City Colonial sherds as chemically similar to TKP106. We can speculate that the unique majolica paste preparation technology underlies the chemical distinctiveness of these ceramics, since their high calcium concentrations (14-18%) indicates that a marly material may have been added during paste preparation. Based on typology and their general chemical similarities to Mexican majolica (see Figure 4), it seems fairly certain that these two specimens did indeed originate in Mexico.

There are three unassigned sherds, two glazed and wheel-made earthenwares and an Olive jar sherd (see Table 1). The olive jar sherd (TKP095) from Cabaseño Ranch and the green-glazed *molcajaete* sherd (TKP414) from Rancho San Bartolo fall within or close to the southern Texas point clouds on most projections of the data (see Figures 2 and 3), and the most parsimonious interpretation is probably that they originate somewhere in Texas. TKP096, a wheel-made coarse earthenware with a green glaze from Cabaseño Ranch, shows many of the distinctive chemical characteristics of the Galera Chemical Reference Group, especially high tantalum (see Figures 3 and 4), and may originate in or close to the Galera production zone. Statistically, however, it cannot be assigned to the Galera Chemical Group.

DISCUSSION AND SUMMARY

It is fortunate that several previous projects—both at MURR (Neff and Glascock 2001, 2002a, 2002b) and at Texas A&M University (Carlson and James 1995)—have generated analytical data for Colonial and historic Native American Texas pottery that could be used for comparative purposes. As a result of the comparisons, we can conclude with confidence that the 38 Colonial-era ceramic specimens from late 18th and 19th century Falcon Reservoir sites analyzed for this project pertain to several different clay sources with differences in chemical compositions, most in southern Texas, some in Mexico, and a few perhaps from the Southwest. Admittedly, some of the attributions remain speculative. The Galera Reference group, for instance, cannot yet be linked to a specific production zone. Nevertheless, new data on the chemical composition of coarse earthenwares in particular strongly suggest that the hand-made and wheel-made manufacture of the utilitarian ceramics from local clay sources was a tradition maintained by the local Mexican and Tejano ranching families along the lower Rio Grande between ca. 1775-1880, and apparently this tradition continued on into the early part of the 20th century.

Additional sampling of Colonial ceramics and raw materials in southern Texas would reduce the speculations in our source attributions. As the ceramic database grows, parameter estimates for the reference groups will improve, and statistical testing of the groups will become possible. In view of their small size, the Rio Grande 1 and Rio Grande 2 groups should be considered especially tentative as compositional units at this point. Sampling of raw materials in hypothesized production zones, especially around Falcon Reservoir and elsewhere on the lower Rio Grande, would provide information to tie the ceramic groups directly to clay sources on the ground as well as to historic ranchos.

ACKNOWLEDGMENTS

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Analysis of Two Pecos River Style Curvilinear Symbols

James B. Harrison III

INTRODUCTION

The rugged Lower Pecos region holds a large body of well preserved rock art. At least six distinct styles are found here, enough information to provide archaeologists unique insights into the cognitive world of its prehistoric inhabitants. Each style is, for the most part, a self-contained, salient vocabulary which seems to represent diverse, or at least temporally different, cultural traditions (Turpin 1990).[1] The Pecos River Style is the oldest and most invested form of rock painting found in the Lower Pecos. This art is believed to have been produced between around 2700 and 4250 years ago (Hyman and Rowe 1997). The Pecos River Style is highly canonical and contains a limited, definable inventory of symbols, figures, and themes (Figure 1).

CURVILINEAR SYMBOLS IN PECOS RIVER STYLE ROCK ART

A 2003 survey of 43 Pecos River Style rock art sites identified 42 elements classified as curvilinear symbols (Harrison 2003). These symbols were depicted in two different manners; the "lazy S" and "lazy C" forms. Seventy-four (n=31) percent of the curvilinear symbols recorded take the lazy S form; 26% (n=11) are lazy Cs. Curvilinear symbols may appear singly; however, in the majority of cases, multiple curvilinear symbols are depicted nested together.

An analysis of the total contexts in which curvilinear symbols appear in the Pecos River Style reveals that these lazy S and lazy C form curvilinear motifs (CM)[2] and should be treated as separate and independent symbols with disparate iconographic roots. These glyphs are termed the S and C symbols, respectively.

The most common context in which both these symbols appear is being wielded by an anthropomorphic figure. These curvilinear motifs are not depicted literally held in the anthropomorph's hand but wielded 'at arms length.' This is similar to the manner in which other motifs that clearly represent weapons and ritual items such as atlatls, spears, clubs, and staffs are held (Kirkland and Newcomb 1996:49).

Figure 1. Two nested S symbols (41VV124 CM-1). Note additional S symbols included in the anthropomorph's interior body centrastyling.

Figure 2. One of several C symbols occurring at Halo Shelter (41VV1230 CM-14).

All of the C symbols are born by anthropomorphs, while 36% of the S symbols appear in this context (Figure 2).

Weapons and ritual accoutrements are some of the most realistically depicted motifs found within the Pecos River Style and some of these items have been recovered as artifacts from the archaeological record. The C symbol resembles an artifact referred to in the literature as a rabbit stick, rabbit club, fending stick, or grooved club (Kirkland and Newcomb 1996:61; Martin 1933; Shafer 1986). These slightly curved, flattened, and grooved wooden objects have been recovered from Lower Pecos dry cave deposits (Martin 1933:30-32). The C symbol may represent such an object: a tool used in hunting or in conflict.[3] At 41VV912, a diminutive red anthropomorph wields an oversized atlatl with notched spear in one hand and a C symbol in the other (Figure 3). Like this and other C symbols, multiple atlatls, spears, and clubs are often nested together, a form of visual elaboration.

Grooved clubs are roughly C-shaped. The S symbol is morphologically different than these artifacts (Martin 1933: Plate XXX; Shafer 1986:104). Unlike the C symbol, the S symbol may not be a realistic representation of any material object (Figure 4). This symbol possesses a deep symbolic significance revealed in part through its depictions in various contexts.

S symbols sometimes appear as isolated elements. At 41VV840 five large gold and red curvilinear symbols are depicted in a series that is not associated with any other figure. At two rock shelters, 41VV1604 and 41VV83, S symbols appear alongside another important Pecos River Style symbol, the single pole ladder; a motif believed by Kirkland and Newcomb (1996:44) and Gebhard (1965:10) to represent a projectile point.

The Pecos River Style is an iconography concerned with the other world. Many compositions depict events taking place in the supernatural realm and feature monstrous enigmatic characters. At Mystic Shelter a centipede-being is illustrated in context with an S symbol. This sinuous creature holds a diminutive anthropomorph in its maw. The S symbol is located just beside the creature's anterior end, a similar "wielded" context as the anthropomorphs discussed above (Figure 5).

The S symbol is inherently linked to the symbolism of the sinuous line, one of the most prevalent and diagnostic motifs found in the Pecos River

Figure 3. Anthropomorph wielding atlatl and C symbols, 41VV912 CM-5.

Style. This is demonstrated by this symbol's usage in 41VV1971, core motif-6; 13 S symbols appear in this composition (Figure 6). This core motif illustrates one of the most persistent themes from the Pecos River Style, an anthropomorph depicted in association with sinuous lines (Harrison 2003). This composition's central anthropomorph wields two double curvilinear symbols, one in each hand. To the figure's left is a vertical sinuous line approximately two meters long. This sinuous line is closely mirrored by nine additional nested S symbols. Verifying its position as the composition with the most multifarious usage of the curvilinear symbol and illustrating the creativity inherent in the Pecos River Style is the inclusion of a unique combination curvilinear symbol/dart motif that visually links the anthropomorph with the sinuous line. This single curvilinear symbol contains an ovate fletching that typically defines the ever present atlatl dart motifs.

Figure 4. C symbols, 41VV770.

Kirkland and Newcomb (1996:56) described sinuous lines as "force lines." The S symbol may represent a segment of a sinuous line; as described above, some occurrences are wielded by anthropomorphic figures (Figure 7).

CONCLUSIONS

Curvilinear motifs present in the Pecos River Style may be classified in one of two categories according to their form, C symbols and S symbols. C symbols may be fairly realistic depictions of the wooden objects known as grooved clubs that are known to have been used by this culture. S symbols seem to be in some way linked to the iconography of sinuous lines. These glyphs have a deep symbolic value and most likely have no "real world" material correlates. Both symbols are essential components of the vocabulary of the Pecos River Style.

Figure 5. S symbol in context with centipede at Mystic Shelter, 41VV612 CM-2. Note ecstatic anthropomorph held in the character's jaws. The lower body of the anthropomorph is obscured by a light water streak.

END NOTES

1. Recent excavations at Lewis Canyon have uncovered several large, previously unknown petroglyph panels (Turpin 2003; Turpin and Bass 1997). This newly uncovered imagery is unlike the bulk of the previously documented rock art at this site and it is believed by Turpin to be an older foundational style, termed Lower Pecos Serpentine Style (Turpin and Bass 1997). The most common components of this style are curvilinear motifs that in some cases appear quite similar to the Pecos River Style S and C symbols. Similar to the contextual appearance of curvilinear symbols within the Pecos River Style, at least three of these curvilinear motifs at Lewis Canyon are borne by

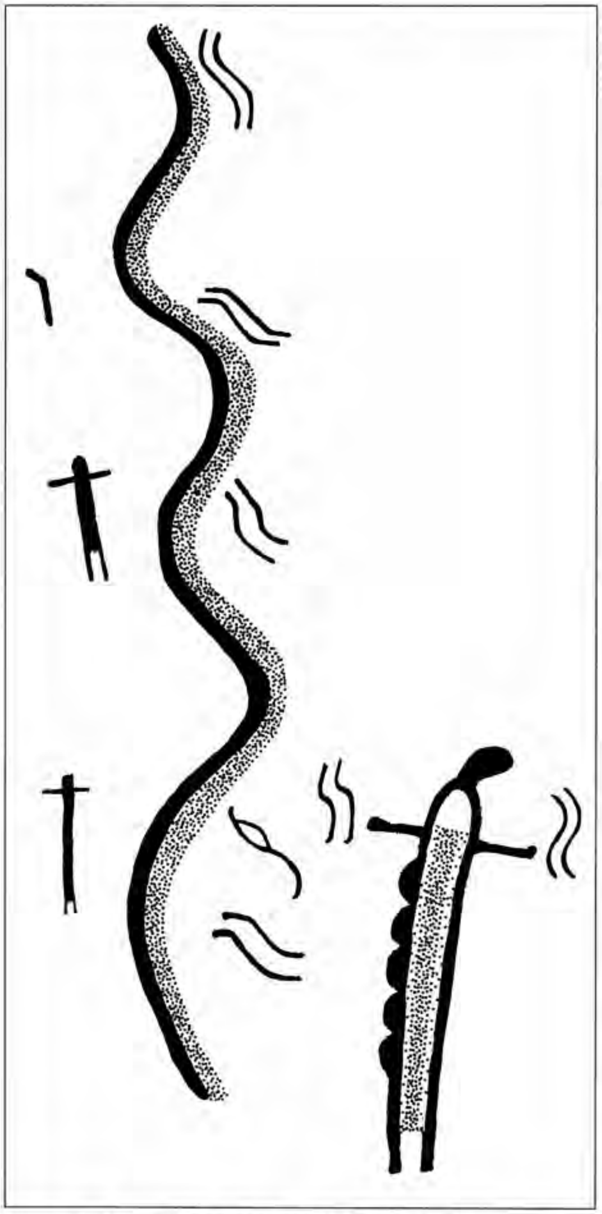

Figure 6. Drawing of 41VV1971 Core Motif 6.

Figure 7. Two black and red S symbols wielded by upside down black, white, and yellow-fringed anthropomorphs. The white paint of the arm has partially faded. The S symbol is located in the center of the frame between two prominent anthropomorphs, 41VV83, CM-20.

anthropomorphic characters. These curvilinear glyphs also appear both singly and multiply-nested within this imagery. However, the iconography of curvilinear motifs at the Lewis Canyon petroglyphs is complex and within this general category several discrete symbols may exist. Whether or not any iconographic relationship exists between these styles remains to be demonstrated.

2. Core motif (CM) numbers are used to designate the recurrent, thematically consistent compositions that are found in Pecos River Style art. Core motif numbers are assigned to salient units of imagery within a panel. Each core motif is assigned a unique label, consisting of: (1) the site's Smithsonian trinomial, and (2) numbers assigned to individual core motifs as they are recognized at a particular site. Many S and C symbols are *part of* a core motif and are identified as such.

3. See Martin (1933:31) for a functional/use wear analysis of grooved clubs recovered at the Shumla Caves.

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Notes and Comments on Human Skeletal Remains Recovered from Hopper's Landing (41RF11D), Refugio County, Texas

Matthew S. Taylor

ABSTRACT

In 2002, the skeletal remains of an old adult male were found eroding out of the shoreline along San Antonio Bay, Refugio County, Texas. The individual was afflicted with several pathologies, including a debilitating infection of the tibiae. Despite his diseased state, the advanced age of this individual demonstrates that he was a healthy member of society until the end of his long life.

INTRODUCTION

Assessments of the health and adaptation of past peoples are often hampered by small sample sizes. Small samples and individual case studies do not offer a platform for broad generalizations or interpretations. However, they have the potential to provide interesting data on specific diseases, forms of trauma, or other important information. Since the Texas Gulf coast region is underrepresented in the paleopathological record (Steele and Olive 1989; Dockall 1997:13), each individual is valuable for our understanding of past processes of health and disease.

BACKGROUND

In 2002, human skeletal remains were recovered from Hopper's Landing (41RF11D), a habitation and burial site in Refugio County, Texas. The remains were found eroding from a bluff above San Antonio Bay. Some of the remains had been lost to erosion into the Gulf of Mexico, but a burial was salvaged by local archaeologists Jimmy Bluhm, Bill Birmingham, and Don Will. Human remains were also collected below the bluff along the shoreline.

Hopper's Landing is one of numerous cemetery sites located on the Texas Gulf Coastal Plain. Many of these cemeteries are quite large and are thought to represent a growing cultural complexity that began in the Middle Archaic period and continued into Historic times (Hall 1995a, 1995b). Based on artifacts recovered at the site, the burial(s) excavated at Hopper's Landing date to the Middle or Late Archaic (Jimmy Bluhm, 2003 personal communication).

The archaeological consensus holds that the peoples of the Texas Gulf Coast practiced a conservative hunting and gathering way of life for the entire time of prehistoric human occupation (Patterson 1995; Story 1985). If this is indeed the case, and there is little archaeological evidence to suggest otherwise, then certain expectations can be formulated concerning the health and adaptive success of the people who inhabited the region. Generally, hunters and gatherers experience an endemic (low occurrence, low frequency) disease pattern, albeit in a physically demanding environment (Armelagos 1997; Cockburn 1971). Contagious infectious disease would have been almost nonexistent, while other infections would manifest themselves using different pathways (Armelagos 1990).

The peoples of the Texas Gulf Coast would have been subject to bacterial infections such as staphylococcus, streptococcus, botulism, and perhaps treponematosis. Other infections would include parasites and viral agents transmitted by either human or animal contact. Recent studies of the human skeletal remains from the Texas Gulf Coastal Plain suggest that prehistoric peoples were generally well adapted to their environment (Dockall 1997; Heubner and Comuzzie 1992; Taylor 2001; Vernon 1989). Past populations of the region generally follow a low occurrence and low frequency pattern of disease. Because the region is rich in food resources (Hall 1998), one should expect that the Archaic peoples of the Texas Gulf Coast were generally well-nourished and healthy.

METHODS

Assessment of the human skeletal remains from Hopper's Landing were carried out following the procedures contained in Buikstra and Ubelaker (1994). Determination of sex was accomplished according to observations of the skull. Assessment of age was performed according to the degree of dental wear (Smith 1984), thinning of the cranial vault, and the degree of osteoarthritis on the surviving joint surfaces (Kerley 1970). The results were compared to a seriation of aging indicators formulated for the Middle Archaic sample from the Ernest Witte site (Taylor 2001).

Pathological conditions of the skeleton and dentition were recorded according to their degree and location, following Buikstra and Ubelaker (1994). Measurements were made using sliding calipers and a cloth tape and were rounded to the nearest millimeter.

Figure 1. Mandibular occlusal dental wear on Burial 1.

Figure 2. Periostitis on the lateral aspect of the right tibia of Burial 1.

DESCRIPTION OF FINDINGS

The remains recovered from Hopper's Landing represent at least two individuals, based on a count of the mandibles. The more complete of the two, hereafter referred to as Burial 1, is sufficiently well-preserved to collect meaningful information. The remains representing Burial 1 are those of an old adult male. The severity of dental wear (Figure 1) and thinning of the cranial vault indicate someone at least over the age of 50.

The individual was suffering from a variety of skeletal and dental pathologies. The most notable of the disorders was severe periostitis of both the right and left tibiae (Figure 2). The infection involved the entire length of both shafts in all aspects, causing the diaphyses to appear swollen and misshapen. Despite the condition of the tibiae, the femorae show no evidence of periostitis, except for a small unsided fragment of diaphysis.

The frontal bone showed no evidence of infection, but it does display some thinning and slight undulations on the endocranial surface. This is interpreted as a result of advanced age. The roofs of the eye orbits display some evidence of well-healed criba orbitalia, indicating an episode of iron-deficiency anemia in this individual's distant past.

The dental remains of Burial 1 consist of 25 teeth: 12 mandibular and 13 maxillary. The left mandibular third molar displays 5 mm of alveolar bone loss, suggesting periodontal disease. The mandibular dentition is severely worn, and only the left third molar, left canine, and left lateral incisor have a thin remnant of enamel. Dental wear scores were 7 or greater on all teeth (a score of 8 is the most severe).

The maxillary teeth appear to be slightly less worn than the mandibular teeth. Alveolar bone loss of greater than 2 mm is present on the left molars and the right lateral incisor. The right second maxillary premolar has an abscess 8 mm in width.

Due to the fragmentary nature of the cranial remains, few measurements could be taken. No measurements could be recorded from the post-cranial remains because of poor preservation, rodent gnawing, or pathological distortion.

Burial 2 consists of small fragments of at least one adult. The remains and their location below the bluff makes it possible (if not likely) that more than one individual is present. Because of the fragmentary nature of these remains, only a descriptive analysis is possible. Meaningful data could be collected from only one fragment. A partial mandible held 7 fully erupted teeth, indicating an adult. Moderate dental wear suggests that this was a young adult, 20-35 years of age. A linear enamel hypoplasia was observed on the right mandibular canine.

DISCUSSION AND CONCLUSIONS

Although the human remains recovered at Hopper's Landing represent only two individuals, they do offer some clues about the past. Burial 1 is beset with a debilitating infection of the lower legs that may have resulted in his death. He also suffered from severe dental wear, a dental abscess, and a past episode of anemia. Traditionally, evidence of skeletal pathology is interpreted as a sign of poor health (Cohen 1994). However, this would not be the correct interpretation for this individual.

Although he was crippled with disease, Burial 1 was an old man at the time of his death. Skeletal evidence indicates an age of at least 50, but the thinning of the cranial vault and the severe dental wear suggest someone much older. It is likely this individual was in his sixties, perhaps even seventies, at the time of death. He had a variety of pathological conditions, but this would hardly have been unusual for someone of that age. Although worn, most of his teeth were present and intact. Sometime in the past he suffered from a bout of iron deficiency anemia but the healed lesions indicate that he recovered. His lower legs were severely infected, but that infection would have taken months, if not years, to advance to their present state.

Periostitis of the tibiae are fairly common in skeletal samples from the Texas Gulf Coast and the associated coastal plain. Some researchers have used such data to assert that treponematosis was a chronic problem. Treponemal disease could be the reason for the infection observed in Burial 1, although the remains are lacking some key diagnositic criteria. For a more secure diagnosis there should be some associated pathology on the frontal bone of the skull (Baker and Armelagos 1988). Without involvement on the cranium it is impossible to differentiate between treponemal disease and a generalized infection (such as that caused by staph or strep).

Based on the skeletal data collected, this person was a healthy, productive individual for most of his long life. This individual demonstrates that it was possible to survive to an advanced age during the Archaic of the Texas Gulf Coast. While prehistoric life was likely very physically demanding, the biological and cultural buffers to environmental stress were successful for this individual.

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Smoothing of Basal Edges of Spear Points

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ABSTRACT

Many types of Paleoindian and Early Archaic projectile points have smoothed basal edges. Possible reasons for smoothing of basal edges are considered, along with manufacturing methods for smoothing stone point edges.

INTRODUCTION

It is well known that lanceolate point types of the Paleoindian period usually have dulled basal edges, including lateral edges and the base edge. In Southeast Texas, all types of projectile points in the Paleoindian (ca. 10,000-5000 B.C.) and Early Archaic (ca. 5000-3000 B.C.) periods usually have smoothed basal edges. All time period date ranges used here for Southeast Texas are nominal time periods previously published for this region (Patterson 1995:243).

In the region, Paleoindian lanceolate points with basal edge smoothing include Clovis, Folsom, Midland, Dalton, Plainview, Scottsbluff, and Angostura. Notched point types of the Paleoindian period with basal edge smoothing include early Side-Notched, early Corner-Notched, San Patrice, and Big Sandy. Early Stemmed (straight stemmed) points of the Late Paleoindian (ca. 8000-5000 B.C.) and Early Archaic (ca. 5000-3000 B.C.) periods have smoothed basal edges. Other point types of the Early Archaic period with smoothed stem edges include Wells and Carrollton. In Southeast Texas, smoothing of point stem edges was usually not done after the start of the Middle Archaic period (ca. 3000-1500 B.C.), although an occasional Pedernales point specimen from the Middle Archaic period has smoothed stem edges (Patterson et al. 1995:Figure 2b).

In Southeast Texas, smoothed basal edges of projectile points is an important diagnostic attribute to distinguish certain early projectile point types from certain similar later point types. For example, except for smoothing of basal edges, some early Side-Notched point specimens (Patterson et al. 1994:Figure 2g) are similar to later Ensor points, and some early Corner-Notched specimens (Patterson et al. 1987:Figure 9b) are similar to later Ellis points.

This article discusses possible reasons for the smoothing of the basal edges of projectile points, and also considers manufacturing techniques to do edge smoothing.

PURPOSE OF BASAL EDGE SMOOTHING

No clear explanation has been given in the archaeological literature for the purpose of smoothing of basal edges of stone projectile points. The most popular reason given is that edge dulling prevented cutting of fiber wrapping of the haft by sharp, freshly flaked lateral edges of the point. Titmus and Woods (1991:126) have discussed problems with this explanation. First, why is the basal edge at the end of the point dulled when only the lateral edges would contact the haft binding material? Second, why are basal edges of many specimens so well ground, well beyond the amount of smoothing that would be necessary to protect even the softest of wrappings?

Titmus and Woods (1991:127) comment that thorough edge dulling may have been done to strengthen basal edges subject to use-stress, especially bending stress (Woods 1987). A smoothed edge strengthens the point in the basal area by removing irregularities that would facilitate fracture initiation.

A possible reason for the smoothing of the basal edges of a projectile point may have been to facilitate disengagement of the spear point from the spear shaft so that the point would remain in the target animal. Easy disconnection of the point from the shaft would also minimize damage to the shaft. Spear shafts were probably reused when possible, but stone spear points were considered expendable items.

Finally, smoothing of the basal edges of stone projectile points may represent a technological tradition in the same manner that various point styles were used over long time periods. During certain time periods, a projectile point was considered finished only after smoothing of basal edges.

MANUFACTURING METHODS

Pressure flaking creates a sharp edge by forming sharp points between scalloped flake scars (Patterson 1998:Figures 5-6). To smooth a sharp edge, the sharp points between scallops must be removed. Several techniques can be used to smooth the edge of a projectile point. One technique for edge smoothing is grinding. Grinding of a projectile point edge can be done by an abrading tool, such as the rough surfaces of a quartzite flake, a quartzite hammerstone, or a piece of sandstone. Another technique for edge smoothing is the use of raking retouch with use of a thick stone flake as a flaking tool (Patterson 1998), and the flaking tool is raked along the edge to be smoothed. I have smoothed stem edges of stone projectile points in about one minute by use of raking retouch.

None of the techniques for smoothing basal edges of projectile points require much time. Basal edge smoothing may be the last step in the manufacture of a spear point, but this is a manufacturing step that can be done in an almost casual manner, even when thorough edge grinding is done.

CONCLUSIONS

Several possibilities have been considered here for the purpose of basal edge smoothing of spear points, but there is no final conclusion concerning why basal smoothing was done on projectile points. It is not even clear what types of additional data would be needed to resolve this question. It is also not clear why smoothing of basal edges of projectile points was discontinued in the Middle Archaic period, after 3000 B.C., in Southeast Texas. In any event, smoothing of basal edges is an important attribute for the identification of certain projectile point types.

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