Archaeological Testing and Data Recovery at the Cibolo Preserve Menger Creek Site (41KE217), Kendall County, Texas

by
Steven W. Ahr, Antonia L. Figueroa, and Steve A. Tomka

Texas Antiquities Permit No. 5490

Volume II

Principal Investigator
Steve A. Tomka

Non-Restricted

Prepared for:
City of Boerne
Public Works Department
P.O. Box 1677
Boerne, Texas 78006-1677

Center for Archaeological Research
Preserving Cultural Resources
The University of Texas at San Antonio

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Center for Archaeological Research
The University of Texas at San Antonio
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San Antonio, Texas 78249-1644
Archaeological Report, No. 427

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Abstract:

Between November 2011 and January of 2012, the Center for Archaeological Research (CAR) of The University of Texas at San Antonio (UTSA) conducted archaeological test and data recovery excavations at site 41KE217, the Cibolo Preserve Menger Creek Site, within the City of Boerne in southeast Kendall County. Archaeological monitoring associated with the Boerne Wastewater Treatment Plant encountered site 41KE217. The project was performed under Texas Antiquities Permit No. 5490 with Dr. Steve Tomka acting as Principal Investigator. For the testing and data recovery excavations, Steve Ahr served as Project Archaeologist.

The excavation of three backhoe trenches revealed two stratigraphically distinct cultural zones. The upper component consisted of a dense burned rock layer (Feature 1), which extended approximately 50 m (164 ft.) northeast-southwest and at least 15 m (49.2 ft.) southeast-northwest. Based on the range of temporally diagnostic dart points recovered from the component, it was deposited during the Middle to Late Archaic Period (6000-3000 BP). Radiocarbon dates suggest that the component dates between 4090-3925 cal. BP (94.2% probability) and 5686-5468 cal. BP (95.4% probability). The lower component is associated with the Early Archaic Period and appears to date between 5586-5468 cal. BP (95.4% probability) and 7325-7170 cal. BP (93.9% probability). National Register of Historical Places (NRHP) eligibility testing followed the trenching and consisted of the hand excavation of four 1-x-1 m (3.28-x-3.28 ft.) test units. The upper component consisted of a multitude of intersecting burned rock features and a range of associated temporally diagnostic projectile points. In contrast, the lower component appeared to be stratigraphically separated from the overlying component, consisted of isolated burned rock hearths, and had a more limited range of temporally diagnostic artifacts. Based on these testing results, it was concluded that the lower component had the highest research potential, and CAR recommended that this component warranted listing to the NRHP and formal designation as a State Archeological Landmark (SAL). Formal data recovery efforts followed the Texas Historical Commission's concurrence with this recommendation. The data recovery efforts focused on the lower component while the upper component was mechanically removed. A block grid was established, and twenty-six 1-x-1 m (3.28-x-3.28 ft.) units and seven 0.5-x-1 m (1.6-x-3.28 ft.) units were excavated. Thirteen burned rock hearth features were revealed, and several lithic tools, including diagnostic dart points, were recovered. Artifacts recovered during the project will be returned to the private landowner unless it is decided that a portion of the artifacts will be donated to the University for research purposes. All project documents are curated at the CAR facility.

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As is the case with most lengthy and complex endeavors, this project could not have been completed without the help of a large number of dedicated and skilled individuals. We greatly appreciate the tremendous help we have received from Deputy Public Works Director Donald J. Burger, P.E., of the City of Boerne during the project. He has been accommodating with the archaeological fieldwork and a great facilitator to get the work done on time. We also express our thanks to Public Works Director Michael G. Mann, P.E., for his understanding of archaeology on the project. Our appreciation also goes out to Senior Project Manager Gary Martin, P.E., with Civil Engineering Consultants. He has been great to work with and extremely helpful in providing access to the site and informing us about site conditions as rains and logistics prevented access to parts of the project area over time. Pat Mercado-Allinger and Mark Denton of the Texas Historical Commission have made several trips to Boerne to visit the project area and provided guidance and advice. Their time and energy is greatly appreciated especially when they are severely limited in both time and resources. Dr. Steve A. Tomka provided sound advice during the different stages of the project and served as Principal Investigator. His assistance is greatly appreciated.

Of course the hard working crews that assisted with the several phases of the project are primarily responsible for the completion of the project and for the discovery of several sites in the project APE. They included Justin Blomquist, Cyndi Dickey, Ben Hull, Lindy Martinez, Tyrone Tatum, Lynn Wack, Alexandria Wadley, and Antonia Figueroa, and they were led by Steven Ahr. Keeping track of the materials generated in the field was Marybeth S.F. Tomka and Melissa Eiring. It is due to their efforts that the project records will be available for future generations to study. The graphics gracing the pages of the report were prepared by Richard Young and the late Bruce Moses, and the editing of the various drafts of the report was ably performed by Kelly Harris.

Last but not least, we would like to express our appreciation and thanks to Mr. Bill Lende of the Cibolo Preserve, for his interest and excitement about the archaeological discoveries made on the property and his desire to learn as much as possible about these resources. He is a genuine preservationist.

Chapter 1: Introduction

Between November 2011 and January of 2012, the Center for Archaeological Research (CAR) of The University of Texas at San Antonio (UTSA) conducted test and data recovery excavations at archaeological site 41KE217 within the City of Boerne in southeast Kendall County (Figure 1-1). The project was precipitated by the construction of the Boerne Wastewater Treatment Plant and the installation of associated sewer lines.

This work directly follows CAR archaeological survey investigations conducted on behalf of City of Boerne in advance of the installation of two sewer interceptor lines (Menger Creek and Browns Creek Lines) as well as the building of a new wastewater treatment plant (Figueroa et al. 2012). Site 41KE217 was identified during construction monitoring activities within the project easement.

Based on the identification of buried and stratified archaeological deposits of Early and Middle Archaic age, CAR, in consultation with Texas Historical Commission (THC), recommended archaeological testing and, ultimately, data recovery of the Early Archaic component. Because portions of the project are publicly owned, all work was conducted in conformance with the Antiquities Code of Texas, which requires state agencies and political subdivisions of

Restricted Image

Figure 1-1. *The location of site 41KE217.*

the state to notify the (THC) of any action on public land involving five or more acres of ground disturbance. The project was performed under Texas Antiquities Permit No. 5490 with Dr. Steve Tomka acting as Principal Investigator. For the testing and data recovery excavations, Steve Ahr served as Project Archaeologist.

This report consists of eleven chapters. The first three chapters provide the introduction, the review of the environmental and cultural setting, and the summary of previous archaeological investigations carried out on the project. Chapter 4 presents the research approach and theoretical orientation employed in the analyses performed and the interpretations of the data. Chapter 5 reviews the field and laboratory methods used during the project, while Chapter 6 provides the testing results of the NRHP eligibility investigations of site 41KE217. Chapter 7, in turn, discusses the results of data recovery investigations performed at the site, while Chapter 8 provides a summary of the geomorphological investigations conducted during the project. Chapter 9 presents the results of the analyses of the lithic artifacts recovered during the investigations, while the Chapter 10 addresses the research domains that were investigated. Chapter 11, the last of the chapters, summarizes the results of the analyses and discusses the significance of the findings of the project. Two appendices provide details on the backhoe trenches excavated during the project (Appendix A) and the radiocarbon dates from the site (Appendix B).

Chapter 2: Environmental and Culture Settings

Environmental Setting

Kendall County is located on the eastern edge of the Edwards Plateau. Cibolo Creek divides the project area. This creek begins 16 km (10 mi.) northwest of the community of Boerne in southwestern Kendall County, continues to the southeast, crosses Karnes City after forming the Bexar-Comal and the Bexar-Guadalupe County lines, and then empties into the San Antonio River in Karnes County (Castañeda 2010). Elevations on the project area range from 421-427 m (1,380-1,400 ft.) above mean sea level (AMSL). The project area has a modified subtropical and subhumid climate with cool winters and hot summers (Norwine 1995). The hot weather is persistent from late May through September.

The cool season begins in early November and extends through March. Winters are typically short and mild with light precipitation. Rainfall reported for San Antonio International Airport averages about 83.62 cm (32.92 in.) a year (based on monthly averages from 1971 to 2000; Southern Regional Climate Center 2010). Monthly temperature averages range from 10°C (50°F) in January to 29°C (84°F) in August (Norwine 1995). Within the project area there are five soil units: Boerne fine sandy loam, Oakalla silty clay loam, Anhalt Clay with 1 to 3 percent slopes, Doss-Brackett association (undulating 69.5 to 56.9 percent), and Krum silty clay with 1 to 3 percent slopes (Web Soil Survey 2010).

Vegetation communities present in the project area include oak savannahs, grasslands, woodlands, and prairie grass/shrub lands (Web Soil Survey 2010). Savannah communities are typically composed of post oaks and tall grasses. Post oak species include Bigelow oak (*Quercus sinuata* var. *breviloba*), blackjack oak (*Quercus marilandica*), Texas oak (*Quercus buckleyi*), and live oak (*Quercus virginiana*). Grasslands (oak and oak juniper grasslands) include grass species such as bluestem (*Poa arachnifera*), indiangrass (*Sorghastrum nutans*), and sideoats grama (*Bouteloua curtipendula*). Major woody species in oak-juniper grasslands consist of honey mesquite (*Prosopis glandulosa*), Texas persimmon (*Diospyros texana*), and prickly pear (*Opuntia* spp.). Other variants of these plant communities are also present that consist of encroaching species such as Ashe juniper (*Juniperus ashei*) called "cedar" locally (Web Soil Survey 2010).

Prairie grasslands have less than five percent canopy. Bluestem (*Poa arachnifera*) and indiangrass (*Sorghastrum nutans*) are the dominant species in this community. In prairie shrublands settings, species such as Texas persimmon, mesquite, and live oak become increasing present as well as prickly pear. Land west of the Cibolo Creek within the project area has been utilized for agricultural purposes and is sparsely vegetated. Figure 2-1 shows the vegetation that is typical in the project area.

All of the mentioned vegetation communities are a consequence of historic land use activity (Web Soil Survey 2010). For example, woodland (hardwood juniper) communities are typically a shift from savannah to woodlands (Web Soil Survey 2010).

Figure 2-1. *Vegetation communities of the project area: a) post oak savannah; b) agricultural land.*

Faunal species in the area include white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), ringtailed cat (*Bassariscus astutus*), striped skunk (*Mephitis mephitis*) and armadillo (*Dasypus novemcinctus*; Davis 1960).

Culture Setting

Kendall County is located in the Central Texas archaeological region. The culture chronology is divided into five culture periods: Paleoindian, Archaic, Late Prehistoric, Protohistoric, and Historic. This section provides a brief overview of each period.

Paleoindian Period (11,500-8800 BP)

This period, associated with the earliest documented presence of humans in Texas, is typically divided into early and late segments. Populations at this time consisted of mobile groups that hunted large, highly mobile megafauna coupled with the exploitation of a variety of small game. Evidence from the Wilson-Leonard Site in Williamson County also suggests the exploitation of riparian forest and grass species (Bousman et al. 2004).

The early segment of the Paleoindian Period is that represented by Clovis and Folsom adaptations. Meltzer and Bever (1995) have documented 406 Clovis sites in Texas. Clovis-age sites usually consist of kill localities, quarry/workshops, residential camps, and burial caches that are indicative of repeated returns to the same locations (Collins 2004). The earliest documented Paleoindian site in Texas is the Aubrey site in Denton County, with radiocarbon assays of 11,542 ± 111 BP and 11,590 ± 93 BP (Bousman et al. 2004:48).

In the later portion of the period, there were stylistic changes in projectile point technology seen in Dalton, Scottsbluff, and Golondrina traditions. While widespread in geographic range, these types occurred in high densities in the High Plains and Central Texas (Meltzer and Bever 1995). As the climate warmed at the end of the Pleistocene, megafauna gradually died off, and subsistence patterns shifted.

Archaic Period (8800-1200 BP)

This period is subdivided into the Early, Middle, and Late sub-periods. The sub-periods are distinguished by differences in climate conditions, resource availability, subsistence practices, and diagnostic projectile points (Collins 2004). Plant gathering appears to have become an important part of subsistence strategies during this time and was probably even more important during xeric periods. This may explain the appearance of burned rock earth ovens. They were used to cook a variety of plant foods that were otherwise inedible, such as roots of sotol (*Dasylirion* spp.) and yucca (*Yucca* sp.; Collins 2004).

In the Early Archaic, 8800-6000 BP, there was a shift in subsistence from large to medium and small game hunting and to plant foods (Collins 2004). Projectile point styles include Angostura and Early Split Stemmed forms. Task-specific tools include Clear Fork gouges and Guadalupe and Nueces bifaces (Turner and Hester 1993:246-256). Early Archaic sites were located along the eastern and southern portions of the Edwards Plateau in areas with reliable water sources (McKinney 1981). Population densities were relatively low during this sub-period and consisted of small highly mobile bands (Story 1985).

The Middle Archaic spans from 6000-4000 BP (Collins 2004). Diagnostic projectile points from this period include Bell, Andice, Taylor, Nolan, and Travis. According to Collins (2004), during the Middle Archaic there was a focus on the hunting of bison. Climate was gradually drying as the onset of the Altithermal drought began. Demographic and cultural change likely occurred in response to these hotter and drier conditions.

The last sub-period of the Archaic is the Late Archaic, which spans 4000-1200 BP (Collins 2004). Dart point diagnostics of the Late Archaic are triangular points with corner notches that include Ensor and Ellis (Turner and Hester 1993:114-122). Other Late Archaic projectile points are Bulverde, Pedernales, Marshall, and Marcos types (Collins 2004). Evidence from the Bering Sinkhole cemetery suggests that territoriality may have been established during the Late Archaic, possibly as a result of population increase (Bement 1994). Some researchers state that the accumulation of burned rock middens ceased at this time though current research has challenged this notion (Black et al. 1997; Mauldin et al. 2003). Recent studies (Mauldin et al. 2010:82) also suggest that while bison were not present in the region in large numbers, they were also not entirely absent during the Late Archaic as it has been previously thought (Mauldin et al. 2010:69-70).

Late Prehistoric Period (1200-350 BP)

The Late Prehistoric Period is divided into the Austin and Toyah phases. During the Austin Phase, the bow and arrow was introduced. Nickels and Mauldin (2001) suggest that at the beginning of this period environmental conditions were warm and dry. More mesic conditions appear to accelerate after 1000 BP. Subsistence practices remained relatively unchanged, especially during the Austin Phase. The Austin Phase may represent the most intensive use of the burned rock middens (Black et al. 1997) and includes diagnostic point types, Scallorn and Edwards (Collins 2004; Turner and Hester 1993).

The presence of bone tempered ceramics (Leon Plain) during the Toyah Phase suggests interaction between Central Texas and ceramic production traditions in East and North Texas (Perttula et al. 1995). Ceramics were in common use in East Texas by 2450 BP, but the first Central Texas wares did not appear until ca. 650-700 BP (Perttula et al. 1995). Other technological traits of this phase include the diagnostic Perdiz point, large hafted hide scrapers, and beveled bifaces. These specialized processing kits are thought to be an adaptation to flourishing bison populations by some (Ricklis 1992) and a sign of intensification of bison exploitation in response to declining populations by others (Mauldin et al. 2010).

Protohistoric Period (ca. 1528-1700)

The Protohistoric Period is a term typically used to describe the transition between the Late Prehistoric and the Colonial Period. This period is not well documented archaeologically in Texas. Some researchers (Wade 2003) argue that the Protohistoric Period may coincide with the end of the Late Prehistoric Toyah interval, spanning the period of A.D. 1250/1300 to A.D. 1600/1650 (Hester 1995). For the purposes of this report, CAR defines the period as beginning with the Early Spanish explorations in Texas (ca. 1528 A.D.) and ending with the establishment of a strong Spanish presence in the region in the late 1600s and early 1700s.

During this period, there was intermittent contact between the native groups and Spanish explorers. The significant impact of the Spanish upon the indigenous groups in the area was not immediate, with the possible exception of the spread of disease. A number of encounters between indigenous communities and Europeans were recorded during this period, including those of Cabeza de Vaca (1528-1536) and the French settlement established by René-Robert Cavelier, Sieur de La Salle (1685-1689). The area of present-day San Antonio was first visited by Domingo de Terán.

Archaeologically, the time period is poorly documented, but it has been identified at several sites in south Texas counties (e.g. Hall et al. 1986; Inman et al. 1998; Mauldin 2004). There is not a clear material culture associated with the period. Sites that have been deemed as "Protohistoric" may have Late Prehistoric and/or Historic artifacts associated with them, and in several cases, radiocarbon dates confirm their Protohistoric designation (Mauldin 2004).

Historic Period and History of Boerne

The Historic Period is characterized by systematic European contact with native cultures in the Americas. While the Spanish explorers had established their presence in Texas since the 1500s, European settlements, the Spanish in particular, became part of the Texas landscape beginning in the late 1600s. Mission settlements began to be established in Bexar County in 1718 with Mission San Antonio de Valero (Chapa 1997).

German immigrants began to arrive in Texas about 1830, and by 1850, five percent of the population of Texas consisted of German immigrants (Jordan 1977). Between 1844 and 1847, an estimated 7,000 German immigrants reached Texas, including the San Antonio area. A group of German colonists camped on the north side of Cibolo Creek in 1849, approximately 1.6 km (1 mi.) west of present-day Boerne. This new community was named Tusculum, but in 1852, Gustav Theissen and John James changed the name of the community to Boerne after Ludwig Boerne, a German author and publicist. The post office was established in 1857. The community continued to flourish with the building of a courthouse in 1870 and a rising population. The arrival of the San Antonio and Aransas Pass Railway in 1887 boosted the economy of the community. With the onset of the Great Depression in the 1930s, the economic and population growth declined. It was not until the 1950s that the community began to flourish again (Smyrl 2010).

Chapter 3: Previous Archaeological Investigations

There were five phases of work associated with the project (see Figueroa et al. 2012). In October 2011, CAR staff observed archaeological materials exposed during construction monitoring activities associated with Phase III of the work conducted on the Boerne Wastewater Treatment Plant project (Figure 3-1). This concentration of burned limestone, chipped stone debitage and tools, and projectile points was subsequently recorded as site 41KE217 (Figure 3-2). The cultural materials are situated within near-surface floodplain deposits of Menger and Cibolo Creeks. The floodplain deposits are, in turn, buried by a variably thick wedge of younger colluvial sediments that originated from the steep hill immediately west of the site. Initial estimates of the site size were 35-x-10 m (114.8-x-3.28 ft.), based on the surface extent of cultural materials.

These deposits were buried roughly 70 cm (27.6 in.) below the ground surface at the base of a hill that is situated immediately west of the Menger Creek floodplain and the Menger Creek and Cibolo Creek confluence. Site 41KE217 is situated approximately 250 m (820.2 ft.) due west of the confluence of Menger and Cibolo Creeks in Kendall County. The site is situated on a relatively level/stable floodplain of Menger Creek, along the upland valley wall margin. Site elevation is 423.8 m (1,390 ft.) and rises approximately 5 m (16.4 ft.) above the active channel level, though the site is periodically flooded by overbank flooding associated with Menger and Cibolo Creeks. The site rests at the base of a steep limestone hill on the east side of a property line fence. The site area lacks trees and contains short, native grasses all the way to the creek bottoms.

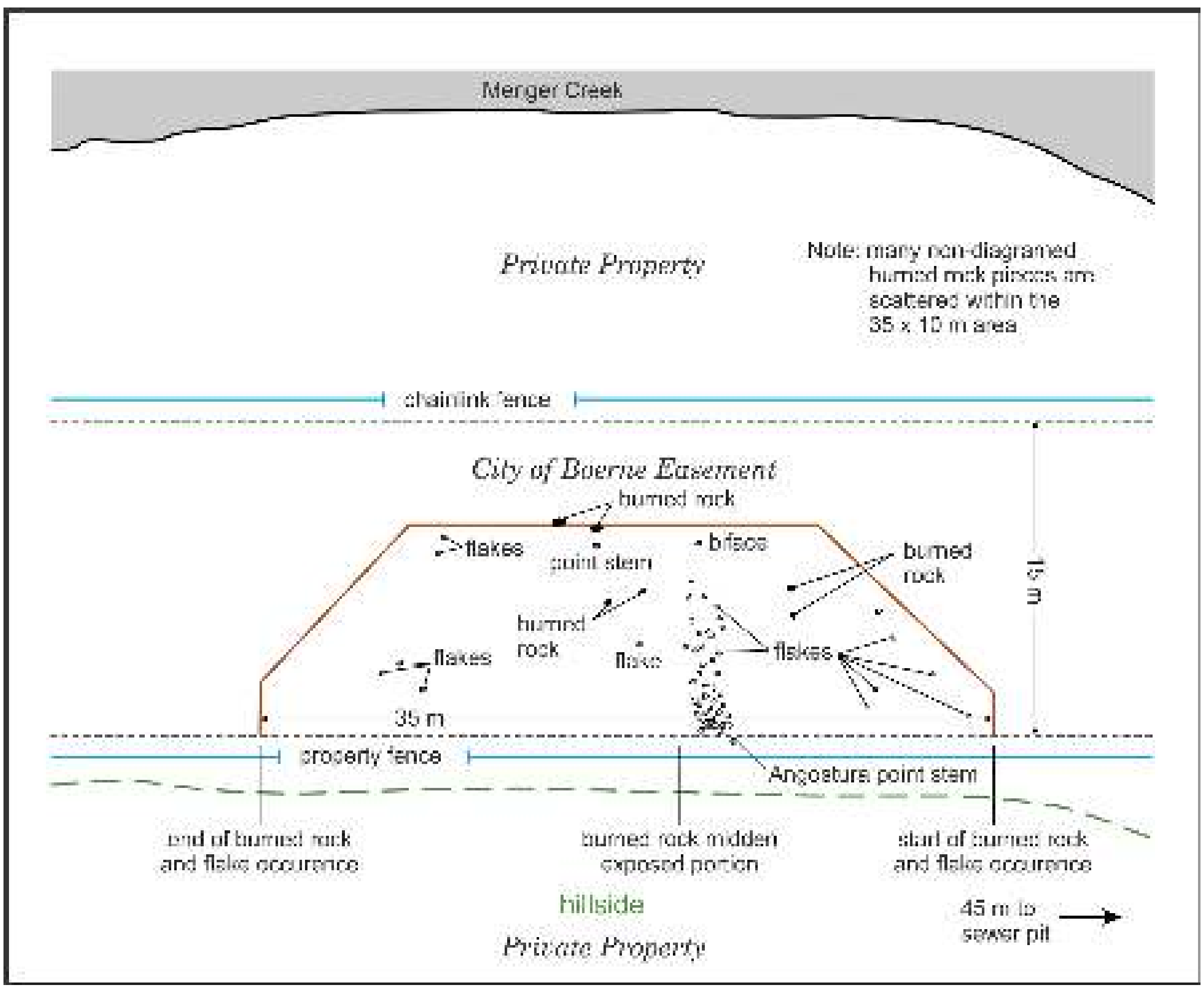

Figure 3-1. *Extent of 41KE217 as revealed from construction scraping.*

Figure 3-2. *Overview of the burned rock cluster during the initial discovery, facing south.*

Following the discovery, the site area was cordoned off from further construction impacts so that it could be fully assessed for significance. In order to further explore the horizontal and vertical extent of these site deposits, three backhoe trenches were excavated in the vicinity of the burned rock concentration.

Backhoe Trenches

Three backhoe trenches (BHTs) were excavated in order to better define the horizontal and vertical extent of the archaeological deposits revealed at site 41KE217 and to investigate the alluvial stratigraphy. In order to avoid confusion with the previous 10 backhoe trenches excavated near Cibolo and Browns Creeks during the archaeological survey, the previous survey trench numbering was continued. Trenches at 41KE217 were thus designated as BHTs 11, 12, and 13. However, during the testing phase they were renumbered BHTs 1, 2, and 3. Their locations are shown on Figure 3-3.

All trenches exposed the upper portion of an eroded/scoured, artifact-sterile Pleistocene terrace surface (designated as alluvial stratigraphic Unit 1B) that begins between 100 and 120 cm below the surface (cmbs; 39.4 and 47.2 in.). This ancient surface is overlain by more recent, Holocene-age floodplain alluvium (Unit 2B), which in turn is overlain by Holocene-age colluvium (Unit 3). Archaeological materials were identified within each of the trenches and are contained within fine-grained (e.g., silt loam to clay loam) floodplain deposits derived from Menger and Cibolo Creeks. No significant amount of cultural materials was identified within the Unit 3 colluvial deposits, which suggests that this may post-date the prehistoric period. A detailed geomorphic assessment of this site and the project area is presented in Chapter 8.

BHT 1 (BHT 11) was oriented along the same alignment as the construction easement, which was northwest to southeast (Figure 3-3). The purpose of BHT 1 was to further explore the extent of the burned rock feature that was initially noted during construction grading and topsoil removal from the easement. BHT 1 was situated at the southern end of the site and measured 20 m (65.6 ft.) in length and 130 cm (51.2 in.) wide, and it was excavated to an average depth of 150 cm (59.1 in.). The ground surface at the top of BHT 1 begins approximately 45 cm (approx., 18 in.) below the top of the colluvial toeslope deposits that covered the site and

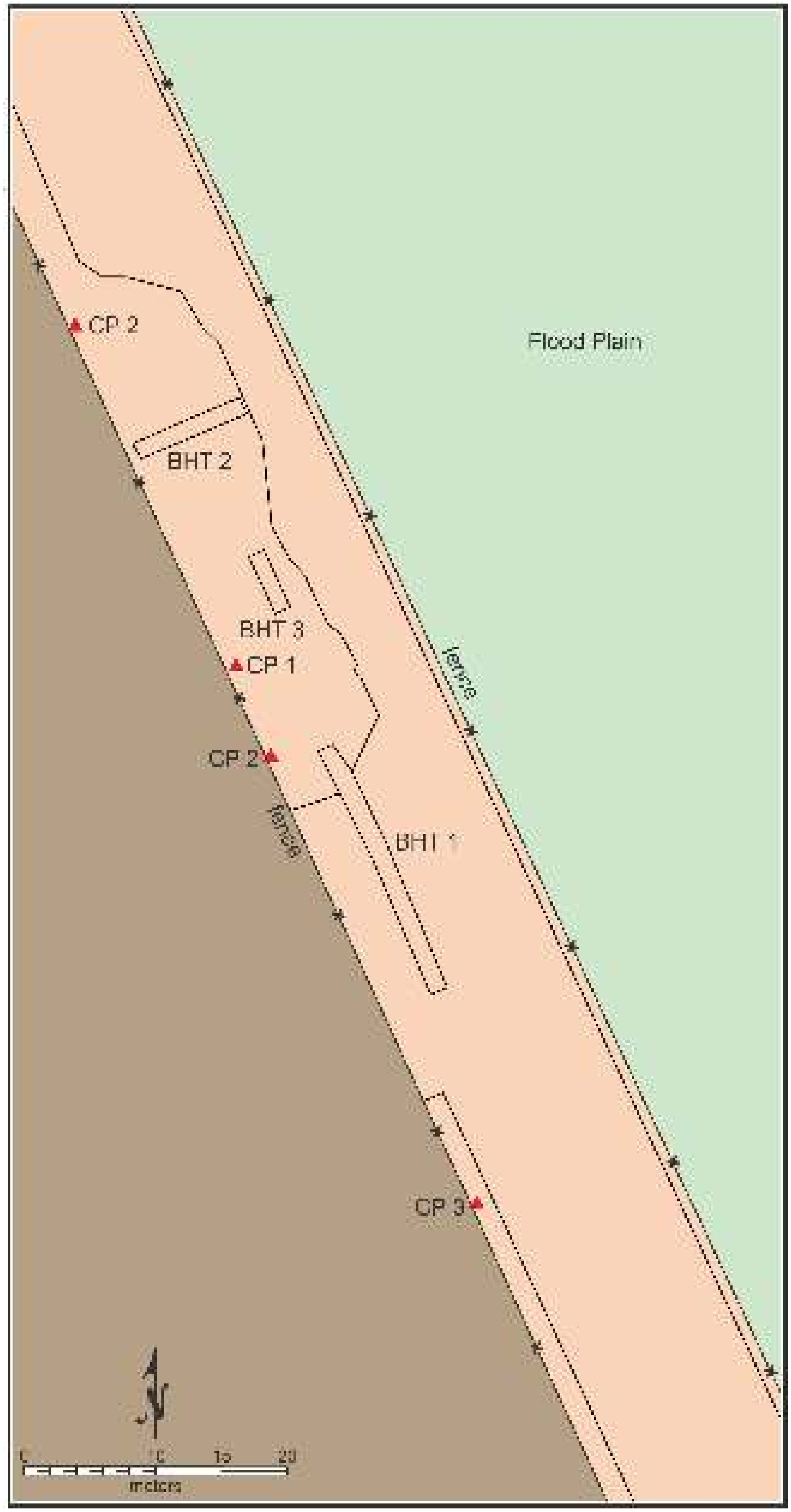

Figure 3-3. *Overview of backhoe trench locations within 41KE217. The initial burned rock concentration was near the north end of BHT 1.*

were mechanically removed during construction grading. However, the northernmost portion of BHT 1 remained intact at the original ground surface.

After hand-troweling the entire west wall of BHT 1, close examination revealed two stratigraphically distinct cultural occupation zones, designated as the upper component, and the lower component (Figure 3-4). The upper component consists of a dense burned rock layer approximately 30 cm (11.8 in.) thick, with abundant large limestone fire-cracked rock (FCR) fragments. This component was found to extend over a much larger area than originally anticipated, extending approximately 50 m (164 ft.) northeast-southwest and at least 15 m (49.2 ft.) southeast-northwest. It is not known how far on either side of the easement boundary the site might be. Dense concentrations of burned rock, lithic flakes, bifaces, utilized flakes, lithic cores, snail shells and fragments, scrapers, and projectile points were identified in the upper component. These materials appear to be confined to the 2A horizon and upper part of the 2Bk1 horizon associated with the uppermost part of the Holocene-age floodplain. Projectile points identified in backhoe trench backdirt appear to include Early, Middle, and Late Archaic styles, such as Bulverde, Pedernales, Langtry, Nolan, and La Jita points. Table 3-1 lists the lithic tools recovered from the backhoe trenches. Based on projectile points presumed to have originated from the upper component, the upper component of the site contains a very compressed zone of cultural materials ranging from 6000-3000 yr. BP.

Located approximately 30 cm (11.8 in.) below the upper component is a second zone of burned rock features, designated as the lower component (Figure 3-4). The lower zone is approximately 30 cm (11.8 in.) in thickness or less. It is contained within fine-grained overbank silts and exhibits excellent preservation potential. Furthermore, the lower component appears to represent a fairly short period of occupation before it was buried. Thus, a higher degree of temporal resolution into Early Archaic lifeways can be obtained at this site.

BHT 2 (BHT 12) was situated at the northwest end of the site and was oriented perpendicular to the easement, thereby cross-cutting the colluvial apron (Figure 3-3). BHT 2 was located approximately 50 m (164 ft.) north of BHT 1. BHT 2 measured 11 m (36.1 ft.) in length and

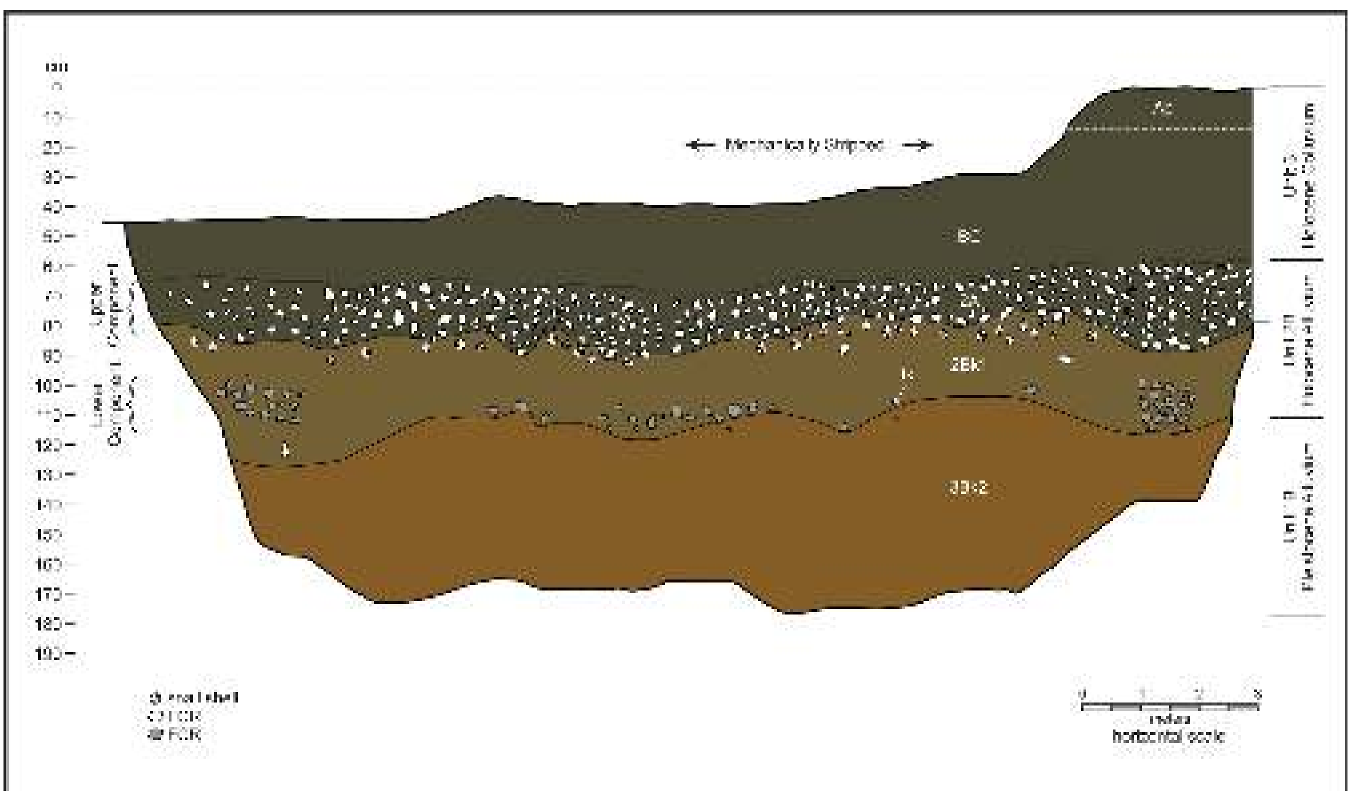

Figure 3-4. *Profile drawing of BHT 1, west wall. (Note vertical scale is exaggerated.)*

Table 3-1. Lithic Tools Recovered from BHTs 1, 2, and 3

Tool	BHT 1	BHT 2	BHT 3	Total
Angostura	0	1	0	1
Bulverde	1	0	0	1
chopper	0	1	0	1
core	1	1	0	2
edge-modified	0	1	0	1
expedient knife	1	0	0	1
expedient knife/scraper	1	0	0	1
knife	2	0	1	3
La Jita	3	0	0	3
Langtry	2	0	0	2
miscellanous biface	7	2	4	13
Nolan	2	0	1	3
Pedernales	2	0	0	2
perferator	0	1	0	1
preform	1	1	0	2
retouched flake	1	0	0	1
scraper	3	0	1	4
tool	1	0	0	1
Tortugas	0	1	0	1
untypable	1	0	0	1
untyped	1	0	0	1
untyped expanding base	1	0	0	1
Uvalde	0	0	1	1
Grand Total	**31**	**9**	**8**	**48**

was 130 cm (51.2 in.) deep at the west end of the trench, located near the top of the footslope. It was 80 cm (31.5 in.) deep at the east end of the trench, which was at the toeslope. No colluvial deposits had been removed in the BHT 2 area, which provided an uninterrupted, continuous soil sequence (Figure 3-5). Careful examination of the BHT 2 profile revealed that only the upper component of the site was present. This upper component consists of a 20-30 cm (7.9-11.8 in.) thick deposit of burned and cracked limestone rocks similar to those observed in BHT 1, though the FCR concentrations appear to be less dense. This upper component, which appears to correlate to the Middle Archaic occupation at this site, rests almost directly upon the eroded Pleistocene-age terrace surface that was designated as alluvial stratigraphic Unit 1B during the geomorphic investigations. The older, lower component was not observed, although the 2Bk1 horizon which contained both components in BHT 1, was present in BHT 2. However, this horizon was only about 10 cm (3.9 in.) thick in BHT 2. The two temporal diagnostic artifacts recovered from the trench consisted of an Angostura and a Tortugas point (Table 3-1).

From the east end of BHT 2, immediately below the upper component, a fairly large, prominent burned zone was identified and examined, and two charcoal samples were collected for radiocarbon assay. As shown in Figure 3-6, the ages that were returned date from 5568 to 5467 cal. BP and 5713 to 5590 cal. BP. These ages are consistent with the central age of the upper component at this site as estimated from diagnostic projectile points.

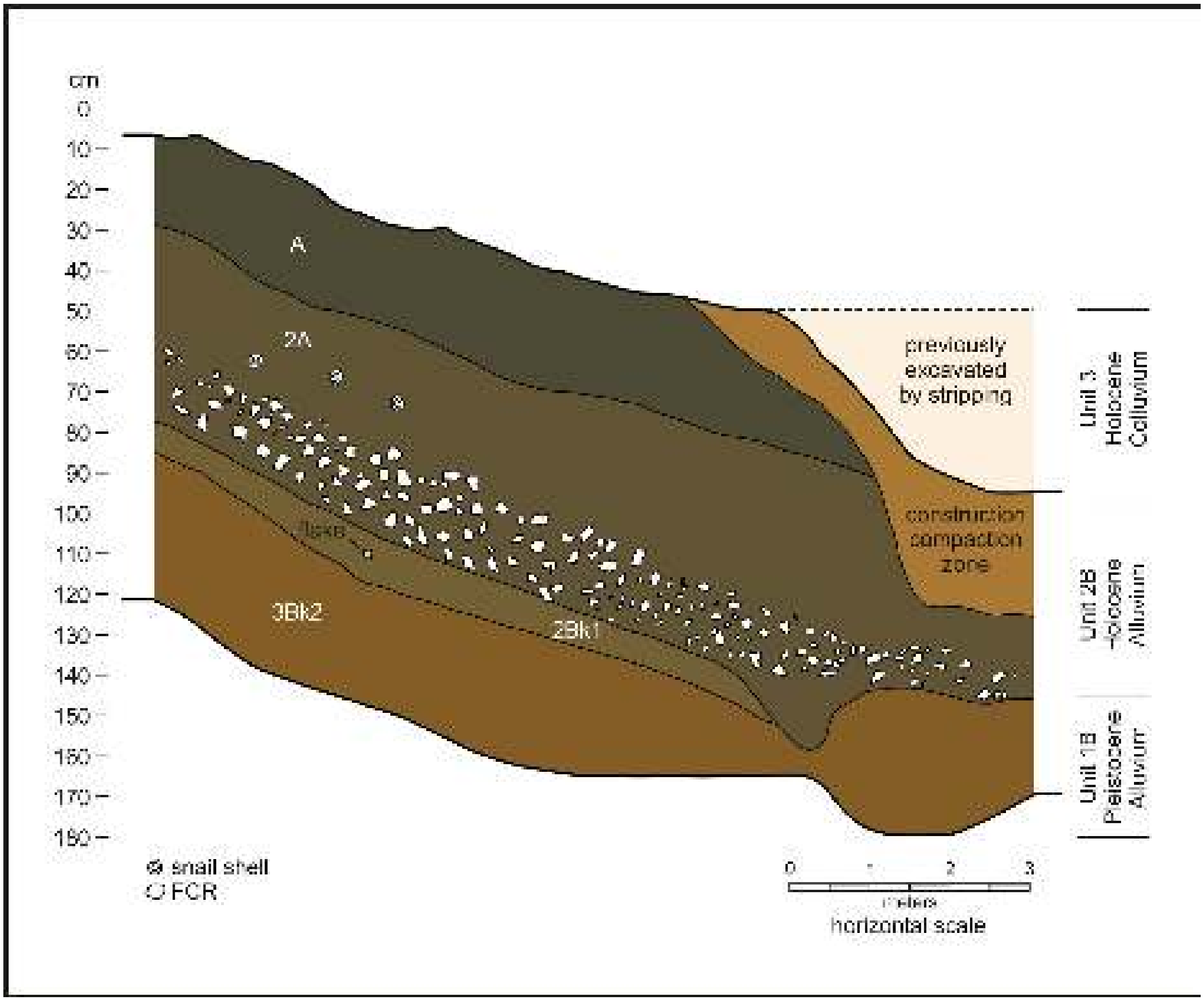

Figure 3-5. *Profile drawing of BHT 2, north wall. (Note vertical scale is exaggerated.)*

BHT 3 (BHT 13) was oriented the same as BHT 1, along the same alignment as the construction easement (Figure 3-3). BHT 3 measured 4.5 m (14.8 ft.) long, 130 cm (51.2 in.) wide, and 150 cm (59.1 in.) deep (Figure 3-7). BHT 3 was located midway between BHTs 1 and 2 in order to investigate the horizontal and vertical distribution of artifacts within the central part of the site. None of the colluvial deposits (e.g., Unit 3) had been removed in the BHT 3 area, which revealed an uninterrupted soil sequence (see Appendix A). Close examination of the cleaned, west wall profile revealed that only the upper component was present at this location and consisted of a 20-30 cm (7.9-11.8 in.) thick zone of cultural materials. These materials were consistent with the Middle and Late Archaic age burned rock fragments already identified in BHTs 1 and 2, likely dating from 6000-3000 BP. The upper component identified in BHT 3 rests directly upon the Pleistocene terrace surface (Unit 1B). No significant lower component appears to be present. Temporal diagnostic artifacts recovered in the trench wall included a Nolan and a Uvalde point (Table 3-1).

Summary

Based on the aerial extent of cultural materials as observed throughout backhoe trenches and construction grading, site 41KE217 measures approximately 50 m (164 ft.) in length from north to south and ranges in depth from approximately 60-140 cmbs (23.6-55.1 in.).

Two temporally distinct cultural components were identified during backhoe trenching. The upper component consists of an approximately 30 cm (11.8 in.) thick zone of late Middle

Figure 3-6. *Overview of BHT 2, facing west. Note absence of lower component and locations of radiocarbon samples.*

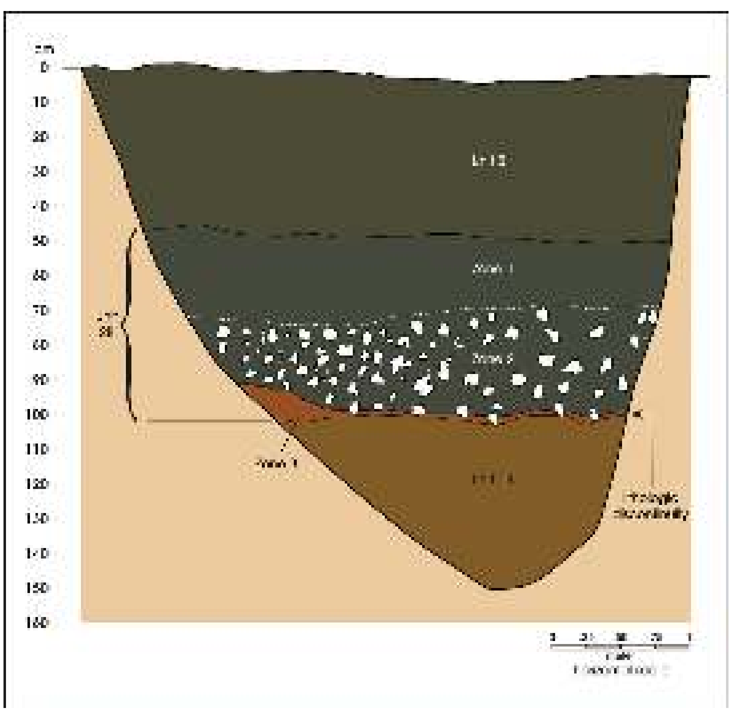

Figure 3-7. *Profile drawing of BHT 3, west wall. (Note vertical scale is exaggerated.)*

Archaic to Late Archaic artifacts and burned rock midden deposits. This upper component is present across the entire site and appears to begin within the 2A horizon and to extend into the uppermost portion of the 2Bk horizon of the floodplain surface. The top of the site is buried and preserved beneath approximately 60 cm (23.6 in.) of recent colluvial hill slope deposits that lack cultural remains.

The lower component, which appears to be limited to the south end of the site within BHT 1, contains a thin, discrete zone of burned rocks, flakes, and tools, and diagnostic Angostura-like projectile points dating to the Early Archaic Period. These artifacts are found within the lowermost part of the 2Bk horizon, within Holocene floodplain deposits. In the BHT 1 part of the site, the 2Bk horizon is substantially thicker than in the northern parts of the site around BHTs 2 and 3. Thus, there is approximately 20-30 cm (7.9-11.8 in.) of vertical separation between the upper and lower components in the BHT 1 area. Within BHTs 2 and 3, the 2Bk horizon is typically less than 10 cm (3.9 in.) thick, and no lower components were identified.

Based on the distribution of features and associated temporal diagnostic artifacts exposed during backhoe trenching, site 41KE217 appeared to contain Early through Late Archaic cultural materials. Coupled with the slowly aggraded, fine-grained sediments at the site, laterally-extensive burned rock midden features, and vertical separation of cultural components, additional testing was conducted at site 41KE217 in order to assess if it is eligible for the NRHP and if it merits designation as a SAL. The results of testing and the subsequent data recovery excavations are presented in Chapters 6 through 10 of this report.

Chapter 4: Research Approach and Theoretical Orientation

Site 41KE217 was discovered during the construction monitoring phase of the archaeological project. As a result, its discovery immediately implicated the scheduling of the construction and the timely completion of the project. First, the need for the NRHP eligibility testing of the deposits had immediate impact on the construction of the pipeline that connected to the planned wastewater treatment plant. In addition, the possibility that the deposits would be determined as eligible to the NRHP further implicated the project completion date. As a result of these anticipated delays and in order to expedite the eligibility testing excavations, no formal research design was produced prior to the initiation of the eligibility testing. The eligibility testing investigations were focused on defining the degree of intactness of the two components noted in BHT 1 and determining the ages of the components, if feasible. At the completion of the eligibility testing, a brief post-field report was produced that summarized the results of the investigations and recommended that the site was potentially eligible to the NRHP. A site visit was made by members of the THC during which the factors that went into the eligibility recommendation were discussed and a strategy for the data recovery phase of the investigations was proposed and agreed upon. Subsequently, a data recovery plan was produced and submitted as a modification to the existing permit and the work was begun following seasonal rains. This chapter, which in broad terms lays out a general research approach to the analysis of the materials recovered from the site, was written well after the completion of the field investigations. It was produced to provide general guidance for the analysis of the materials that were recovered during the field investigations. The approach and discussion is based on the research design employed by Mauldin and Thompson (2012) for the analysis of materials derived from 41KM69, the Flat Rock Site, recently excavated in Junction, Texas.

The theoretical orientation of the proposed analyses is a combination of cultural ecology (Kirch 1982; Netting 1986; Sutton and Anderson 2004) and optimal foraging theory (Charnov et al. 1976; Emlen 1966; MacArthur and Pianka 1966; Winterhalder 1981). Here the focus is on the various types of responses prehistoric hunter-gatherers exhibit in the face of changing environmental and social landscapes and condition. We expect that these responses will range from changes in technological repertoire to adjustments in mobility and subsistence strategies. We anticipate that the principal factors that will cause such adaptive adjustments are climatological and are reflected in changes in available resources and the spatial and temporal structure of these resources. Therefore, we anticipate that hunter-gatherer adaptations to such changes will manifest in terms of spatio-temporal parameters of adaptation. That is, we expect that hunter-gatherer groups will change their patterns of mobility to adjust to new prey types and also may change their technology to increase procurement rates for these prey species.

Prey models derived from optimal foraging theory were developed for a single predator, searching in a random pattern, sequentially encountering potential prey in a homogenous environment (Charnov et al. 1976; Emlen 1966; MacArthur and Pianka 1966; Winterhalder 1981). Prey models (see Stephens and Krebs 1986) frequently quantify returns (benefits) as energy (kilocalories [Kcal]) obtained from food (see Jochim 1975; Sih and Milton 1985; Speth and Spielmann 1983), and quantify costs as time expended on searching for, pursuing, capturing, and processing that food. They assume that foragers will attempt to maximize average return rates in the context of different cost/benefit ratios for different prey. Costs are usually broadly framed as search costs, the amount of time spent looking for resources, and handling costs, the amount of time required to pursue, capture, and process foods. Models assume that searching and handling are mutually exclusive, and that foragers have perfect knowledge of cost and benefits of all resources under consideration. The models focus on the question “should I pursue that resource, or should I continue to forage?” We find the explicit cost/benefit framework appealing, and we used elements of prey models to guide our analysis.

One such element is ranking of prey alternatives in terms of handling costs and benefits. For human foragers, this ranking often reflects body size with larger-bodied animals (e.g., mammoths, bison) being more profitable (higher returns relative to handling costs) than smaller-sized animals (e.g., rabbit, deer) and plants. Search costs, though not taken into account in potential prey profitability rankings, play a critical role in determining the actual diet. In a classic prey foraging model, as foragers add more resource types to their diet, search costs decline because foragers encounter dietary items more frequently. There is a cost to incorporating less profitable resources into a diet. Time saved in searching is offset by the higher handling cost and/or lower caloric benefits of lower ranking resources. The inclusion of a resource must serve the overall profitability of the diet and will not be included until the value of higher ranked resources drops below a certain threshold. Therefore, the inclusion of a low ranked resource is dependent on its profitability relative to that of higher ranked, more profitable resources. Foraging models predict a trade-off, then, between handling cost, benefits (energy return), and search costs that will maximize the average return and produce an optimal diet. These models predict that foragers will continue to add lower-ranked resources to the diet, increasing the diet breadth, so long as the overall profitability of the diet, seen in terms of total costs to benefits, is increased. Furthermore, foragers should drop resources from the diet, reducing their diet breadth, when doing so would increase overall profitability. Many factors, however, influence the profitability of a food item including, but not limited to, relative scarcity, climate, rainfall, and food procurement and processing technologies.

Changes in technological approaches to prey acquisition also will influence aspects of optimal foraging. For instance, shifts in the types of tools (e.g., use of ceramics) or processing facilities (e.g., features) will primarily influence handling costs associated with the acquisition of a given resource, although in some cases, they may also influence kill or capture rates and nutritional returns. We envision facilities and tools as ranging from generalized to specialized in form. We envision facilities and tools as ranging from generalized to specialized in form. Specialized tools (e.g., ceramics; hafted lithic tools, bows and arrows) and features (e.g., burned rock middens) tend to be more expensive to produce. Formal tools require more time, are usually more complex, and in some cases may require specific raw materials that have limited distributions. As a group, hunters and gatherers frequently maintain specialized tools and facilities, also increasing their overall costs (see Binford 1977, 1979). However, because of their specialized nature, these tools and facilities tend to be more efficient at accomplishing their designed task. Generalized tools or facilities, conversely, are less expensive to produce. They are often expediently made (e.g., utilized flakes), they tend to have few components, and they may have more flexible raw material requirements. In addition, they often have short use-lives and minimum associated maintenance costs. While less costly and potentially useful in the performance of a variety of tasks, generalized tools and facilities will be less efficient at any given task.

Another set of responses that will affect parameters of optimal foraging is mobility. Mobility, in terms of search costs (travel time), plays a critical role in modeling diet breadth in prey models. Researchers increasingly discuss hunter-gatherer mobility systems in terms of "forager" and "collector" strategies (Binford 1980). Collector strategies have low residential mobility, relying extensively on task-specific groups to acquire resources and move those resources back to residential locations. Binford's foragers, in contrast, make frequent, shorter moves of residential camps and acquire food on a daily basis. Binford (1980; see also Kelly 1995) broadly framed these two strategies as responses to different environmental conditions with foragers present in environments characterized by ubiquitous, low-density resources, and collectors present in settings with high temporal and/or spatial disparity in resources. In practice, these two strategies are frequently present within the same cultural system, with seasonal or resource-specific shifts in search strategies possible.

Logistical systems of resource procurement are a more specialized strategy relative to foraging-based systems. They are more costly in terms of distances covered, as well as requiring more planning, preparation, and coordination. Task groups of hunters and gatherers use logistical strategies to gather resources in excess of immediate needs, with that excess returned to residential locations. It is likely, then, that when logistical strategies are used, their target will tend to be higher-ranked resources. This is because the distance at which hunters and gatherers can effectively acquire resources in bulk is tied to the resources overall return rates, load-bearing abilities of the participants, and distance (e.g., Jones and Madsen 1989; Metcalfe and Barlow 1992). It is likely that the use of a logistical strategy would increase encounter rates for the targeted resource.

Data Types and Research Domains

Having briefly summarized the theoretical foundations of the research, the data types that have been obtained during the eligibility testing and mitigation of the site are briefly reviewed next. The summary allows us to define what research domains were pursuable following the fieldwork and based on artifact categories and other data recovered during the field investigations.

During testing, four 1-x-1 m (3.28-x-3.28 ft.) units were excavated amounting to approximately 4.3 m^3 (47.2 $in.^3$) of deposits. These excavations revealed an expansive burned rock layer and produced a moderate assemblage of unmodified lithic debitage, a small number of temporally diagnostic projectile points, a small number of edge-retouched tool forms, and a number of rock-lined thermal features. In addition, the soil matrix yielded a large number of snails recovered in the ¼-inch hardware cloth. The majority of the chipped lithic artifacts are patinated either on one or both faces. Minimal animal bones were identified during field screening suggesting that bone preservation is relatively poor. During data recovery efforts that focused on the lower component, the crews recovered a small sample of lithic debitage, formal and informal tools, and temporally diagnostic projectile points. Thirteen features were encountered, and five radiocarbon samples were submitted for radiocarbon assay.

One of the first challenges of every archaeological project is to determine the age of the components represented by the materials recovered. This temporal anchor provides a comparative basis for the analysis of the materials and also allows for the proper contextualization of hunter-gatherer adaptations into the climatic and resource regimes that may have been operational at the time of the formation of the archaeological record. Therefore, one of the first research domains pursued is the determination of the age of the deposits. Given that chipped lithic artifacts and their manufacture debris is one of the most abundant material correlates of prehistoric occupations of the site, additional research will focus on assessing the technological organization of the site's occupants. Due to their portable nature, lithic artifacts also can serve to address issues of mobility, particularly in terms of the scale and regional patterns. Fire-cracked rocks are likely to be even more common than chipped lithics among the artifacts recovered from 41KE217. Because of their integral role in food preparation, they can provide useful insights into the investigation of food preparation and consumption patterns, and they can serve as proxy indicators of diet breadth and plant use. The remaining sections of this chapter briefly expand on each of the research domains that could be pursued given the data types obtained during eligibility and data recovery investigations at the site.

Chronology

One of the first research domains to be addressed is the age of the two cultural components identified at the site. To define the chronological sequence, we will rely on a combination of radiocarbon samples and projectile points recovered from the site. Four radiocarbon samples were submitted for dating and have return dates. In addition, a large number of typed projectile points were recovered from each of the components. Using the projectile points as a basis of relative dates, along with radiocarbon assays collected during testing and data recovery, we can attempt to reconstruct the formation and chronology of the site and bracket the ages of the two distinct cultural components.

Assessing Technological Organization and Change

Major shifts in faunal assemblages had taken place at the close of the Pleistocene, and hunter-gatherer groups had to shift to the procurement of smaller-bodied prey, such as deer and antelope, and away from larger-bodied prey, such as mammoth, mastodon, and *Bison antiquus*. Collins (1995) suggests that modern bison re-entered the region during the Early Archaic, and if so, hunters shifted their strategies and weaponry to the procurement of the larger-bodied prey species. Recent research (Munoz et al. 2011) has established the presence of bison on archaeological sites throughout the Middle and Late Archaic Periods.

In our general hunter-gatherer model, we argue that changes in the relative density of bison within the area exploited by hunter-gatherers could significantly affect not only diet breadth but also tool design and the organization of tool manufacture and repair strategies. Specifically, we suggest that possible decreases in bison availability, a restricted spatial distribution, and increasing fluctuations in bison availability, especially during the Early Archaic, may have resulted in the intensification of bison procurement. A shift to a tool kit that was more specialized, and consequently more expensive to produce and maintain, may have been part of this intensification process. In contrast, we expect more generalized tools that are less energy intensive to manufacture (i.e., flakes with suitable working edges) would have been favored by hunter-gatherers during the Early Archaic as processing requirements were not temporally restricted, did not occur in bulk, and were dictated more by day-to-day needs. While it is likely that both specialized and generalized tools would have been present in any given system, it is our expectation that the increased costs associated with the production of specialized tools would tend to favor their use in situations where the intensified exploitation of high-ranked resources was the primary focus of activities. This would especially be the case if an important component of annual subsistence relied on resources that were declining in number, were becoming restricted spatially, and were fluctuating dramatically on a year-to-year basis. Under these conditions, there is pressure on hunters-gatherers to acquire large quantities of that resource during the period of availability (see Bamforth and Bleed 1997). In contrast, the day-to-day acquisition of resources within a forager system does not lead to intensive energy expenditures since some resources are procured each day, and a failed hunting or collecting trip can easily turn into a successful one the next day.

As outcomes of these suggestions, we would expect hunter-gatherer tool kits to consist of forms that have high manufacture costs as fluctuations in bison populations become common during the Early Archaic. In contrast, during the Middle Archaic, we anticipate to find fewer tools with high manufacture costs and little evidence of what some have termed gearing up (see Binford 1977, 1979; Bleed 1986). In addition, signs of gearing up should be more prevalent during Early Archaic times compared to later time periods. The results of these analyses are presented in Chapter 10.

To investigate the assumed relationship between tool design (i.e., energy expended in the manufacture of a tool) and the changes in bison population densities, we will focus on the lithic assemblages recovered during the excavations to identify tools. Next, the assemblage will be divided into distinct groups reflecting the level of energy that had been expended for its manufacture.

The making of lithic tools is a reductive activity that leaves evidence of the amount of effort that a knapper invested in the manufacture process. Specifically, we suggest that the area covered by retouch (i.e., flake removals) present on a tool can serve as a proxy for the level of effort expended in the manufacture of tools. Here, we refer to manufacture costs as only those aspects of tool making that include the percussion and/or pressure flaking of a piece of raw material into a finished product. That is, the costs of raw material procurement are not part of the consideration. In addition, we do understand that the stone portion of the tool often represents only one element of a compound tool. Ethnographic studies indicated that the perishable portion of a compound tool is often the most expensive portion. Nonetheless, we assume that under circumstances when tools are manufactured anew rather than reworked from recycled specimens, there is a correlation between the level of effort expended in overall tool manufacture and the level of effort that is used in the manufacture of the stone portion of the tool.

Accepting this assumption and given the relationship between the manufacture costs (i.e., generalized versus specialized tools) and resource procurement strategies (i.e., residential versus logistical foragers), we suggest that comparisons of assemblages in terms of stone tool manufacture costs can be a productive research avenue to identify and differentiate technological organization and resource procurement strategies. Specifically, we would expect that during the Early Archaic, when we have argued that hunters and gatherers may have procured bison through logistical mobility and bison populations were increasingly variable from year to year, the primary emphasis would have been on the manufacture of specialized tools. In contrast, during the later times when resource procurement occurs on a day-to-day basis, tool manufacture costs on average will be low given a heavy reliance on generalized tools and decreased likelihood of curated specimens.

We assume here that within any tool kit employed by hunter-gatherers, there may be functionally specific forms (i.e., projectile points) that may not fit these general expectations since manufacture costs are conditioned by the degree of dependence of the tool user upon the specific tool (Tomka 2001). That is, even within residentially mobile foragers, some of the tools employed will be costly to manufacture because of the high degree of dependence on this tool to carry out tasks in an efficient and effective manner.

Relying on these assumptions and expectations, we categorized stone tools from selected assemblages into one of four manufacture-cost categories. From the least energy expensive to the most expensive these categories are: 1) utilized flakes; 2) marginally retouched items; 3) unifacially retouched specimens; and 4) bifacially retouched forms. This classification scheme assumes that as the number of faces being retouched increases the energy expended during tool manufacture also increases. As mentioned above, costs associated with the construction of the haft element add to the overall manufacture costs of a compound tool.

When we could not classify selected specimens into functional categories based on macroscopic use wear, they were subjected to low powered micro-wear analysis at 40–80x magnification to discern the utilized edge and the manner of use or the task performed with the tool. Following this examination, if we could not classify the specimen into a functional category, we excluded that item from further consideration. Once we quantified the total number of use-modified tools and their associated tasks, we estimated the total number of specimens within the collection by dividing the total number of debitage from the component/site by the count in each class.

Next, we assigned each tool to one of the four manufacture cost groups dependent on the degree of retouch that has gone into their manufacture. Once we established the number of specimens in each manufacture cost category within the assemblage derived from each of the components, the data will be entered into contingency tables, and inter-assemblage comparisons will be made using standard statistical techniques (i.e., residual analysis). Through careful examination, we can identify any reused or reworked tools that may have changed from its original form. The only effect on measurements that retouch may have on reworked tools is that it will decrease the length of tool thereby decreasing the amount of surface area available for future retouch.

Investigating the Scale of Mobility

The final research domain considered under this module involves investigating the scale of mobility practiced by the site's occupants. We have argued that mobility levels should be responding, in part, to alterations in diet. Specifically, when diet breadth is expanding within the context of residential foraging, the scale of mobility within the annual round should decrease. While the number of residential moves may increase in a foraging system relative to a logistically organized system, the scale covered by the entire mobility system should be drastically reduced with a system heavily reliant on daily foraging trips (see Kelly 1995). In contrast, during the Early Archaic, when hunter-gatherers were focused on the returning bison herds, they would have shifted their hunting strategies to a logistically based system, and subsequently, they would also have increased the scale of mobility within the annual round.

We suggest that as the scale of the mobility increases, there should be concomitant increases in the range of tool stone encountered and used in tool production. A corollary of this expectation is that the greater the scale of mobility, the more likely that some of the tool stone present on site arrived there from non-local resources in the form of staged, finished tools or well-worn tools and represents the debris from staged manufacture, tool rejuvenation, and reworking. Several studies (e.g., Amick 1994) have shown that debitage and tools can be used to track mobility. While these studies often involve the matching of specific raw materials with known source locations, the relationship demonstrated by these earlier studies is applicable even if the specific tool stone source areas are not known.

Whether the acquisition of tool stone is embedded in other activities or is a task-specific activity, logistical residential components should reflect the range of raw materials present in the system. Regardless of the activities, task-specific, special-purpose locations should have a smaller range of raw materials present. Similarly, foraging systems should access a smaller range of raw materials simply as a function of the more limited scale of mobility. For instance, forager groups centered on the exploitation of the Hill Country region of the Edwards Plateau will have access to good quality cherts characterized by tan, brown, and gray color ranges. These resources would include both primary sources as well as a variety of secondary sources available in river gravel deposits. Foraging groups exploiting resources in South Texas would have a more limited selection of tool stone primarily limited to river gravel deposits and some lower quality raw materials blanketing high spots across the landscape.

The distribution of lithic raw materials does not always coincide with the locations where human populations position themselves relative to other resources (e.g., water, fuel, animals, and plants). In addition, because the discard of artifacts is conditioned by such factors as the cost of manufacture, length of use-life, length of site occupation, and overall raw material availability, some artifacts (e.g., curated) manufactured at one site may be used and refurbished at several sites prior to discard. These circumstances lead to the movement and discard of tool stone in a variety of conditions (i.e., stages of reduction) and forms (i.e. brand new, refurbished, manufacture broken, use broken, and recycled tools). Which of these conditions will be reflected by the tool stone materials (e.g., debitage, cores, manufacture failed, finished, and recycled) recovered from the two components will be conditioned by the availability of raw materials across the landscape and the distances that the raw material will be moved as part of hunter-gatherer mobility strategies. Tool stone resources on and off the Edwards Plateau, such as in South Texas and the lower Pecos, are dramatically different from each other in terms of color, texture, and size. Therefore, to track the scale of mobility of the sites prehistoric inhabitants, we will categorize debitage, projectile points, and bifaces within distinct raw material color and texture groups (minimum analytical nodules) that should allow us to track how raw materials came into the assemblage.

Investigating Diet Breadth and Plant Use

Currently there are no well-established methodologies for assessing the importance of plants in archaeological assemblages. Ethnographic data (Wandsnider 1997) suggests that there is a strong relationship between the use of rock in thermal features and plant processing and that thermal features with different amounts of rock are likely to be used to process different types of plants. We also suggest that the frequency of thermal features with rock as the principal heating element may serve as gross proxy indicator of the intensity of plant processing, while the variety of feature types, defined by feature size and rock weight, may provide an indirect measure of the variety of plants represented in the diet of hunter-gatherers. We expect differences between the features in the two components, particularly if the lower component dates to the Early Archaic when bison were more available. The density and/or area devoted to burned rock features should be lower during the Early Archaic when bison was available, compared to the Middle Archaic when bison appears to have been present in lower numbers.

Summary

This chapter reviewed the four research domains used for the analysis of material collected at 41KE217. These research domains included chronology, technological organization and change, scales of mobility, and diet breadth and plant use. Associated with each domain are a set of data needs, and analytical methods. The results and presentation of these research domains are provided in Chapter 10.

Chapter 5: Field and Laboratory Methods

Investigations conducted at 41KE217 consisted of both NRHP eligibility testing and data recovery. The focus of testing was to target both the upper and lower components of the site that were observed during previous backhoe trenching. Subsequent to eligibility testing it was decided by the THC, based on the recommendation of the CAR Principal Investigator, that the lower component of the site should be the focus of data recovery efforts. Therefore, the upper component of the site was mechanically removed and blocks of units were hand-excavated as part of the data recovery. This chapter briefly discusses the field and laboratory methods used on this project.

Archaeological Testing

CAR conducted NRHP eligibility testing from November 2, 2011, to December 8, 2011. The focus of the eligibility testing was to determine the degree of integrity of the deposits, whether datable materials were present within the site, what the preservation of faunal materials was, and how the site could contribute to our understanding of the prehistory of Kendall County and the southern edge of the Texas Hill Country.

Forty-three levels were excavated within four 1-x-1 m (3.28-x-3.28 ft.) test units (4.3 m^3) during the testing phase. Test Units (TUs) 1 through 3 were excavated off the west wall of BHT 1, and TU 4 was excavated on the north wall of BHT 2 (Figure 5-1). TUs 1-3 began at the scraped surface that exposed the burned rock concentration pictured in Figure 3-2. It is estimated that this surface was approximately 45-50 cm (17.7-19.7 in.) below the original ground surface. Test Unit 4 was excavated adjoining BHT 2 and was begun from the original ground surface present along the base of the hill where 41KE217 was located. Hand-excavation was carried out in arbitrary 10 cm (3.9 in.) levels; all matrix was screened through ¼-inch hardware cloth. For all excavated levels, up to 1-liter samples of soil was collected for fine-screening in the CAR lab. All encountered features were documented using standard archaeological procedures. This included completion of feature forms, measured drawings, and photographs. Where appropriate, a variety of samples were collected, including soil samples for flotation. Charcoal or other macrobotanical samples, when observed in context, were collected for possible radiocarbon analysis. All encountered artifacts, ecofacts, and associated samples were recorded with appropriate provenience information and transported to the CAR laboratory for processing and analysis.

Each unit was hand-excavated in arbitrary 10 cm (3.9 in.) levels by shovel skimming and troweling, and all sediments were screened using ¼-inch hardware cloth. All level data was recorded on standardized level forms. When identified in-situ, artifacts were mapped in the unit floor and an elevation from local datum was recorded. All artifacts were collected, cleaned, catalogued, and placed in bags. At the completion of a test unit, at least one unit wall was profiled. Profiling included field descriptions of color, texture, cultural materials, and any other salient features.

To minimize delays, the processing of the artifacts in the CAR laboratory took place concurrently with the field investigations. This allowed the generation of preliminary artifact counts by the time the testing excavations were completed. The preliminary counts of burned rock and chipped lithic artifacts derived from TUs 1, 2, and 3 indicated that at least two archaeological components may be distinguishable within these three units and along BHT 1 (Figure 5-1). The upper component appeared to consist of a 20-30 cm (7.9-11.8 in.) thick continuous zone of burned rock associated with a variety of projectile points dating from the Middle and Late Archaic Periods. The component appeared to represent a heavily used and frequently reused surface upon which multiple rock-lined hearths were established and reused over time. Underlying this zone of burned rock, exposed in the wall of BHT 1, as well as noted in TUs 1-3, were a series of isolated rock-lined hearths separated in some instances by as much as 15-20 cm (5.9-7.9 in.) from the upper component. The vertical separation between the components appeared to increase from north to south along BHT 1, and only the upper component was present in TU 4 near the northern end of the site.

Because the upper component appeared to represent cultural materials derived from intensive use and reuse of the landform and seemed to cover several thousand years based on the range of projectile points, the Principal Investigator recommended that only the lower component of the site had research potential worthy of additional investigation. Furthermore, because the vertical separation between the two components was greatest near the southern half of BHT 1, it was recommended that the lower component be investigated systematically near the southern half of the site boundary in an area encompassing TUs 2 and 3. These recommendations were presented to the representatives of the THC during an on-site meeting that was also attended by representatives of the City of Boerne and the construction firm. The THC

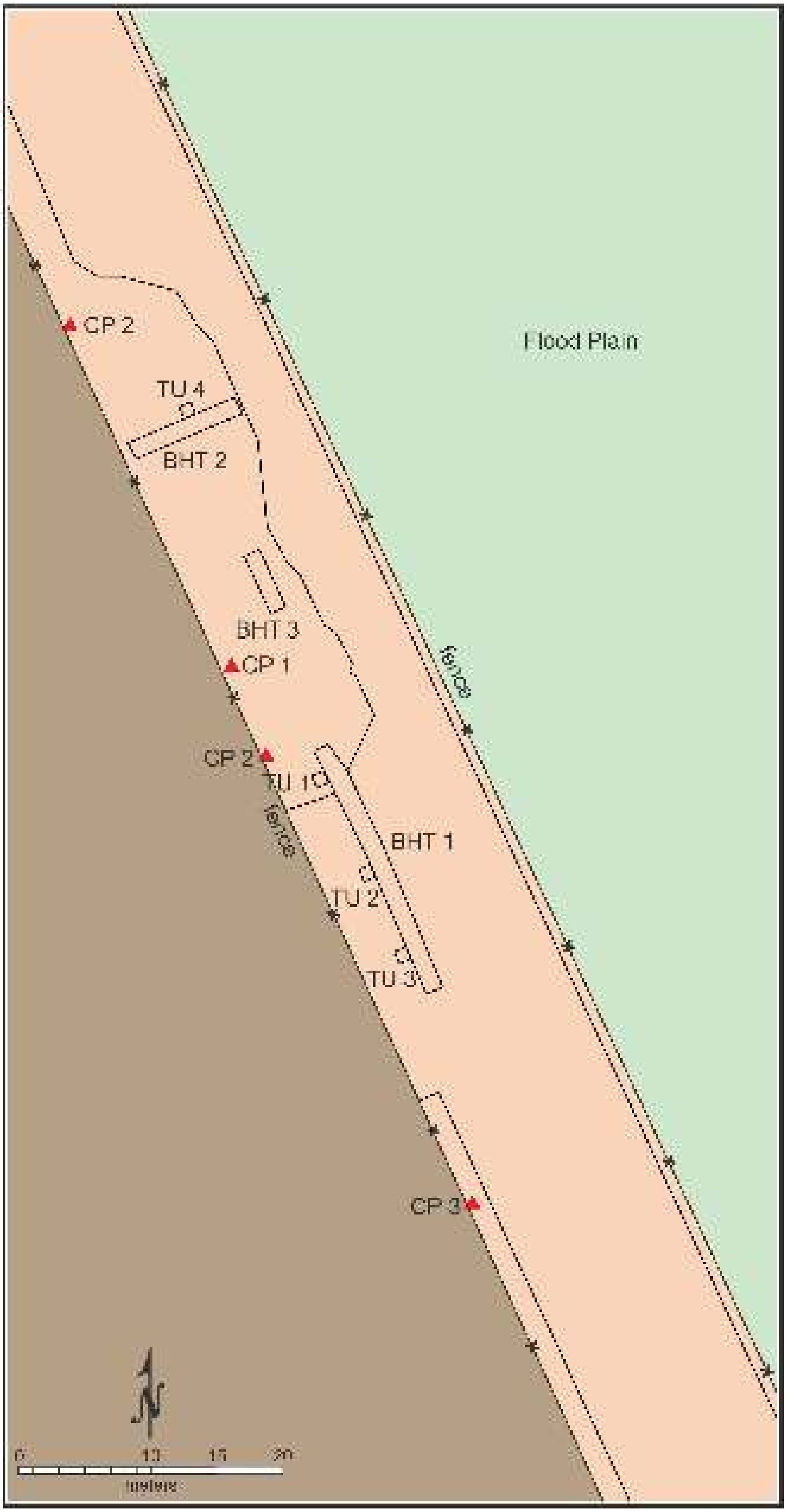

Figure 5-1. *Location of test units in relation to backhoe trenches excavated at 41KE217.*

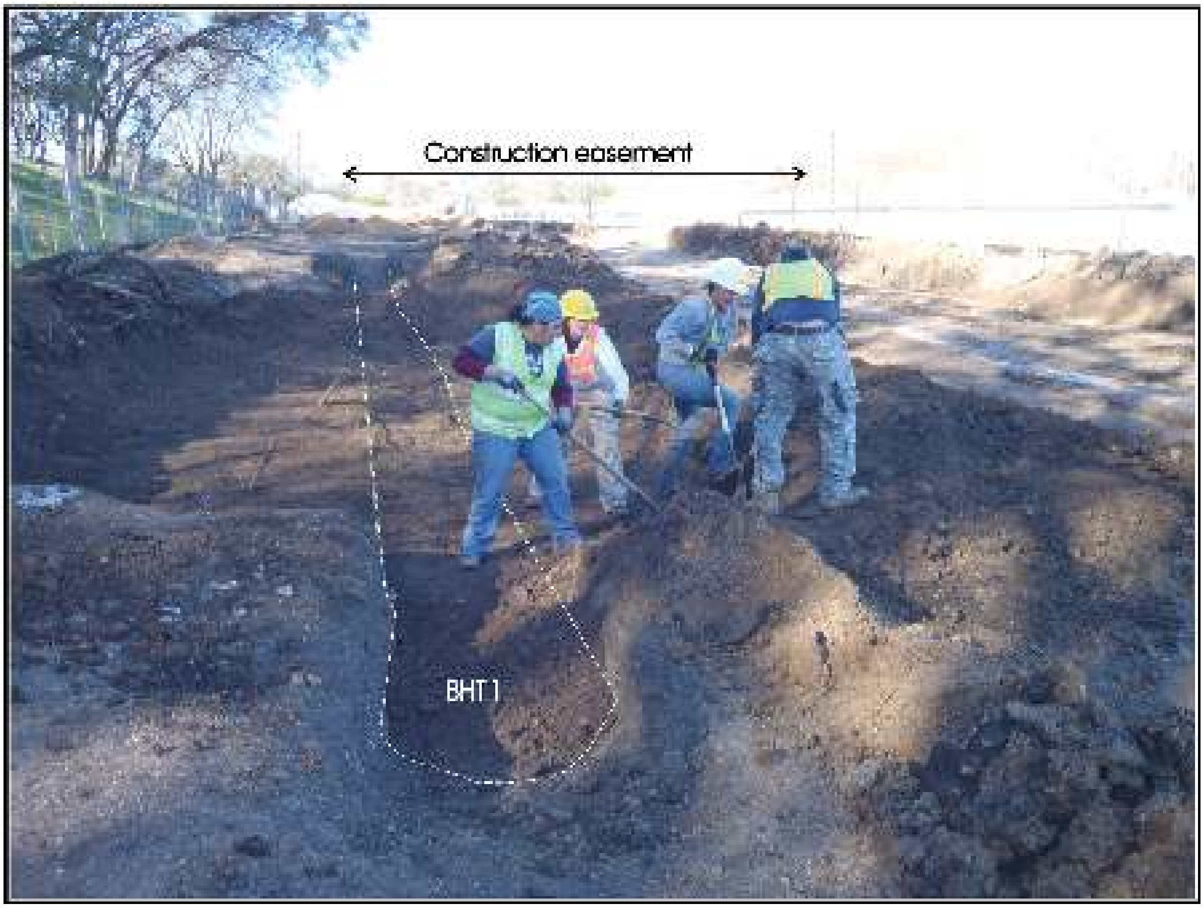

Figure 5-2. *Field crew shovel-stripping soil overburden located 5-10 cm (2-3.9 in.) above the lower site component at 41KE217.*

representatives approved the recommendations pending the approval of a Scope of Work (SOW) that outlined the proposed excavation strategies and methods. The requested SOW was prepared and subsequently approved by the THC, and data recovery was initiated shortly thereafter.

Following the testing, the City of Boerne, CAR, and the THC agreed that the additional archaeological efforts should focus on the deeper (lower) of the cultural components.

Archaeological Data Recovery

Between January 3, 2012, and January 25, 2012, CAR staff conducted data recovery investigations at 41KE217. As per the project SOW, the data recovery efforts focused on the deeper of the two components. To reach and explore this deeper component in a cost-effective manner, it was also agreed that the upper component would be mechanically stripped. The mechanical removal of the upper component was carefully monitored and was halted approximately 15-20 cm (5.9-7.9 in.) above the top of the deeper component. Archaeological crews then proceeded to shovel strip an additional 5-10 cm (2-3.9 in.) of soil, stopping approximately 10 cm (3.9 in.) above the lower component (Figure 5-2).

The initial data recovery plan called for the excavation of 30 additional 1-x-1 m (3.28-x-3.28 ft.) units with three 10 cm (3.9 in.) thick levels dug in each unit. Two of the units excavated during testing (TUs 2 and 3) were incorporated within this block. The original data recovery plan called for the positioning of units in a contiguous manner so that they formed a 3-x-8 m (9.8-x-26.2 ft.) block on the west side of BHT 1 and a 1-x-8 m (3.28-x-26.2 ft.) block on the east side of BHT 1.

Following shovel scraping, a block grid was established. Because of the presence of large, deep tree roots along the western easement edge of the excavation block, it was necessary to modify the originally proposed grid layout, and

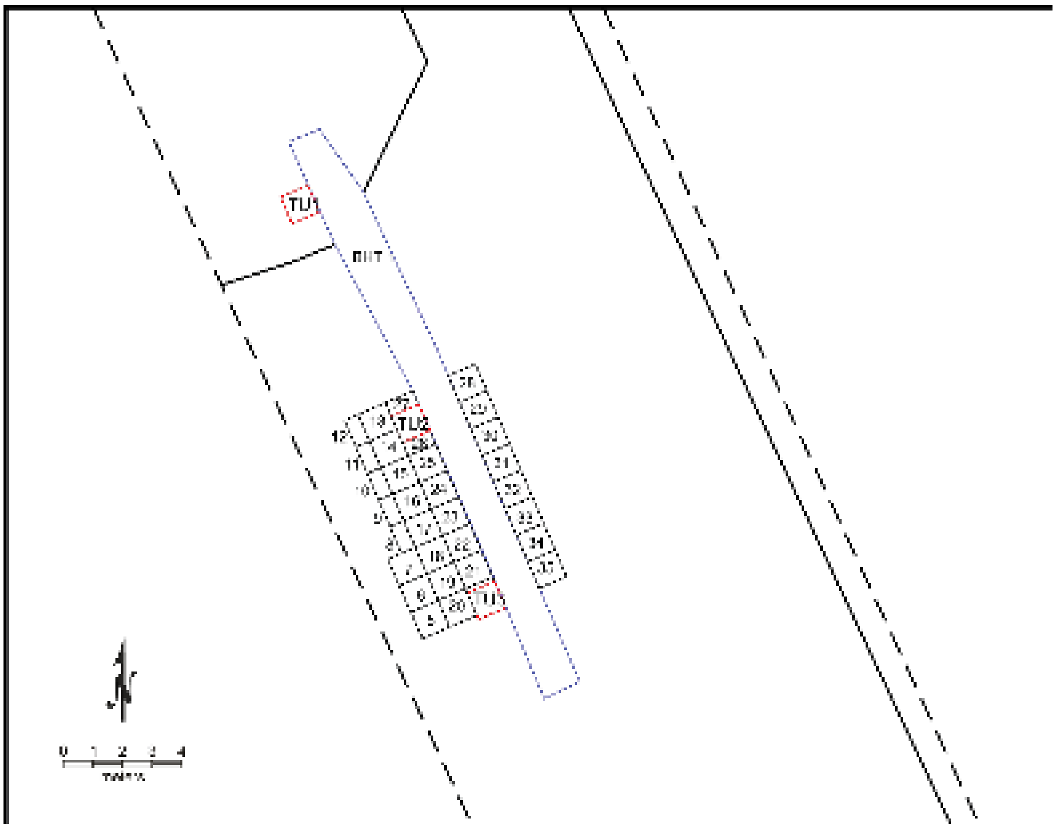

Figure 5-3. *Excavation block at 41KE217. Test Units 1-3 were previously excavated during site testing.*

Figure 5-4. *Soil magnetic susceptibility and snail sampling within BHT 1 (BHT 11) at 41KE217.*

five of 1-x-1 m (3.28-x-3.28 ft.) units along the western edge of the block had to be converted to 1-x-0.5 m (3.28-x-1.64 ft.) units. The final grid layout is illustrated in Figure 5-3. This grid included a total of 26 1-x-1 m (3.28-x-3.28 ft.) units (two of which were previously excavated) and seven 0.5-x-1 m (1.64-x-3.28 ft.) units for a total of 33 hand-excavated units encompassing an area of 29.5 m^2. To ensure that no additional components were buried below this targeted zone, EU 19, on the west side of BHT 1, and EU 35, on the east side of BHT 1, were excavated 2-3 levels through the component. Both of these units revealed a rapid drop in artifact counts below the base of the target component. Additional sample collections were made during the data recovery phase and are discussed below.

Soil Samples: Snail Shells and Soil Magnetic Susceptibility

Soil samples were also collected for the extraction of snails that can aid in the reconstruction of paleoclimate at the time of the site's occupation. A vertically continuous column sample was collected from the northwest corner of TU 1, located within BHT 1 (Figure 5-4). Each sample consisted of approximately 3 gallons of bulk sediment, collected in 10 cm (3.9 in.) increments. A total of 15 samples was collected, extending 150 cm (59.1 in.) below the natural ground surface. The snail samples extracted from these soil samples are curated at the CAR.

Soil samples for magnetic susceptibility analysis, used to define any buried surfaces that may have been associated with prehistoric occupations, were collected from two vertically soil columns from the east wall of BHT 1. One of the sample columns came from between TUs 1 and 2 (Figure 5-4). The second came from the west wall of TU 1 and the same location as the snail column collected earlier. A total of 55 sediment samples at 5 cm (2 in.) increments were collected from the two columns, which span the entire thickness of the site's cultural occupation zones. Column 1 extended from 0-150 cmbs (0-59.1 in.) in BHT 1, and Column 2 extended from 60-190 cmbs (23.6-59.1 in.). Overlap between the two columns occurs between 60 and 150 cmbs (23.6 and 59.1 in.). Each sample consisted of 10 cm^3 soil in plastic implements and measured using a Bartington MS2. The results of the soil magnetic susceptibility analysis are presented in Chapter 6 along with the testing results.

Geoarchaeological and Geomorphological Methods

Geoarchaeological and geomorphological methods and results are discussed in detail in Chapter 8 of this report. In general, the geoarchaeological assessment was initiated during the intensive archaeological survey phase of work. Natural creek cutbank exposures along Menger and Cibolo Creeks, as well as exposed construction excavations in portions of the study area, provided further exposures of soils and sediments that aided in the refinement of the geomorphological interpretations.

Laboratory and Curation Methods

Artifacts and other material returned to the CAR laboratory were washed, air-dried, and stored in zip-lock archival-quality bags with appropriate provenience information. The laboratory staff processed the materials recovered, and detailed analyses were conducted. Field notes, forms, and hard copies of photographs were placed in labeled archival folders. All field forms were completed in pencil on acid-free paper. Any field forms that were soiled during use were placed in archival-quality page protectors. Currently, all notes, photographs, artifacts, burned rock, chipped stone, and other associated materials and documents are temporarily stored at the CAR in accordance with federal regulations 36 part 79, THC requirements, and the current guidelines of the Texas Archaeological Laboratory. All or a sample of the materials from 41KE217, the Cibolo Preserve Menger Creek site, will be returned to Mr. Bill Lende upon request since they derive from the privately held Cibolo Preserve.

Chapter 6: Testing Results

Test Unit Descriptions

Four 1-x-1 m (3.28-x-3.28 ft.) units were excavated during the testing phase. Test Units 1 through 3 were excavated off the west wall of BHT 1 (BHT 11), and TU 4 was excavated on the north wall of BHT 2 (BHT 12). Forty-three levels were excavated within the four 1-x-1 m (3.28-x-3.28 ft.) units (4.3 m^3). Table 6-1 presents artifact counts from each of the excavated units. Detailed descriptions of chipped stone and burned rock are presented in the analysis section of this chapter.

Test Unit 1

Test Unit 1 was excavated to 130 cmbs (thirteen 10 cm [3.9 in.] levels), for a total of 1.3 m^3 (of excavated sediment

Table 6-1. Artifacts from Archaeological Testing, Test Units 1-4

Test Unit	Level	Bone	Burned Rock (wt in grams)	Debitage	Lithic Tools and Cores	Total
Test Unit 1	1	0	6 (331.7)	2	0	8
	2	0	28 (315.9)	107	8	142
	3	0	2 (218.1)	5	0	8
	4	0	8 (229.8)	6	2	15
	5	0	25 (453.9)	37	1	63
	6	1	321 (1,390.7)	158	3	491
	7	0	33 (59)	222	2	257
	8	1	41 (78.2)	375	14	433
	9	1	20 (107.2)	235	5	263
	10	0	69 (4,121.8)	84	2	156
	11	0	47 (2,803.1)	18	1	66
	12	0	311 (1,818.9)	56	0	367
	13	0	85 (509)	2	0	87
Total		**3**	**996 (12,437.3)**	**1,307**	**38**	**2,356**
Test Unit 2	1	1	135 (2,369.1)	36	4	187
	2	0	107 (3,307.2)	84	2	195
	3	1	204 (5,156.3)	297	14	313
	4	1	333 (6,377.3)	193	10	537
	5	0	99 (1,251.5)	76	4	180
	6	0	45 (2,404)	25	1	70
	7	0	55 (3,364.8)	21	0	76
	8	0	63 (2,000.2)	4	0	67
	9	0	85 (1,252.9)	8	0	93
	10	0	18 (168.8)	0	0	18
	11	0	3 (50.8)	0	0	3
	12	0	27 (195.7)	0	0	27
Total		**3**	**1,174 (27,898.6)**	**744**	**35**	**1,766**

Table 6-1. Artifacts from Archaeological Testing, Test Units 1-4, continued....

Test Unit	Level	Bone	Burned Rock (wt in grams)	Debitage	Lithic Tools and Cores	Total
Test Unit 3	1	1	17 (95.3)	13	0	31
	2	0	59 (857.3)	116	6	180
	3	1	260 (1,977.6)	275	9	546
	4	1	211 (2,065.3)	181	3	397
	5	0	45 (3,117.6)	36	1	82
	6	0	48 (761.2)	49	1	98
	7	0	56 (1,473.8)	11	0	67
	8	0	40 (1,350.7)	14	3	58
Total		**3**	**736 (11,699)**	**695**	**23**	**1,459**
Test Unit 4	1	0	0	0	0	0
	2	0	3 (31.4)	2	0	5
	3	0	15 (466.6)	5	0	20
	4	0	23 (125.3)	23	0	46
	5	0	22 (505.7)	18	0	41
	6	0	100 (2,197.7)	8	0	108
	7	1	286 (5,751.1)	126	1	414
	8	0	157 (5,513.9)	11	0	168
	9	0	1 (34.5)	1	0	2
	10	0	0	0	0	0
Total		**1**	**607 (14,626.2)**	**194**	**1**	**804**
Grand Total		**10**	**3,513 (66,661.1)**	**2,940**	**97**	**6,351**

(Figure 6-1). Soils from TU 1 are consistent with previously described soils representative of BHT 1. Specific to TU 1 is an A-BC-2A-2Bk1-3Bk2 horizon sequence. Soil textures were generally silty clay loam in the upper part, grading to silt loam in the lower part of the profile. Soil colors in the upper portion are generally darker and black (10YR 2/1), with dark yellowish brown (10YR 4/4) colors in the lower sola. The upper component, consisting of the approximately 30 cm (11.8 in.) thick zone of angular burned rock fragments, was encountered at 50 cmbs (19.7 in.) in TU 1. The lower component was reached at a depth of approximately 116 cmbs (45.7 in.).

The highest amounts of cultural material were recovered from this test unit. Artifacts recovered from TU 1 consisted of chipped stone and burned rock. As noted in Table 6-1, there is an increase in lithic debitage (n=107) in Level 2. In this level there also are lithic tools, which consist of a miscellaneous biface (n=1), retouched flakes (n=2), a miscellaneous uniface (n=1), scrapers (n=3), and one untyped projectile point. Only 28 pieces of burned rock (315.1 g) were recovered from Level 2, but they do represent higher counts than those in neighboring levels. It is possible that this peak in artifacts represents a very late occupation veneer that was not identified in the field at the time of the excavations.

Artifact densities remained low until a drastic increase of burned rock (n= 321) and debitage (n=158) in Level 6, 50-60 cm below the surface (cmbs;19.7-23.6 in.), where the upper component was recorded (see Feature section for more details). Lithic tools present in Level 6 included two biface fragments and a Bulverde dart point. The upper component continued through Level 9 (80-90 cmbs; 31.5-35.4 in.). Although the highest amount of burned rock was present in Level 6, a high number of lithic debitage

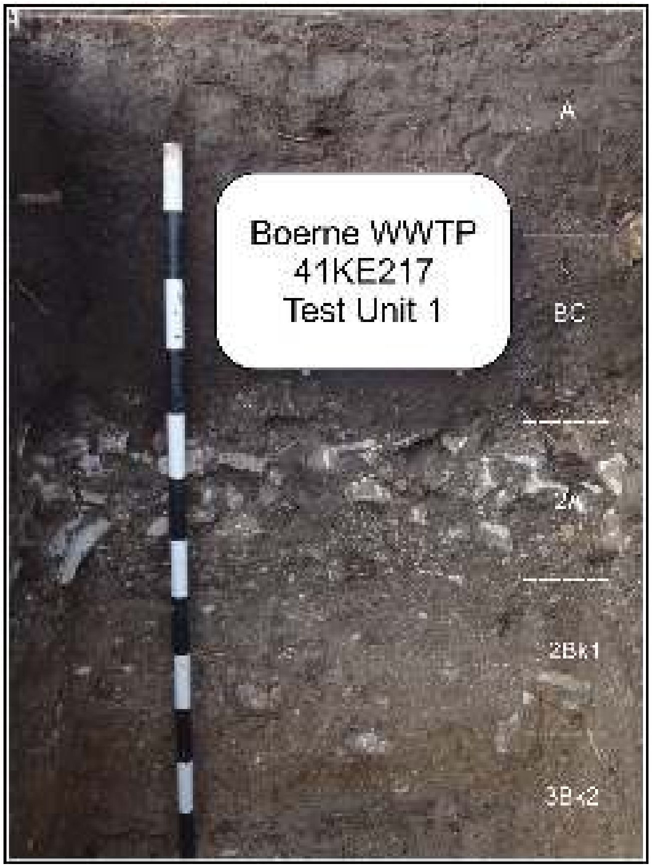

Figure 6-1. *TU 1, west wall profile.*

was present throughout the feature. The highest amount of chipped stone in the upper component occurred in Level 8 (70-80 cmbs; 27.6-31.5 in.), which produced 375 pieces of debitage and 14 lithic tools. The lithic tools included miscellaneous bifaces (n=5), projectile points (n=7), and two miscellaneous unifaces. Lithic tool and debitage counts decreased slightly in Levels 10 and 11, only to peak again in Level 12 (110-120 cmbs; 43.3-47.2 in.). Fifty-six pieces of debitage also were recovered from this level. Artifact densities decrease dramatically in Level 13, the last level excavated in the unit.

Test Unit 2

Test Unit 2 was excavated to 120 cmbs (twelve 10 cm [3.9 in.] levels; 47.2 in.) for a total of 1.2 m^3 of excavated sediment (Figure 6-2). The unit was located off the west wall of BHT 1, in the central part of the trench (Figure 5-1). Level 1, which would have been roughly 30-40 cmbs (11.8-15.7 in.) prior to the grading, contained a large number of burned rocks in addition to lithic debitage and tools. Burned rock counts decrease in Level 2, but lithic debitage increases. Burned rock counts begin increasing in Level 3 and peak in the next level, while debitage counts are high in both levels. A final peak in burned rock counts is seen in Level 9, although it is associated with debitage counts and no tools. The soil horizons exposed within TU 2 consist of a BC-2A-2Bk1-3Bk2 horizon sequence. Soil textures were generally silty clay loam in the upper part, grading to silt loam in the lower part of the profile. Soil colors in the upper portion are generally darker and black (10YR 2/1) to dark brown (10 YR 3/3) with dark yellowish brown (10 YR 3/6) colors in the lower strata.

Test Unit 3

Test Unit 3 was excavated to 80 cmbs (eight 10 cm [3.9 in.] levels; 31.5 in.), for a total of 0.8 m^3 of excavated sediment (Figure 6-3). Test Unit 3 was located on the west wall profile of BHT 1, at the south end of the trench (Figure 5-1). Soils expressed within the west wall profile of TU 3 exhibit the same sequence as TU 2, along with similar textures and colors.

Cultural materials in TU 3 consisted of faunal material (n=3), burned rock (n=736; 11,699 g), debitage (n=695), and lithic tools (n=24; Table 6-1). A peak in cultural materials was recorded starting in Level 3 and continued into Level

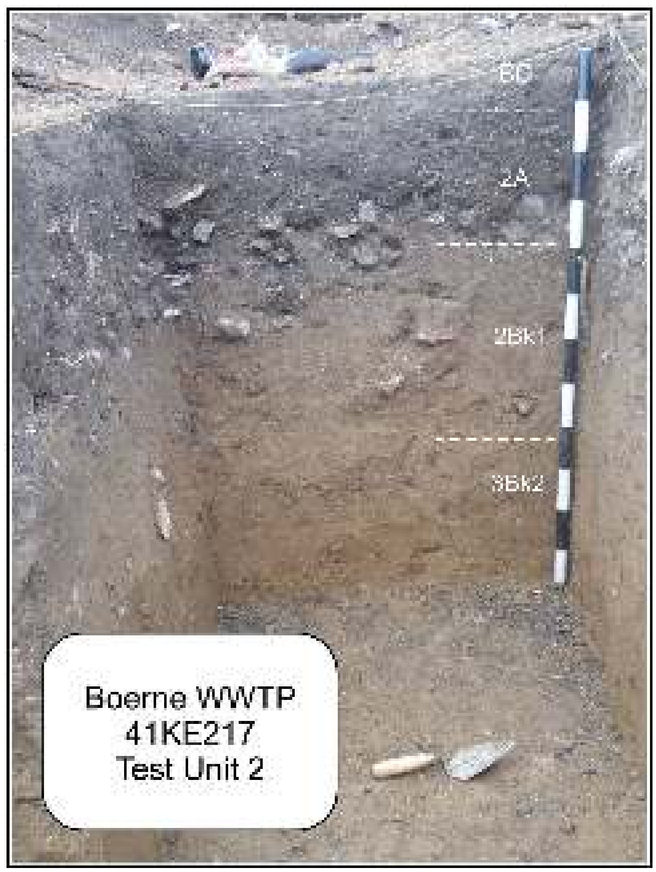

Figure 6-2. *TU 2, west wall profile.*

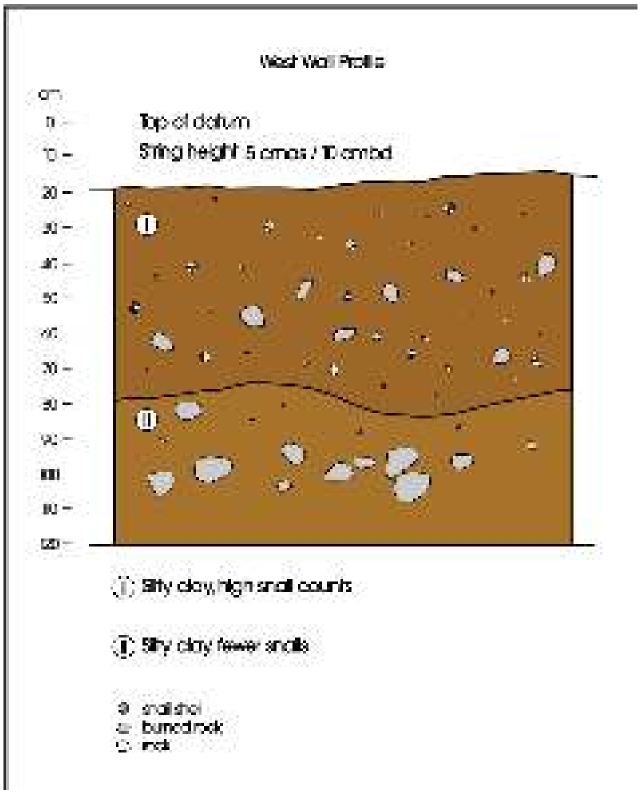

Figure 6-3. *TU 3, west wall profile.*

4. In Level 3, there was an increase in burned rock (n=260; 1977.6 g) and debitage (n=275). The majority of lithic tools were recovered in Levels 2 and 3, including miscellaneous bifaces, miscellaneous unifaces, expedient scrapers, drills, and projectile points (Langtry). The lower peak in materials began in Level 5 and continued through Level 7. These levels contained burned rock, debitage, and few lithic tools. Lithic tools (n=3) encountered in Level 8 consisted of a miscellaneous biface, a miscellaneous uniface and an Uvalde dart point.

Test Unit 4

Test Unit 4 was excavated to 100 cmbs (ten 10 cm [3.9 in.] levels; 39.4 in.), for a total of 1.0 m^3 of excavated sediment (Figure 6-4). Test Unit 4 was located off the northwest wall of BHT 2 (Figure 5-1). From the natural ground surface, the soil horizons exposed in the test unit exhibit an AC-2A-2Bk1-3Bk2 sequence. Within TU 4, a burned rock zone was encountered at approximately 60 cmbs (23.6 in.). No lower peak in cultural materials was encountered in TU 4. Soils consisted of dark grayish brown silty clay in the upper horizons, grading to reddish brown, silty clay in the lower horizons. Compared to the other three test units, TU 4 produced few artifacts. Upper levels of the test unit, including Levels 1-5 were sparse with cultural material. The upper zone of cultural materials was encountered in Level 5 but was most evident in Level 7 (70-80 cmbs; 27.6-31.5 in.) with high amounts of burned rock (n=286, 5,751.1 g) and debitage (n=126). There was a lack in lithic tools with the exception of one possible ground stone fragment in Level 7.

Distribution of Cultural Materials

The preliminary examination of the cultural materials recovered from the four test units indicated that there were at least three peaks in cultural materials that were present in the three units excavated along BHT 1. The uppermost peak was evident in TU 1 (Level 2) and TU 2 (Level 1). Given that the upper 30-40 cm (11.8-15.7 in.) of deposit have been graded off the location of TU 2, it is difficult to precisely equate the peak in cultural materials in the two test units. Nonetheless, since they occur above the dense zone of burned rock seen in all three units, it is likely that they represent the same occupation. No typed projectile points were recovered from this uppermost peak in cultural materials. However, the single untyped dart point fragment suggests that the materials date to at least the Late Archaic Period.

Some 20-30 cm (7.9-11.8 in.) below the upper component is a dense zone of burned rock that extends the entire length of BHT 1 and also may be present in TU 4, north of BHT 1.

Figure 6-4. *TU 4, west wall profile.*

The deposit consists of a fairly continuous zone of burned and broken, angular, blocky limestone rocks surrounded by a dark soil matrix (Figures 6-5 and 6-6). This zone appears to be thickest at the center of the site, at about 30 cm (11.8 in.) and pinches out toward the margins. The full aerial extent of the burned rock layer is unknown, due to the lack of investigation outside of the project easement. However, within the easement, the zone extends for a linear distance of over 50 m (164 ft.). This layer of burned rock was identified in profile in all three backhoe trenches, and it was encountered in each of the four test units. The component is buried by the uppermost floodplain silts and clays of the Menger Creek floodplain, which in turn is covered by the colluvial toeslope deposits.

Table 6-2 lists the lithic tools recovered from the thick burned rock zone. A variety of lithic tools were present, including dart points. The burned rock zone was identified in all test units, and in TU 1, it was identified in Levels 6-9 and associated with a Bulverde projectile point. In TU 2, the zone was evident in Levels 4 and 5, and diagnostic projectile points associated with this portion of the feature include La Jita and Pedernales types. The zone is evident in Level 3 of TU 3 and in Level 5 of TU 4. Relative dating according to projectile point types and absolute dating from radiocarbon samples suggest that this burned rock zone began forming during the latter part of the Earl Archaic (ca. 6,000-4,000 BP) and continued to the Late Archaic sub-period.

The deeper of the peaks in cultural materials was only observed within the limits of BHT 1, approximately 20-30 cm (7.9-11.8 in.) below the bottom of the upper burned rock zone (Figure 6-7). This lower peak in materials was found primarily within the limits of BHT 1 and was encountered in TUs 1-3. Feature rocks found in this component exhibited less overall breakage and were, in general, larger than the

Figure 6-5. *Upper and lower burned rock zones exposed in BHT 1. The uppermost zone has been graded from above BHT 1. Facing north.*

Figure 6-6. *View of the upper burned rock zone, as seen in plan-view in TU 1 at 70 cmbs (27.6 in.).*

overlying rocks. Furthermore, burned rocks found in the lower zone were arranged in more discrete feature clusters, representing individual hearths and hearth areas, as opposed to a midden discard area for the upper burned rock zone. The lower peak in cultural materials was found in Level 12 of TU 1 and in Levels 6 and 7 of TU 2. In TU 3, it was encountered in Level 5. Few lithic tools were found in the lower zone (presented in Table 6-2). One Uvalde dart point was encountered in TU 3, which dates to the Early Archaic Period (Turner and Hester 1993).

Interpretations and Conclusions

Archaeological testing confirmed the presence of at least three temporally and stratigraphically distinct cultural components. The upper most peak in cultural materials present in TUs 1 and 2 is shallowly buried and poorly dated. A single untyped dart point suggests that the component dates to the Late Archaic Period. An approximately 30 cm (11.8 in.) thick zone of late Early Archaic to Late Archaic artifacts and burned rock underlies this upper peak in materials. This second zone of burned rock is present across the entire site, as defined by surface artifacts and backhoe trenching. The top of the site is buried and preserved beneath approximately 60 cm (23.6 in.) of recent colluvial hill slope deposits that lack cultural remains.

A third peak in cultural materials has been noted throughout the length of BHT 1. It contains a thin, discrete zone of burned rocks, flakes, tools, and diagnostic Angostura-like projectile points dating to the Early Archaic Period. These artifacts are found in the lowermost part of the 2Bk horizon and within Holocene floodplain deposits. In the BHT 1 part of the site, the 2Bk horizon is substantially thicker than in the northern parts of the site around BHTs 2 and 3. Thus, there is approximately 20-30 cm (7.9-11.8 in.) of vertical separation between the second and third burned rock zones in the BHT 1 area. Within BHTs 2 and 3, the 2Bk horizon is typically less than 10 cm (3.9 in.) thick, and no lowest burned rock zone was identified.

Table 6-2. Lithic Tools Recovered by Component

Tool type	Lower	Upper	Total
Bell	0	1	1
Bulverde	0	4	4
burin flake	0	3	3
core	0	1	1
expedient drill	0	1	1
expedient knife	0	3	3
expedient scraper	1	15	16
Gower	0	2	2
graver	0	1	1
ground stone	0	1	1
knife	0	1	1
La Jita	0	2	2
Langtry	1	1	2
minimially retouched scraper	0	1	1
miscellanous biface	2	25	27
miscellanous uniface	0	2	2
multifunctional tool	0	1	1
Nolan	0	3	3
Pedernales	0	4	4
preform	0	1	1
retouched flake	0	5	5
scraper/knife	0	1	1
uniface	0	6	6
untypable	0	2	2
untyped	0	4	4
Uvalde	1	0	1
Williams	0	1	1
Grand Total	**5**	**92**	**97**

Figure 6-7. *View of burned rock in lower depositional zone, TU 3 at 60 cmbs (23.6 in.).*

Based on test excavations, the lowest of the burned rock zones (i.e., Early Archaic) at site 41KE217 exhibited excellent integrity and high research potential. These isolated burned rock features are contained within slowly aggraded, fine-grained sediments deposited by Menger and Cibolo Creeks. Test unit excavations further confirmed the occurrence of a laterally extensive burned rock feature zone within a tightly sealed depositional setting.

Magnetic susceptibility columns collected from BHT 1 and the west wall of TU 1 (Figure 6-8) indicate higher magnetic susceptibility measurements in the middle burned rock zone as well as a smaller peak in Level 12 of the sample from TU 1. No such peak is noted in the soil column collected from the wall of BHT 1. Burning in the soil can result in the formation of minerals (Le Borgne 1960), which give high magnetic susceptibility measurements. Diagnostics recovered from the site further suggest that the activities are temporally limited and that the site was buried by overbank deposits shortly after occupation. As a result, it was concluded that the lowest of the burned rock zones exhibited excellent research potential and was considered eligible for NRHP listing and formal SAL designation.

Furthermore, it was concluded that a much lower level of research potential is exhibited by the two overlying burned rock zones since in the case of the thick burned rock midden zone materials occur within a compressed occupation zone with little or no vertical separation. In the case of the uppermost zone of cultural materials, the age of the deposits is poorly defined, and part of the deposit was removed through grading, leaving an unknown portion of cultural materials with poorly known temporal affiliation. Consequently, following the archaeological testing, the project Principal Investigator recommended that the selected deposits at the site may be potentially eligible for listing on the NRHP. Specifically, it was recommended that the deposits with the greatest research potential are those found at the base of the stratigraphic column revealed in BHT 1. At a field meeting held at the conclusion of the testing excavation and attended by representatives of the City of Boerne, CAR, and the THC, the project review team agreed that the additional data recovery efforts should focus on the deeper of the cultural deposits. To reach and explore this deeper component in a cost-effective manner, it was also agreed that the upper deposits would be mechanically stripped to allow the crews to focus on excavation of the lower component during data recovery efforts.

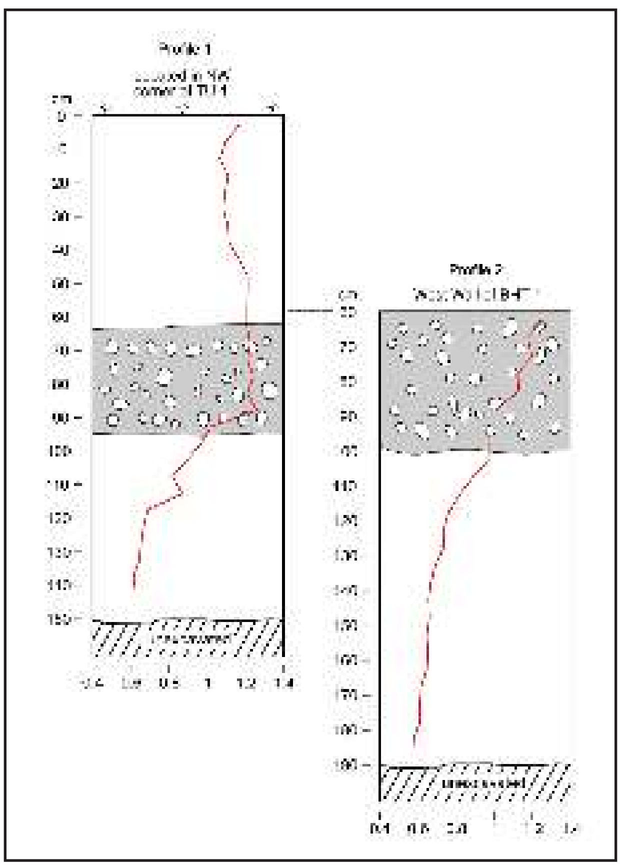

Figure 6-8. *Magnetic susceptibility columns collected from BHT 1 at site 41KE217.*

Chapter 7: Data Recovery Excavations

Between January 3, 2012, and January 25, 2012, CAR staff conducted data recovery investigations within the lower component at 41KE217. Prior to the inception of the data recovery investigations approximately 70 cm (27.6 in.) of matrix had already been graded off much of the easement resulting in the discovery of the burned rock cluster that eventually lead to the recognition of the site. Backhoe Trench 1 and the three test units excavated along the trench indicated that this burned rock zone was approximately 30 cm (11.8 in.) thick and below it was a deeper component consisting of isolated hearths. Since it was recommended and subsequently agreed upon that the deeper of the components appeared to have higher research potential, the overlying burned rock zone was removed in preparation for the data recovery excavations. Prior to this grading operation, BHT 1 was backfilled to provide an even and flat surface for the operation of the grading equipment. The mechanical removal of the overlying burned rock zone was carefully monitored and was halted approximately 15 cm (5.9 in.) above the top of the deeper component. Archaeological crews then proceeded to shovel strip an additional 5 cm (2 in.) of soil, stopping approximately 10 cm (3.9 in.) above the level of the lower component. The newly defined surface was higher in elevation along the west margin of the easement (hillside) and dipped approximately 30 cm (11.8 in.) as one moved east across the easement. It was anticipated that archaeological deposits along the western margin of the easement would have been deposited at a slightly higher elevation than along the eastern edge as a result of colluvial redeposition derived from the hillside. Therefore, less was stripped along the western edge of the easement and slightly more was removed east of BHT 1. The newly defined surface ranged from 100-105 cm (39.3-41.3 in.) below the original ground surface along the western margin of the easement and dropped to approximately 130-135 cm (51.2-53.1 in.) just east of the former location of BHT 1. The subsequent grid laid over the stripped area included a total of 26 1-x-1 m (3.28-x-3.28 ft.) units (two of which were previously excavated) and seven 0.5-x-1 m (1.6-x-3.28 ft.) units for a total of 33 hand-excavated units encompassing an area of 29.5 m^2 (Figure 5-3).

Excavation Units

Data recovery efforts resulted in the excavation of 33 units and 115 partial or full (10 cm [3.9 in.] thick) levels for an estimated total of 10.66 m^3 of excavations. As a result of the sloping surface, the volume of matrix excavated per level varied across the site with Level 1 excavated along the western edge of the grid represented by the smallest volume and Levels 3-5 containing the three highest volumes of matrix excavated during data recovery (see Table 7-1).

This section gives an overview of artifact trends within the block by level. Table 7-2 presents artifact recovery by level, while Table 7-3 standardizes these artifact counts by the actual volume of matrix excavated in each level.

Table 7-2 presents the materials recovered by level during data recovery investigations. The majority of the artifacts

Table 7-1. Number of Levels and Volume of Matrix Excavated during Data Recovery

Levels (cmbd)	Number of Excavated Levels	Volume of Matrix
1 (0-10)	5	0.3
2 (10-20)	19	1.07
3 (20-30)	29	3.54
4 (30-40)	31	2.65
5 (40-50)	26	2.5
6 (60-70)	2	0.3
7 (70-80)	2	0.2
8 (80-90)	1	0.1
Grand Total	**115**	**10.66**

Table 7-2. Artifact Counts per Level for Data Recovery

Levels (cmbd)	Bone	Burned rock	Debitage	Lithic tools and cores	Mussel shell	Total
1 (0-10)	2	248	268	17	0	535
2 (10-20)	3	960	454	26	0	1,443
3 (20-30)	4	944	437	20	0	1,405
4 (30-40)	4	1,829	874	32	2	2,741
5 (40-50)	3	809	602	22	6	1,442
6 (60-70)	1	93	76	1	0	171
7 (70-80)	1	30	21	2	0	53
8 (80-90)	0	3	1	0	0	6
Grand Total	18	4,916	2,733	120	8	7,796

Table 7-3. Artifact Counts per Level for Data Recovery, Standardized by Volume of Excavated Matrix

Levels (cmbd)	Bone	Burned rock	Debitage	Lithic tools and cores	Mussel shell	Total
1 (0-10)	7	827	893	57	0	535
2 (10-20)	3	897	424	24	0	1,443
3 (20-30)	1	266	123	6	0	1,405
4 (30-40)	2	689	329	12	1	2,741
5 (40-50)	1	324	241	9	2	1,442
6 (60-70)	0	37	30	0	0	171
7 (70-80)	5	150	105	10	0	53
8 (80-90)	0	30	10	0	0	6
Grand Total	19	3,220	2,155	118	3	7,796

consist of burned rock (n=4,916), lithic debitage (n=2,733), lithic tools and cores (n=120), a small amount of faunal material (n=18), and mussel shell (n=8). The distribution of materials exhibits a single peak that is found in Level 4. The three most common artifact categories (burned rock, unmodified debitage, and lithic tools/cores) all show similar vertical distributions. However, because of the dramatically different volumes of matrix excavated by level, the adjusted artifact counts presented in Table 7-3 provide a different pattern in artifact distributions. This table suggests that there are as many as three peaks in the vertical distribution of burned rock, debitage and lithic tools recovered. The three peaks in burned rock distribution occur in Levels 2, 4, and 7, while debitage and tools and cores peak in count in Levels 1, 4, and 7.

Because 57 percent of the volume of matrix excavated from Levels 1 and 2 comes from the westernmost row of units, (EUs 5-12), it is likely that the peak in cultural materials may derive from the base of the thick zone of burned rock graded off in advance of the data recovery investigations. That is, it is likely that the upper peak in materials represents an earlier component rather than that intended to be targeted during data recovery.

This interpretation is supported by the distribution and relative age of the typed projectile points recovered during the investigations (Table 7-4). For instance, all eight of the Baker and Bandy points were from Levels 3 and below, while points recovered from Levels 1 and 2 include both Early and Middle Archaic forms (i.e., Andice, La Jita, Langtry, Nolan, and Uvalde). These point forms date to either the Middle Archaic (Bulverde, Langtry) or, in combination, span a long portion of the Early Archaic (Andice, Nolan, and La Jita). To be sure, the point distributions also show that some degree

Table 7-4. Projectile Points from Data Recovery by Level

Tool	Level 1	Level 2	Level 3	Level 4	Level 5	Total
Andice	0	1	0	0	0	1
Baker	0	0	2	2	1	5
Bandy	0	0	0	2	1	3
Bell/Andice	0	0	1	0	0	1
Bulverde	0	0	1	0	0	1
La Jita	0	2	1	1	0	4
Langtry	0	1	0	0	1	2
Nolan	1	0	0	0	0	1
Uvalde	1	0	0	0	1	2
untypable	0	1	0	0	1	2
untyped	1	0	1	0	0	2
Grand Total	**3**	**5**	**6**	**5**	**5**	**24**

of mixture of the older deposits may also have occurred. The presence of a Langtry point in Level 5 and of a Bulverde specimen in Level 3 attests to this conclusion.

Three charcoal samples were collected for radiocarbon assays. Two came from EU 5 (Level 3; 20-30 cmbd; 7.9-11.8 in.) from above Feature 4 sandwiched between a La Jita point in Level 2 and another La Jita specimen in Level 4. The second sample came from EU 14 (Level 5) just below Feature 9, a burned rock hearth that is centered in EU 15. The two samples from EU 5 returned with dates of 4083 to 3847 cal. BP (95.4% probability) and 4090-3925 cal. BP (95.4% probability). The samples from EU 5 were obtained just above Feature 4, the largest feature in the lower component. Diagnostic projectile points from Level 3 of EU 5 indicate signs of Early and Middle Archaic use. The sample from EU 14 returned dates of 7325-7170 cal. BP (93.9% probability).

Features

Thirteen discrete burned rock hearth features (Features 3 through 15) were identified and recorded in the lower component during data recovery (Table 7-5).

Feature 3 (Figure 7-1) was encountered in EUs 11 and 14 at a depth of 11-20 cmbd (4.3-7.9 in.). The dimensions of the feature were 60-x-70 cm (23.6-x-27.6 in.) in an oblong shape. This feature consisted of 45 pieces weighing 11,140 g and was contained in the central portions of EU 11 and the eastern portion of EU 14. The burned rock ranged in size from 1.3-7.6 cm (0-3 in.), with the majority (42 percent) being 2.5 cm (1 in.) in size, 40 percent were 5.1-7.6 cm (2-3 in.) in size, and 18 percent were 1.3 cm (0.5 in.) in size. This associated level with this feature (Level 2) contained more burned rock (n=59), lithic debitage (n=21), and tools (n=4), including expedient scrapers and a graver.

Feature 4 was located in EUs 5 and 20 (Figure 7-2) with elevations between 20 and 40 cmbd (7.9 and 15.7 in.) in the southern portion of the units and consisted of burned rock. Soils associated with the feature consisted of a compact, dark yellowish brown, clay loam. This feature is the largest feature and was oblong in shape. It measured 2-x-1 m (6.6-x-3.28 ft.) wide, and the total weight of burned rock was 66,052.2 g (n=284). Size sorting of the burned rock revealed that 40 percent of the burned rock was 2.5 cm (1 in.) in size, and 19 percent were 1.3 cm (0.5 in.). The remaining 41 percent of burned rock measures between 5.1 and 7.6 cm (2 and 3 in.) in size. In Levels 3 and 4 (20-40 cmbd; 7.9-15.7 in.) of EUs 5 and 20, there was also a high number of burned rock (n=484), lithic debitage (n=138), and lithic tools (n=5). Lithic tools included a miscellaneous biface, two dart points (Baker and La Jita), two lanceolate points, and one expedient knife.

Feature 5 was located in the northeastern portion of EU 27, from 29-40 cmbd (11.4-15.7 in.; Figure 7-3). The irregular feature measured 41-x-35 cm (16.1-x-13.8 in.) in size and contained 16 pieces of burned rock, weighing 4,027.5 g. The soil associated with the feature consisted of silty clay that was dark yellowish brown in color. When size sorting was conducted, it was revealed that 62 percent of the burned rock measured between 2.5 and 5.1 cm (1 and 2 in.). The remaining 38 percent was 6.4-7.6 cm (2.5-3 in.) in size. At the same depth in this unit there were 38 pieces of burned rock and 15 pieces of lithic debitage.

Table 7-5. Features Excavated during Testing and Data Recovery Efforts

Feature #	Associated Test Units	Top Elevation (cmbd)	Bottom Elevation (cmbd)	Length-x-Width (cm)	Description	Shape	Count	Weight (g)
3	11 and 14	11	20	60-x-70	burned rock	oblong	45	11,140.40
4	5 and 20	30	40	200-x-100	burned rock	oblong	284	66,052.20
5	27	27	40	41-x-35	burned rock	irregular	16	4,027.50
6	7, 8, 17, 18, 19, 21, and 22	30	40	200-x-100	burned rock	oblong	126	23,492.30
7	6	27	34	42-x-20	burned rock	oblong	19	2,258.90
8	8, 9, 16, and 17	30	50	200-x-100	burned rock	oblong	151	48,981.90
9	10, 11, 14, and 15	30	40	130-x-100	burned rock	round	65+	12,040.30
10	11, 12, and 13	30	40	70-x-130	burned rock	oblong	19	4,608.80
11	13 and 14	30	40	40-x-100	burned rock	oblong	17	9,903.10
12	28	29	40	80-x-100	burned rock	oblong	39	5,830
13	31	30	40	50-x-50	burned rock	round	34	5,622.90
14	32	30	40	30-x-40	burned rock	oval	14	16,520
15	29	30	40	75-x-75	burned rock	round	58	10,790

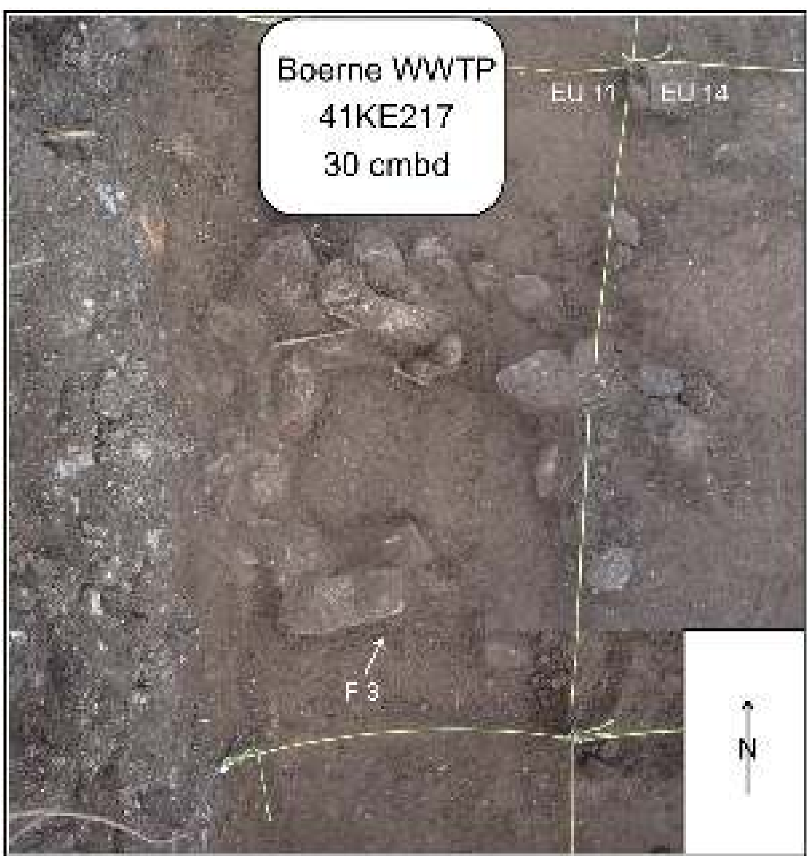

Figure 7-1. *Feature 3 exposed in EU 11.*

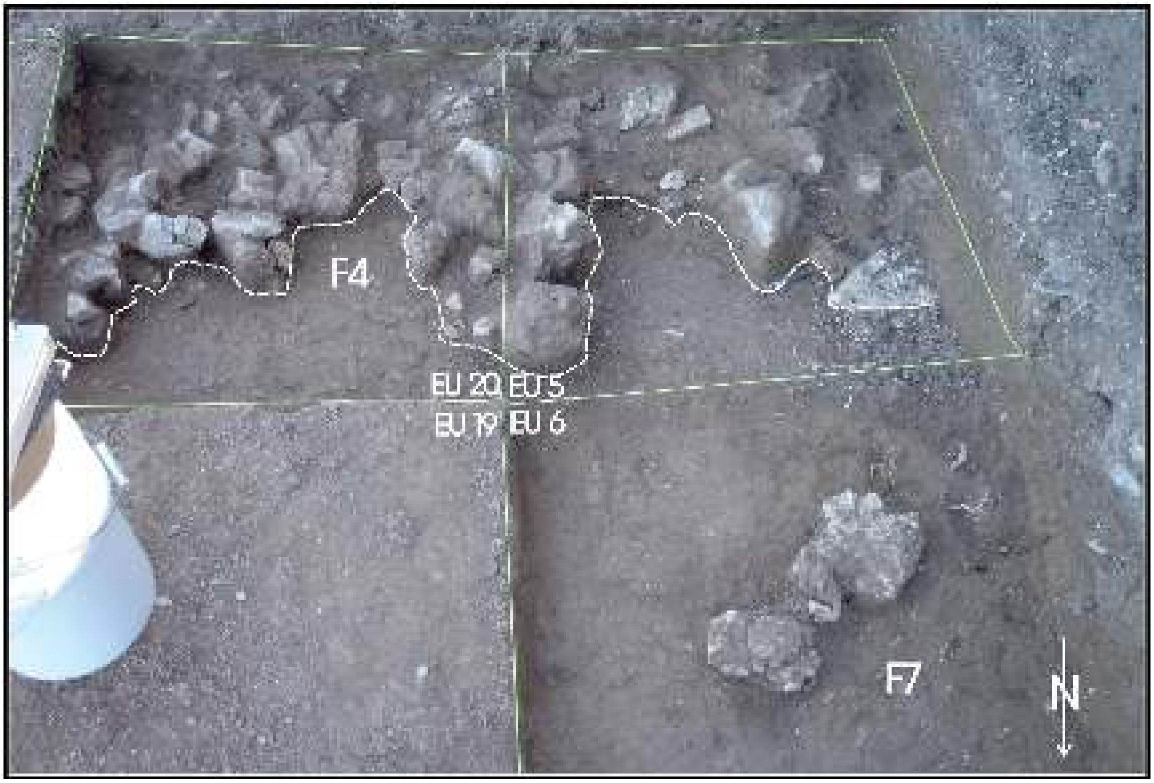

Figure 7-2. *Burned rock Feature 4.*

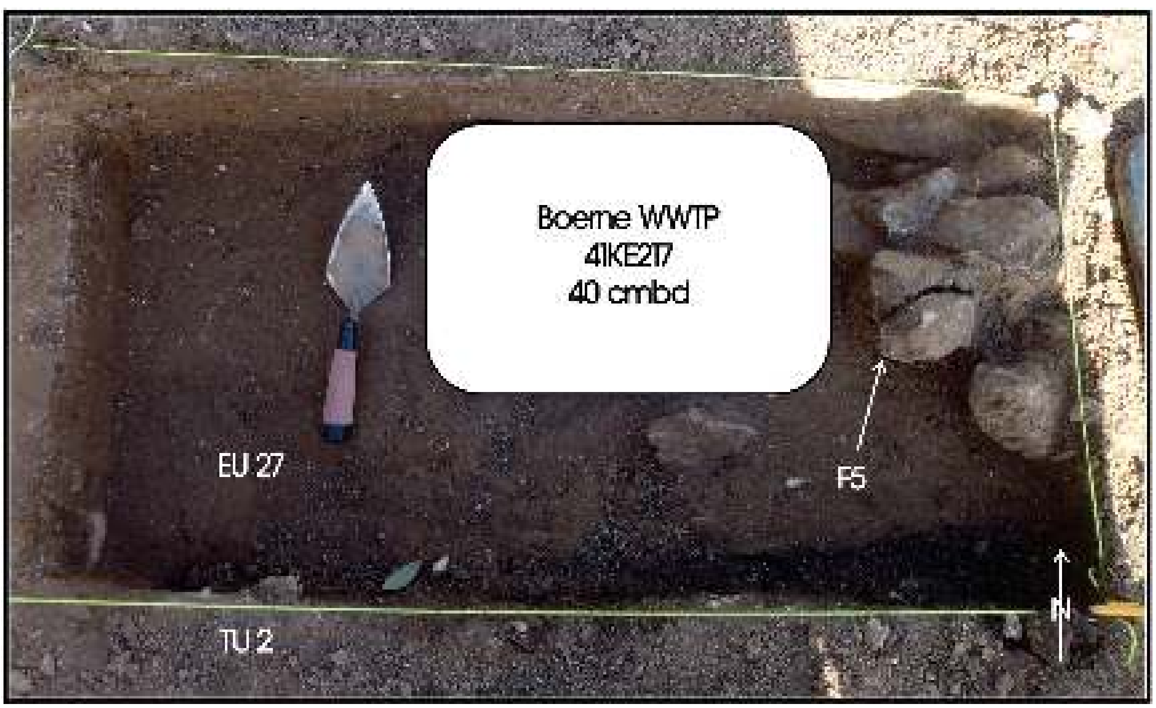

Figure 7-3. *Portion of Feature 5, exposed during data recovery.*

Feature 6 was a large cluster of burned rock measuring 2-x-1 m (6.6-x-3.28 ft.). It encompassed seven units (EUs 7, 8, 17, 18, 19, 21, and 22; Figure 7-4) and was composed of burned rock and some snail. The feature was encountered at 30 cmbd (11.8 in.) and spanned to 40 cmbd (15.7 in.). The feature was irregular in shape and had a rectangular cross-section. Soils associated with the feature consisted of a compact, dark yellowish brown matrix. Feature 6 was made up of 126 pieces of burned rock (23,492.3 g). The majority (31 percent) of burned rock were 1.3 cm (0.5 in.) in size, and 55 percent were between 2.5 and 5.1 cm (1 and 2 in.) in size. Only 14 percent of the burned rock were 6.4-7.6 cm (2.5-3 in.) in size. Level 4, which was at the same depth as Feature 6, contained burned rock (n=463), lithic debitage (n=264), and lithic tools (n=11). Lithic tools included cores (n=3), an expedient scraper (n=1), miscellaneous bifaces (n=2), a miscellaneous uniface, one knife, and one graver. Also, two Early Archaic dart points (Baker and Bandy) were encountered at similar depths in EUs 7 and 19.

Feature 7 was a small feature located in EU 6, and it was encountered 27-34 cmbd (10.6-13.4 in.; Figure 7-5). The size of the feature was 42-x-20 cm (16.5-x-7.9 in.). The feature consisted of burned rock that was associated with a soft, silty clay that was dark yellowish brown in color. The feature was oblong in plan-view and rectangular in cross-section. This feature contained 19 pieces of burned rock (2,258.9 g). The largest rock in the feature was 7.6 cm (3 in.) in size and weighted 827.8 g. The remaining 18 pieces of burned rock ranged from 13-6.4 cm (0.5-2.5 in.). Levels 3 and 4 of EU 6, occurring at similar depths as Feature 7, contained burned rock (n=341), lithic debitage (n=152), and four lithic tools that consisted of a miscellaneous biface, miscellaneous uniface, a burin flake, and a Bulverde dart point.

Feature 8 was primarily located in EU 9, but portions of it were in EUs 8, 16, and 17 (Figure 7-6). The feature was at 30-50 cmbd (11.8-19.7 in.), with the deepest portion of the feature in EU 17. There was a total of 151 pieces of burned rock in this feature (48,981.9 g), and it measured 2-x-1 m (6.6-x-3.28 ft.). The feature was within a compact, sandy clay that was dark yellowish brown in color. The majority (54 percent) of burned rock from Feature 8 were between 2.5 and 5.1 cm (1 and 2 in.) in size, while 11 percent were 1.3 cm (0.5 in.). Twenty-two percent of the burned rock were 7.6 cm (3 in.) in size, and 21 percent were 6.4 cm (2.5 in.) in size. Levels 4 and 5 (30-50 cmbd; 11.8-19.7 in.) of the associated test units contained burned rock (n=404), lithic debitage (n=205), and lithic tools. Two cores were in the associated levels as well as an expedient scraper, a burin flake, and an untypable point. A Bandy dart point and an Uvalde dart point were also included in the tools recovered.

Figure 7-4. *Feature 6, fully exposed during data recovery.*

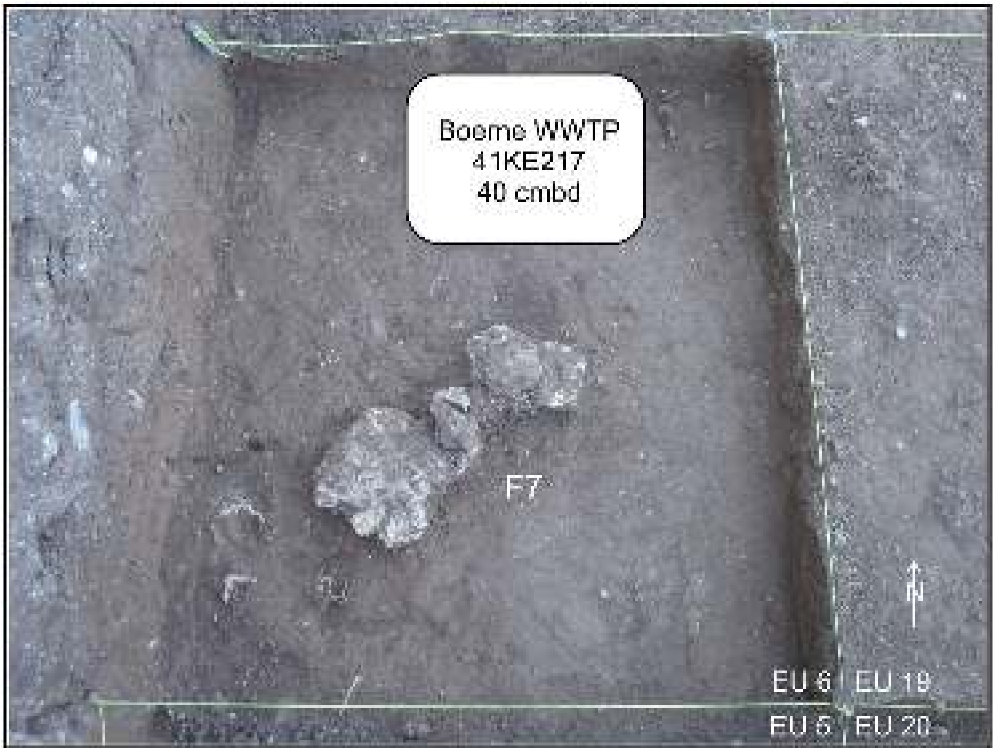

Figure 7-5. *Feature 7, small burned rock cluster.*

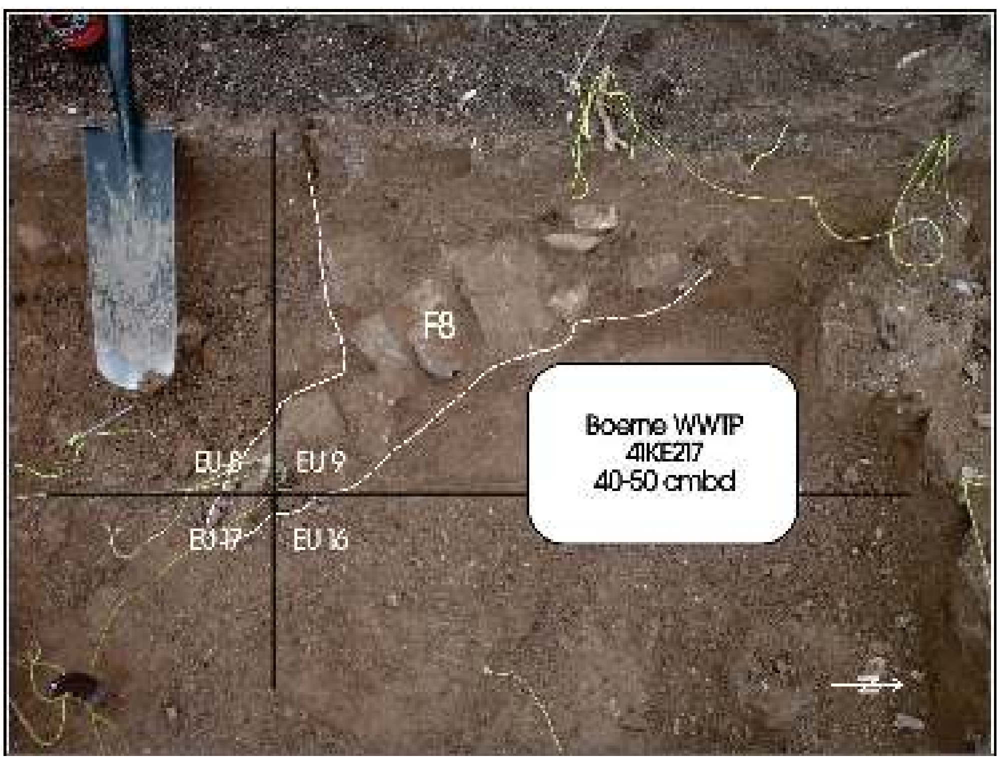

Figure 7-6. *Feature 8, partially exposed.*

Feature 9 was located in EUs 10, 11, 14, and 15 at 30-40 cmbd (11.8-15.7 in.; Figure 7-7). The feature measured 130-100 cm (51.2-39.3 in.) in size and was oval in shape. The feature was surrounded with compact, dark yellowish brown matrix. Sixty-five pieces of burned rock, weighing 12,040.3 g, made up the feature. The majority (42 percent) of burned rocks from the feature were 2.5 cm (1 in.) in size. Twenty-five percent of the burned rock were 1.3 cm (0.5 in.) in size, while 22 percent were 5.1 cm (2 in.) in size. Only 11 percent of the feature burned rock were 6.4-7.6 cm (2.5-3 in.) in size. At similar depths (30 to 40 cmbd; 11.8-15.7 in.) within the associated excavation units, burned rock (n=70), lithic debitage (n=31), and one core were present.

Feature 10 was located in the EUs 11, 12, 13, and 14 (Figure 7-8). It ranged in elevation from 30-40 cmbd (11.8-15.7 in.) and consisted of burned rock. The feature was associated with a dark yellowish brown soil with flecks of calcium carbonate. It was 70-x-130 cm (27.6-x-51.2 in.), oblong in shape, and had a rectangular cross-section. Feature 10 contained 19 pieces of burned rock (4,608.8 g). Most of the burned rock (26 percent) were 2.5 cm (1 in.) in size, and 21 percent were 7.6 cm (3 in.) in size. Only 11 percent were 1.3 cm (0.5 in.) in size, while 22 percent were 5.1-6.4 cm (2-2.5 in.) in size. At the depths of 30 to 40 cmbd (11.8-15.7 in.) in the test units where the feature was encountered, burned rock (n=79), lithic debitage (n=55), two retouched flakes, and a scraper were present.

Feature 11 was encountered in EUs 13 and 14 at 30-40 cmbd (11.8-15.7 in.; Figure 7-9). The feature consisted of burned rock and mussel shell in a dark yellowish brown matrix. It measured 40-x-100 cm (15.7-x-39.3 in.) and was an oblong shape. Seventeen pieces of burned rock (9,903.1 g) made up the feature with all pieces being 2.5-12.7 cm (1-5 in.) in size. Twenty-nine percent of the burned rock (n=5) was 2.5-5.1 cm (1-2 in.) in size, while 71 percent (n=12) was 5.1 cm (2 in.) or larger. In the associated test units at similar depths, burned rock (n=94), lithic debitage (n=64), and lithic tools were also recovered. The lithic tools consisted of a scraper and two retouched flakes.

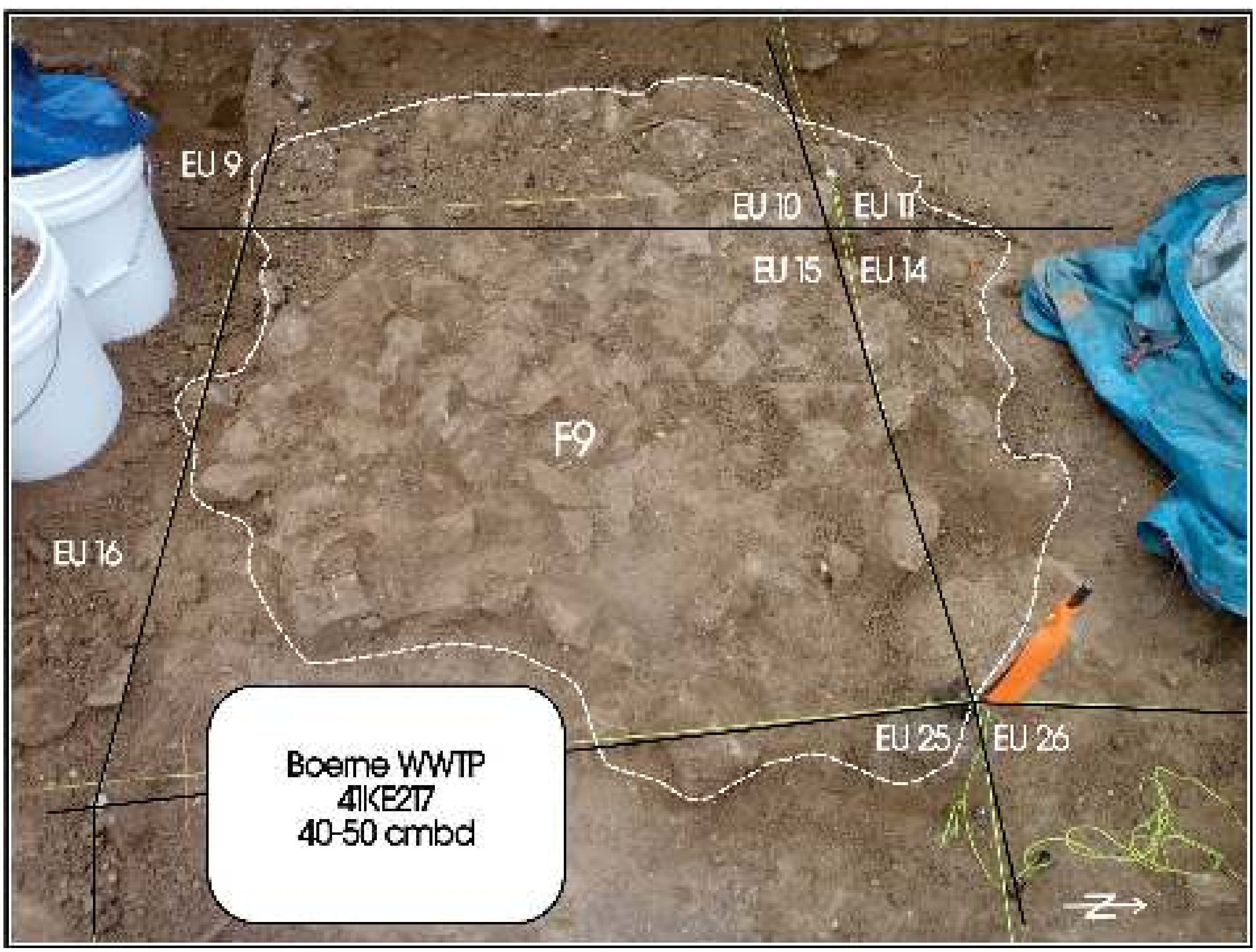

Figure 7-7. *Feature 9, fully exposed.*

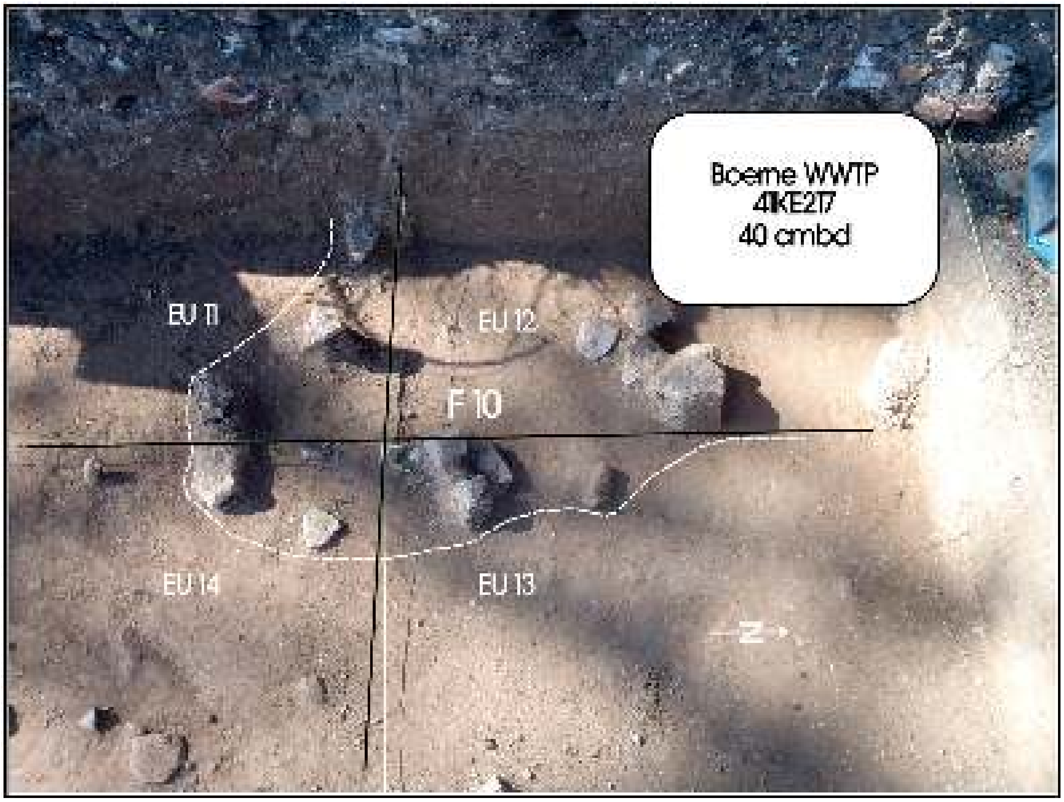

Figure 7-8. *Feature 10, partially exposed during data recovery.*

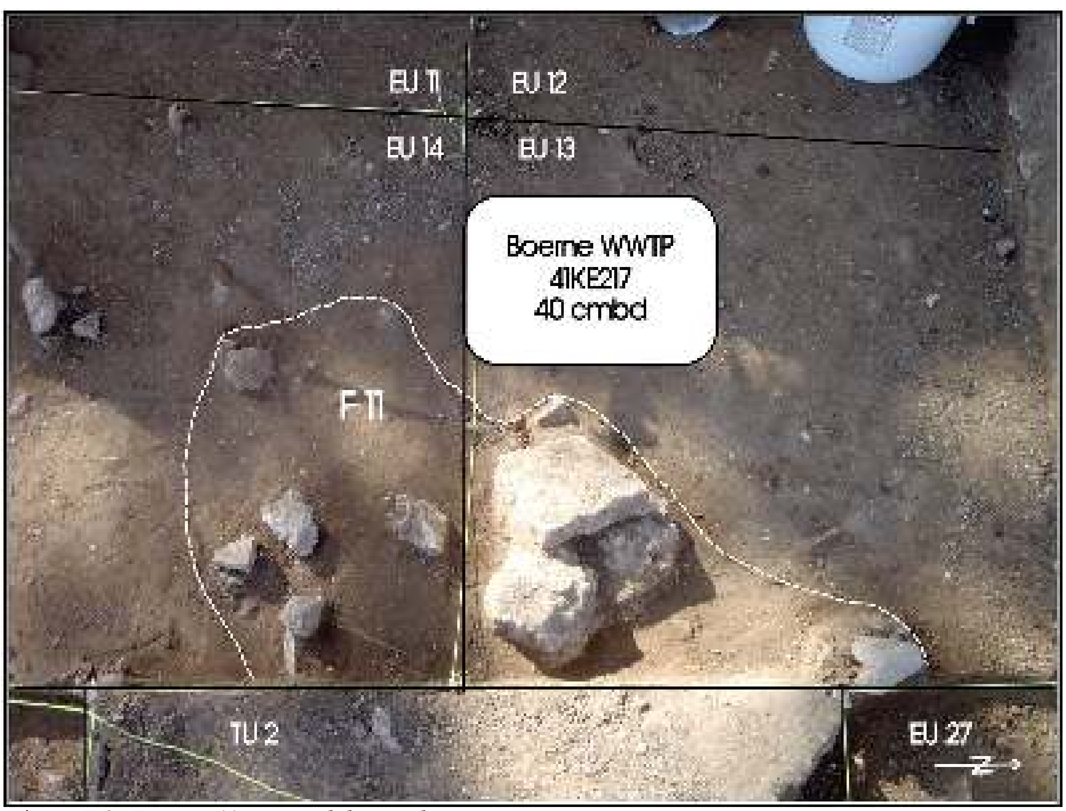

Figure 7-9. *Feature 11, exposed during data recovery.*

Feature 12 was uncovered in EU 28 at 30 cmbd (11.8 in.) and extended to a depth of 40 cmbd (15.7 in.; Figure 7-10). The feature was composed of burned rock and measured 50-x-50 cm (19.7-x-19.7 in.). It was associated with a dark yellowish brown matrix. Thirty-nine pieces of burned rock (10,105 g) formed the feature. The majority of burned rock (38 percent) was 2.5 cm (1 in.) in size, while 41 percent was 5.1-7.6 cm (2-3 in.) in size. Only 21 percent of the burned rock was 1.3 cm (0.5 in.) in size. At similar depths in the excavation unit, burned rock (n=49), and lithic debitage (n=7) were also present.

Feature 13 was found in EUs 30 and 31 at 30-40 cmbd (11.8-15.7 in.; Figure 7-11). The feature consisted of a cluster of burned rock situated in a compact, dark yellowish brown, silty clay matrix. Feature 13 measured 50-x-50 cm (19.7-x-19.7 in.) in size and was round in shape. It contained thirty-four pieces of burned rock (5,622.9 g). Eight of the pieces were 7.6 cm (3 in.) in size, 12 (35 percent) were 6.4 cm (2.5 in.) in size, and the remaining 41 percent were 2.5 cm (1 in.) or less in size. In the associated levels of EUs 30 and 31, burned rock (n=1210), lithic debitage (n=81), and three lithic tools (expedient knife, miscellaneous biface, and scraper).

Feature 14 was located in EU 32 at a depth of 30-40 cmbd (11.8-15.7 in.; Figure 7-12). The feature was 40-x-30 cm (15.7-x-11.8 in.) and oval in shape. The surrounding matrix consisted of compact, dark yellowish brown, silty clay. The feature consisted of one larger burned rock (16,520 g) that was broken in smaller pieces (n=14). Fifty percent of the burned rock was 1.3 cm (0.5 in.) in size, while the remaining 50 percent measured 5.1-7.6 cm (2-3 in.) in size. In Level 4 of the same unit, additional burned rock (n=29) and lithic debitage (n=11) were present.

Feature 15 was contained in EU 29 at 30-40 cmbd (11.8-15.7 in.; Figure 7-13). It was 75-x-75 cm (29.5-x-29.5 in.) and round in size. Soils associated with the feature consisted of compact, dark yellowish brown, silty clay. Fifty-eight pieces of burned rock, weighing 18,200.5 g, made up the feature. Forty-four percent of the burned rock from this feature was 1.3 cm (0.5 in.) in size, and nine percent was 2.5 cm (1 in.) in size. The remaining 47 percent of the burned rock ranges from 5.1-7.6 cm (2-3 in.) in size. At the same depths in EU 29, burned rock (n=28), lithic debitage (n=23), one miscellaneous uniface, and a graver were encountered.

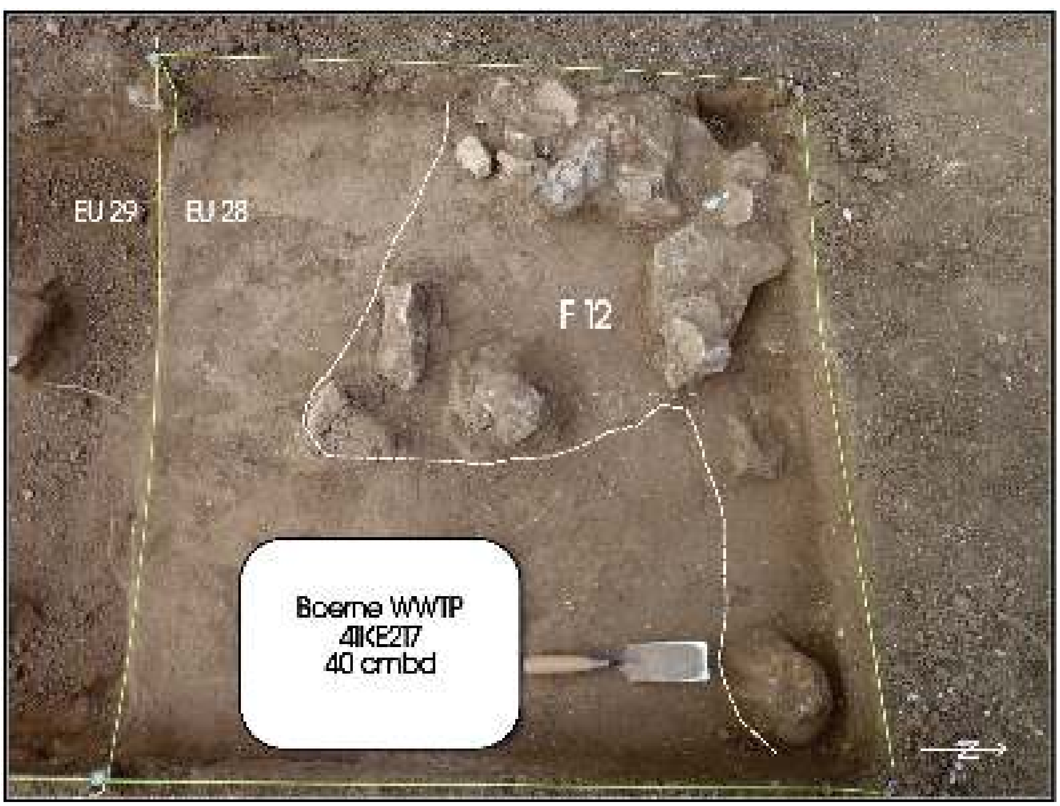

Figure 7-10. *Feature 12, partially exposed during data recovery.*

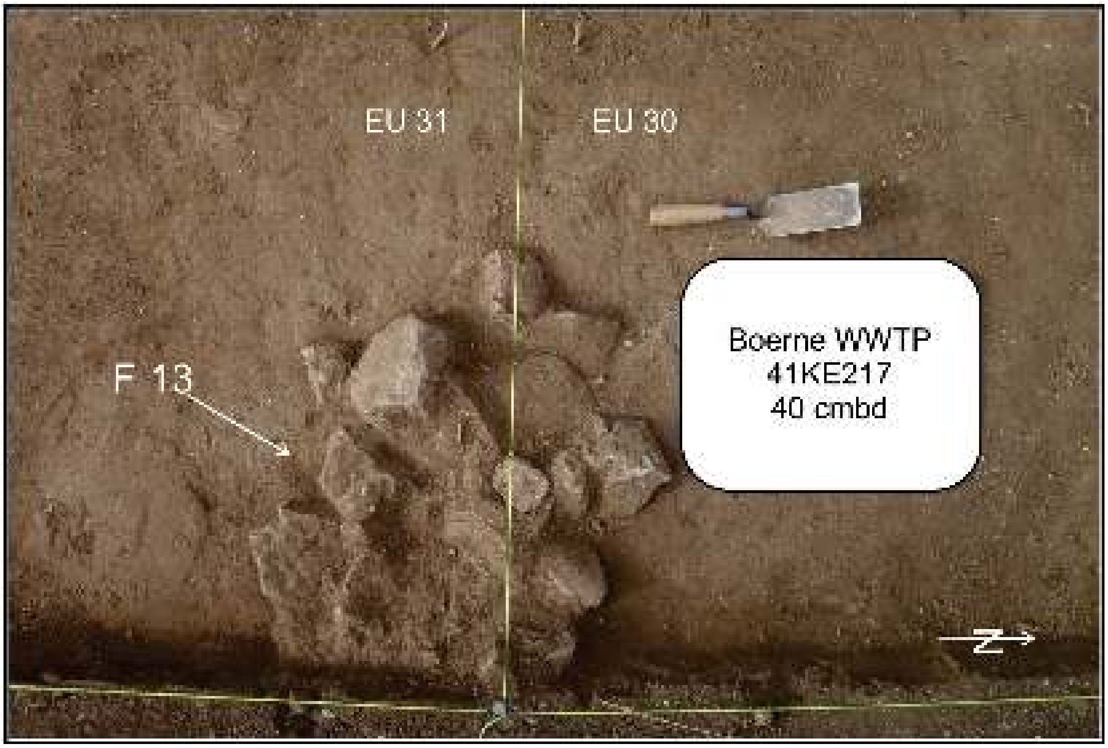

Figure 7-11. *Feature 13, almost entirely exposed during data recovery.*

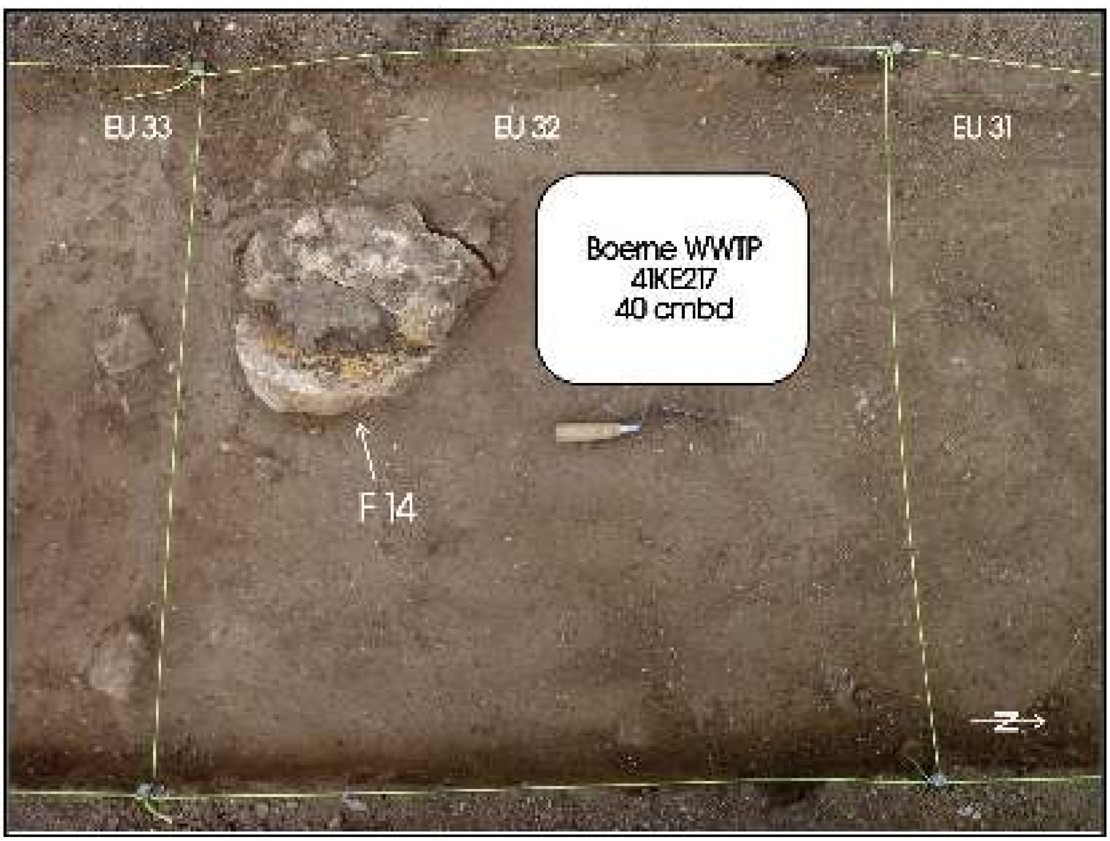

Figure 7-12. *Feature 14, small burned rock cluster.*

Figure 7-13. *Feature 15, fully exposed during data recovery.*

Summary

Data recovery efforts concentrated on the lowest zone of burned rock features identified during the testing of the site. These investigations at site 41KE217 uncovered 13 burned rock features along with a plethora of chipped stone tool, including several diagnostic projectiles. The earliest point style is a lanceolate specimen found in association with Feature 4. However, later point styles dating to the Early Archaic are also present within this feature. More importantly, radiocarbon assays date the upper portions of the component targeted during data recovery to ca. 4000 BP. A radiocarbon sample derived from beneath the burned rock zone was dated to 7325-7170 cal. BP (93.9% probability). Based on the data collected during this phase of work, it appears that the lowest archaeological component investigated at 41KE217 dates to the early portion of the Early Archaic Period. The accumulation of the component ceased some 3000 years later after several intermittent visits to the locality formed a zone of isolated burned rock features used to prepare food for consumption. The archaeological component that formed above it consisted of a significantly thicker zone of inter-layered burned rock suggesting a more intensive utilization of the site. The next chapter discusses the geomorphological context of the site and its immediate vicinity.

Chapter 8: Geoarchaeological Investigations

Introduction and Objectives

This section documents the results of geomorphological and geoarchaeological studies that were conducted during archaeological investigations for the proposed construction of the Boerne Wastewater Treatment Plant and pipeline located in Boerne, Kendall County, Texas, as well as the results obtained during testing and data recovery excavations at 41KE217. The purpose of the geomorphological and geoarcheological investigations is to provide a stratigraphic and pedologic framework for evaluating archeological site visibility and preservation potential. Thus, the specific objectives include the following: 1) construct a geomorphic map of the study area; 2) conduct field morphological descriptions of soils and alluvial-stratigraphic units through the excavation and examination of backhoe trenches and natural creek cutbank exposures; and 3) relate the soil-geomorphic field observations to the development of a local-scale model for predicting the presence/absence and preservation potential of any cultural materials.

Physical Setting

Cibolo Creek originates northwest of San Antonio in western Kendall County. On the Edwards Plateau this drainage is deeply incised and primarily drains Lower Cretaceous Glen Rose and faulted Edwards Formation limestone as well as Upper Cretaceous Pecan Gap Chalk limestone (Barnes 1974). Several soils are mapped within the surrounding uplands of the project area and include soils of the Doss-Brackett association; Anhalt clay, 1-3 percent slopes; and Denton silty clay, 1-3 percent slopes. Each of these consists of shallow, well-drained, residual clay soils that weathered in place from underlying Cretaceous limestone (Web Soil Survey 2012).

Quaternary terrace deposits (Qt) are mapped within the narrow stream valleys of the project area and are bordered by weathering-resistant limestone bedrock valley walls. The terraces are described on *Geologic Atlas of Texas* maps as late Pleistocene deposits that occur mostly above flood levels along entrenched streams. Fluvial morphological features, such as point bars, oxbows, and abandoned channel segments, are often preserved in these deposits (Barnes 1974). Remnants of these terraces exist on both sides of Cibolo Creek, indicating a maximum ancient valley width of 600 m (1,969 ft.). Terrace treads rise approximately 5 m (16.4 ft.) above the low-water Cibolo Creek channel. Holocene-age floodplain deposits (Qal) are not mapped within the study area, though this is not surprising given the coarse scale (1:250,000) of current geologic maps. Local informants indicated that the alluvial surfaces above Cibolo, Menger, and Browns Creeks are periodically inundated by large floods.

Soils on the floodplain adjacent to the Menger Creek channel are mapped as Oakalla silty clay loam. These soils are deep, well-drained, nearly level deposits that are associated with floodplains and are frequently flooded. Alluvium is derived from the surrounding Cretaceous limestone. A typical profile consists of at least 1.5 m (4.9 ft.) of silty clay loam (Web Soil Survey 2011). The area above the confluence between Menger and Cibolo Creeks is composed of Boerne fine sandy loam and is frequently flooded. This soil occurs on treads of floodplains and stream terraces. Parent material for this soil is alluvium derived from surrounding Cretaceous limestone. A typical profile includes 0-20 cm (0-8 in.) of fine sandy loam over at least 1.3 m (4.3 ft.) of loam (Web Soil Survey 2011). Along the margins of Browns Creek soils consist of Krum silty clay, 1-3% slopes. These soils are mapped along stream terraces and consist of alluvium derived from limestone. A typical profile indicates 0-119 cm (0-47 in.) of silty clay over clay loam to at least a depth of 1.5 m (4.9 ft.; Web Soil Survey 2011).

Methods

The geomorphological and geoarchaeological studies were conducted by a reconnaissance of the overall project area, examination of natural stream cut-bank exposures, and detailed descriptions of the ten backhoe trenches that were excavated along the northern valley margin of Cibolo Creek, those on both sides of Browns Creek, and three additional trenches excavated within the boundaries of site 41KE217. Trenches ranged in depth from 57-200 cmbs (22.4-78.7 in.). A representative profile section within each trench was hand-cleared and plucked out, and standard field morphological attributes were recorded. The soil column was subdivided into genetic soil horizons based on observable variations in soil properties. Each horizon was described following the Natural Resources Conservation Service (NRCS) standards for soil profile descriptions (Schoenberger et al. 2002). These descriptions included horizon, color, texture, roots, structure, consistence, percentage of coarse fragments, carbonate abundance, type, morphology (e.g., stage), the presence/absence of redoximorphic features, and any other salient pedogenic features. Detailed pedologic descriptions for each profile are provided in Appendix A. Each profile was photographed, and all trenches were backfilled after field descriptions were completed.

Alluvial Stratigraphy and Geoarchaeological Potential

A geomorphic map of the study area is presented in Figure 8-1. Soil-geomorphic relationships were established by cross-comparisons of USGS topographic maps, aerial photographs, Geologic Atlas of Texas sheets from the Bureau of Economic Geology, and the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) soil survey for Kendall County, Texas. The geomorphic map illustrates the three major depositional landforms that were encountered and investigated during the project. These include a terrace designated as T-1, a floodplain designated as T-0, and colluvial footslope designated as C-fs. Intervening uplands consist of Cretaceous bedrock.

The T-1 terrace extends across the Menger Creek and Cibolo Creek valley and is situated approximately 5 m (16.4 ft.) above the low water channel level (Figure 8-2). Examination of natural creek cutbank exposures and backhoe trench profiles revealed a succession of laterally accreted channel gravels (Unit 1A) that fine upward into vertical accretion deposits of sands, silts, and clay (Unit 1B). Most of these older fill deposits are buried beneath variably thick wedges of more recent floodplain alluvium and colluvium (Unit 2) though portions of the older fill do outcrop upstream from the confluence of Menger and Cibolo Creeks. In some areas adjacent to steep hillsides, younger colluvial deposits (Unit 3) rest unconformably upon the Unit 2 deposits (Figure 8-3).

Unit 1

Unit 1 is widely mapped across the Cibolo Creek and Menger Creek valley on Geologic Atlas of Texas maps as undifferentiated Pleistocene terrace deposits (Qt). However, because of the more recent alluvial fill that overlies Unit 1, the exact aerial extent of Unit 1 is currently unknown. Though unconfirmed presently, it is likely that Unit 1 extends across a significant portion of the valley floor. Unit 1 was subdivided into Units 1A and 1B on the basis of the two sedimentary facies observed within natural cutbank profiles.

Gravelly channel facies (1A) probably cover most of the valley floor in the study area. These deposits consist of crudely

Restricted Image

Figure 8-1. *Geomorphic map of Boerne Wastewater Treatment Plant.*

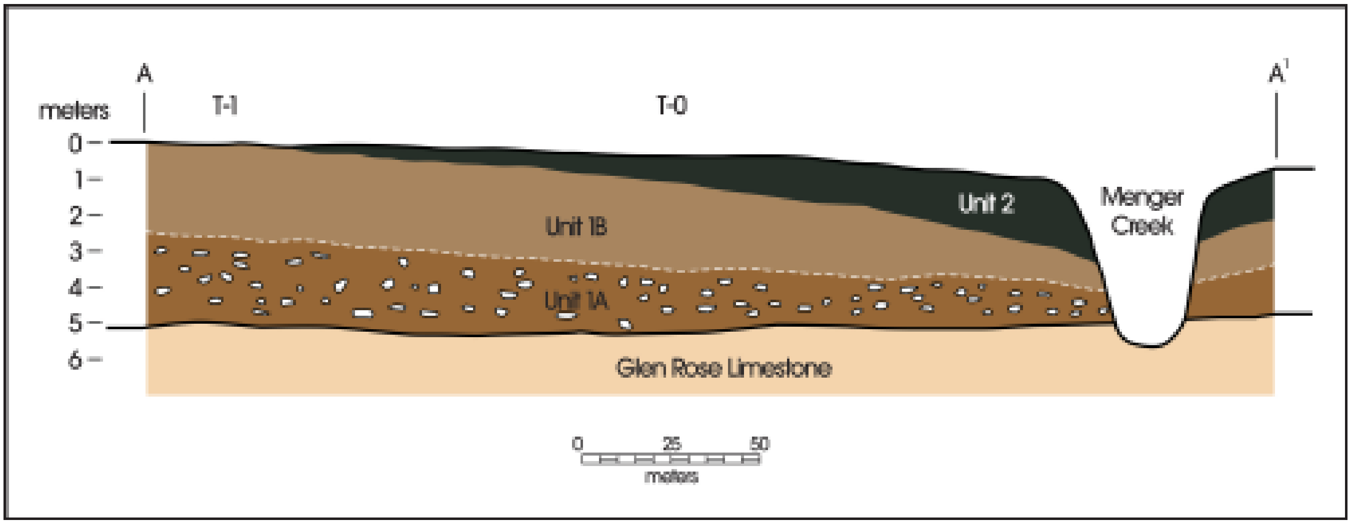

Figure 8-2. *Menger Creek valley cross-section A-A', illustrating the major depositional units.*

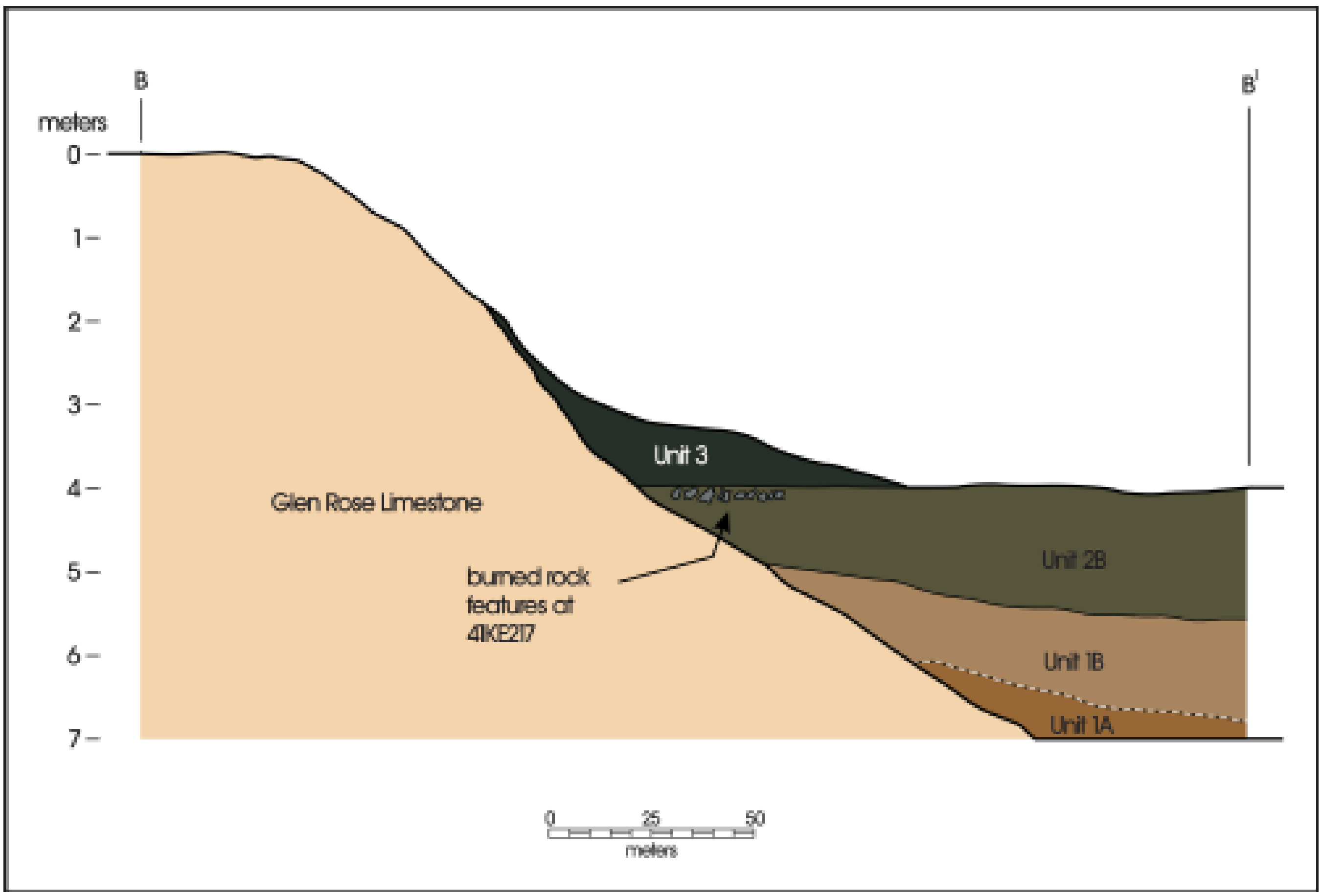

Figure 8-3. *Generalized stratigraphic cross-section B-B', at site 41KE217, illustrating major depositional units and including Unit 3 colluvial deposits burying archaeological site components. All cultural materials are contained within Unit 2B.*

stratified, laterally and vertically accreted, upward-fining and down-dipping gravel clasts. These deposits were observed exhibiting moderate imbrication in cutbank exposures along the lower reaches of Menger Creek. These alluvial channel gravels rest unconformably upon Cretaceous-age Glen Rose limestone at a depth of 5 m (16 ft.) below the terrace/floodplain surface. Unit 1A was identified near the base of BHTs 9 and 10 on the east side of Browns Creek in an area that begins to slope up the adjacent valley wall to the uplands (Figure 8-4). Within these trenches Unit 1A is reported to consist of brown (7.5YR 4/4) to strong brown (7.5YR 4/6) gravelly silty clay loam, with moderate medium subangular blocky structure, and hard (dry) and very firm (moist) consistence. These deposits also contained between 15-20 percent rounded channel gravels ranging from 20-40 cm (7.9–15.7 in.) in diameter. Secondary calcium carbonate accumulations are extensive within this unit, including common fine filaments and carbonate nodules <1 cm (0.4 in.) in diameter and soft masses and coatings on gravel surfaces. These deposits are characterized pedologically as CBk horizons exhibiting stage II carbonate development (Figure 8-5).

Fine-grained floodplain facies (1B) comprise the upper part of vertical accretion deposits associated with construction of the T-1 terrace during the late Pleistocene. Unit 1B deposits were identified in BHTs 2 through 9 and in BHTs 11-13 (BHTs 1-3, testing and data recovery). Colors range from reddish brown (5YR 5/4), brown (7.5 YR 5/4), and dark yellowish brown (10YR 4/4), and the deposits are generally comprised of silty clay loam and silt loams exhibiting moderate medium, subangular, blocky structure parting to moderate coarse, angular, blocky and medium prismatic ped structures. Secondary calcium carbonate accumulations include common fine filaments and 1-2 mm (0.04-0.08 in.) diameter nodules. Coarse fragments include 2-10 percent small pebbles that are indicative of the fining upward sequence from the lower gravelly facies. Also commonly present within Unit 1B are *Rabdotus* sp. snail shells and shell fragments in 5-10 percent abundance. Occasional angular non-cultural limestone fragments were noted throughout this unit. Given the nature of the secondary calcium carbonate accumulations, these deposits are classified pedologically as Bk horizons with estimated stage II carbonate development. No buried A horizons were found in association with the upper part of these fine-grained floodplain deposits. Most likely, any former A horizon would have been scoured and eroded away prior to the deposition of the overlying Unit 2 alluvium. This interpretation is supported by field observations of an abrupt and wavy contact between Units 1 and 2, as seen in the majority of backhoe trench profiles, which suggests high-energy flood scours have occurred in the past. No cultural materials were identified within Unit 1.

Intensive pedogenic weathering of Unit 1 is evidenced by very well developed ped structure and extremely firm consistence, rubification of the soil matrix, which is largely time-dependent, and abundant secondary calcium carbonate segregations that include numerous fine filaments, small rounded nodules, and soft carbonate masses. Given these observations, the lower Unit 1 fill deposits are likely Pleistocene in age. Cultural materials could be present on top of Unit 1. If such materials were subsequently buried after deposition, reasonable integrity is possible. However, cultural materials upon unburied or exhumed portions of Unit 1 would not likely retain integrity due to post-depositional impacts. No potential exists for archeological materials to be naturally buried within Unit 1 deposits themselves.

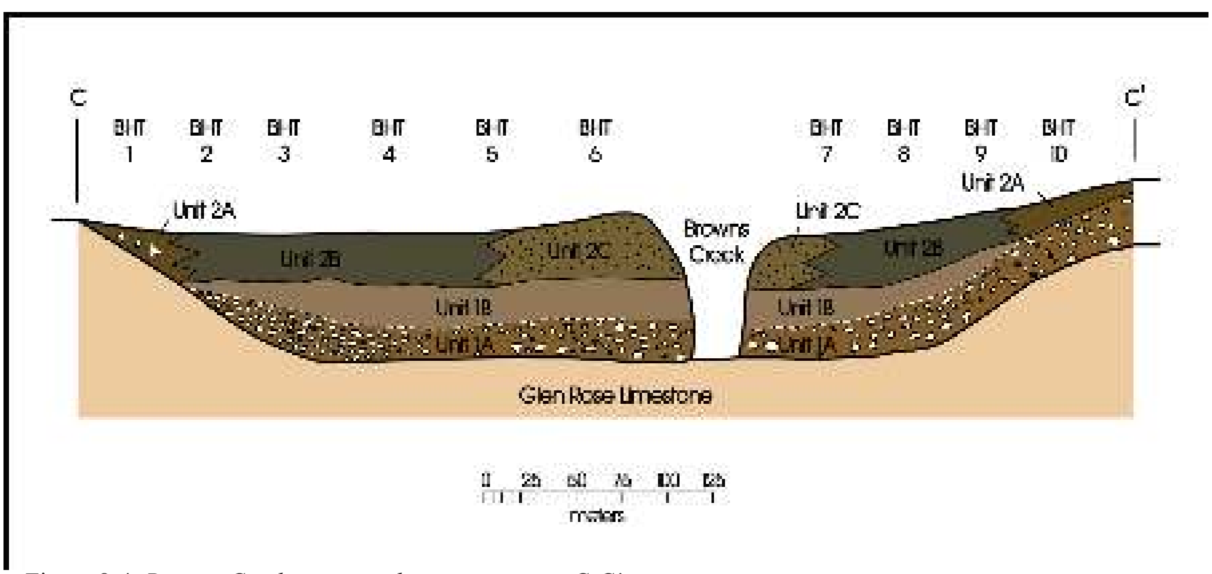

Figure 8-4. *Browns Creek stratigraphic cross-section C-C'.*

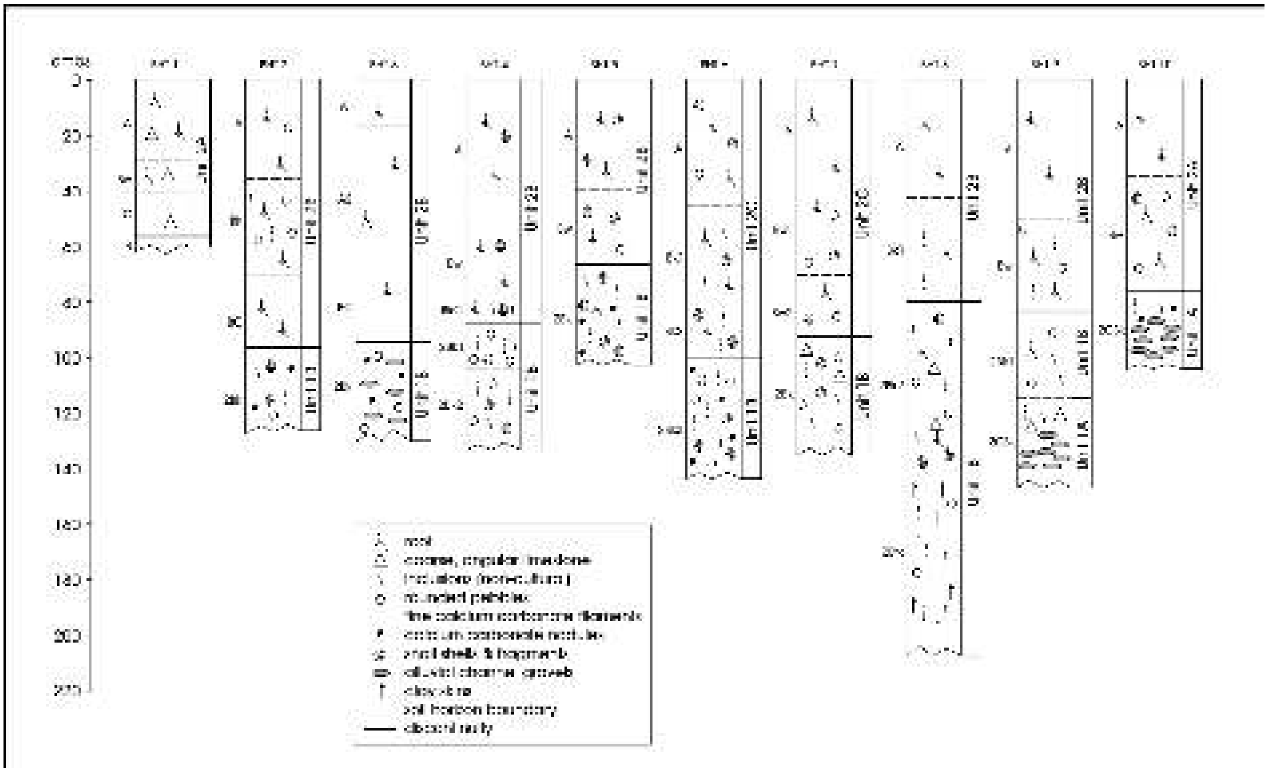

Figure 8-5. *Soil-stratigraphic columns for BHT profiles examined within Cibolo Creek and Browns Creek.*

Unit 2

Unit 2 is present across the entire valley of the study area. Examination of backhoe trench profiles revealed this unit unconformably overlies an eroded/truncated upper section of Unit 1. Except in areas where Unit 1 outcrops onto the modern ground surface, the T-1 surface is underlain by Unit 2 deposits. Unit 2 contains three distinct facies, which are subdivided on the basis of lithology, pedology, and geomorphic position. These include gravelly clay loam toeslope facies (2A), fine-grained distal floodplain facies (2B), and coarse-grained channel margin facies (2C).

Gravelly clay loam toeslope facies (2A) include the colluvial deposits along the lower valley walls that intersect the outer floodplain margin. These deposits were observed within BHTs 1 and 10, which are located at the bottom edge of the footslope above Cibolo Creek and Browns Creek, respectively. BHT 1 revealed an A-Bw-C-R pedogenic horizon sequence to an excavated depth of 57 cm (22.4 in.). Soils colors in the upper sola range from black (10YR 2/1) to dark yellowish brown (10YR 3/4) and consist of weakly developed silty clay loams, silt loams, clay loams, and sandy clay loams exhibiting fine subangular blocky ped structure. In BHT 1, 2 percent coarse fragments consisting of non-cultural angular and subangular limestone fragments were observed in the A and Bw horizons, which suggest colluvial origins. Colluvial slope deposits in BHT 1 were found to directly and shallowly overlie limestone bedrock at 57 cmbs (22.4 in.). Similar colluvial deposits are reported for BHT 10, located on the outer valley margin east of Browns Creek. Soils examined in BHT 10 revealed a weakly developed A-Bw soil horizon sequence to a depth of 75 cm (29.5 in.), which unconformably overlies Unit 1A. The potential of Unit 2A to contain intact archaeological materials is considered low to moderate. In areas where archaeological deposits may have been transported down-slope via graviturbation, little integrity is expected because of the secondary depositional context. However, any archaeological materials buried in place by slope deposits could be potentially preserved.

Fine-grained distal floodplain facies (2B) were observed in BHTs 2-5 and BHTs 8-13. In each of these trenches, Unit 2B deposits were found to unconformably overlie Unit 1B. The lower boundary and contact between Unit 2B and Unit 1B is abrupt and wavy in most cases, which suggests that high-energy flood scours have truncated the upper portions of Unit 1B. Textures within Unit 2B generally range from silt loam to silty clay, and colors gradually transition from black (10YR 2/1) in the upper A horizons to dark yellowish brown (10YR 4/4) in the lower Bw and Bk horizons. Ped structures are generally weak fine granular to subangular blocky, parting to moderate medium subangular blocky in the upper A and B horizons. Soil horizons include fairly thickened A horizons (cumulic) over weakly expressed Bw horizons. Very faint carbonates were observed in the Bk horizon of BHT 2, and except for these secondary carbonate inclusions, they were virtually identical to other soil properties. Coarse fragments are relatively minor within Unit 2B and are generally made up of <5 percent small pebbles <10 mm (<0.4 in.) in diameter and also snail shells and fragments. The low abundance and small sizes of these inclusions in BHTs 2-5 attest to the relatively low-energy depositional environment of the outer floodplain margin. The potential for Unit 2B to contain buried and intact archaeological materials is very high, given the fine-grained particle size and low-energy depositional setting.

Site 41KE217 was initially exposed after the Unit 3 colluvial slope deposits were removed during scraping activities. The exposed portion of the site revealed a dense 3-x-1.5 m (9.8-x-4.9 ft.) concentration of burned limestone (designated as the upper component), chipped stone, two projectile points, and a low density scatter of burned rock.

Coarse-grained channel margin facies (2C) were recorded only in BHTs 6 and 7 along Browns Creek and unconformably overlie Unit 1B. Soil textures within Unit 2C consist of fine, sandy loam, indicating higher-energy overbank deposits that would be expected with increased proximity to the active channel. Colors range from dark brown (10YR 3/3) in the upper A horizons to dark yellowish brown (10YR 4/4) in the lower Bw and Bk horizons. Ped structures are weak, fine granular and part to weak, fine, subangular blocky. Secondary pedogenic carbonates are present within the Bk horizons in BHT 6 and consist of very faint and fine calcium carbonate threads. Coarse fragments consisting of snail shells and fragments and rounded pebbles were less than 2 percent for all Unit 2C horizons within each trench. The contact between Unit 2C and Unit 1B is abrupt and wavy, indicating that high-energy flood scours have likely truncated the upper portions of Unit 1B adjacent to Browns Creek. The potential for Unit 2C to contain buried and intact archaeological materials is moderate. Unit 2C deposits are coarser grained loams and sandy loams, which require higher-energy depositional environments. Thus, greater potential for flood scour exists in such settings, which could potentially disarticulate cultural features.

Unit 3

Unit 3 unconformably overlies Unit 2A and was only observed as a slope deposit covering site components at 41KE217. This unit, which was exposed in BHTs 11-13 (referred to as BHTs 1-3 in remainder of the report), is situated along the western slope wall of the adjacent hill is approximately 80 cm (31.5 in.) thick, and tapers eastward onto the Menger Creek floodplain surface. At site 41KE217, Unit 3 exhibits a weakly developed soil that is friable to very friable silty clay loam with granular to subangular blocky ped structure. Snail shells and fragments 1-2 mm (0.04-0.08 in.) diameter are in approximately 2 percent abundance in the upper A horizon. The contact between Unit 3 and Unit 2B is abrupt and smooth with Unit 3 directly overlying the burned rock concentration identified at 41KE217. The potential for Unit 3 to contain buried and intact archaeological materials ranges from low to moderate. In areas where archaeological deposits may have been transported down-slope, little integrity is expected since the cultural materials would be in a secondary depositional context. However, any archaeological materials on the floodplain that are buried by Unit 3 could potentially be preserved.

Summary

Geomorphological and geoarchaeological investigations revealed that the terraces in the study area are underlain by two major alluvial stratigraphic units, designated as Units 1 and 2. These units were further subdivided on the basis of geomorphic, lithologic, and pedologic attributes. An additional colluvial unit (Unit 3) covering a portion of the floodplain was identified only in the area of site 41KE217.

Unit 1 is comprised of Pleistocene alluvium. Cultural materials could be present on top of Unit 1. If such materials were subsequently buried after deposition, reasonable integrity is possible. However, cultural materials upon unburied or exhumed portions of Unit 1 would not likely retain integrity due to post-depositional impacts. No potential exists for archeological materials to be naturally buried within Unit 1 deposits.

Unit 2 is comprised of Holocene alluvium and colluvium and exhibits varying archaeological burial and preservation potential. The greatest potential is observed within the slowly aggrading, fine-grained, distal floodplain setting (Unit 2B), which is a low-energy depositional environment capable of preserving the systemic context of site materials. One site, 41KE217, was found within Unit 2B deposits. Additional archaeological test excavations were conducted to assess the overall site integrity and research potential. Lesser potential exists for Unit 2A, which consists of colluvial deposits, and Unit 2B, which consists of higher-energy channel margin deposits.

Unit 3 consists of a colluvial deposit lacking cultural materials. These colluvial deposits rest unconformably upon lower floodplain deposits. The geoarchaeological potential for Unit 3 ranges from low to moderate.

Chapter 9: Lithic Analysis

This chapter describes in greater detail the chipped and ground stone artifacts recovered from 41KE217 during all phases of archaeological investigations. In the last section of the chapter, the distribution of the temporally diagnostic artifacts in conjunction with the distribution of burned rock zones defined during testing and data recovery is used to identify broad analytical units. The discussion of specific research domains in Chapter 10 is based on these analytical units.

Projectile Points

A total of 68 dart points were retrieved from testing and data recovery efforts at 41KE217. Thirteen different projectile point styles were identified. The majority of information on the temporal affiliation of the dart point styles derives from Turner et al. (2011). Table 9-1 lists the projectile points recovered from backhoe trenches and testing and data recovery units.

The following section discusses the projectile points grouped by broad temporal affiliation. The discussion of the Early Archaic forms precedes the Middle Archaic specimens. The small number of specimens that cannot be grouped into these two temporal units are described last.

Early Archaic Projectile Points

Twenty-three Early Archaic points have been recovered from 41KE217. They include the Angostura, Baker, Bandy, Bell/Andice, Gower, and Uvalde types. In addition, one untypable longitudinal lanceolate dart point fragment and a lanceolate concave based untyped specimen also are considered Early Archaic in age. Therefore, 23 specimens are affiliated with the Early Archaic component. They are discussed in alphabetical order below.

Table 9-1. Projectile Points from Testing and Data Recovery

Tool	Time Period	BHT	Testing and Data Recovery	Total
Angostura	Early Archaic	2	0	2
Baker	Early Archaic	0	5	5
Bandy	Early Archaic	0	3	3
Bell/Andice	Early Archaic	1	3	4
Bulverde	Middle Archaic	1	5	6
Gower	Early Archaic	1	2	3
La Jita	early Middle Archaic	4	7	11
Langtry	Middle Archaic	3	5	8
Nolan	Middle Archaic	4	4	8
Pedernales	Middle Archaic	2	4	6
Tortugas	Middle to Late Archaic	1	0	1
Uvalde	Early Archaic	2	2	4
Williams	Middle Archaic	0	2	2
untypable lanceolate		0	1	1
untypable medial fragment		0	1	1
untypable proximal fragment		0	1	1
untyped expanding stem concave base		1	0	1
untyped parallel stem concave base		0	1	1
Grand Total		22	46	68

Angostura (n=2)

The Angostura dart point is a lanceolate point that can possess a narrow, concave, or straight base (Turner et al. 2011). This dart point is typically associated with the Early Archaic Period, 9000-8000 BP (Thoms 1992:23). Two Angostura specimens (Figure 9-1a, b) were encountered at the site. Both derive from poorly documented proveniences, one in BHT 2 possibly within the upper component, and the second from the backdirt of a backhoe trench. One specimen is a medial fragment, while the other is a proximal specimen. The proximal fragment measured 16.2 mm in blade width, 14.4 mm in neck width, 11.1 mm in stem length, 12.2 mm in stem width, and 6.5 mm in thickness.

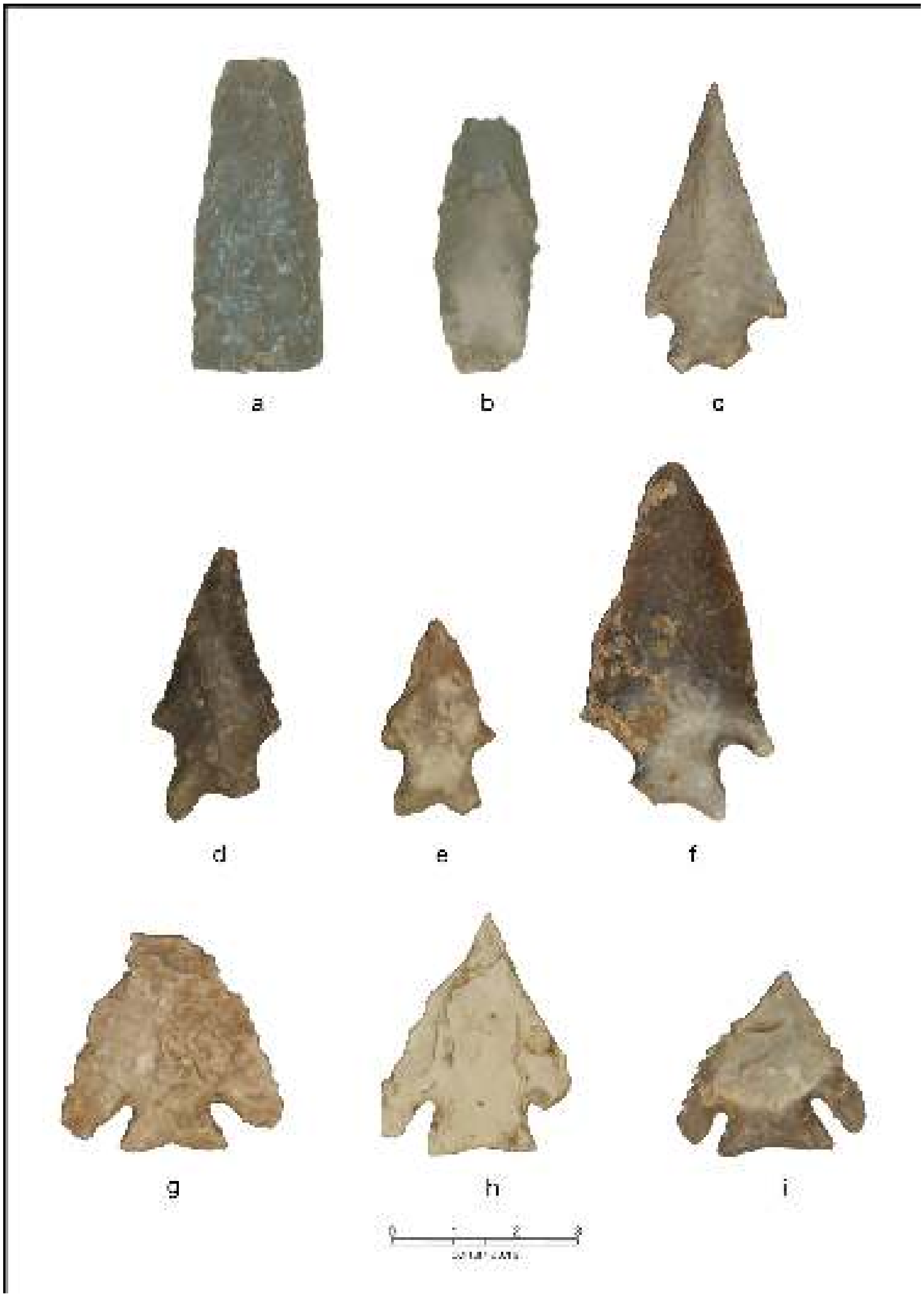

Figure 9-1. *Dart points from testing and data recovery: Angostura (a-b); Baker (c-f), and Bandy (g-i) points.*

Baker (n=5)

This dart point has an expanding stem and a bifurcated base (Turner et al. 2011). The style dates to the Early Archaic Period, ca. 8000-6000 BP. It is most common in the lower Pecos region and is encountered infrequently east of that area. Five Baker specimens were recovered during the excavations at the site. Four are shown in Figure 9-1 (c-f). Four of the five are complete, and one is a proximal fragment. Three of the specimens are relatively short (48, 44, and 36 mm, respectively). The other specimen that is complete is much larger (60 mm in length) and is made of local raw material that matches the color and texture of some of the cores recovered from the site. The average blade length of the analyzed dart points was 34.8 mm. Average stem length for the specimens was 11.4 mm.

Bandy (n=3)

This dart point has an expanding stem, and the base has a fishtail shape (Turner et al. 2011), and some researchers (Houk et al. 2009: 72) include Bandy in the Martindale style. The Bandy type is associated with the Early Archaic Period (ca. 8000-6000 BP). It appeared at the Gatlin site around ca. 6440 cal. BP and remained in use until about 5040 cal. BP. As in the case of the Baker points, the Bandy type is also more common in the lower Pecos, and it is infrequently encountered in the Bexar County area. Three Bandy points were recovered during the excavations (Figure 9-1 g-i). Two of the specimens are complete, while the third is a proximal fragment. The complete specimens are relatively short (39 and 31 mm). The average blade length for the two complete specimens was 31.85 mm, the average maximum blade width was 30.05 mm, the average neck width was 14.15 mm, the average stem length was 7.3 mm, the average stem width was 17.55 mm, and the average thickness was 8.8 mm. Two of the specimens are made of light tan colored raw materials, and one of the two possesses a number of inclusions that are not common to local cherts. The other complete specimen is heavily patinated.

Bell/Andice (n=4)

The four points classified in this group (not shown) are part of the Calf Creek series and could be classified as either Bell or Andice. One of the specimens, due to its smaller size, is more typical of the Bell type, but heavily reduced Andice points can be mistaken for Bells as well. The point type is associated with the Early Archaic Period. According to Houk et al. (2009), Bell/Andice types span from ca. 5320 BP to 4140 cal. BP. All four of the specimens retrieved during the testing and data recovery efforts are proximal fragments that are missing their downward pointing barbs.

Gower (n=3)

The Gower dart point has a short body and, typically, a parallel stem edge and concave base (Turner et al. 2011). This dart point is associated with the Early Archaic Period. Gower points date to ca. 7160 cal. BP and ca. 6290 cal. BP (Houk et al. 2009) although Oksanen (2008) reports Gower points associated with deposits dating between ca. 8600-7400 cal. BP at the Icehouse Site (41HY161). Only one of the recovered specimens is complete, the other two are proximal fragments. Based on the heavy heat spalling present on their bodies, all three appeared to be burned. The blade length for the complete specimens is 26.4 mm, the blade width is 19.4 mm, the neck width was 15.25 mm, and the stem is 17.75 mm long and 15.3 mm wide. The complete specimen is 7.45 mm thick.

Uvalde (n=4)

According to Turner et al. (2011), this type is known for its triangular to elongated body. The stem is usually expanding, and it has rounded shoulders or barbs (Turner et al. 2011). Uvalde points are affiliated with the Early Archaic Period. Four specimens were recovered from the site, and two of these are shown in Figure 9-2 (a-b). Only one was complete measuring 34.5 mm in blade length, 23.4 mm in blade width, 14.4 mm in neck width, 16.1 mm in stem length, 15.4 mm in stem width, and 7.09 mm in thickness.

Untyped (n=1) and Untypable (n=1) projectile points

The untyped specimen is a short, parallel stemmed, concave based, complete dart point (Figure 9-2c). It is heavily patinated, and the stem margins retain light grinding commonly present on Paleoindian specimens. Typically, untyped specimens are those that are sufficiently complete to place into a given type category yet they do not fit any of the existing forms defined in the regional typology. The blade has been extensively reworked, and it is likely that its shortness led to its discard. Neither face retains channel flake scars, while the deeply concave base and downward pointing ears are reminiscent of Plainview points. The maximum length is 28 mm, the stem is 23 mm wide and 12 mm long, and the base is 2.5 mm deep. It was recovered in Level 3 of EU 20. The untypable specimen is a longitudinal fragment (Figure 9-2d). It has a lanceolate shape, parallel stem edges, and a strongly convex cross-section characteristic of Angostura-like forms. Untypable point fragments are those that are too fragmentary to ascertain their overall morphology, that is, they lack the key elements (i.e. stem, barbs, base) that allow them to be assigned to a given type. Both specimens are considered as falling within the Early Archaic period although it is possible that at least one of them may be late Paleoinidian in affiliation.

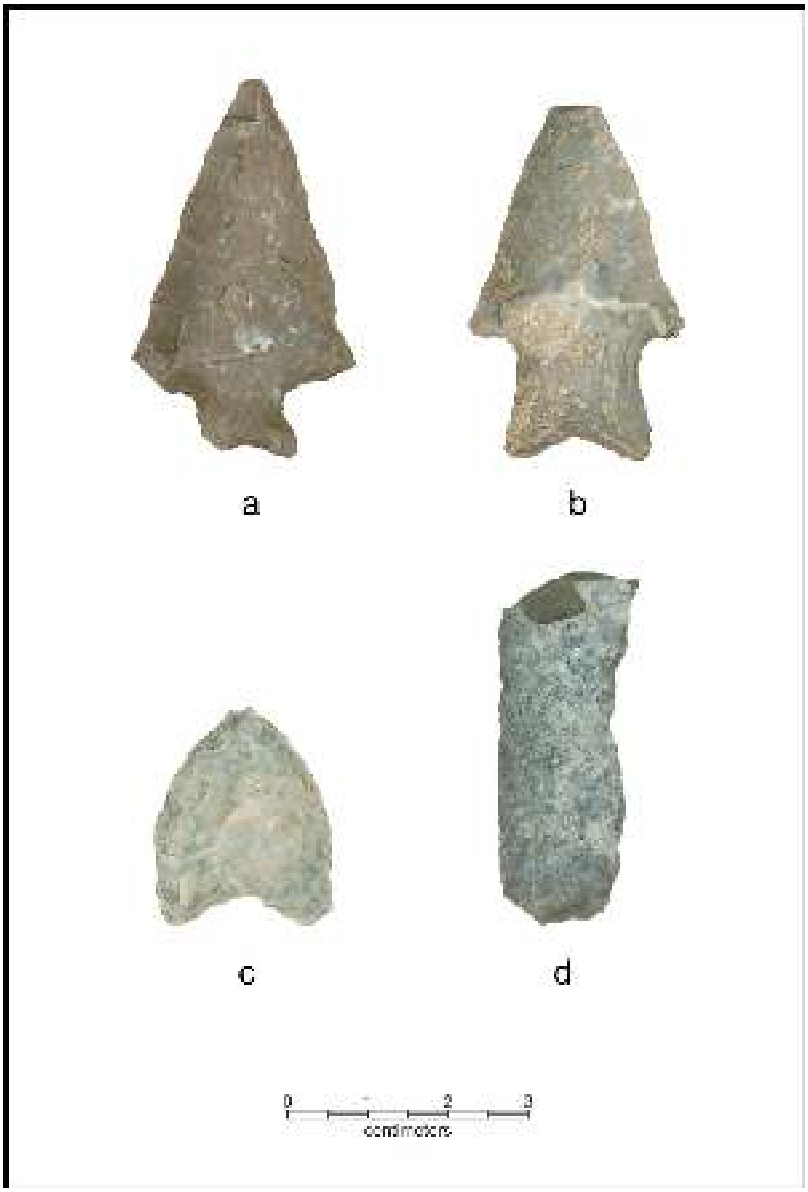

Figure 9-2. *Uvalde (a-b) and untyped (c) and untypable (d) projectile points.*

Middle Archaic Projectile Points

Forty-two Middle Archaic points have been recovered from 41KE217. They include the Bulverde, La Jita, Langtry, Nolan, Pedernales, Tortugas, and Williams types. They are discussed in alphabetical order.

Bulverde (n=6)

The Bulverde point is known for its rectangular and slightly contracting stem (Turner et al. 2011). The base of the dart point is wedge-shaped. The point style is most common in the central Texas archaeological region and in the Texas Hill Country. This point type is Middle Archaic (4000-3500 BP) in age. Six Bulverde specimens were retrieved from testing and data recovery efforts. Five of the specimens are proximal fragments, and four of these have long blade segments that could easily have been rejuvenated into functional points. The sixth specimen is a stem fragment. Three of the specimens are illustrated in Figure 9-3 (a-c). Five of the six have the typical squared stem morphologies while the sixth has the narrower stem present on some variants (Figure 9-3b). The average stem length of the specimens is 17.8 mm, and the average stem width is 17 mm.

La Jita (n=11)

The La Jita dart point is broad bladed and has narrow shoulders that define a broad and rounded stem (Turner et al. 2011). It is a common type that has a relatively localized distribution centered on the southeast corner of the Edwards Plateau. Eleven specimens were recovered from the excavations conducted at the site, and five specimens are shown in Figure 9-3 (d-h). This dart point is usually associated with the early Middle Archaic (Turner et al. 2011:126) although Houk et al. (2009) propose dates ranging from ca. 4820 to 3980 cal. BP at the Gatlin site. The earliest portion of this range may extend into the Early Archaic Period. It is the most common point type found at the site. Of the eleven specimens, only four were complete or nearly complete. Two complete specimens are shown in Figure 9-3(d, g)and they possess an average blade length of 33.85 mm, blade width of 27.45 mm, neck width of 24.2 mm, stem length of 14.1 mm, stem width of 26.5 mm, and thickness of 7.95 mm.

Langtry (n=8)

These dart points are typically thin with straight-to-concave lateral edges (Turner et al. 2011). They usually have a tapered stem, and the bases range from straight to slightly convex to slightly concave. Langtry points are affiliated with the Middle Archaic Period. This projectile point form is non-local and is common mostly in the lower Pecos, South Texas, the

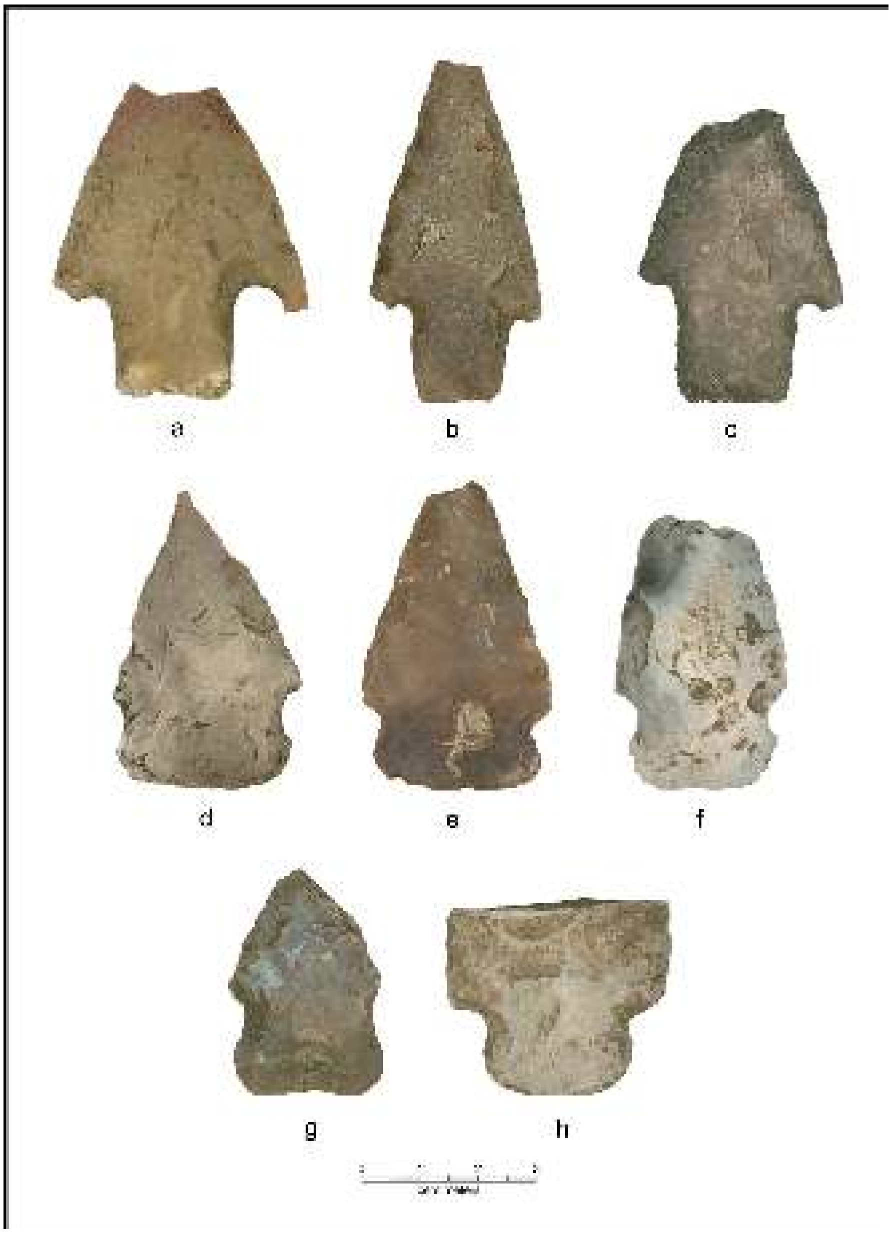

Figure 9-3. *Middle Archaic dart points: a-c) Bulverde; d-h) La Jita.*

southwestern portion of the Edwards Plateau, and in the Big Bend area (Turner et al. 2011). Eight specimens were found during testing and data recovery at the site. Two of the seven points illustrated in Figure 9-4 (b-c) are complete, while the five remaining points are proximal fragments. The last two (Figure 9-4 f-g) are proximal Langtry preforms that have the stems roughed out and have suffered tangential blade breaks during shaping and thinning. The mean measurements for the complete specimens are as follows: 35.3 mm blade length, 28.7 mm blade width, 12.1 mm neck width, 20.2 mm stem length, 8.4 mm stem width, and 4.5 mm thickness.

Nolan (n=8)

Nolan dart points tend to have elongated blades with tapered shoulders. The stem edges are alternately beveled (Turner et al. 2011). This point is associated with the Middle Archaic (ca. 6000-4500 BP); however, Houk et al. (2009) propose similar dates to La Jita dart points at ca. 4820 to 3980 cal. BP. Eight Nolan points were recovered from testing and data recovery at the site. Five of the specimens are complete, and three are broken at the distal end. Six of the specimens are illustrated in Figure 9-5. The average blade length for the five

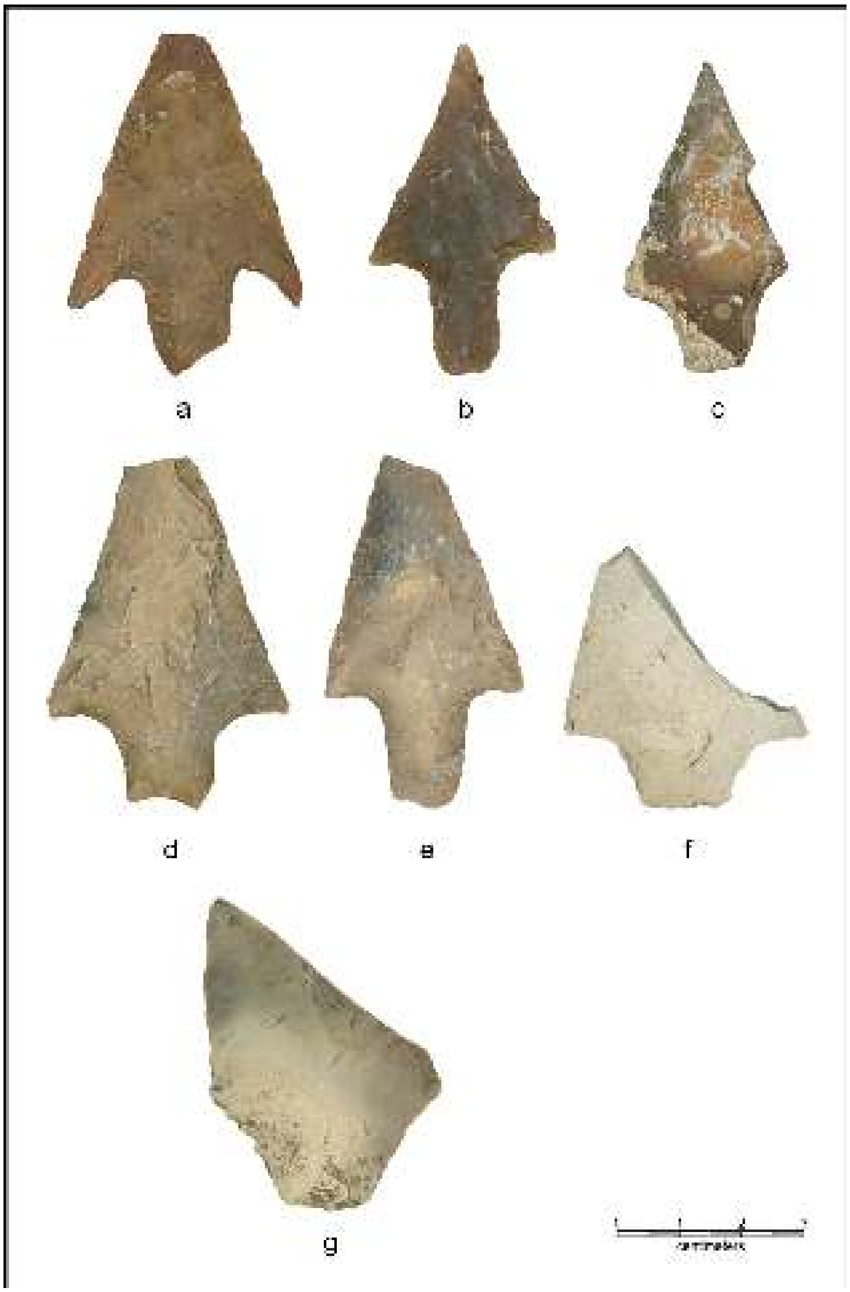

Figure 9-4. *Langtry dart points from testing and data recovery. The last two specimens are preforms.*

complete specimens is 37.4 mm, the average blade width is 26 mm, and the average neck width is 18.4 mm. On average, the stem length was 13.9 mm, while width was 19.8 mm. The average thickness for the specimens was 7.8 mm. The longer of the specimens (Figure 9-5) has a blade length of 45.8 mm, a blade width of 26.4 mm, a neck width of 16.3 mm, a stem length of 11.1 mm, a stem width of 19.6 mm, and a thickness of 8.2 mm.

Pedernales (n=6)

Pedernales dart points have rectangular stems and concave bases that are sometimes deeply notched. The point style is common in Central Texas (Turner et al. 2011). The Pedernales point is associated with the Middle Archaic Period (ca. 2500-3500 BP). Six Pedernales points were recovered during the excavations (Figure 9-6). The specimens are shown in Figure 9-6. One specimen is complete, four are missing distal ends. Those specimens with measurable stems (Figure 9-6a, b, c, and e) had an average stem length of 17.8 mm. Specimen 9-6d only had a partial stem so a width could not be measured, however the remaining four specimens had an average stem width of 19.7 mm. The mean thickness of the six specimens equaled 6.8 mm. The complete specimen had a maximum length of 73 mm.

Tortugas (n=1)

This point type is triangular, and its base ranges from straight to slightly concave (Turner et al. 2011). The Tortugas style is associated with the Middle to Late Archaic. A complete specimen was found at the site in BHT 2 (Figure 9-7a). The

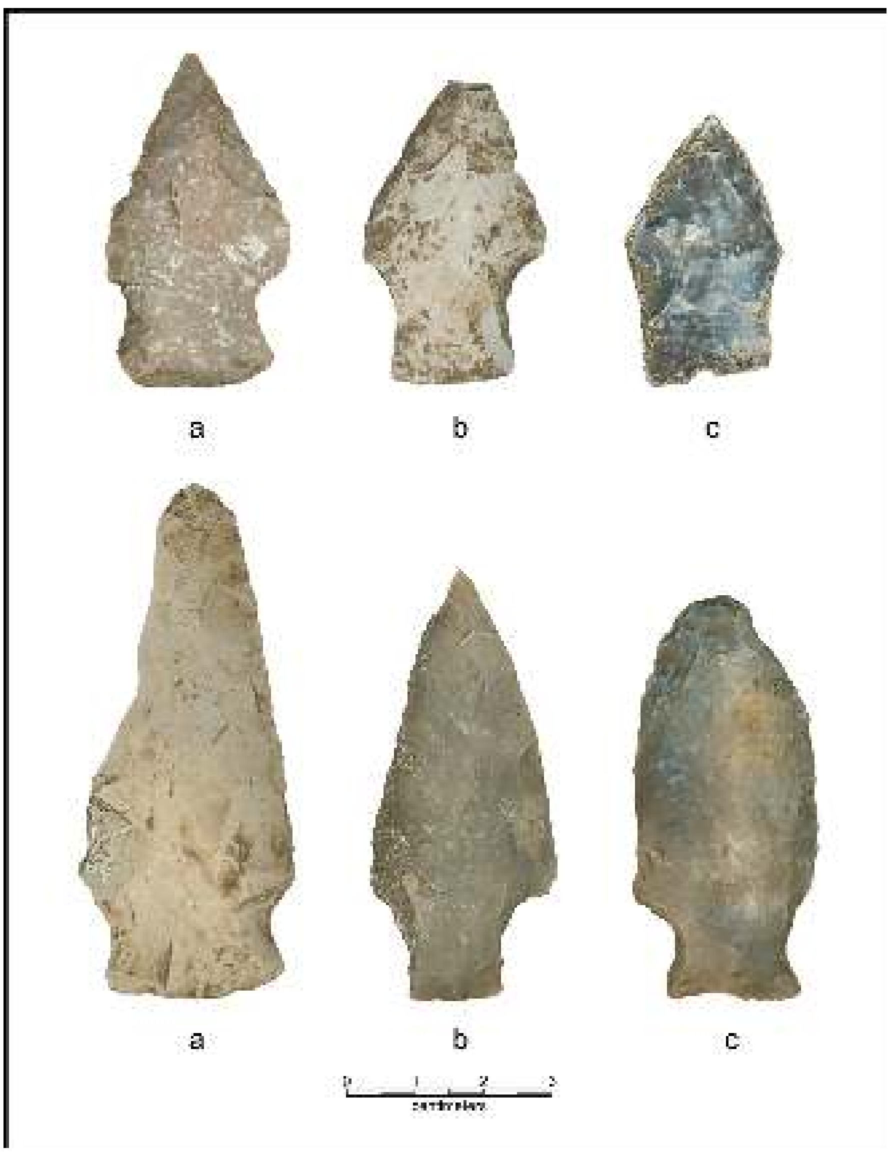

Figure 9-5. *Nolan dart points from testing and data recovery.*

point had a blade length of 51.2 mm and a blade width of 32.2 mm. The thickness was 7.4 mm. The base of the specimen was concave.

Williams (n=2)

This point has a broad body with short barbs, an expanding stem, and a concave to straight base (Turner et al. 2011). Williams points are associated with the Middle to Late Archaic Period. Two proximal fragments were recovered from the site (Figure 9-7b). The mean neck width was 20.6 mm, stem length was 14.7 mm, stem width was 22.7 mm, and thickness was 7.6 mm.

Untyped (n=1) and Untypable (n=2) projectile points

One untyped specimen is part of the collection. It is a broad expanding stem, concave based, proximal fragment recovered in the backdirt of BHT 1 (Figure 9-7c). It has large outward expanding barbs that are only partially preserved. While it is reminiscent of Bandy points of the Early Archaic Period, it cannot be securely placed in this type due to its overall thickness and bulkier body than those of the Bandy form. Two untypable fragments were recovered from the testing and data recovery efforts at the site (not pictured). They consist of one medial fragment and one proximal fragment. The medial

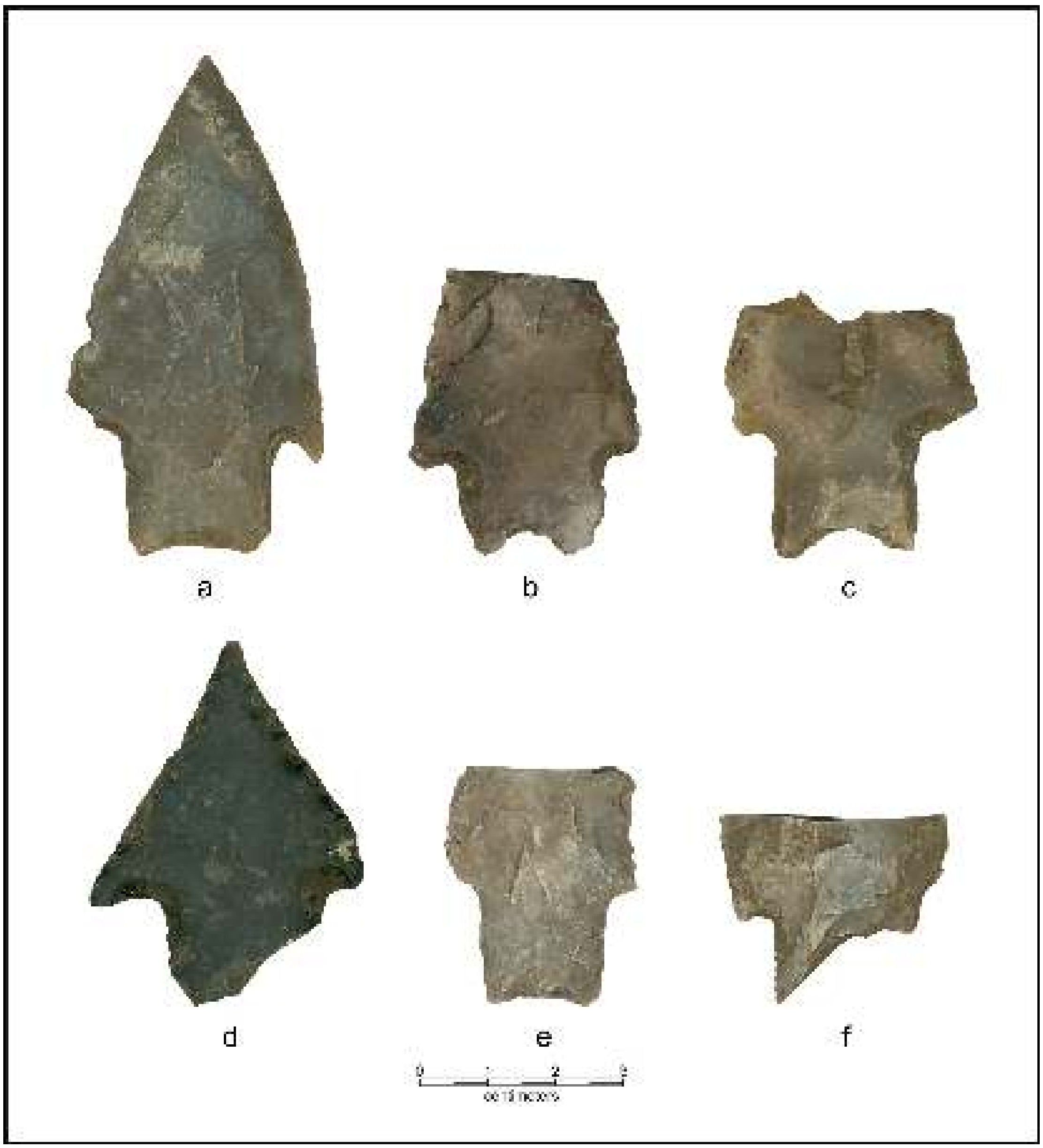

Figure 9-6. *Pedernales dart points from testing and data recovery.*

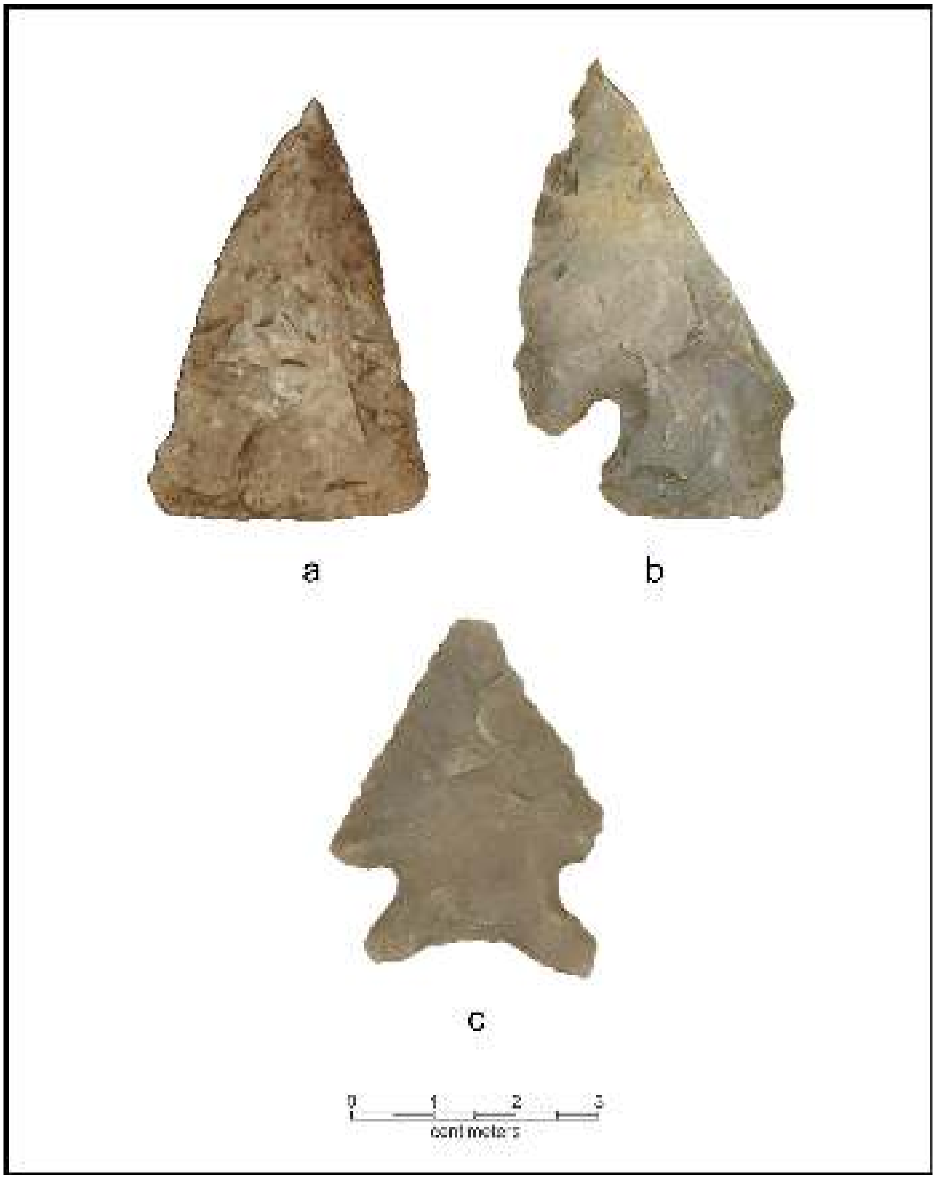

Figure 9-7. *Middle Archaic and untyped points a) Tortugas, b) Williams, and c) untyped dart point.*

fragment is missing a large portion of its stem and cannot be typed. The proximal fragment was broken very early in the reduction sequence, and its stem in unfinished.

Non-Projectile Points

This section discusses other functional categories of lithic tools encountered during testing and data recovery, not including projectile points. Because these artifacts are not temporal indicators, they are discussed here in alphabetical order. Table 9-2 lists the lithic tools found during backhoe trenching and testing and data recovery efforts. The twenty-six cutting tools recovered from the site are not included in the table.

Three adzes were recovered from the site. One specimen was from Level 3 of EU 23. The remaining two specimens were encountered in backhoe excavations at the site. One of the specimens derived from the west wall of BHT 1 is complete, and the other two are distal fragments. Two of the three are heavily patinated on both faces, while the third has patina on one face only.

Gravers

Tools with retouched or naturally occurring sharp projections that have been used to engrave or striate lines into soft materials are classified as gravers. Graver tips may be created through the unifacial retouch of a flake edge or by simply using a flake with a sharp projection. In some instances, broken bifacially flaked artifacts are also reused as gravers since the intersection of the blade break and the bifacially flaked edge often forms a strong and sharp working tip that is ideal as a graver. When these edges are dulled, they are often resharpened by removing the worn edge by a burin removal. Many times, the burin flake will terminate in a hinge as it progresses along the length of the bifacial artifact. Graver tips will often accumulate micro-fracture scars as the utilized edge is forced against the material being worked. Seventeen gravers were found during work at 41KE217. Six of these specimens are expedient forms, and the remaining specimens are minimally retouched tools.

Ground Stone

Two pieces of ground stone were found during excavations at the site. The complete specimen was encountered in the wall of Backhoe Trench 1. It is a small specimen (95 mm in length, 73 mm in width, and 41 mm in thickness) with grinding wear on both faces and battering along the two ends. There is a shallow and small concavity on one face that may have been purposefully created. The mano fragment was recovered from Level 7 of TU 4. While it is a mano edge fragment, it retains a small ground facet on one face of the tool.

Knives

Twenty-six knives were identified in the chipped stone assemblage recovered from the site. Eighteen of the specimens are expedient knives. Three additional specimens have minimally retouched working edges, and two others were multifunctional tools also used as gravers and scrapers, respectively. Finally, three bifacially flaked tool fragments appear to be formal knives based on the presence of use wear on the edges.

Perforator

According to Turner et al. (2011), perforators are characterized by long and cylindrical, tapered bits that are diamond shaped. One perforator was recovered from BHT 2. In addition, an expedient drill was retrieved from Level 3 of TU 3. The perforator is made on a middle reduction stage biface. The specimen is heavily patinated on both faces.

Scrapers

Twenty-eight scrapers were recovered from excavations at the site. Scrapers are either hand-held or hafted tools employed in activities typically associated with hide processing.

Table 9-2. Tools from Testing and Data Recovery

Tool Type	BHT	Testing and Data Recovery	Total
adze	2	1	3
expedient graver	0	5	5
minimally retouched graver	1	10	11
expedient graver and knife*	0	1	1
ground stone	1	1	2
expedient drill	0	1	1
perforator	1	1	1
expedient scraper	1	24	25
formal scraper	1	1	2
expedient scraper; retouched knife**	0	1	1
wedge	1	1	3
miscellaneous biface	16	62	78
miscellaneous uniface	2	14	16
core	2	6	8
Grand Total	**28**	**129**	**157**

* note this specimen is also counted as a knife
**note this specimen is also counted as a retouched knife

Only two formal scrapers were among this assemblage, while the large majority (n=26) were expedient specimens. Of the two formal tools, one was retrieved from BHT 1 and the second from Level 2 of EU 19.

Wedges

Wedges resemble choppers or cobble tools in rough morphology. They have bifacially worked distal edges and are typically cortex backed. However, unlike choppers, they are much smaller and lighter than the former and, therefore, would not serve as effective choppers. Wedges will sometimes retain signs of crushing or impact on their corticated proximal ends. The crushing results from contact between the proximal corticated end of the tool and a battering tool that is used to force the wedge into and along the material as the crack forms ahead of the tool. The working edge may retain step fracturing that results from contact with the material being worked, and polish may be present on the widest portions of the faces that would be consistently in contact with the material being split. Micro-step fracturing may also occur on hinged or step-fractured flake scars as the upper edge of the step fracture comes in contact with the material it is being driven into.

Three wedges were found during excavations at 41KE217. Two specimens were found during data recovery efforts, and a third was recovered from a backhoe trench. One of the specimens from excavation derived from Level 5 (40-50 cmbd; 15.7-19.7 in.) of EU 18, while the other is from Level 5 of EU 21. The third wedge came from the backdirt removed from BHT 2.

Miscellaneous Bifaces

Chipped stone specimens that have been flaked on both sides and were broken during the manufacturing process or remained complete but that could not be made into functional tools (i.e., were missing evidence of use wear) were considered miscellaneous bifaces. A total of 78 bifaces were collected during the testing and data recovery efforts at the site (Table 9-3). Twenty percent (n=16) derived from backhoe trenching at the site, while the large majority came from hand-excavations.

Miscellaneous Unifaces

Artifacts that have been flaked on only one side are classified as unifaces. The unifaces discussed in this section have not been assigned to a functional category because they lack use wear and appear to have been made into finished tools. Sixteen miscellaneous unifaces were recovered from the testing and data recovery efforts. Fifty percent of the entire assemblage consisted of unifaces made on tertiary flakes, 37.5 percent are made on secondary flakes, and 12.5 percent are primary flakes (Table 9-4). Only five (31 percent) of the specimens were complete. Two miscellaneous unifaces were found during backhoe trenching, and the remainder were derived from testing and data recovery investigations.

Cores

Cores are chert nodules that have multiple flake removals from one or more directions. The flakes removed from these nodules are often used in the performance of simple tasks but may also be used as blanks for the manufacture of formal tools such as dart and arrow points. Eight cores were recovered from backhoe trenching and testing and data recovery efforts at 41KE217. Two specimens were from BHTs 1 and 2, while six came from testing and data recovery. Seven of the cores are multidirectional, while only one specimen is unidirectional. The largest specimen is a nodular core that is unidirectional and measured 79.11 mm. The smallest specimen, a multidirectional nodular core, measures 45.08 mm in maximum dimension.

Table 9-3. Biface Completeness

Biface	BHT	Testing and Data Recovery	Total
complete	1	8	9
distal	6	27	33
medial	4	9	13
proximal	5	18	23
Total	**16**	**62**	**78**

Unmodified Lithic Debitage

In addition to fragments of burned rock that were used in cooking facilities, the next most numerous artifact category consists of unmodified lithic debitage. Lithic debitage, or flakes, are the debris generated during core reduction and tool manufacture or repair. Their analysis can provide information related to the reduction strategies employed by the site's inhabitants, the reduction sequences represented, and possibly even the tools manufactured and rejuvenated on site. Burin flakes provide one such specialized bit of technological information. Burin flakes are removed to resharpen or rejuvenate a graving tool's working edge. The burin flakes have unique morphologies that are easily recognized and provide information not only about the practice of this particular rejuvenation technique but also about the existence of gravers in the tool assemblage. Four burin flakes were encountered in the unmodified lithic debitage from 41KE217, and two of them showed signs of use wear.

Table 9-4. Miscellaneous Unifaces

FS	BHT/TU/EU	Level	Maximum Size (mm)	Blank	Completeness
65	BHT 2		97.5	primary	complete
10	BHT 1		41.1	secondary	medial
29	1	9	37.5	secondary	medial
49	3	8	36.9	tertiary	distal
26	1	8	25.4	secondary	distal
174	6	3	30.1	tertiary	medial
226	7	4	45.2	tertiary	complete
138	5	1	26.4	tertiary	medial
26	1	8	35.3	tertiary	medial
201	29	4	47.1	tertiary	distal
220	15	4	45.8	secondary	medial
22	3	3	37.7	secondary	complete
22	3	3	16.9	tertiary	medial
3	1	2	40.3	secondary	medial
13	2	4	37.4	tertiary	complete
6	2	3	35.2	primary	complete

A total of 4,475 pieces of unmodified lithic debitage was analyzed from testing and data recovery investigations. A very basic analysis of the unmodified lithic debitage showed that of the 4,475 pieces, 3,987 (89 percent) were decorticate, while the remainder retained some cortex on the dorsal face of the flake. The percentage of decorticate debitage is relatively high, when considering that the typical reduction of a nodule to a finished bifacial tool produces 70-80 percent decorticate specimens (Tomka 1989). The slightly higher percentage in this assemblage suggests that late stage reduction and perhaps finished tool repair may contribute a sizable proportion of debitage to the sample. These pieces of decorticate debitage would derive from the reworking of worn or use-broken tools that would have arrived on site already finished. The analysis of debitage or flake completeness showed that only 848 (19 percent) of the pieces were complete. The remaining pieces were proximal, medial, and distal fragments which suggest that the majority of the sample derives from tool manufacture rather than core reduction (Sullivan and Rozen 1985).

Analytical Units

The definition of the analytical units is based on a combination of factors including the examination of the peaks in the cultural materials by level across the excavation block; the stratigraphic position of the peaks vis-à-vis the western, central, and eastern portions of the excavation blocks; the stratigraphic distribution of typed projectile points; and the radiocarbon assays derived from units located within the data recovery block and/or associated BHT 1.

Since BHTs 2 and 3 and TU 4 cannot be stratigraphically linked to BHT 1 and TUs 1-3, artifacts derived from TU 4 are not included in the subsequent analyses and the definition of the analytical units. While the excavation of TU 1 began from the original ground surface prior to the grading of the project easement, all other units were excavated from a once- or twice-graded surface; therefore, the levels excavated during eligibility testing and subsequently during data recovery are not equivalent to each other. For instance, because the excavation of TUs 2 and 3 began some 70 cm (27.6 in.) below the original surface, Levels 1 in TUs 2 and 3 are equivalent to Level 7 in TU 1. Similarly, because the excavation units in the data recovery block were begun after the dense zone of burned rock was removed, Level 1 in the units located along the western edge of the block (i.e., EUs 5-12) is equivalent to Level 10 in TU 1 and Level 4 in TUs 2 and 3. Figure 9-8 shows the vertical relationships between the excavation levels associated with TUs 1-3 and the EUs excavated at the site.

Furthermore, since the ground surface sloped away from the hillside, Level 1 in the two rows of units located furthest east of the hill (EUs 13-35) was equivalent to level two in the westernmost row of excavation units, Level 5 in TUs 2 and 3, and Level 11 in TU 1. This incongruity was caused

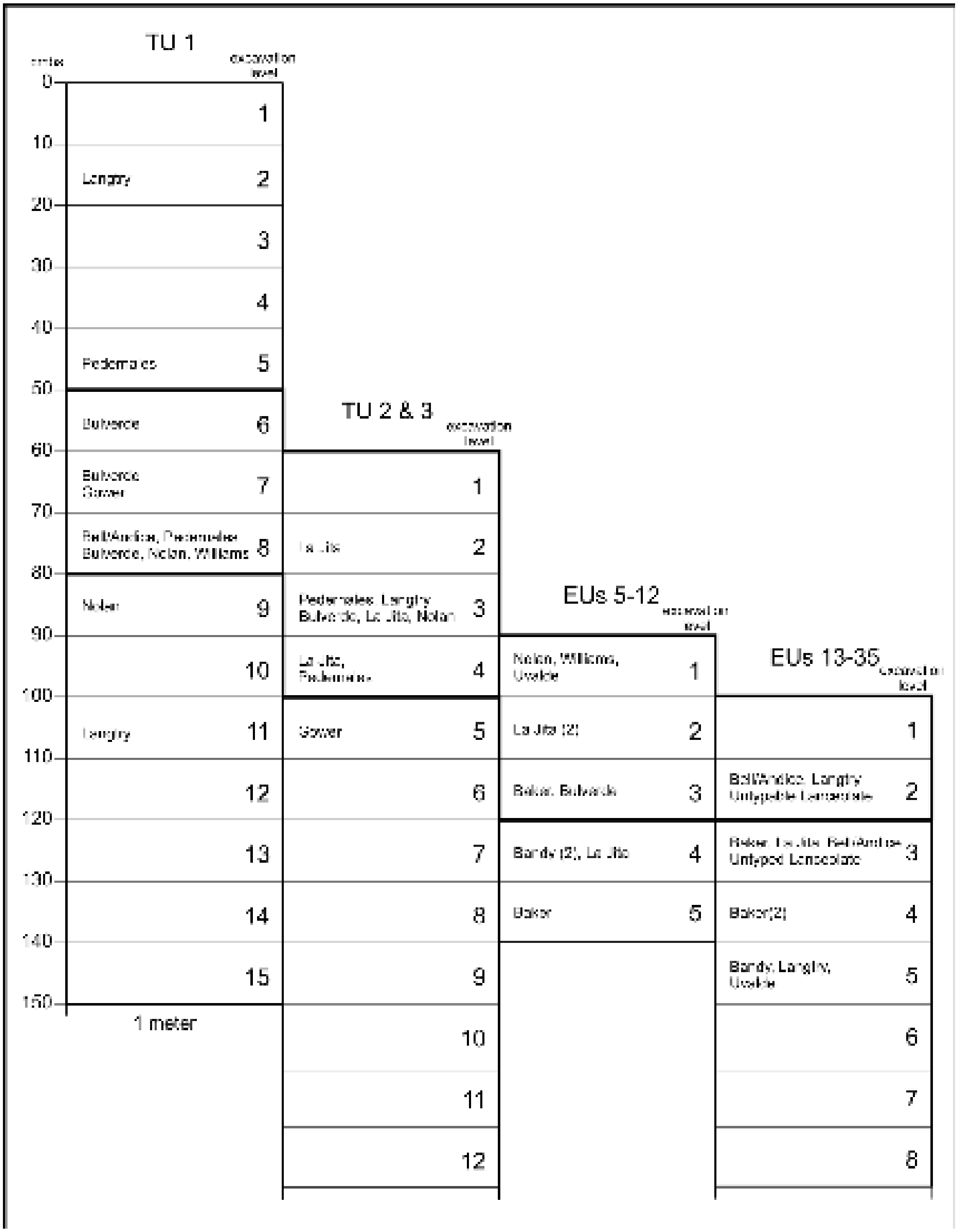

Figure 9-8. *Stratigraphic relationship between test units dug during testing and data recovery at 41KE217. Also note the projectile point types recovered from the excavation levels.*

by the deposition of colluviums eroding off the hillside, redepositing at the base of the slope in a thicker layer near the hill, and thinning as it moved away from its base. As a result of this uneven surface, excavations along the eastern row of units did not begin until the units along the western edge had already been excavated one to two levels below the graded surface (Figure 9-9). Therefore, many of the first two levels in the central and eastern row of units (Figure 5-3) were either partial or were not excavated at all since they were well below the high point of the block's western edge.

Table 9-5 lists the principal artifact categories recovered by level during testing and data recovery excavations. The appropriate excavation levels are combined with each other, as per the above descriptions, to quantify the amount of cultural material derived by level. In addition, the counts of burned rock, debitage and lithic tools are standardized to .10 m^3 of matrix per excavation level. Only the typed projectile points derived from testing and data recovery are listed in the table.

Sixty-eight projectile points were recovered during testing and data recovery investigations at the site (Table 9-6). Of these, 22 (32 percent) derive from backhoe trenches or backdirt and cannot be assigned to an excavation level-based provenience. Two additional specimens are untypable fragments leaving a total of 44 specimens associated with hand-excavated levels and recovered either in situ or in the screen while processing the matrix from a specific excavation level. The prove-

TU/EU Number	Excavation Levels												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
2	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	
3	.10	.10	.10	.10	.10	.10	.10	.10					
5	.10	.10	.10	.10	.10								
6	.04	.10	.10	.10	.10								
7	.04	.10	.10	.10	.10								
8	.04	.06	.05	.05	.05								
9		.05	.05	.05	.05								
10		.07	.05	.05									
11		.08	.05	.05	.05								
12		.09	.05	.05	.05								
13		.05	.10	.10	.10								
14		.06	.10	.10	.10								
15		.05	.07	.10									
16			.08	.10	.10								
17		.03	.09	.10	.10								
18		.03	.10	.10	.10								
19		.10	.10	.10	.10	.10	.10						
20	.10	.10	.10	.10	.10								
21		.03	.10	.10	.10								
22		.04	.10	.10	.10								
23		.07	.10	.10	.10								
24			.09	.10	.10								
25			.06	.10	.10								
26			.02	.10	.10								
27			.10	.10	.10								
28			.05	.10	.10								
29			.04	.10	.10								
30			.02	.10									
31			.03	.10									
32				.10	.10								
33				.06									
34			.04	.08	.10								
35			.15	.10	.10	.10	.10	.10					

Figure 9-9. *The levels excavated within each TU and EU and the volume of matrix derived from each level and unit.*

nience of these 44 typed projectile points and of two additional specimens that are untyped and untypable, respectively, but yet can be assigned to a broad time period (Early Archaic), is presented in Figure 9-8 overlaid on the excavation levels in which they were found.

Three radiocarbon assays from the excavation block area are useful in defining the ages of the two deepest components identified at 41KE217. Two of the three assays derive from Level 5 of EU 14 and they yielded the following calibrated dates: 4090-3925 cal. BP (94.2% probability) and 5686-5468 cal. BP (95.4% probability). These samples derived from the bottom of the thick burned rock zone and likely date the inception of this intensive occupation of the site. The third and final radiocarbon sample comes from below the deepest isolated burned rock hearth identified in the west profile of BHT 1. It is not associated with a feature, but it is likely to date the initial occupation of the landform that produced the subsequent isolated hearths of this Early Archaic component. The assay yielded the following calibrated date: 7325-7170 cal. BP (93.9% probability).

Based on the information summarized above, we conclude that three distinct archaeological components or depositional units are present within the site (Figure 9-10). The uppermost of these components consists of excavation Levels 1-5 in TU 1. The small number of artifacts, including the peak in lithic debitage noted in Level 2 (Table 9-5), is part of a thin deposit that is likely late Middle Archaic or Late Archaic in age. A Langtry specimen and a Pedernales dart point were the only temporally diagnostic artifacts recovered from this component (Figure 9-10 and Table 9-6). Given that only these five proveniences sampled this component, conducted no additional analyses of the materials derived from these proveniences was conducted. Using the same observations and data, we have determined that Levels 6-8 in TU 1, Levels 1-4 in TUs 2 and 3, Levels 1-3 in EUs 5-12, and Levels 1 and 2 in EUs 13-35 are part of the Middle Archaic component that consists of a thick zone of burned rock that was originally identified during monitoring and more fully exposed in BHT 1 and TUs 1-3. Twenty-five typed projectile points have been recovered from these proveniences (Table 9-6). Of these, 19 (76 percent) are Middle Archaic forms (Turner et al. 2011). Finally, deposits from Levels 9-5 in TU 1, Level 5 and below in TUs 2 and 3, Levels 4 and 5 in EUs 5-12, and Levels 3-8 in EUs 13-35 derive from the deepest deposits sampled during data recovery. Eighteen dart points were recovered from these proveniences (Table 9-6), and of these, 16 are typable specimens. Of these 18 points, 12 (67 percent) are associated with the Early Archaic period, and the remaining 6 are affiliated with the Middle Archaic (Turner et al. 2011).

Table 9-5. Combined Artifact Counts per Level for Eligibility Testing and Data Recovery

Depth Below Surface (cm)	Burned Rock Counts	Debitage	Lithic Tools/ cores	Projectile Points	Totals
0-10	6	2	0		8
10-20	28	107	8	1	144
20-30	2	5	0		7
30-40	8	6	2		16
40-50	25	37	1	1	64
50-60	321	158	3	1	483
60-70	185	271	6	2	464
70-80	207	575	22	6	810
80-90	484	807	28	6	1,325
90-100	1,440	1,351	72	5	2,868
100-110	1,088	554	30	7	1,679
110-120	670	253	8	6	937
120-130	885	363	12	5	1,265
130-140	427	259	12	4	703
140-150	122	38	0	0	160
150-160	168	105	10	0	283
160-170	33	10	0	0	43
170-180	27	0	0	0	27
Grand Total	**6,126**	**4,901**	**214**	**44**	**11,286**

Table 9-6. Distribution of Projectile Points from 41KE217 and Their Temporal Affiliation and Recovery Context by Component

	Recovery Context					
Projectile Point Type/Classification	**Early Archaic**	**Middle Archaic**	**Late Archaic**	**unassigned**	**Grand Total**	**Temporal Affiliation**
Angostura				2	2	Early Archaic
Baker	5				5	Early Archaic
Bandy	3				3	Early Archaic
Bell/Andice	1	2		1	4	Early Archaic
Bulverde	1	4		1	6	Middle Archaic
Gower	1	1		1	3	Early Archaic
La Jita	2	5		4	11	early Middle Archaic
Langtry	2	2	1	3	8	Middle Archaic
Nolan	1	3		4	8	Middle Archaic
Pedernales		3	1	2	6	Middle Archaic
Tortugas				1	1	Middle Archaic
Uvalde	1	1		2	4	Early Archaic
Williams		2			2	Middle Archaic
untypable longitudinal lanceolate fragment		1			1	Early Archaic
untypable medial fragment		1			1	unknown
untyped expanding stem concave base				1	1	unknown
untyped concave based lanceolate	1				1	Early Archaic
Grand Total	**18**	**25**	**1**	**22**	**68**	

The specific levels and volumes of matrix excavated within each test and excavation unit are listed in Figure 9-11. The figure provides this information overlaid on the three archaeological components identified at 41KE217.

The analyses conducted to define the three analytical units indicate that neither the Middle Archaic nor the Early Archaic component is pristine and that both have experienced some degree of depositional mixture. The majority of the typed projectile points in both components date to the assumed age of the component but it is not known what proportion of the unmodified lithic debitage, burned rock, and lithic tools is also affiliated with the components. A high degree of confidence regarding the depositional integrity of cultural strata is rarely feasible in archaeological research. Therefore, in continuing the analyses of these materials, we assume that the two principal depositional packages and the materials contained within them date to the Middle and Early Archaic periods, respectively.

Summary

This chapter presented the chipped stone assemblage recovered from 41KE217 during backhoe trenching and testing and data recovery efforts. A total of 289 ground and chipped lithic artifacts were retrieved from the archaeological work at the site. These specimens represent a combination of artifacts that were employed in the performance of single or multiple tasks and artifacts that were broken in the process of manufacture or for other reasons did not reach the completed stage. The largest single category of tools consists of 68 projectile points. Fourteen different projectile point styles were identified in this assemblage, dating to the Early, Middle, and Late Archaic periods. Other functional categories of tools discussed in this chapter included adzes, burins, gravers, knives, perforators, drills, scrapers, wedges, and miscellaneous bifaces and unifaces. Of these functional categories the most frequently occurring tools (besides miscellaneous bifaces) were knives (n=25) and gravers (n=16). Two pieces of ground and battered stone artifacts, a mano and a metate fragment, also were recovered.

The initial discovery of the archaeological deposits was made only after a portion of the overburden had been graded off the project easement. Subsequent data recovery strategies called for further grading of the surface to remove the thick, burned rock zone that overlaid the deeper cultural deposits that consisted of isolated hearths. In turn, data recovery focused on

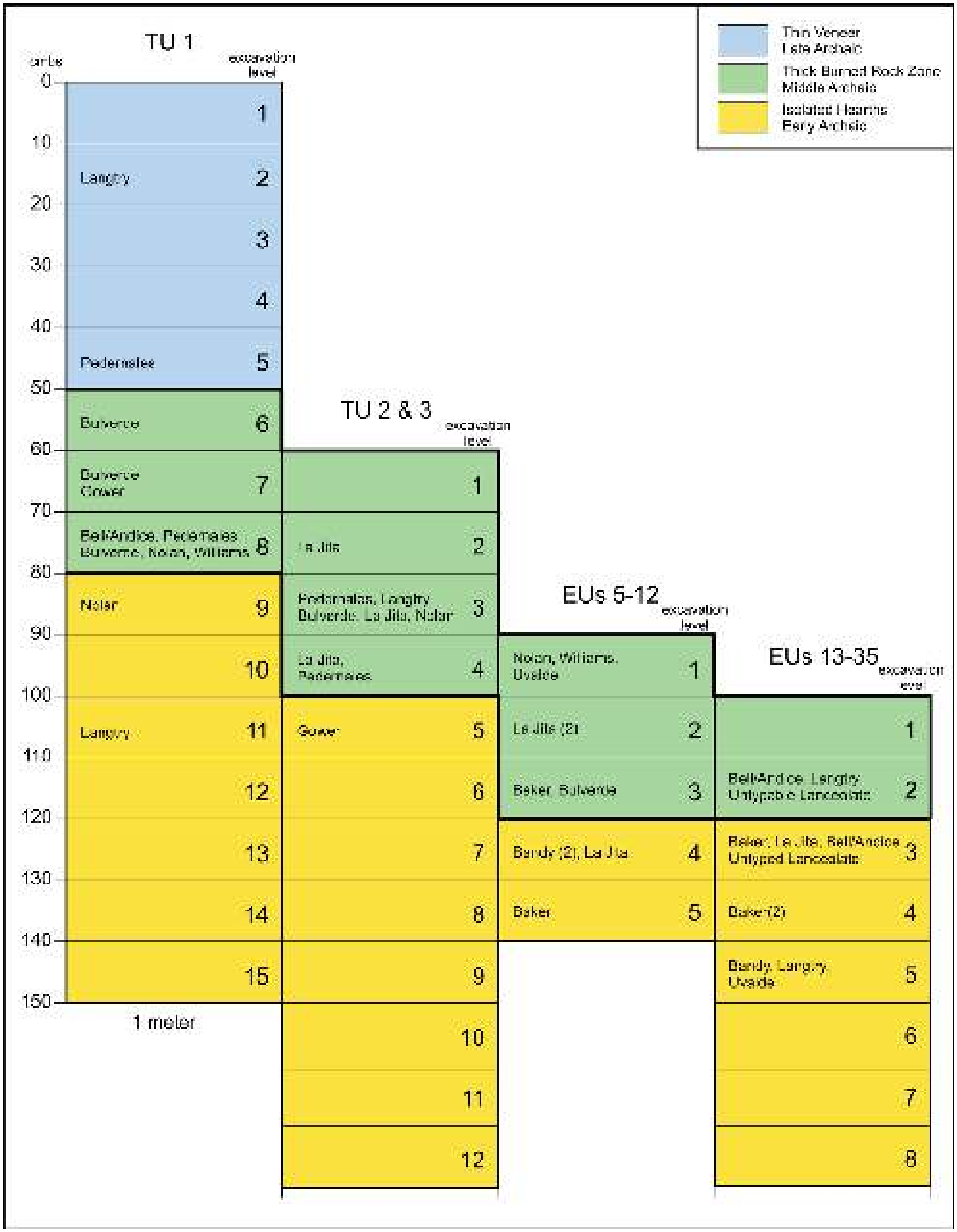

Figure 9-10. *Breakdown of levels excavated within each TU and EU and the analytical components they are grouped into.*

TU/EU Number	Excavation Levels 1	2	3	4	5	6	7	8	9	10	11	12	13
1	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
2	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	
3	.10	.10	.10	.10	.10	.10	.10	.10					
5	.10	.10	.10	.10	.10								
6	.04	.10	.10	.10	.10								
7	.04	.10	.10	.10	.10								
8	.04	.06	.05	.05	.05								
9		.05	.05	.05	.05								
10		.07	.05	.05									
11		.08	.05	.05	.05								
12		.09	.05	.05	.05								
13		.05	.10	.10	.10								
14		.06	.10	.10	.10								
15		.05	.07	.10									
16			.08	.10	.10								
17		.03	.09	.10	.10								
18		.03	.10	.10	.10								
19		.10	.10	.10	.10	.10	.10						
20	.10	.10	.10	.10	.10								
21		.03	.10	.10	.10								
22		.04	.10	.10	.10								
23		.07	.10	.10	.10								
24			.09	.10	.10								
25			.06	.10	.10								
26			.02	.10	.10								
27			.10	.10	.10								
28			.05	.10	.10								
29			.04	.10	.10								
30			.02	.10									
31			.03	.10									
32				.10	.10								
33				.06									
34			.04	.06	.10								
35			.15	.10	.10	.10	.10	.10					

archaeological components: LA, MA, EA
.10 = volume of matrix

Figure 9-11. *Breakdown of excavation levels and volumes associated with the three components identified at 41KE217.*

these earlier deposits. Radiocarbon assays and the vertical distribution of the cultural materials confirmed that the thick, burned rock zone was Middle Archaic in age. It was overlain by a veneer of late Middle Archaic and Late Archaic materials that were identified only in the laboratory. The deeper of the deposits contained primarily Early Archaic temporal diagnostics although 30 percent of the projectile points were Middle Archaic in age. A radiocarbon assay from the base of the deposits and two assays from near the top of this component confirmed the Early Archaic age of the materials. Discussions in the next chapter focus on the comparison of the Middle and Early Archaic materials recovered from the site.

Chapter 10: Research Domains

In this chapter, we elaborate on the research domains introduced in Chapter 4 of this technical report. The three broad research domains include chronology, the organization of hunter-gatherer technology as manifested primarily in the lithic technology and hot rock cooking facilities, and the investigations of scales of mobility exhibited by the former inhabitants of site 41KE217.

Chronology

While we have addressed in specific terms the chronological affiliation of the three archaeological components present at the site, a number of broad issues remain to be discussed related to the occupation of the site. The youngest of the components is found near the surface and consists of a thin veneer of archaeological materials that contains a Langtry point dated to the early Middle Archaic. This point could have been extracted from one of the deeper components on the site since these older components contain a number of basin-shaped, rock-lined hearths, the construction of which could have extracted older deposits buried on site. There is a small peak in lithic debitage associated with this thin veneer of material, but the sample sizes are too small to derive any meaningful patterns related to the nature of the activities carried out on site. However, no burned rock hearths were encountered within this component suggesting that the occupation was the result of brief stays possibly associated with raw material procurement and/or tool manufacture.

The Middle Archaic component underlying this occupation consists of a 30-35 cm thick zone of burned rock. Although only three units were hand-excavated through this component, none of the three resulted in the identification of individual rock-lined hearths within the zone of burned rock. Rather, it appeared that the burned rock represented a discard area for "exhausted" burned rock that had been reduced in size to a point that it would no longer be an effective heating element. Whether the hearths were built within the zone of burned rock or the hearths were constructed and used at another location with only the discarded heating elements ending up in the 30-cm thick layer cannot be determined. Nonetheless, it is clear that the zone formed sometime after 4090 BP which approximates the terminal date of the Early Archaic component found under the dense zone of burned rock.

In terms of temporally diagnostic projectile points, the Middle Archaic component has yielded numerous points ranging in age from 6000-3000 BP. As noted by geoarchaeological investigations, this component appears to exhibit compressed soils (see Chapter 3). Early Archaic point types seen in the Middle Archaic component include Bell/Andice (n=2) and Gower (n=1) dart points, as well as a lanceolate longitudinal fragment. Middle Archaic dart points are the most common in the component and include Bulverde, La Jita, Langtry, Nolan, Pedernales, and Williams types.

Two charcoal samples were collected that help date the initiation of the Middle Archaic component at the site (Appendix B). Both (D-AMS-71 and D-AMS-72) derive from Level 3 of EU 5 and are associated with Feature 4, a burned rock concentration. The feature was found 27 cm (10.6 in.) below the graded surface from which the data recovery excavations were initiated. The two samples yielded the following calibrated date ranges: 4083-3874 cal. BP (D-AMS-71) and 4090-3925 cal. BP (D-AMS-72). Since the samples come from the western line of excavation units where the Middle Archaic deposits are more deeply buried due to colluvial slope wash, it is our contention that these samples date from soon after the termination of the Early Archaic component and the initial Middle Archaic occupation of the site.

The Early Archaic component underlies the thick, burned-rock-rich Middle Archaic deposits. In BHT 1, a clear separation could be seen between the two components particularly as one moved southward along the trench wall. The radiocarbon assay derived from the base of the deepest component indicates that it began to form after 7325-7170 cal. BP (93.9% probability). In contrast to the overlying Middle Archaic occupation, the use of the site appears to have been different during the Early Archaic. Specifically, the replacement of the dense layer of burned rock with isolated rock lined hearths indicates a less intensive use of the site, at least for the purposes of constructing heating and cooking features.

Two charcoal samples from near the base of BHT 2 yielded the following calibrated dates: 5686-5468 cal. BP (95.4% probability) and 5665-5590 cal. BP (84.8% probability). The samples are from the same cluster of charcoal and come from an area of the site where only intermittent burned rock is present. TU 4 excavated adjoining this trench produced a total of 195 pieces of debitage with the most pronounced peak in materials coming from Level 7 (n=126). By Level 9 only a single piece of debitage was recovered in the excavation unit. Therefore, based on the radiocarbon dates alone, it would appear that the archaeological deposits in the vicinity of BHT 2 also are of Early Archaic affiliation.

The occupation of the site begins at a time when a dramatic dry period, the Altithermal, sets in across much of the continent resulting in conditions that are warm and highly moisture deficient. These conditions lead to the retreat of woodlands and forests from the open plains into more protected river valleys. In addition, the settlement of desert environments shrinks as human populations retreat into the Edwards Plateau and the Edwards Escarpment that remain veritable oases of deep-water-table fed springs that provide a predictable and sought-after resource.

As part of this adjustment in regional settlement patterns, the archaeological record suggests that groups of hunter-gatherers who originally lived in the lower Pecos region began fanning out of the area toward the north and the Edwards Plateau (McKinney 1978). This out-migration was likely in response to the increased aridity of the Chihuahuan desert and the northward spread of desert succulents into the Edwards Plateau. The increased aridity may have served as an impetus for out-migration, while the increased availability of desert-adapted plant species on the Edward Plateau may have served as a magnet for resettlement.

Organization of Technology

In our discussion of the theoretical orientation of this research study and of the domains being considered, we have suggested that significant changes were taking place in the faunal resources available to hunter-gatherers during the late Pleistocene. Specifically, with the demise of the mega-fauna, hunter-gatherer groups had to shift to the procurement of smaller-bodied prey, such as deer and antelope. However, the extinct ion of the mega-fauna did not mean the total absence of large-bodies species across the continent. Modern bison, which appears to have ranged across the northern and central plains, was available at least on a seasonal basis in the lower reaches of the southern plains, including Texas. While modern bison would have left the southern plains at the end of the Pleistocene, Collins (1995) suggests that the species reentered the region during the very late Early Archaic perhaps between 6000-5500 BP. Prior to this time frame, unless the archaeological record is influenced by differential preservation of faunal elements, bison would have been absent throughout much of the Early Archaic from the region. Following the brief return of bison to the region mentioned above, the species again decreases in abundance through the remainder of the Middle Archaic (5500-4000 BP; Collins 1995). Recent research (Munoz et al. 2011) has shown that bison were present in Texas during the Middle Archaic period. It is not known whether bison populations were as abundant throughout the latter half of the period (5500-4000 BP) as they were early during the Middle Archaic (6000-5500 BP).

In our research design (Chapter 4 we suggested, in congruence with the expectations from optimal foraging theory, that changes in the relative density of bison would significantly affect the diet breadth of the human populations as well as the organization of lithic technology, including the design of tools and the composition of toolkits, as well as strategies used in their manufacture and repair. It is possible that bison population densities during the formation of our deepest archaeological component (Early Archaic Period) may have been below a threshold that would have made the medium-bodied deer and antelope optimal prey. While bison would have been pursued each time when encountered, the focus of the subsistence strategies may have been medium-bodied prey species. Under such circumstances, and given the ubiquitous availability of deer and antelope, we anticipate that the procurement of meat protein would have been a day-to-day activity organized as part of daily foraging trips rather than bulk procurement, which may have been practiced during seasonal hunting expeditions (i.e., bison hunting). Under the daily hunting and foraging strategy, we anticipate that generalized tools that are less energy intensive to manufacture (i.e., flakes with suitable working edges) would have been favored by hunter-gatherers. These expectations are derived from the hypothesized relationships between tool design and tool kit composition in addition to prey availability and processing requirements described by a number of archaeologists (Bamforth and Bleed 1997; Tomka 2001).

Although recent research indicates that bison availability may have increased during the Middle Archaic (Collins 1995; Munoz et al. 2011), given that the project area is at the southern margin of the southern plains, it is expected that even small perturbations in climatic conditions that influence forage availability could lead to fluctuations in bison populations leading to more restricted spatial and more variable temporal distributions. Changes in availability and/or spatial distribution of bison may have led to the intensification of bison procurement. Such changes may have occurred during the first part of the Middle Archaic as paleoclimatic conditions were changing during the mid-Holocene Altithermal drought (Bousman 1998). Such a shift toward intensification may be manifested in the production of lithic toolkits that contained more task-specific tools that would have taken more time to produce (i.e., more energy expensive).

Based on these apparent trends in bison availability during the Early and Middle Archaic periods, we would expect hunter-gatherer tool kits to consist of fewer tools with high manufacture costs and little evidence of what some have termed gearing up (see Binford 1977, 1979; Bleed 1986) during the Early Archaic. In contrast, during the Middle Archaic tool kits should consist of higher proportions of implements that have high manufacture costs and higher proportions of specialized tools. In addition, signs of gearing up should be more prevalent in the lithic assemblage created during the Middle Archaic occupation compared to the preceding use of the site.

To investigate the relationship between tool design, defined here as the relative amount of energy expended in the manufacture of a tool, and changes in bison population densities, we inspected the lithic assemblages recovered during the excavations at 41KE217 to identify tools. Next, we categorized each tool according to the level of energy that has been expended for its manufacture. We classified all tools that represented unmodified flake blanks used in the performance of cutting, scraping, graving, and perforating tasks as informal (i.e., expedient) implements. Typically, these implements consisted of secondary or tertiary flakes that had an unmodified edge that was well suited as it was to carry out a particular short-duration task. Once the task was completed or the tool's edge was worn and had become ineffective, the tool would be discarded in favor or another flake. No rejuvenation of the worn edge would take place. In contrast, all tools that required some modifications of the parent material to make them functional were classified as formal tools. The degree of modification ranged from minimal edge retouch to extensive unifacial or bifacial flaking to create a hafting element or alter a working edge to the desired angle or length. We assume here that within any tool kit employed by hunter-gatherers there may be functionally specific forms (i.e., projectile points) that may not fit these general expectations since manufacture costs are conditioned by the degree of dependence of the tool user upon the specific tool (Tomka 2001). That is, even within residentially mobile foragers, some of the tools employed will be costly to manufacture because of the high degree of dependence on this tool to carry out tasks in an efficient and effective manner.

Table 10-1 presents the number of informal versus formal tools found in the upper and lower components of the site. An analysis of the adjusted standardized residuals (Everitt 1977) derived from this contingency table indicated that there were no statistically significant differences in the distribution of the tool forms by component.

To further investigate whether differences in tool kit composition are present at a finer scale of analysis, we categorized stone tools from the Early and Middle Archaic assemblages into one of four manufacture cost categories. From the least energy expensive to the most expensive these categories are: 1) utilized flakes; 2) marginally retouched items; 3) unifacially retouched specimens; and 4) bifacially retouched forms. This classification scheme assumes that as the number of faces being retouched increases the energy expended during tool manufacture also increases. Because there were only two specimens that were unifacially retouched, we eventually combined the marginally retouched and unifacially retouched implement counts into a single group to allow for statistical analysis (i.e. adjusted standardized residuals).

Relying on these assumptions and expectations, Table 10-2 presents the breakdown of the lithic tools from the Early and Middle Archaic assemblages into these more fine-grained manufacture cost categories. Miscellaneous bifaces and unifaces were not included in this analysis because they tended to be incomplete making it difficult to accurately categorize them into a specific manufacture cost group. For both the Early and Middle Archaic components, the most expensive tool in terms of energy invested in its manufacture are bifacially retouched tools. The analysis of the contingency table using adjusted standardized residuals indicates that there is no statistically significant difference in the number of bifacially retouched tools between the two components. In contrast, there is a statistically significant over-representation of minimally and unifacially retouched tool forms between components. The over-representation of these tools in the Early Archaic component is consistent with the expectations outlined above. In contrast, utilized flakes (expedient tools) tend to be

Table 10-1. Expedient Versus Formal Tools by Component

	Formal	**Expedient**	**Total**
Early Archaic	45	75	120
Adjusted Standardized Residual	+.51	-.51	
Middle Archaic	30	58	88
Adjusted Standardized Residual	-0.51	+.51	
Total	**75**	**133**	**208**

Table 10-2. Tool Manufacture Costs by Component

Component		Manufacture			Total
		bifacially retouched	marginally and unifacially retouched	utilized flake	
Early Archaic	n	34	23	22	79
	ASR*	-0.41	**2.12**	-1.45	
Middle Archaic	n	27	8	23	58
	ASR	0.41	-2.12	1.45	
Total		61	31	45	137

*Adjusted Standardized Residuals

under-represented in the Early Archaic assemblage compared to the Middle Archaic component. However, the trend is not statistically significant (i.e., does not exceed a value of +/-1.96, the significance threshold at 0.05 level of significance). The broader implications of these findings are considered in greater detail in the summary section of this chapter.

Assessing the Scale of Mobility

In this section, we investigate the scale of hunter-gatherer mobility as it is reflected in the diversity of lithic raw materials contained within the Early and Middle Archaic assemblages recovered from 41KE217. In our earlier discussion of research domains, we proposed that a relationship should exist between the scale of hunter-gatherer mobility and the diversity of tool stone resources represented in the lithic assemblages produced. We anticipate that as the scale of mobility increases there should be associated increases in the range of tool stone encountered and used in tool production. Hunter-gatherer tool kits are composed of both expedient and formal curate tools. While expedient tools are typically discarded in proximity to the locations of use, curate tools tend to be transported by individuals to new locations in anticipation of future needs. We proposed that the greater the scale of mobility the more likely it is that some of the curated tools present on any archaeological site were made of raw materials representing distant localities. Often, the tools made of non-local raw materials will be staged, finished, or well-worn, and the lithic debris derived from non-local sources will consist of debitage representing staged reduction episodes or tool rejuvenation and reworking (i.e., small decorticate flakes, flakes with use wear).

To investigate the relationships between raw material variety and different strategies of mobility we examined projectile points, a sample of miscellaneous bifaces, and a sample of debitage. The artifacts were separated by color using a standard Munsell chart. Heat treated and heavily patinated specimens were removed from the analysis unless fresh breaks have exposed portions of the original raw material allowing for an accurate classification of the artifact Color groups were further divided based on inclusions and raw material grain (fine, medium, coarse) as well as internal color and texture variability within a single nodule. Some local materials exhibited a consistent color (i.e., brown) inside the nodule, but as the material transitioned to near the cortex (Figure 10-1), the color and/or texture of the materials changed. Other raw materials tended to be relatively homogenous in terms of color and texture (Figure 10-2).

Thirteen color groups were defined during the sorting of the debitage, projectile points and bifaces. These color groupings were used to define Minimum Analytical Nodules as the basic analytical unit (Larson and Kornfield 1997; Hall 2004; Pletka 2005). Table 10-3 lists the color groupings and their characteristics. As it can be noted, a number of color groups contain a range of colors within the group. At first, the range of colors within a single group seems to be too broad; however, it is representative of the variability noted within specific flakes and/or cores noted during the preliminary examination of the collection.

Table10-4 lists the color groups for debitage, projectile points, and lithic tools. For this analysis, 1,387 pieces of debitage, 66 projectile points, and 71 miscellaneous bifaces were examined. Table 10-5 exhibits the color groups for projectile points.

Of the thirteen color groups identified, eight are represented by debitage, projectile points, and bifaces. The remaining five color groups (4, 8, 9, 11, and 12) are only represented by projectile points only (Color Group 4, 11, and 12) or a combination of projectile points and bifaces (Color Group 8 and 9). Below we provide a brief summary of the characteristics of each color group.

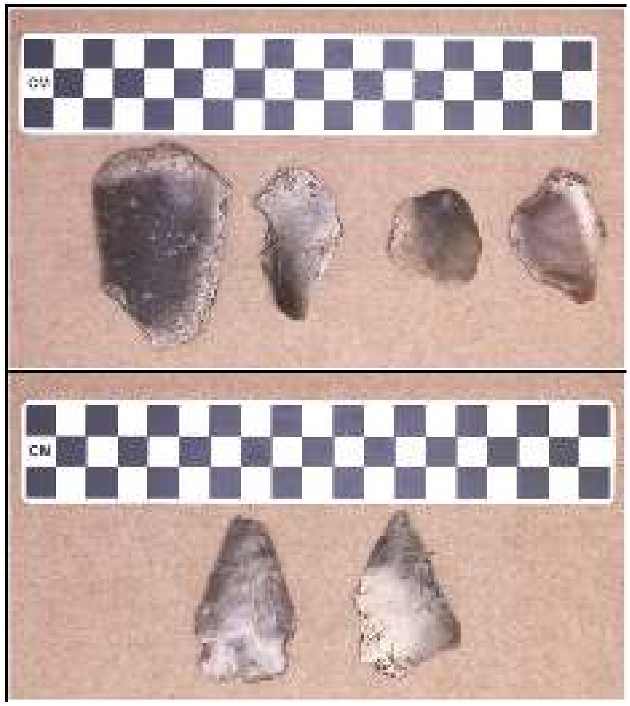

Figure 10-1. *Shows internal color variability within locally available raw material.*

Figure 10-2. *Examples of non-local materials. A small piece broken off the patinated specimen at top left exposed dark brown fine-grained material.*

Table 10-3. Color, Mottling, and Inclusion Characteristics of the Chert Color Groups

Color Group	Principal Colors	Mottling	Inclusions	Grain	Origin
1	reddish gray (5YR 5/2), brown (10YR 4/3), dark gray (10YR 4/1), very dark grayish brown (10YR 3/2)	pale brown (10YR 6/3)	white, gray (10YR 6/1)	fine, medium	local
2	very pale brown (10YR 8/2), pinkish gray (5YR 7/2)		white	fine, medium	local
3	light reddish brown (2.5YR 6/3), reddish brown (5YR 5/3), dark yellowish brown (10YR 4/4), reddish brown (5YR 4/3), yellowish brown (10YR 5/4), pinkish gray (5YR 7/2)	reddish brown (2.5YR 4/4), reddish brown (2.5YR 5/4)	white, yellow (10YR 8/6)	fine, medium	local
4	dark grayish brown (10YR 4/2)			fine	non-local
5	ranges from gray (10YR 6/1) to very pale brown (10YR 7/4)			coarse	local
6	ranges from gray (10YR 6/1) to brown (10YR 10/3)		white	fine	local
7	light yellowish brown (10YR 6/4), brown (10YR 4/3), yellowish brown (10YR 5/6), brown (10YR 5/3), gray (7.5YR 4/1)	white	white, very pale brown (10YR 7/3), quartz	fine, medium	local
8	black (10YR 2/1)			fine	non-local
9	light gray (10YR 7/1)		gray (10YR 5/1)	medium	non-local
10	light brownish gray (10YR 6/2)		pale brown (10YR 6/3)	medium	local
11	reddish brown (5YR 4/3)	very dark gray (10YR 3/1)		coarse	non-local
12	light gray (10YR 7/1)			coarse	non-local
13	light gray (10YR 7/2)			fine	local

Table 10-4. Color Groups for Chipped Stone

Color Group	Debitage	Projectile Points	Bifaces	Total
1	391	5	20	416
2	61	2	5	68
3	148	8	3	159
4	0	4	0	4
5	49	2	6	57
6	256	20	16	292
7	226	16	11	253
8	0	2	2	4
9	0	3	3	6
10	241	1	3	245
11	0	1	0	1
12	0	1	0	1
13	15	1	2	18
Total	**1,387**	**66**	**71**	**1,524**

Table 10-5. Projecile Points According to Color Groups

Points	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	Total
Andice	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Angostura	0	0	0	1	0	0	1	0	0	0	0	0	0	2
Baker	0	0	0	0	0	3	2	0	0	0	0	0	0	5
Bandy	0	2	0	0	0	1	0	0	0	0	0	0	0	3
Bell	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Bell/Andice	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Bulverde	0	0	2	0	1	1	1	0	0	0	0	0	0	5
La Jita	0	0	1	0	0	2	1	0	1	0	0	0	0	5
Langtry	2	0	1	0	0	0	2	0	0	0	1	1	0	7
Nolan	0	0	0	1	0	2	1	0	1	1	0	0	1	7
Pedernales	1	0	0	0	0	2	0	1	0	0	0	0	0	4
Tortugas	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Uvalde	0	0	0	0	0	3	0	0	0	0	0	0	0	3
Williams	0	0	0	0	0	1	0	0	0	0	0	0	0	1
untypable	0	0	2	0	0	3	2	0	0	0	0	0	0	7
untyped	1	0	0	0	1	2	2	1	1	0	0	0	0	8
untyped expanding base	0	0	0	0	0	0	1	0	0	0	0	0	0	1
untyped expanding stem	0	0	1	0	0	0	0	0	0	0	0	0	0	1
untyped lanceolate	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Grand Total	**5**	**2**	**8**	**4**	**2**	**20**	**16**	**2**	**3**	**1**	**1**	**1**	**1**	**66**

Group 1 - Three hundred ninety-one pieces of debitage, five projectile points, and 20 bifaces were classified into this color group (Table 10-4). The projectile points consisted of Bell, Langtry, Pedernales, and one untyped specimen (Table 10-4). Two non-local projectile point forms, both Langtry, were made from material included in this group.

Group 2 - The group consists of 61 pieces of debitage, two projectile points, and five bifaces (Table 10-4). The projectile points included two Bandy specimens (Table 10-5). We assume that Group 2 specimens represent local raw materials.

Group 3 - One hundred and forty-eight pieces of debitage, eight projectiles points, and three bifaces were identified (Table 10-4. Projectile points included Andice, Bulverde, La Jita, Langtry (non-local form), and untypable specimens (Table 10-5). We assume that the cherts in this group were obtained from local sources.

Group 4 - No debitage was placed in this color group. However, four projectile points (Angostura, Nolan, and two untyped lanceolates) were identified in this category. This material is thought to be non-local.

Group 5 - Forty-nine pieces of debitage, two projectile points (Bulverde and an untyped specimen), and six bifaces were classified into this color group (Table 10-4). We assume that this group of cherts represents locally obtained raw materials.

Group 6 - Two hundred and fifty-six pieces of debitage, 20 projectile points, and 16 bifaces were placed in this color group (Table 10-4). Table 10-5 lists the various projectile points placed in this group. This appears to be a local material.

Group 7 - This group contains 226 pieces of debitage, 16 projectile points, and 11 bifaces (Table 10-3). Projectile points for this group are listed in Table 10-5. Two Langtry points are placed in this group. This group consists of local material.

Group 8 - This color group contained no debitage and included only two projectile points and two bifaces (Tables 10-4 and 10-5). We anticipate that this group consists of non-local cherts.

Group 9 - Three projectile points and three bifaces were included in this group (Tables 10-4 and 10-5). Based on the lack of debitage samples, we assume that this color group consists of non-local materials.

Group 10 - This group consisted of 241 pieces of debitage, one projectile point, and three bifaces (Tables 10-4 and 10-5). We anticipate that the color group consists of locally available raw materials.

Table 10-6. Features Excavated during Testing and Data Recovery Efforts

Feature #	Associated Test Units	Length x Width (cm)	Description	Time Period	Shape	Count	Weight (g)
1	1, 2, and 3	unknown	burned rock	Middle Archaic	sheet	1,998	315,125
2	1 and 3	100 x 100	burned rock	unknown	scatter	217	77,613.60
3	11 and 14	60 x 70	burned rock	unknown	oblong	45	11,140.40
4	5 and 20	200 x 100	burned rock	Early Archaic	oblong	284	66,052.20
5	27	41 x 35	burned rock	unknown	irregular	16	4,027.50
6	7, 8, 17, 18, 19, 21, and 22	200 x 100	burned rock	Early Archaic	oblong	126	23,492.30
7	6	42 x 20	burned rock	Middle Archaic	oblong	19	2,258.90
8	8, 9, 16, and 17	200 x 100	burned rock	Early Archaic	oblong	151	48,981.90
9	10, 11, 14, and 15	130 x 100	burned rock	unknown	round	65	12,040.30
10	11, 12, and 13	70 x 130	burned rock	unknown	oblong	19	4,608.80
11	13 and 14	40 x 100	burned rock	unknown	oblong	17	9,903.10
12	28	80 x 100	burned rock	unknown	oblong	39	5,830
13	31	50 x 50	burned rock	unknown	round	34	5,622.90
14	32	30 x 40	burned rock	unknown	oval	14	16,520
15	29	75 x 75	burned rock	unknown	round	58	10,790

Group 11 - A single artifact, a Langtry projectile point, is included in this color category (Tables 10-4 and 10-5). We assume that the raw material is of non-local origin.

Group 12 - Only one projectile point, a Langtry dart point, is included in this category (Tables 10-4 and 10-5). We expect that the color group represents non-local raw material.

Group 13 - This color group includes 15 pieces of debitage, one projectile point, and two bifaces (Tables 10-4 and 10-5). We anticipate that the raw material is of local origin. A more detailed discussion of the implications of these patterns is provided in the summary section of this chapter.

Investigating Diet Breadth and Plant Use

Although faunal remains were virtually absent from the assemblage at 41KE217, the presence of burned rock features suggest some evidence for plant processing. It has been noted that many plant resources (bulbs, roots, and nuts) contain starches that require extended cooking times to convert them into sugars and make them digestible (Wandsnider 1997). Moreover, based on ethnographic data, it is suggested that there is a strong correlation between plant processing and the use rock in thermal features (Wandsnider 1997). We suggest that features with significant quantities of rock were probably associated with long-term cooking. Moreover, experimental heated-rock cooking simulations using limestone nodules (Figueroa et al. 2011) has demonstrated that repeated heating of rocks leads to their breakage. The breaks in turn reduce the size of the nodules and the thermal efficiency of the individual rocks and the overall feature. These experimental results suggest that features with increasing smaller fractured rocks have been reused while those with larger rocks may have seen limited reuse. Using this model, we evaluated the characteristics of burned rock features found in the Middle (Features 3-15) and Early Archaic (Feature 1) components of the site (Table 10-6). Only a sample of the Middle Archaic feature (Feature 1) was used as comparison since only three 1-x-1 m (3.28-x-3.28 ft.) test units sampled this feature, which consisted of an extensive burned rock zone stretching nearly the entire length of BHT 1.

We counted and size-graded burned rock in large metal sieves (ranging in size from 1.3-7.6 cm [0.5-3 in.]). The sample of burned rock from Feature 1 consisted of 1,998 pieces of burned rock with a weight of 315,125 g (314.1 kg). The proveniences included in this analysis included TU 1 (Levels 6, 7, 8, and 9), TU 2 (Levels 3 and 5), and TU 3 (Levels 3, 4, and 5). The results showed that 68 percent of the burned rock (n=1,359) from Feature 1 was 2.5 cm (1 in.) or smaller in size. Only 32 percent of the burned rock exceeded 2.5 cm (1 in.) in size (16 percent between 2.5-5 cm [1-2 in.]; 16 percent greater than 5 cm [2 in.]).

The sample size of burned rock from the Early Archaic component consisted of 217 pieces of burned rock, weighing 77,613.6 g. The proveniences that were used in this sample included TU 1 (Level 12) and TU 3 (Levels 6 and 7). Burned rock size ranged from 1.3 cm (0.5 in.) to 7.6 cm (3 in.) in size. Forty-seven percent of the burned rock recovered from the Early Archaic features was less than or equal to 2.5 cm (1 in.) in maximum dimension. The remaining 53 percent were larger than 5 cm (2 in.) in maximum dimension. This comparison indicates the Middle Archaic burned rock feature tended to be more intensively used and reused than the underlying Early Archaic features.

Chapter 11: Summary and Conclusions

Between November 2011 and January of 2012, the Center for Archaeological Research (CAR) of The University of Texas at San Antonio (UTSA) conducted archaeological test excavations and data recovery investigations at 41KE217 within the City of Boerne in southeast Kendall County, Texas. The archaeological work was conducted on behalf of the City of Boerne in advance of the installation of two sewer interceptor lines (Menger Creek and Browns Creek) as well as the building of a new wastewater treatment plant.

Backhoe trenching within the project easement encountered a deposit of burned rock and lithic tools. The locality was designated as site 41KE217. During archaeological testing, four 1-x-1 m (3.28-x-3.28 ft.) test units were excavated. Testing confirmed the presence of two temporally and stratigraphically distinct cultural components. The upper component consists of an approximately 30 cm (11.8 in.) thick late Middle Archaic burned rock midden. This upper component is present across the entire site, as defined by surface artifacts and backhoe trenching. The Middle Archaic component (Feature 1) consisted of 1,998 (314.1 kg) pieces of burned rock, with 68 percent of the rocks being 2.5 cm (1 in.) in size or smaller. The spatial coverage of the upper component coupled with the high frequency of smaller burned rock sizes suggest the feature accumulated over a long time and was the product of repeated site reuse. Two charcoal samples help date the initiation of the Middle Archaic component at the site (Appendix B). Both (D-AMS -71 and D-AMS-72) derive from Level 3 of Excavation Unit 5 and are associated with a feature (Feature 4) found 27 cm (10.6 in.) below the graded surface from which the data recovery excavations were initiated. The two assays yielded the following calibrated date ranges: 4083-3874 cal. BP (D-AMS-71) and 4090-3925 cal. BP (D-AMS-72). These samples date from soon after the termination of the Early Archaic component and the initial Middle Archaic occupation of the site.

The Middle Archaic component contained a series of temporally diagnostic projectile points that suggested the deposits accumulated over several thousand years of site reuse. While under typical circumstances such occupations would be important to investigate, it was felt that the underlying component may have formed over a more limited time period, and therefore, it would have greater research potential. After having reached this conclusion based on the preliminary assessment of the archaeological materials obtained during testing, the Principal Investigator recommended additional investigations of the lower archaeological component, and the Texas Historical Commission concurred with this recommendation. Subsequently, the Middle Archaic component was mechanically removed, and the lower component was targeted during the investigations.

The lower component is limited to the south end of the site within BHT 1. As defined in testing, the component contains a thin zone of burned rocks and chipped stone, including diagnostic projectile points. During the data recovery efforts, 13 features were recovered along with diagnostic artifacts and burned rock. The highest densities of artifacts were encountered in Level 4, the same depth where the majority of the features were encountered. The radiocarbon assay derived from the base of the deepest component indicates that it began to form after 7325-7170 cal. BP (93.9% probability). Feature 4, the burned rock features found at the top of the lower component, was the largest (200-x-100 m; 656-x-328 ft.) of the features in this component. As indicated above, this feature really dates to the Middle Archaic, and given its size, it signals the shift in site use from intermittent use for isolated cooking to repeated reuse and increased food processing capacity. The Early Archaic component then began forming around 7325-7170 cal. BP, and it is represented by the construction and use of small isolated hearths over the next 1,000 years or so. With the start of the Middle Archaic around 6000 BP, the nature of the site occupation changes, and burned rock features increase in size as signaled by the larger size of Feature 4.

Chapter 9 reviewed the chipped stone recovered from 41KE217. Projectile points consisted of dart points, and in all, there were 68 specimens grouped into 14 types. Several other categories of lithic tools were encountered. Gravers and knives were the most frequently found lithic tools at the site. Seventeen gravers were found during archaeological work at 41KE217. Fourteen of the graver specimens were found in the Early Archaic component of the site. Twenty-six knives were identified in the lithic tool assemblage, with the majority (n=14) from the lower component. Sixteen miscellaneous unifaces were recovered from the site. The majority were from the Early Archaic component. An analysis of the debitage revealed a high percentage (89 percent) of decorticate flakes present in the collection.

In Chapter 10 several research domains were discussed including chronology, technological organization, and the scale of mobility practiced by the site's inhabitants. The radiocarbon assays in combination with the temporally diagnostic projectile points suggested that the occupation of the site began around 7300-7100 BP during the Early Archaic Period.

Paleoclimatic conditions that dominated during this time were characterized by warmer than modern temperatures and extended water-deficient conditions. These Altithermal conditions began around 7000 BP and lasted until approximately 4000 BP. The only interruption in these conditions occurred around 6000 BP when for a brief period or approximately 200 years conditions return to normal (Bousman 1998:212).

These moisture deficient conditions caused the northward expansion of the limits of the Chihuahuan desert and made conditions on the southern edge of the Edwards Plateau favorable for the spread of desert succulents. At the same time it also intensified desert conditions in northeastern Mexico and the lower Pecos likely leading to waves of human population out-migration from the region. The Middle Archaic Period, which encompasses the bulk of the occupation of the site and is responsible for the deposition of the thick burned rock zone near the top of the site, lasted from 6000-3000 BP (Collins 1995). For the first 1,000 years of the period, environmental conditions continued to deteriorate in terms of moisture balances and the continued expansion of desert conditions northward. Conditions began to improve around 4000 BP but did not reach normal levels until around 3000 BP.

The human occupation of site 41KE217 appears to reflect these patterns of paleoclimatic change in that the Early Archaic deposit appears to have been formed during intermittent visits to the site by groups from the lower Pecos. The isolated burned rock features, with most showing little evidence of reuse, support the observation that site occupation was intermittent. The presence of hot-rock cooking facilities also indicates that a feature well suited for the preparation of foods that require extended heating is making its appearance on the Edwards Plateau. This in conjunction with the presence of Langtry dart points is indicative that it is being introduced by desert-adapted human populations likely pushed out of the lower Pecos as a result of the worsening climatic conditions that dominated the region between 7000 and 5000 BP.

As desert-like conditions became even more intensive by 5000 BP, the nature of the site's occupation changed dramatically. This change is reflected in the intensive utilization of the site for the harvesting and preparation of desert adapted plants, most likely sotol and lecheguia cabbages. It is highly probable that these species extended their range northward with the increased aridity of the region and became more abundant on the southern lip of the plateau. With the availability of dependable water derived from deep-seated springs and the increased abundance of desert species that would have been available, the region would have offered a dramatically improved home territory for groups that out-migrated from the lower Pecos. The shift in the nature of the occupation is signaled by the amount and degree of fragmentation of the exhausted limestone rock heating elements. The repeated re-use of rock-lined hearths increased the fragmentation of the heating elements, and their replacement with fresh and larger rock and the discard of exhausted pieces contributed to the formation of the thick layer of burned rock that was the hallmark of the Middle Archaic occupation of 41KE217.

How do we know that there were two waves of migration onto the southern edge of the Edwards Plateau, and from where did these migrations originate? The radiocarbon dates offer strong evidence of the occupations of the site and the time frame when the isolated burned rock features were created and the thick burned rock zone was formed. In contrast, the presence of lower Pecos projectile point styles is indicative of the direction of the migration. The Bandy and Baker points found in the deepest portion of the site are archetypical styles of the lower Pecos. While they have extended eastward out of the lower Pecos, the extension reflects the aforementioned settlement shift in response to the climatic conditions in the lower Pecos during the Altithermal of the Early Archaic. Similarly, the Langtry type of the Middle Archaic, when the intensive occupation of the site takes place, also is a point style that originates out of the lower Pecos. A small number of these lower Pecos points are made of non-local raw materials, likely cherts found in the lower Pecos. We know this from the recovery of points made of cherts that have no associated chipping debris (i.e., flakes). Typically, tool manufacture and even repair would create chipping debris that would allow one to link the manufacture of an artifact to the debris produced during the making of the tool, however, many of the lower Pecos points are made of locally available cherts. This indicates that the lower Pecos migrants were well aware of the availability and quality of the lithic raw materials on the southern edge of the Edwards Plateau.

There are even older point forms present on site, including the two Angostura fragments and the heavily patinated lanceolate specimen. Angostura points date to around 8500-8000 BP in the upper San Antonio river basin (Thoms et al. 1996:32; Nichols et al. 2013). These points occur in low numbers at the site, and no features or facilities could be associated with them. Therefore, while these points are made of non-local raw materials, it appears that the groups that discarded them at the site only briefly visited the locality and left little behind beyond the projectile tips.

The occupation of 41KE217 closed during the Late Archaic. A thin veneer of burned rock is present buried shallowly below the present ground surface. Artifact densities, including lithic manufacture debris, also were present at this occupation surface. Unfortunately, with the exception of the initial three test units placed in the site, no other units sampled this occupation, therefore, little is known about it.

One of the goals of the original research design was to compare and contrast the nature of the Early and Middle Archaic lithic assemblages in light of the fact that they may have formed under different conditioning circumstances. That is, the Early Archaic assemblage may have been created in response to hunter-gatherers operating under daily foraging conditions, while the Middle Archaic assemblage may have been used under logistically organized land-use strategies. The results of the analyses indicated that there are no major differences in the composition of the two assemblages. The only statistically significant difference is noted in the over-representation of minimally retouched tools in the Early Archaic assemblage compared to the Middle Archaic samples. There is also a tendency for expedient tools to be over-represented in the Middle Archaic assemblage and under-represented in the underlying component. These findings tend to contradict the expectations outlined in the research design. The contradiction may be due to differences in the organization of mobility and land use between the two components. While in both Early and Middle Archaic components the bulk of the archaeological materials may have been deposited by groups from outside the region, it is likely that the later occupation (Middle Archaic) may have taken on more of a daily foraging aspect as groups exploited dense patches of sotol and lecheguia from a central location. Under such conditions, the tool kits would more closely resemble assemblages dominated by expedient and multi-purpose tools. This interpretation also takes into account the fact that no evidence of bison procurement has been recovered at the site in either of the two principal components. However, it is possible that the absence of bison bone may simply be a product of poor preservation. It is also possible that bison was present in the broader region but not in the vicinity of the site or on the margins of the Edwards Plateau. If so, we may see evidence of the inhabitants of the site targeting bison in a logistical manner from the site. Evidence of this would be expected in the form of gearing up, the on-site manufacture of excess bifacial and unifacial tools that would be used and perhaps discarded away from the site while on hunting expeditions. A look at the number of miscellaneous bifaces present in the two components indicates that within the Early Archaic component bifaces that have been discarded as a result of manufacture failures greatly outnumber the same group of bifaces noted in the Middle Archaic assemblage. This result again contradicts expectations in that it should Middle Archaic bifaces that outnumber Early Archaic specimens. Overall, the pattern suggests that bison procurement was not a significant subsistence pursuit during the Middle Archaic. Furthermore, the pattern during the Early Archaic may reflect an emphasis on raw material procurement within the context of relatively high inter-regional mobility and lower Pecos raw material availability rather than bison procurement. That is, the hunter-gatherer groups that visited the site during the Early Archaic came from an area of relative raw material scarcity and lesser quality (medium-to-coarse-grained and containing many inclusions). The Edwards Plateau cherts were superior in both size range and quality, and therefore, it is likely that one of the main goals of these groups while in the region was to procure raw materials and produce stage-reduced (i.e., quarry blanks, late-stage bifaces, projectile point preforms) artifacts for transport back to the lower Pecos. Such an over-production of bifaces could explain the high proportion of manufacture broken bifaces in the Early Archaic component; however, it is interesting that this practice did not continue into the Middle Archaic component and occupation of the site.

The excavations at 41KE217 provided an important opportunity to investigate the prehistory of the region and document the long-standing inter-regional interactions with the lower Pecos during periods of dramatic climatic changes that impacted hunter-gatherer adaptations across all of South Texas. As such, these investigations add yet another key piece of evidence regarding the role of the Hill Country and the southern edge of the Edwards Escarpment in human adaptations over a period of some 4000 years that stretch across the Early and Middle Archaic.

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Appendix A:

Boerne Wastewater Treatment Plant Archaeological Survey Detailed Backhoe Trench Descriptions

Appendix A

Boerne Wastewater Treatment Plant Archaeological Survey Detailed Backhoe Trench Descriptions

BHT 1: Cibolo Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-29	10YR 2/1 silt loam; weak fine granular structure; friable consistence; common medium, fine, and very fine roots; 2% coarse fragments of angular and subangular limestone fragments 2-mm diameter; clear smooth boundary	Unit 2A
Bw	29-40	10YR 3/3 clay loam; weak fine granular structure; friable consistence; very few very fine and fine roots; 2% coarse fragments of angular and subangular limestone fragments 2-mm diameter; abrupt smooth boundary	
C	40-57	10YR 3/4 gravelly sandy clay loam; structureless; friable consistence; abrupt smooth boundary	
R	57+	Limestone bedrock	Bedrock

BHT 2: Cibolo Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-35	10YR 2/1 silty clay loam; weak fine subangular blocky structure; friable consistence; common medium, fine, and very fine roots; 3% coarse fragments consisting of rounded to sub-rounded pebbles 1-10 mm diameter; gradual smooth boundary	Unit 2B
Bk	35-70	10YR 3/3 sandy clay loam; weak fine subangular blocky structure; very friable consistence; common fine and very fine roots; few very fine calcium carbonate filaments; % coarse fragments consisting of rounded to sub-rounded pebbles 1-10 mm diameter; clears smooth boundary	
BC	70-96	10YR 4/4 sandy clay loam; weak fine subangular blocky structure; very friable consistence; few fine and very fine roots; few very fine calcium carbonate filaments along root pores and ped faces; 5% rounded pebbles 10-20 mm diameter; abrupt wavy boundary	
2Bk	96-125	5YR 5/4 gravelly silt loam; moderate medium subangular blocky structure; friable consistence; many fine calcium carbonate threads and very few 2-mm diameter secondary carbonate nodules; 15% angular to sub-rounded gravels and pebbles 1-20 mm diameter, common snail (*Rab*.) shell fragments	Unit 1B

BHT 3: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A1	0-15	10YR 3/2 silty clay loam; weak fine granular structure; friable consistence; common medium, fine, and very fine roots; <1% coarse fragments <1mm diameter; abrupt smooth boundary	Unit 2B
A2	15-65	10YR 2/1 silty clay; weak fine subangular blocky structure; firm consistence; common fine and very fine roots; <1% coarse fragments <1mm diameter; diffuse smooth boundary	
BC	65-93	10YR 3/1 silty clay; moderate medium subangular blocky structure; firm consistence; few fine and very fine roots; <1% coarse fragments <1mm diameter; abrupt wavy boundary	
2Bk	93-125	5YR 5/4 gravelly silt loam; strong coarse angular blocky structure; very firm; very few very fine roots; common to many secondary calcium carbonate nodules 2-5mm diameter; 15% rounded pebbles and gravels 1-20 cm diameter	Unit 1B

BHT 4: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-48	10YR 2/1 silty clay loam; weak fine subangular blocky ped structure; friable consistence; common fine and very fine roots; <1% coarse fragments consisting of pebbles; 2% snail shell fragments of *Rabdotus*; clear smooth boundary	Unit 2B
Bw	48-76	10YR 3/3 silty clay loam; weak fine subangular blocky ped structure; friable consistence; few fine and very fine roots; <1% coarse fragments consisting of pebbles; 2% snail shell fragments of *Rabdotus* sp.; clear smooth boundary	
BkC	76-86	10YR 4/4 silt loam; weak fine subangular blocky ped structure; friable consistence; very few very fine roots; few very fine threads of secondary calcium carbonate; <1% coarse fragments consisting of pebbles; 2% snail shell fragments of *Rabdotus*; abrupt wavy boundary	
2Bk1	86-113	5YR 5/8 silt loam; moderate medium subangular blocky ped structure; hard (dry), very firm (moist) consistence; many fine secondary calcium carbonate threads; common 1-mm diameter rounded pebbles; 10% whole *Rabdotus* sp. snails and fragments; a single 30 mm diameter angular clast was present; clear smooth boundary	Unit 1B
2Bk2	113-130	7.5YR 5/4 silt loam; moderate medium subangular blocky structure; hard (dry), very firm (moist) consistence; many fine threads of secondary pedogenic calcium carbonate; 2% 1-10 mm diameter pebbles; 5% concentration of *Rabdotus* sp. snails and fragments	

BHT 5: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-40	10YR 2/1 clay loam; weak fine subangular blocky structure; friable consistence; common fine and very fine roots; <1% coarse fragments; very few *Rabdotus* sp. snail fragments; gradual smooth boundary	Unit 2B
Bw	40-67	10YR 3/3 silty clay loam; weak fine subangular blocky structure; friable consistence; few fine and very fine roots; 3% fine *Rabdotus* sp. snail shell fragments; <1% 1-5 mm rounded pebbles; abrupt wavy boundary	
2Bk	67-105	7.5YR 5/4 silty clay loam; moderate medium subangular blocky structure; hard (dry), extremely firm (moist) consistence; very few very fine roots; many fine threads and common 10-mm diameter nodules of secondary calcium carbonate; 10% whole *Rabdotus* sp. snails and shell fragments; common 1-10 mm diameter rounded pebbles	Unit 1B

BHT 6: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-45	10YR 3/4 fine sandy loam; weak fine granular structure; very friable; common fine and very fine roots; 2% snails and <1cm diameter rounded pebbles; gradual smooth boundary	Unit 2C
Bk1	45-80	10YR 4/4 fine sandy loam; weak fine granular structure; very friable consistence; few fine and very fine roots; very faint fine calcium carbonate threads; <1% snails and <1cm diameter rounded pebbles; clear smooth boundary	
Bk2	80-100	10YR 4/4 fine sandy loam; weak fine granular structure; very friable consistence; very few fine and very fine roots; few faint calcium carbonate threads; 2% whole snail shells and fragments; abrupt wavy boundary	
2Bk3	100-140	7.5YR 5/4 silty clay loam; moderate medium subangular blocky structure; hard (dry), extremely firm (moist) consistence; very few very fine roots; 10% whole snail shells and fragments; common 1-10 mm diameter rounded pebbles; many fine calcium carbonate threads and few 10-mm diameter nodules	Unit 1B

BHT 7: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-38	10YR 3/2 silty clay loam; weak fine subangular blocky ped structure; friable consistence; common medium, fine, and very fine roots; <1% coarse fragments; gradual smooth boundary	Unit 2C
Bw1	38-70	10YR 3/3 sandy clay loam; weak fine subangular blocky structure; very friable consistence; very few medium, fine, and very fine roots; 2% rounded pebbles and <1% snail shell fragments of *Rabdotus*; clear smooth boundary	
Bw2	70-92	10YR 4/4 sandy clay loam; weak fine subangular blocky structure; very friable consistence; very few fine and very fine roots; 1% coarse pebbles and snail shell fragments of *Rabdotus*; abrupt wavy boundary	
2Bk	92-130	10YR 4/4 sandy clay loam; massive/structureless; common fine filaments of secondary calcium carbonate (stage I); 10% pebbles ranging from 1 to 10 mm diameter; 5% snail shell fragments of *Rabdotus*; 5% angular limestone fragments 30 cm in diameter; <1% coarse 2mm grains	Unit 1B

BHT 8: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-42	10YR 3/2 fine sandy loam; weak fine granular ped structure; very friable; few fine and very fine roots; clear smooth boundary	Unit 2B
Bk1	42-81	10YR 4/4 fine sandy loam; weak fine granular structure; very friable; very few medium and fine roots; very few fine filaments of secondary calcium carbonate; abrupt wavy boundary	
2Bk2	81-140	10YR 4/4 silt loam; moderate medium subangular blocky structure; slightly hard (dry), and firm (moist) consistence; 15% fine secondary calcium carbonate filaments; <1% rounded pebbles and angular limestone fragments; common snail shell fragments of *Rabdotus*; abrupt smooth boundary	Unit 1B
2Btk	140-200	10YR 4/4 silty clay loam; moderate medium subangular blocky structure; slightly hard (dry), and firm (moist) consistence; 15% fine calcium carbonate filaments; 2% rounded pebbles; common prominent clay skins on ped faces; common coarse sand grains	

BHT 9: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-50	10YR 2/2 clay loam; weak fine subangular blocky ped structure; friable consistence; common medium, fine, and very fine roots; <1% rounded pebbles; clear smooth boundary	Unit 2B
Bw	50-83	10YR 3/4 clay loam; weak fine subangular blocky structure; friable consistence; few fine, very fine, and medium roots; <1% coarse fragments; abrupt smooth boundary	
2Bk	83-113	10YR 4/4 silt loam; moderate medium prismatic ped structure; firm consistence; few fine filaments of secondary pedogenic calcium carbonate; 2% rounded pebbles 1-5mm diameter; abrupt smooth boundary	Unit 1B
2CBk	113-140	7.5YR 4/4 silt loam; moderate medium subangular blocky structure; firm consistence; common fine secondary calcium carbonate threads, and few nodules; 15-20% small gravels at base; few limestone fragments	Unit 1A

BHT 10: Cibolo Creek and Browns Creek

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-35	10YR 2/1 clay loam; weak fine granular structure; firm consistence; common medium, fine, and very fine roots; <1% coarse fragments; gradual smooth boundary	Unit 2A
Bw	35-75	10YR 3/6 clay loam; weak fine granular structure; firm consistence; few fine and very fine roots; 2% rounded pebbles and shell snail fragments of *Rabdotus;* abrupt wavy boundary	
2CBk	75-100	7.5 YR 4/6 gravelly silty clay loam; moderate medium subangular blocky structure; hard (dry) and very firm (moist) consistence; very few very fine roots; 10% secondary calcium carbonate filaments and <5% nodules; 20% gravels ranging from 20-40 cm diameter	Unit 1A

BHT 11: 41KE217. Note: approximately 70 cm of overburden removed during construction

Horizon	Depth (cm)	Description	Stratigraphic Context
BC	0-20	10YR 3/2 silty clay loam; moderate fine subangular blocky structure; very friable; common fine, common very fine, and few medium roots; few snail shells; few small FCR fragments in lower part; abrupt wavy boundary.	Unit 3
2A	20-40	10YR 3/2 silty clay loam; moderate fine subangular blocky structure; very friable; common fine and very fine roots; very few medium roots; 15-20% snail shells and fragments; 5% FCR fragments in upper part, increasing to 20% in lower; clear smooth boundary.	Unit 2B
2Bk1	40-76	10YR 4/4 silty clay loam; weak medium granular structure; friable; very few fine and very fine roots; 3% snail shell fragments; few isolated pieces of FCR at lower boundary; abrupt wavy boundary.	
3Bk2	76-125	7.5YR 4/6 clay loam; moderate medium subangular blocky ped structure; hard (dry), firm (moist); very few fine and very fine roots; 10% fine calcium carbonate filaments on ped faces and interior of peds; very few snail fragments; few isolated small limestone fragments.	Unit 1B

BHT 12: 41KE217

Horizon	Depth (cm)	Description	Stratigraphic Context
A	0-25	10YR 2/2 clay loam; weak fine granular ped structure; clear smooth lower boundary	Unit 3
2A	25-78	10YR 3/4 silty clay loam; weak fine granular structure; soft (dry), friable (moist); few fine and very fine roots; very few medium roots; 10% rounded and sub-rounded pebbles, snails and fragments; common detrital $CaCO_3$ nodules; below 55 cm, increase to 15% snails and snail shell fragments; 15% angular FCR fragments; matrix-supported midden zone; abrupt wavy boundary.	Unit 2B
2Bk1	78-90	10YR 4/6 silty clay loam; moderate fine subangular blocky structure; firm consistence; very few fine, very fine, and medium roots; 2% fine CaCO3 filaments; abrupt wavy boundary.	
3Bk2	90-120	7.5YR 5/8 clay loam; moderate medium subangular blocky ped structure; hard (dry), firm (moist); very few fine and very fine roots; 10% fine calcium carbonate filaments on ped faces and interior of peds; 5% carbonate nodules 2-3 mm diameter; very few snail fragments; few isolated small limestone fragments; <5% rounded and angular pebbles; few angular limestone clasts	Unit 1B

BHT 13: 41KE217

Horizon	Depth (cm)	Description	Stratigraphic Context
Ap-A	0-45	10YR 3/2 silty clay loam; weak fine granular structure; friable consistence; common medium, common fine, few coarse roots; <1% pebbles; clear smooth boundary.	Unit 3
2A	45-103	10YR 3/3 silty clay loam; weak fine granular structure; very friable consistence; few fine and very fine roots; common pebbles, snail shell fragments in upper 30 cm, and a few small burned rock fragments; increase to 20% matrix supported FCR zone with 5-15 cm diameter FCR; abrupt wavy boundary	Unit 2B
3Bk	103-135	7.5YR 4/6 silty clay loam; moderate medium subangular blocky structure; firm consistence; very few very fine and fine roots; very few fine oxidized Fe concentrations; common secondary pedogenic calcium carbonate filaments; few rounded ironstone pebbles, snail shells, and snail fragments	Unit 1B

Appendix B:
Radiocarbon Dates

Appendix B

Radiocarbon Dates

Five radiocarbon samples were measured from 41KE217. All five samples consisted of charcoal, and all were processed at the Paleo-Research Laboratory (PRL) at the Center for Archaeological Research at UTSA. Sample preparation followed an acid-base-acid protocol. The samples were initially inspected, and any rootlets were removed. The charcoal was gently crushed and washed in ultra-pure water in a sonicator for 60 minutes. If the water was dark or muddy following this treatment, the process was repeated with clean water. Once clean, samples were dried in a heating block and then exposed to hydrochloric acid (HCL) for 20 minutes at 80°C. After this, samples were washed to a neutral PH. A 25 minute exposure to heated sodium hydroxide (NaOH) followed, with samples again washed to neutral. Finally, samples were again treated with heated HCL, washed to neutral, and dried. The dried samples were shipped to Direct-AMS (D-AMS) in Seattle, Washington (Zoppi et al. 2007). The samples were measured using a National Electrostatics Corporation Model 1.5SDH-1 Pelletron Accelerator. The D-AMS laboratory has an overall precision and accuracy of 0.3 to 0.5% for modern samples (Zoppi et al. 2007). D-AMS measures δ13C on prepared graphite samples using the AMS spectrometer. These measurements often differ from the true isotopic values of the original material. We assume that wood charcoal in this portion of Texas has an isotopic fractionation of -27‰ and use that value to correct for isotopic fractionation in these samples.

Sample D-AMS 1206-39 (CN7) yielded a radiocarbon age of 4874 +/-31 radiocarbon years before present (RCYBP). Assuming an isotopic reading of -27‰, the radiocarbon date corrects to 4910 RCYBP, and when using OxCal version 4.2 (Bronk Ramsey 2009), this calibrates to a range of 5713 to 5590 cal. BP (95.4% probability; see Figure B-1).

Sample D-AMS 1206-40 (CN8) yielded a radiocarbon age of 4661 +/-22 RCYBP. If we assume an isotopic measure of -27‰ for the original wood, the date corrects to 4763 RCYBP. This calibrates, using OxCAL version 4.2 (Brock Ramsey 2009), to a range of 5586 to 5468 cal. BP (95.4% probability; see Figure B-2).

Two samples were run from a single provenience as the sample was composed of two distinct pieces of charcoal. The original sample was from FS 178, extension 2 (Test Unit 5, Level 3, at 27 cmbd) and the split samples were designated FS 178-2-1 and FS 178-2-2. The first sample (FS 178-2-1) was run as D-AMS 1206-71 and yielded a radiocarbon age of 3640 +/-29 RCYBP. If we assume an isotopic measure of -27‰ for the original wood, the date corrects to 3644 RCYBP. Again using OxCAL version 4.2, this calibrates to a range of 4083 to 3874 cal. BP (95.4% probability; see Figure B-3). D-AMS 1206-72 (FS 178-2-2) yielded a radiocarbon age of 3670 +/-27 RCYBP. If we assume an isotopic measure of -27‰ for the original wood, the date corrects to 3681 RCYBP, and using OxCAL version 4.2 (Brock Ramsey 2009), this calibrates to a range of 4090 to 3925 cal. BP (95.4% probability; see Figure B-4).

The fifth sample from 41KE217 is D-AMS 1206-69 (FS 247, Test Unit 14, Level 5). This charcoal sample produced an age of 6397 +/-32 RCYBP. Assuming a -27‰ for the original wood, the sample corrects to 6337 and calibrates, using OxCAL version 4.2 (Brock Ramsey 2009), to a range of 7325 to 7170 cal. BP (93.9% probability; see Figure B-5).

References Cited:

Bronk Ramsey, C.
2009 Bayesian Analysis of Radiocarbon Dates. *Radiocarbon* 51:337-360.

Zoppi, U., Crye, J., and Song, Q.
2007 Performance Evaluation of the New AMS System at Accium BioSciences. *Radiocarbon* 49:171-180.

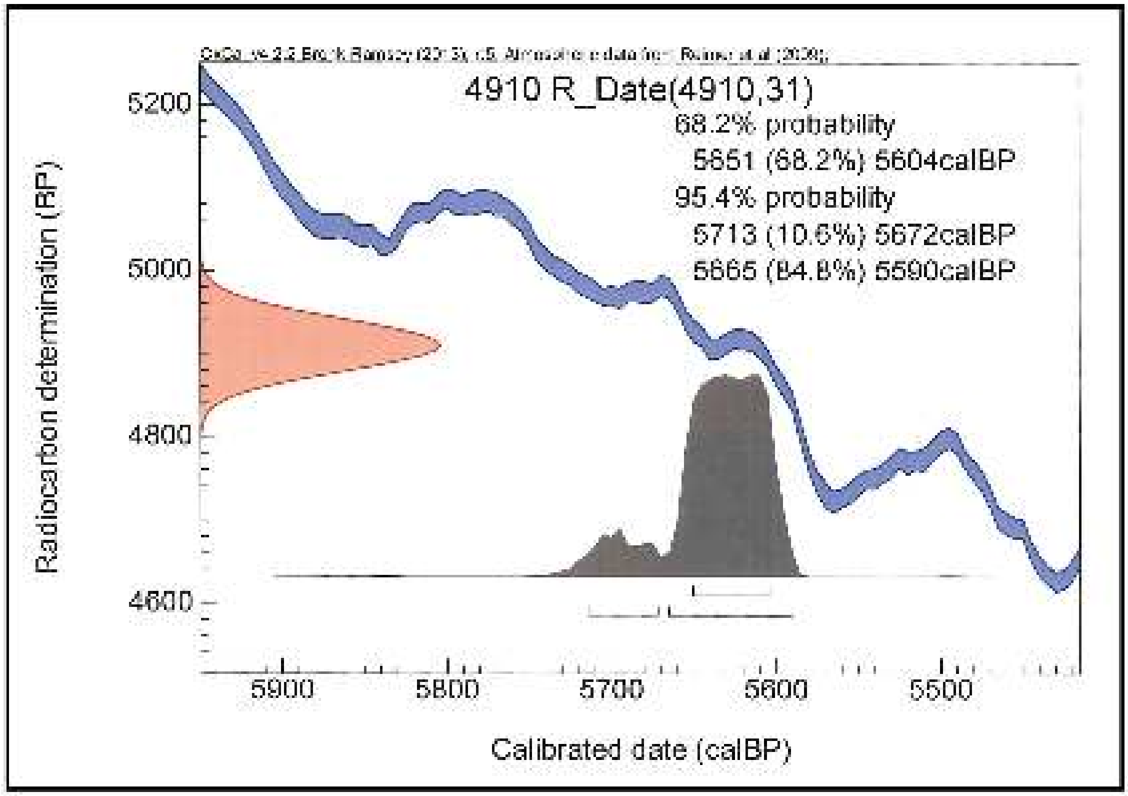

Figure B-1. *Sample D-AMS 1206-39.*

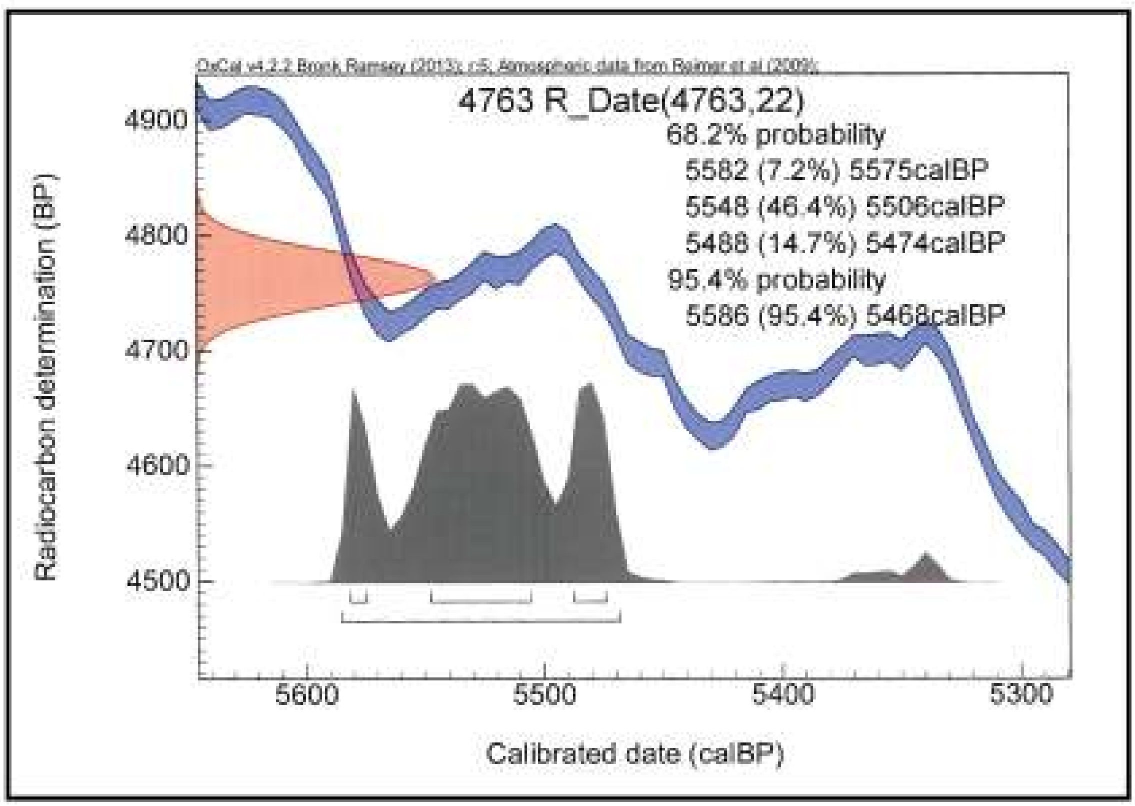

Figure B-2. *Sample D-AMS 1206-40.*

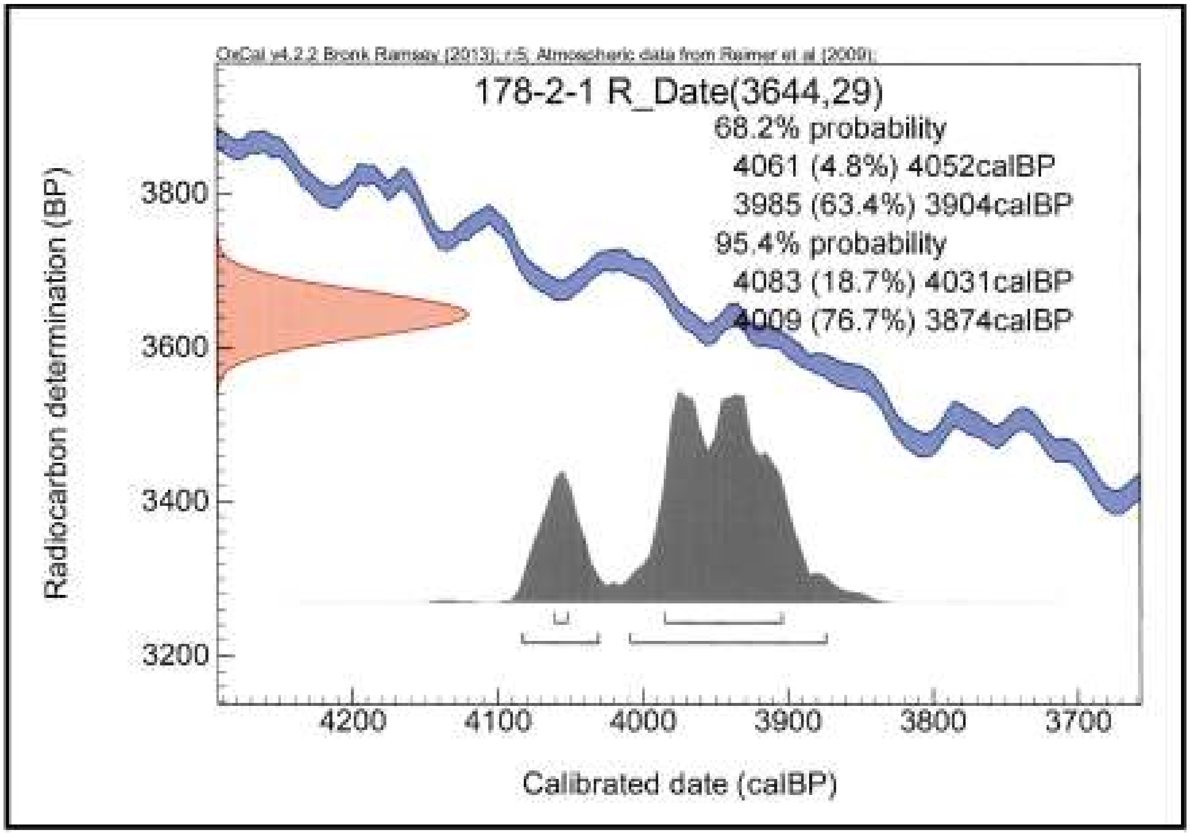

Figure B-3. *Sample D-AMS 1206-71.*

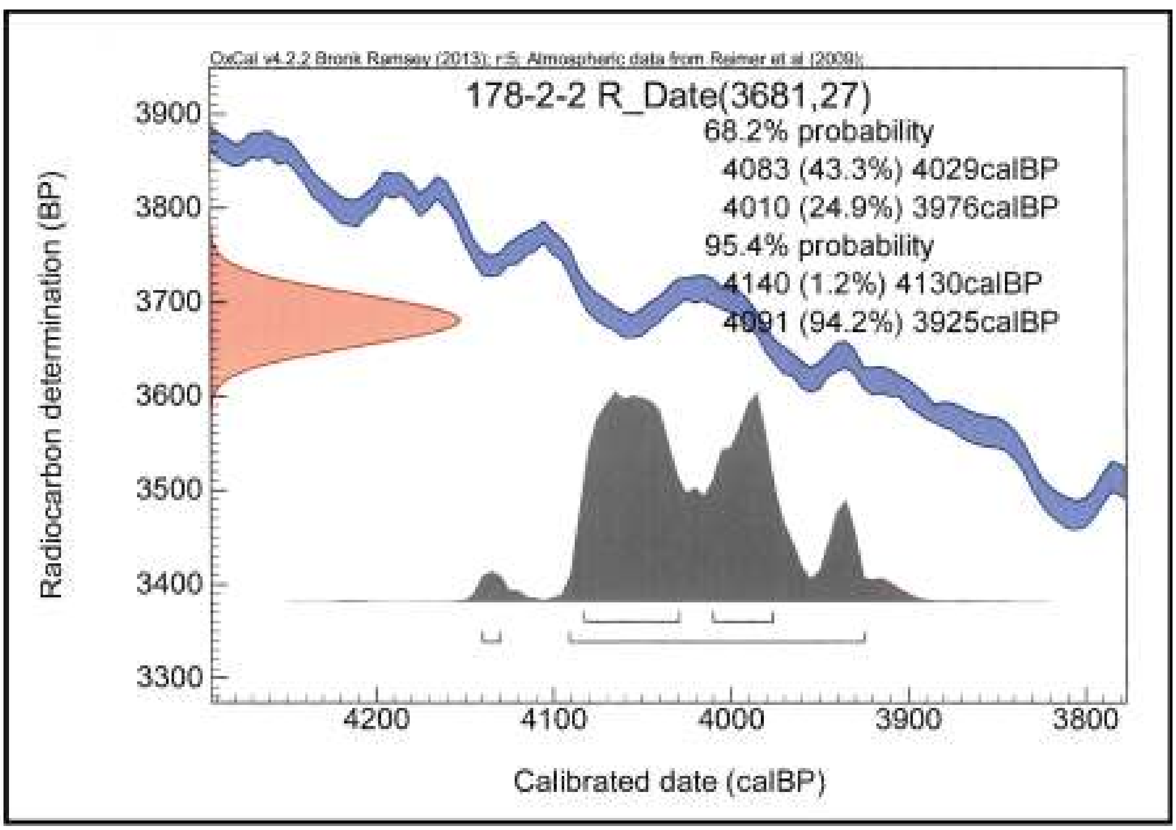

Figure B-4. *Sample D-AMS 1206-72.*

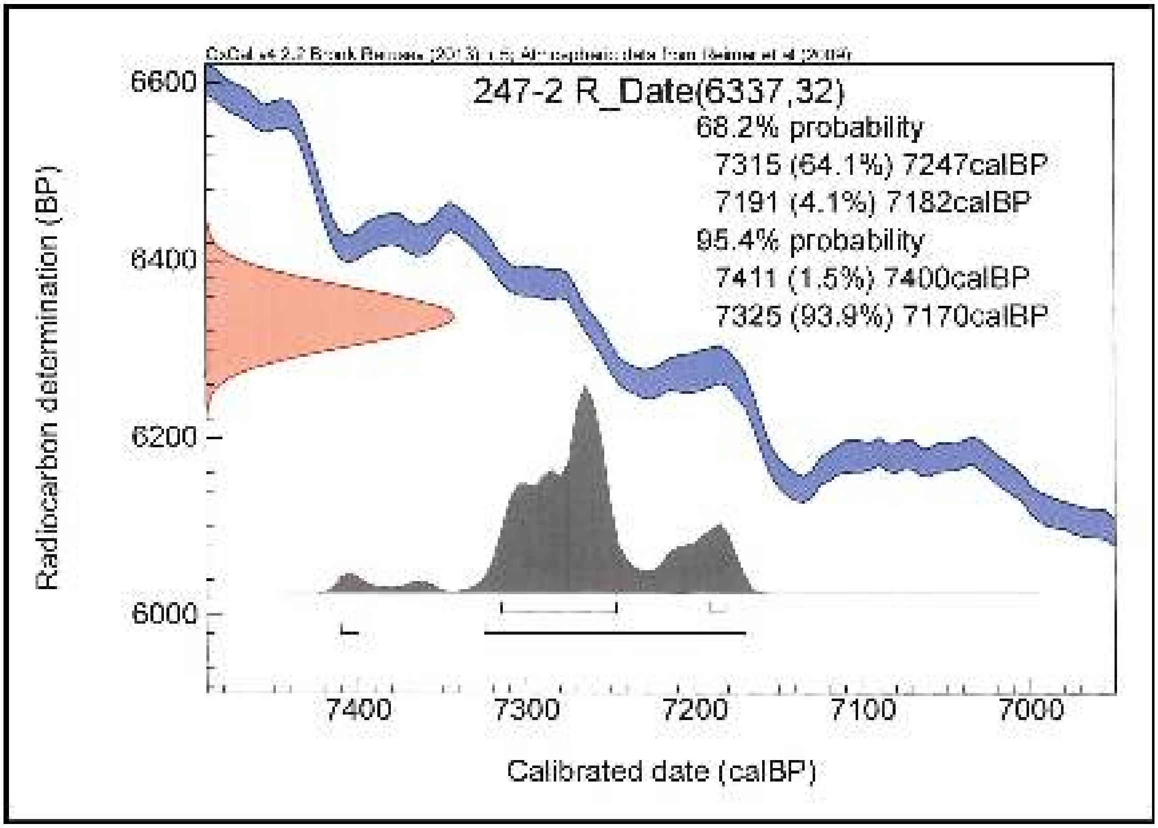

Figure B-5. *Sample D-AMS 1206-69.*

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