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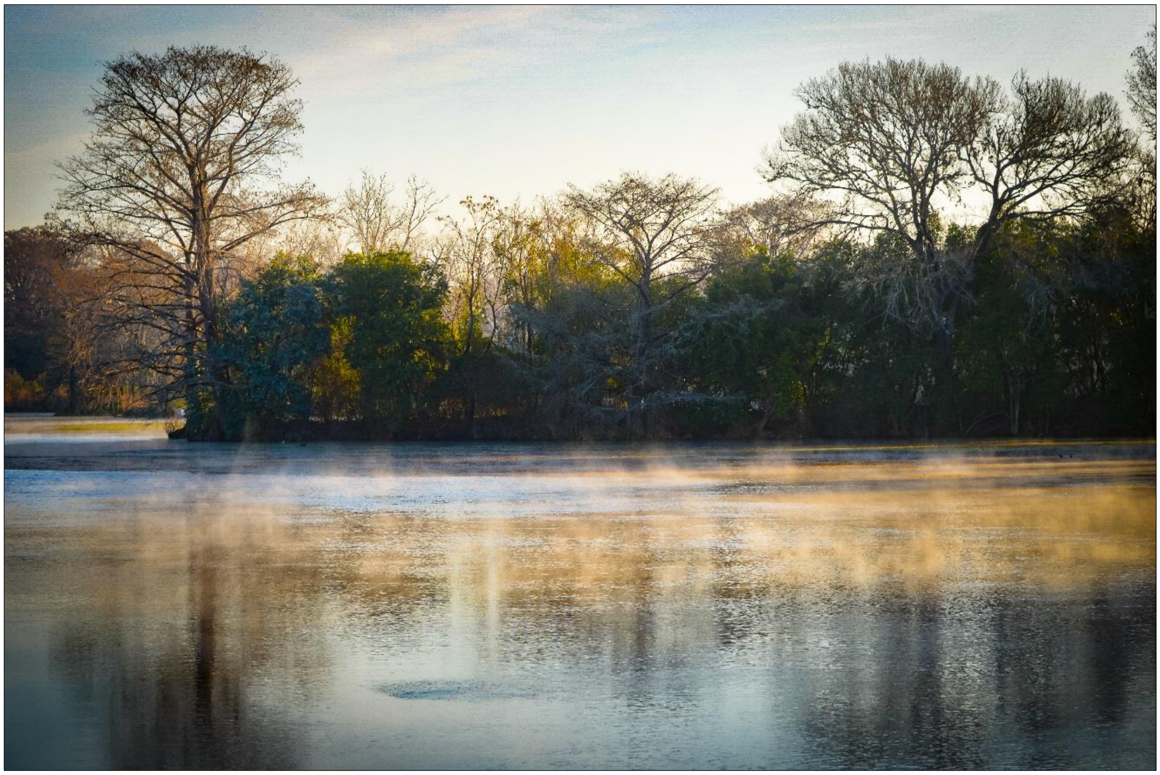

Edited by Amy E. Reid

With contributions by:
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Archaeological Studies Report No. 29
Texas Antiquities Permit No. 2623

CENTER FOR ARCHAEOLOGICAL STUDIES
Texas State University-San Marcos

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ABSTRACT

In response to anticipated impacts associated with the proposed construction of the Texas Rivers Center, archaeological investigations were conducted during the 2001, 2002, 2003, and 2006 Texas State University (formerly Southwest Texas State University) field schools. Since the project was to be carried out on land that is owned by Texas State University, an institution of higher education receiving funds from the State of Texas, it is subject to provisions of the Antiquities Code of Texas (TAC). As such, the University was required to apply for a Texas Antiquities Permit, issued by the Texas Historical Commission. The permit was issued to Texas State University as Texas Antiquities Permit No. 2623 with Dr. C. Britt Bousman serving as the initial Principal Investigator. The permit was transferred to Dr. Jon C. Lohse, Center for Archaeological Studies (CAS), in 2009 and then to Amy E. Reid (Editor) in 2014.

Though the University ultimately terminated its plans to construct the Texas River Center to instead establish the Rivers System Institute in 2002 (presently The Meadows Center for Water and the Environment housed in the restored Spring Lake Hotel), CAS conducted detailed analyses of the data recovered from the 2001, 2002, 2003 and 2006 University field school seasons. These analyses, which began in 2010, were initiated to finalize the requirements of the Texas Antiquities Permit that was obtained for the four field school data recovery years, to synthesize the information, and to address the broader research goals established for data recovery investigations at 41HY160. This report summarizes the results of the investigations, presents the subsequent analyses of the data recovered, and represents the final reporting for the mitigation efforts associated with the proposed Texas Rivers Center construction. Discussions presented within this report are drawn from the artifact collection and associated project records. Analyses were designed to reconstruct the distribution of artifacts and features at the site. These reconstructions, supplemented with new radiometric dates, provide the content for the present report. A primary contribution of this report is an emphasis on understanding the chronological sequence of the immediate Spring Lake area and relating this chronology to broader patterns of cultural and ecological change through time. Specifically, research was focused on characterizing the Middle Archaic period. Although intact Middle Archaic deposits are difficult to find within the Central Texas region, the 41HY160 field school excavations revealed a robust Middle Archaic deposit with excellent contextual integrity.

MANAGEMENT SUMMARY

Project Title: Defining the Middle Archaic at the Spring Lake Site: Data Recovery and Analysis at 41HY160 for the Texas Rivers Center—Results and Analysis of the 2001, 2002, 2003 and 2006 Texas State University Field School Investigations, San Marcos, Hays County, Texas

Project Description: Data Recovery and Analysis

Local Sponsor: Texas State University

Institution: Center for Archaeological Studies, Texas State University

Principal Investigator: Amy E. Reid

Texas Antiquities Permit: No. 2623

Dates of Work: Archaeological investigations associated with 4 Texas State University field school seasons: 2001, 2002, 2003 and 2006. Analysis and reporting from 2010-2019.

Number of Sites: 1—State Antiquities Landmark (SAL) 41HY160

Curation: All artifacts collected were processed and curated at CAS.

Comments: The 2001, 2002, 2003, and 2006 field school investigations succeeded in recovering a robust artifact assemblage and dateable samples. Detailed analyses of the data recovered from these investigations has added greatly to our knowledge of Spring Lake's prehistory and has highlighted an outstanding and discrete Middle Archaic component.

TEXAS RIVERS CENTER MITIGATION, 41HY160: AQUARENA SPRINGS LIST OF FIELD SCHOOL PARTICIPANTS

2001

Principal Investigator: C. Britt Bousman

Students:	Damon Stone	Julia Carlisle
	Barry Calwell	Jesse Leiker
	Jack Johnson	Carrie Davis
	Sean Headden	Kat Brown
	Matt Melancon	Van Rae

2002

Principal Investigator: C. Britt Bousman

Students:	Chase Heinrich	Kris Hartley
	Ron Baldridge	Amy Hail
	Susie Dobson	David Peyton
	Dan Mauldin	Manuel Lopez

2003

Principal Investigator: C. Britt Bousman
CAS Employees: Jimmie Barrera & Antonio Padilla

Students:	Charlie Baker	Jessica Aguilar
	Gabriel Mata	Diana Kimble
	Cody Davis	John Greer
	Shannon May	Roger "Rocky" Hernandez
	Aaron Huff	Kim Wehrenberg
	M. Lehman	Logan Ralph
	Patrick Marty	Miguel Gomez

2006

Principal Investigator: C. Britt Bousman
Graduate Instructional Assistant: Deidra Aery

Students:	Lauren Falcon	Michelle Hildebrand
	Lori Sloat	Haley Rush
	Franchesca Cabrera	Megan Ralston
	Sandra Wier	Lisa Zotz
	Theresa Darby	Bo Baker
	Zach Horn	Terrie Simmons

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ACKNOWLEDGEMENTS

The Center for Archaeological Studies at Texas State University would like to acknowledge the assistance and support of Nancy K. Nusbaum, Associate VP, Planning, Finance and Support Services; and the department of Facilities Planning, Design and Construction (FPDC). Their commitment to protecting and preserving the cultural resources of Texas State University is greatly appreciated! The authors would also like to thank Pamela Cobb for her help with editing, formatting and designing this report. Thanks also go to the many field school participants and CAS employees who contributed numerous hours of field and lab work. Dr. Jon Lohse played an integral role in establishing the analytical methodology and chronological framework for the analyses. Artifacts, photographs and associated project records were prepared for curation by Amy E. Reid, Veronica Suarez, Patricia Christmas and Maximilian Hall.

CHAPTER 1: INTRODUCTION

By Senna Thornton-Barnett and Amy E. Reid

Project History

The Spring Lake site, 41HY160, is a multicomponent site situated within the Sink Creek floodplain on a peninsula separating Spring Lake from Sink Creek in San Marcos, Hays County, Texas (Figure 1-1). 41HY160, was first recorded in 1982 when the land was a privately owned amusement park known as Aquarena Springs. Texas State University (University) purchased Aquarena Springs in 1994 with the intention of developing a public interpretive and educational center focused on rivers and springs in Texas. In 1998, the University began developing plans with the Texas Parks and Wildlife Department (TPWD) to establish the Texas Rivers Center, to be located at the headwaters of the San Marcos River in the building occupied by the former hotel at Aquarena Springs. In preparation for the construction, a Phase I archaeological testing project was conducted by the Center for Archaeological Studies (CAS) in January 2001. These investigations demonstrated the presence of intact and well stratified archaeological deposits dating from Paleoindian to Late Prehistoric times (Nickels and Bousman 2010). Therefore, it was determined that any future construction with the potential to adversely impact the cultural resources associated with 41HY160, should be mitigated. Data recovery excavations were considered necessary to mitigate the loss of information anticipated from impacts associated with the proposed construction of the Texas Rivers Center. These data recovery excavations at site 41HY160 began shortly after the completion of the 2001 testing project. A 3x4-meter (m) excavation block was established adjacent to Test Unit 6, excavated during Phase I testing investigations next to the current River Systems Institute parking lot in the area known as the Pecan Grove (Nickels and Bousman, 2010). This location was determined to have an excellent potential for encountering stratified cultural components. In all, the mitigation investigations occurred during four separate field schools in 2001, 2002, 2003, and 2006. Subsequent field schools during the summers of 2002, 2003 and 2006 continued excavating in this block; each are summarized below.

Summary of Presented Analysis.

In 2001, the field school crew was supervised by Kathryn Brown and Dr. C. Britt Bousman. A 3 x 4-meter (m) block was established and excavated in the area of Test Unit 6 (excavated during the Texas River Center Testing Project) within the pecan grove adjacent to the Texas River Center parking lot (Aery 2007). Unit 6 had been excavated to approximately 150 centimeters below surface (cmbs) and yielded several diagnostic artifacts before excavations were halted upon encountering the water table. Four additional units (Units 7, 8, 9, and 10) were excavated adjacent to Unit 6. Units were excavated in 10-cm levels, and features and diagnostic artifacts were point-provenienced. Unit 7 was excavated to a depth of 80 cm below datum (cmbd), Unit 8 to 80 cmbd, Unit 9 to 100 cmbd, and Unit 10 to 80 cmbd. The entire excavated matrix was water screened through ¼-inch hardware cloth (Aery 2007).

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Figure 1-1. Project area location. Yellow polygon indicated by red arrow, on 7.5’ United States Geological Survey topographic map; San Marcos North and South sheets.

During the 2002 field school, supervised by Bousman, students continued excavation on the previously opened units and opened additional units 11, 12, 13, and 15. At the end of the field season, Unit 7 was at 143 cmbd, Unit 8 at 139 cmbd, Unit 9 at 145 cmbd, Unit 10 at 143 cmbd, Unit 11 at 103 cmbd, Unit 12 at 113 cmbd, Unit 13 at 85 cmbd, and Unit 15 at 75 cmbd. At the end of the field season, the units were protected by backfilling with sediment and covered by tarps and plywood (Aery 2007).

During the 2003 field school, also supervised by Bousman, three additional units (Units 14, 16 and 17) were opened. Units 14 and 16 were excavated to 140 cmbd, and Unit 17 to 130 cmbd. The field school also continued excavating in Units 11, 12 and 13 to approximately 140 cmbd, and Unit 15 to

130 cmbd. During this season, archaeomagnetic samples were taken from some of the fire-cracked rocks in identified thermal features (Aery 2007).

The 2006 field school, supervised by Bousman and Deidra Aery Black, continued excavations throughout the whole block. The entire block was excavated to a depth of 170 cmbd (Aery 2007). During the 2001–2006 field schools, 31 fire-cracked rock features were identified. Recovered material included ground stone, modified flakes, bifaces, cores, core tools, unifaces, projectile points, faunal remains, shell and ceramic sherds. Based on the recovery of chronologically diagnostic materials the excavated deposits date from the Early Archaic to the Late Prehistoric, with the Middle Archaic being the most well-represented cultural period in terms of artifact density and stratigraphic integrity.

The University ultimately terminated its plans to construct the Texas River Center to instead establish the Rivers System Institute in 2002 (presently The Meadows Center for Water and the Environment housed in the restored Spring Lake Hotel).

In 2010, CAS began conducting detailed analyses of the data recovered from the investigations during the 2001, 2002, 2003, and 2006 University field school seasons. The primary goal of this work was to synthesize the information and address the broader research goals established for data recovery investigations (see Chapter 4). This report summarizes the results of the investigations and presents the subsequent analyses of the data recovered.

Aside from a Master's thesis written by Aery (2007), no formal, comprehensive reporting of these excavations exists. This report, therefore, represents the final reporting for the mitigation efforts associated with the proposed Texas Rivers Center construction. Discussions presented within this report are drawn from the artifact collection and associated records including (but not limited to) student field notes, daily journals, unit level forms, unit level plan maps, artifact inventory sheets, and collected artifacts. Analyses were designed to reconstruct the distribution of artifacts and features at the site. These reconstructions, supplemented with new radiometric dates, provide the content for the present report.

Regulatory Concerns

In response to anticipated impacts associated with the proposed construction of the Texas Rivers Center, archaeological investigations were conducted during the 2001, 2002, 2003, and 2006 field schools. Since the project was to be carried out on land that is owned by Texas State University, an institution of higher education receiving funds from the State of Texas, it is subject to provisions of the Antiquities Code of Texas (TAC). The TAC requires that such an undertaking consider the potential impact on any cultural resources that might be present and that might contribute information that is meaningful or significant to understanding the history and/or prehistory of the State of Texas. Cultural resources located on land owned or controlled by the State of Texas, or its political subdivisions, are protected by the TAC (Texas Natural Resources Code, Title 9, Chapter 191), which identifies significant sites as State Antiquities Landmarks (SALs). As such, the University was required to apply for a Texas Antiquities Permit, issued by the Texas Historical Commission. The permit was issued to Texas State University as Texas Antiquities Permit No. 2623 with Dr. C. Britt Bousman serving as

Principal Investigator. The permit was transferred to Dr. Jon C. Lohse, Center for Archaeological Studies, in 2009 and then to Amy E. Reid (Editor) in 2014.

Organization of This Report

The report is organized into thirteen chapters including this introduction. The second chapter describes the site's environmental context and the land use history. Chapter 3 presents a cultural context and a history of previous investigations in the area. The research design and the general research goals of CAS's work at 41HY160 are outlined in Chapter 4. The analytical units and analytical approaches are defined in Chapter 5. Chapter 6 presents the results of the lithic analysis, while the results of the prehistoric ceramic analysis is presented in Chapter 7. Archaeobotanical analysis is discussed in Chapter 8 and a description of the cultural features is presented in Chapter 9. Geoarchaeology and site formation processes are discussed in Chapter 10. The analysis of faunal remains, including an analysis of fish vertebrate remains, is presented in Chapter 11. And finally, a synthesis and conclusions are presented in Chapter 12.

Goals

The current research was initiated to finalize the Texas Antiquities Permit that was obtained for the four field school seasons in 2001, 2002, 2003, and 2006. A primary goal was to address a number of questions established for the current study as well as for previous investigations at 41HY160 and nearby sites. These research questions, outlined in Chapter 4, examine how humans adapted to natural changes in the environment and the availability of fluctuating resources. A primary contribution of this report is an emphasis on understanding the chronological sequence of the immediate Spring Lake area and relating this chronology to broader patterns of cultural and ecological change through time. Specifically, research was focused on characterizing the Middle Archaic period. Although intact Middle Archaic deposits are difficult to find within the Central Texas region, they are relatively extensive at Spring Lake. The 41HY160 field school excavations revealed Middle Archaic deposits with excellent contextual integrity. Therefore, the analyses presented in this report focus on providing temporal resolution and discussing subsistence and technological trends identified during the Middle Archaic.

CHAPTER 2: ENVIRONMENTAL SETTING

David M. Yelacic

Contemporary Environment – Regional and Local

Site 41HY160 is located along Spring Lake near the Meadows Center for Water and the Environment (formerly Aquarena Center) and Spring Lake within the city limits of San Marcos on the Texas State University campus (see Figure 1-1).

Spring Lake is a unique and somewhat dynamic environment near the center of the Balcones Escarpment (Figure 2-1). Here, cool, fresh water issues forth from numerous artesian springs in lower Cretaceous limestone bedrock and confluences with another spring-fed stream that also drains a portion of the Escarpment-Canyonlands ecotone, Sink Creek. These sources of water that draw and support vegetation, wildlife, and culture also serve as a mode to preserve the signatures of each. That is, this alluvial system is capable of encapsulating former ground surfaces that contain remnants of past lifeways. Understanding how this landscape changes through time, then, is an important part of understanding the archaeological record.

First, from Nordt (Nickels and Bousman 2010), who compiled geological data from across the Spring Lake peninsula and beyond, it is necessary to get an idea of the broad patterns and processes in landscape formation at this location. What Nordt found through the analysis of 22 geological cores was that the earliest extant phase of sedimentation in the valley begins around 11,470±100 radiocarbon years before present (BP). From a series of cores recently removed from sediments composing the lake bottom (Leezer et al. 2011), two other late Pleistocene dates (i.e., 13,155 ±65 [wood] and 19,160 ±140 [bulk humate] BP) were recovered, which suggest that there are at least patches of sediment predating the late Pleistocene entrenchment and sediment aggradation observed by Nordt. In any event, late Pleistocene to early Holocene sediment accumulation in a wet, marshy environment was terminated by channel entrenchment and subsequent overbank sediment accumulation by approximately 7,365 BP. Rapid sedimentation persists through a period of time from approximately 5,900 to 3,300 BP, and likely represents a relatively dramatic change in the nature of the fluvial system. After 3,300 BP, depositional rates diminish and geomorphology slowly develops into the present landscape.

From a series of excavation units near the confluence of Sink Creek and the San Marcos Springs, Ringstaff (2000) notes the particularities of landform development and site formation of nearby site 41HY165. At this location, early Holocene sediments are truncated by mid-Holocene erosion, which creates an unconformity or a period of missing time between 6,500 and 4,500 BP. This period of sediment loss is followed by slow aggradation of sediments and soil formation during the late Holocene. In this final phase of landscape development, Ringstaff (2000) notes that there is a possible period of erosion, marked by an unconformity, between 2,400 and 1,400 BP.

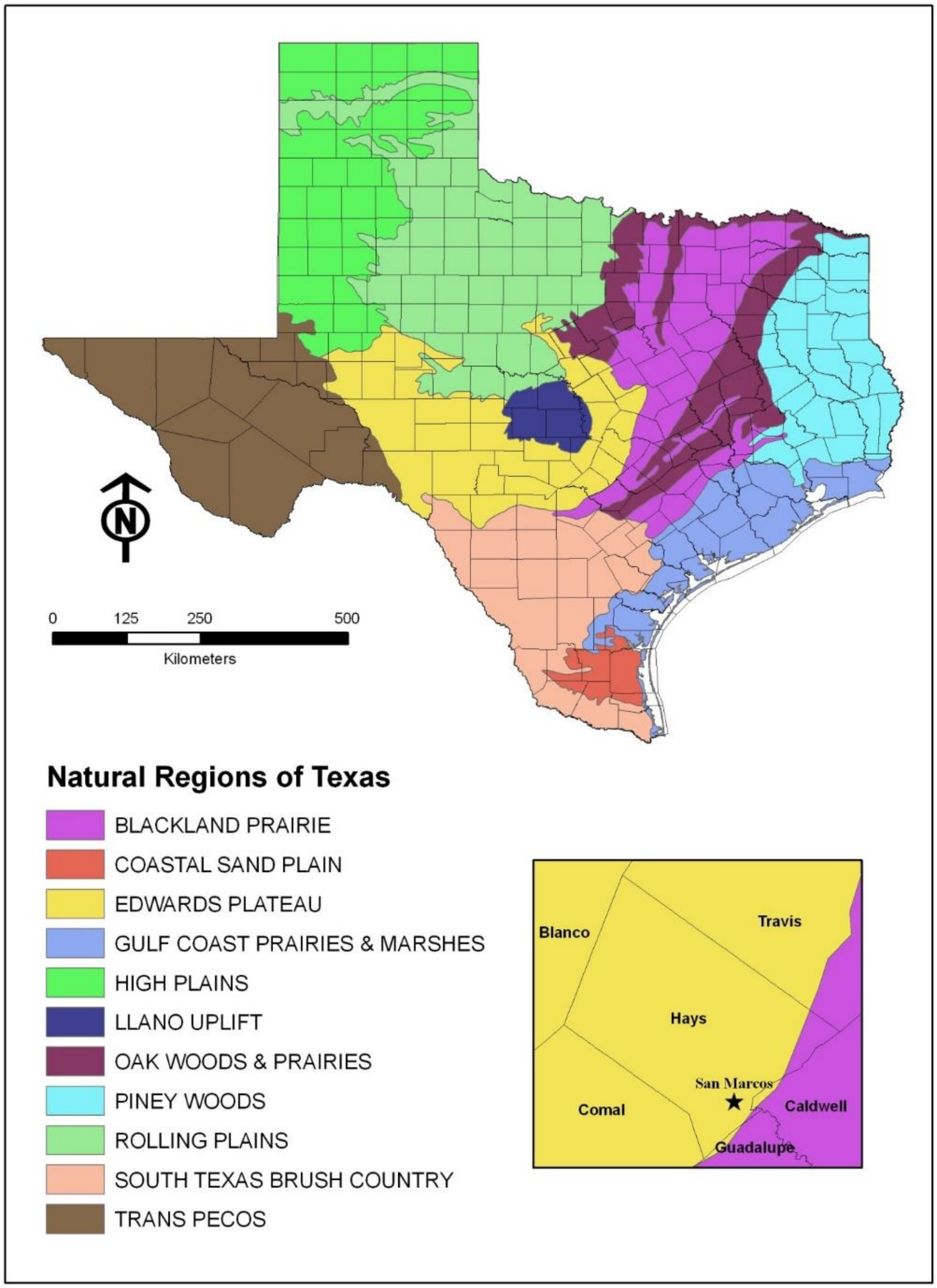

Figure 2-1. Natural Regions of Texas with Hays County inset.

Climate

Site 41HY160 is located within the Subtropical Humid climate region of Texas. This region extends from north to south across the eastern portion of the state and is characterized by warm summers (Larkin and Bomar 1983). The average annual precipitation within the region is about 81.3 cm, which falls mostly as rain in the early summer and fall. Precipitation is highest in the months of May and September

(9.6 to 8.0 cm) and also in the month of September (9.2 cm) (Anaya 2004; Carr 1967; Larkin and Bomar 1983). This is due to the direction of prevailing winds coming from the southeast off the Gulf of Mexico during these times (Slade 1986). These southerly, moisture-laden winds generally clash with cooler, dryer air from the north causing a release of moisture over the Edwards Plateau during these months. In addition, the warm, moist air from the Gulf of Mexico rises along the Balcones Escarpment and cools, causing precipitation along this feature, and often times heavy storms, during these months (Carr 1967; Slade 1986). During the winter months between November and March, precipitation drops to around 4.4 to 6.4 cm as colder, dryer air moves in from the plains (Larkin and Bomar 1983).

Average temperatures in Hays County typically reach up to 35º centigrade (C) during the summer months with average low temperatures reaching to just above freezing during the winter (Bomar 1983). The average annual temperature of the region is 21.1ºC (Carr 1967). January is typically the coldest month with average low/high temperatures of 2.2º/16ºC, while July and August are generally the hottest months with average low/high temperatures of 21.7º/35.1ºC degrees (Bomar 1983).

Physiography and Geology

The Balcones Escarpment represents the remains of the Ouachita Mountains that formed during a tectonic event at the end of the Paleozoic Era (Anaya 2004; Edwards Aquifer Authority 2004). The Ouachita Mountains extended from Mexico to Arkansas and allowed for the formation of shallow seas to the northwest. During the Early Cretaceous, shallow seas advanced across this area depositing sediments that formed the Glen Rose formation and began formation of the Stuart City Reef Trend (Anaya 2004). In the Cenozoic Era, faulting along the buried Ouachita Mountains range caused regional uplift forming the Balcones Fault Zone displacing Cretaceous and Lower Tertiary sediments (Anaya 2004; Edwards Aquifer Authority 2004). The current landscape has been formed by the continual down cutting of streams and rivers through the Balcones Escarpment as they make their way to the Gulf of Mexico.

Site 41HY160 is situated at the base of the Balcones Escarpment on a deep, frequently flooded alluvial terrace at the confluence of the headwaters of the San Marcos River and adjacent intermittent tributary, Sink Creek. Clear artesian waters emanate from approximately 200 small springs and three large fissures along the Balcones Fault. Fluvial terrace deposits (Qal) composed of eroded gravel, sand, silt, and clay from the Edwards Plateau formed along the upper San Marcos River from the Late Pleistocene to Late Holocene. These deposits consist of quartz sand, chert, quartzite, and petrified wood gravels, and limestone (Geologic Atlas of Texas 1974). Northwest of the site the uplands overlooking Sink Creek consist of the undivided Del Rio clay and Georgetown Formation which are made up of calcareous and gypsiferous clays and fine-grained-nodular limestone (Bureau of Economic Geology 1974).

Soils

The soils at Site 41HY160 consist of mollisols that formed under hot conditions in primarily grassland with sparse trees. In some areas these soils formed under wet conditions with vertic qualities and a high salt content (Batte 1984). Specifically, the soils are mapped as Oakalla clay loam (Ok), with Tinn clay (Tn) (Figure 2-2) occurring along the southeastern portion of the site (Batte 1984). Oakalla clay loam (Ok) soils are generally dark grayish brown in color, moderately alkaline and calcareous throughout, with approximately 60 percent calcium carbonate, and contain an extremely firm to very hard, moderate, fine sub-angular blocky clay structure (Batte 1984:34, 75). This compact structure allows for less cracking and movement than other clays. This means that archaeological investigations within these soils should be less hampered by the movement of artifacts as a result of cracking dynamics. Tinn clay (Tn) is generally dark gray to grayish brown in color, and like Oakalla soils, is moderately alkaline and calcareous. Its structure, however, ranges from moderate, medium and sub-angular to weak, medium, blocky. As a result of its structure and higher clay content, it is more likely to crack, thus allowing for possible vertical movement of artifacts.

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Figure 2-2 Soils mapped at Spring Lake and 41HY160.

As a result of the 1996-1998 field schools at 41HY165, Ringstaff (2000) identified three locally defined soil horizons (Figure 2-3) from two excavation units at the site, which he designated Units III through I. Unit III is the uppermost A horizon and occurs between 15 and 50 cmbs. This unit is described as a very dark brown silty clay loam with granular structure. Ringstaff (2000:50) identified an Ap horizon (Unit IIIa) in the upper 15 cm of this horizon as a thin, gravelly, humic zone. Unit II is an ABb horizon between 50 and 90 cm below the ground surface and Ringstaff (2000:50) describes the boundary between Unit III and Unit II as clear and smooth. This horizon consists of dark yellowish brown silty clay with moderate sub angular blocky structure due to its higher clay content. Ringstaff

(2000:51) noted little evidence of bioturbation in this horizon. The final horizon consists of two soil units occurring from 95 to 110 cm to a depth of 280 cm where excavation was deepest. The upper portion of this horizon (Unit Ia) ranges from a Bw2b to Bwk2b dark reddish brown silty loam with weak sub angular blocky structure. Ringstaff (2000:52) notes some krotovina in this horizon filled with artifacts and sediments from Unit II. Underlying Unit Ia is a C2b horizon (Unit 1b) consisting of reddish brown silty clay with moderate sub angular block structure. Ringstaff (2000:53) also notes that the soil is friable with little evidence of bioturbation and may extend to a depth of 6 to 9 m below ground surface.

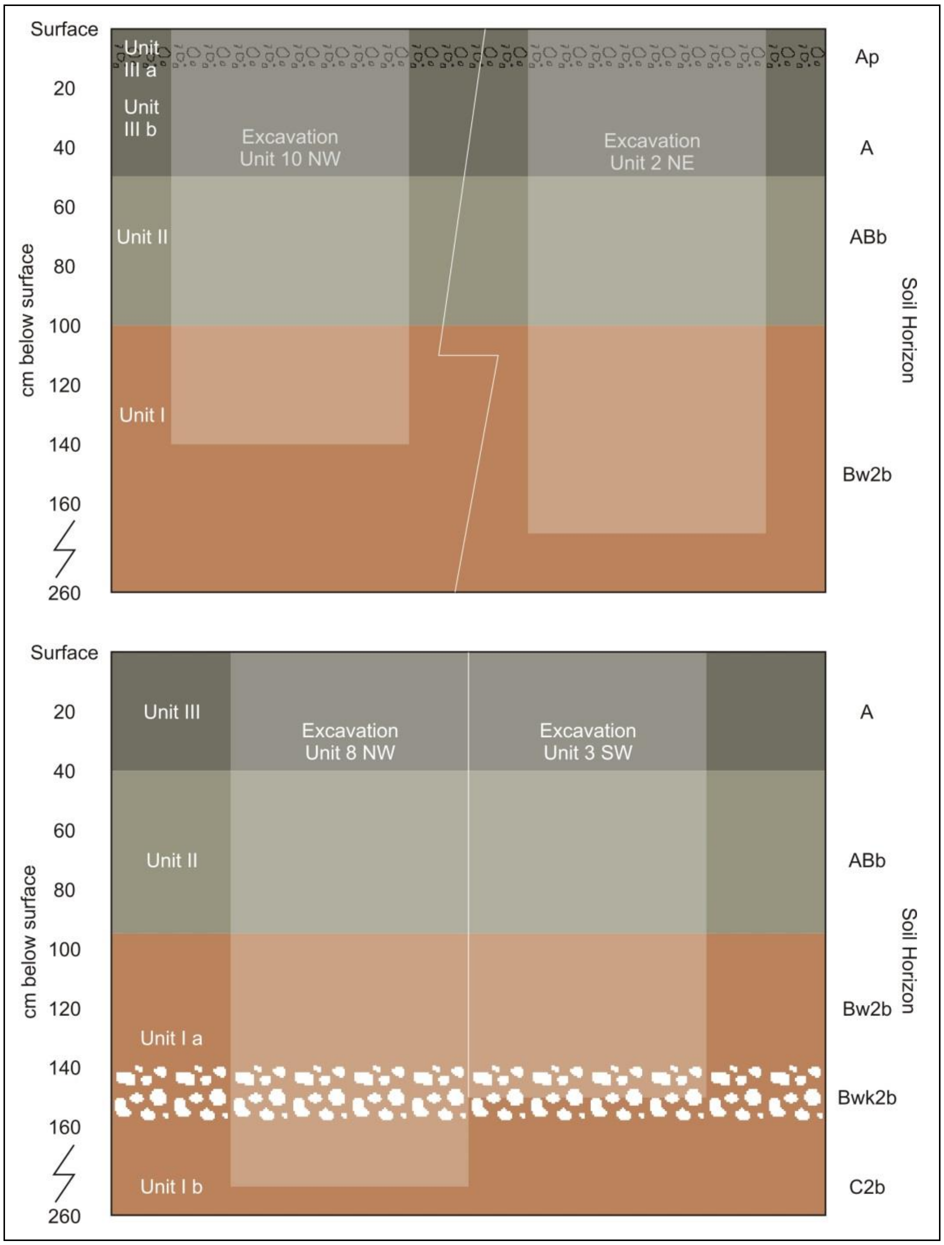

Figure 2-3. Soil horizons at 41HY165 identified by Ringstaff (2000).

Lee C. Nordt (2010) identified six major depositional units of the Aquarena Center during the 2001 investigations of 41HY160. Units A through F were defined as reflecting changes in the course of Sink Creek, periods of increased and decreased stream flow, and changes in the resulting depositional regimes. These Units were deposited in chronological order, from oldest to most recent, and range from Paleoindian (A) to Late Prehistoric and Historic periods (F) (Figure 2-4). Geology, soils and site formation are further explored in Chapter 10 as part of larger geoarchaeological discussion.

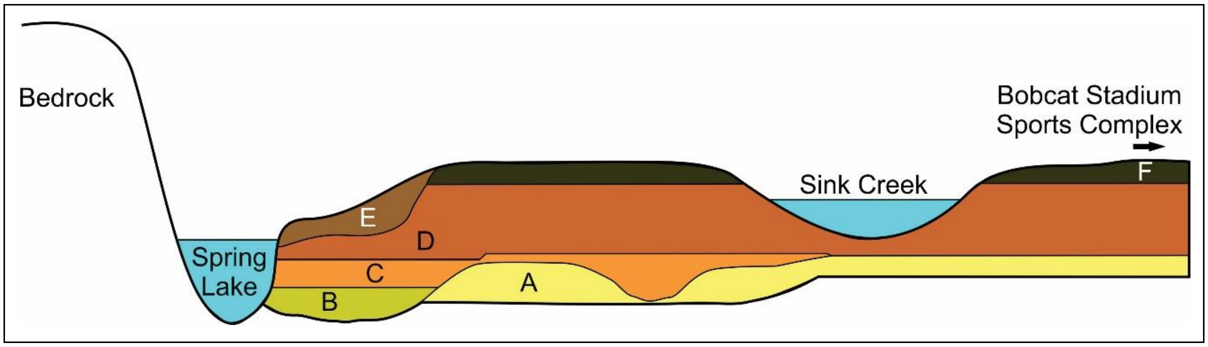

Figure 2-4. Reconstructed geoarchaeological cross-section of Sink Creek Valley, looking upstream, illustrating alluvial units and their expected prehistoric preservation (redrawn from Nordt 2010:Figure 6-8).

Chapter 3: Cultural and Historic Context

Central Texas Cultural Chronology

Prehistoric

The Prehistoric period covers the vast majority of the time span of human presence in North America and is divided into three major temporal stages: Paleoindian, Archaic and Late Prehistoric. Evidence for prehistoric occupation in and around the San Marcos area extends from the Clovis period, approximately 11,500 radiocarbon years ago up until the arrival of Spanish explorers almost 400 years ago. Historic documents record the use of the San Marcos springs by Spanish and Native American groups in the seventeenth, eighteenth, and nineteenth centuries, and as early as the mid-nineteenth century by Anglo settlers such as General Edward Burleson.

Paleoindian

The Paleoindian stage begins with the earliest known human occupation of North America and extends until approximately 8800 years before present (BP). Collins (1995:381–385, 2004) dated the Paleoindian period in Central Texas to 11,500–8800 BP. Although researchers have long believed Clovis hunters were the first people to explore the New World roughly 13,500 years ago, recent archaeological evidence is increasingly challenging the "Clovis First" hypothesis. Excavations at the Gault Site, located northwest of Austin, have revealed a significant assemblage of stone artifacts dating from 16-20,000 years ago, pushing back the timeline of the earliest human habitation of North America at least 2,500 years before Clovis (Williams et al 2018). Still, the Paleoindian period is divided into Early (ca. 13,500–10,200 BP) and Late (ca. 10,200–8800 BP) phases. Diagnostic Early Paleoindian point types include Clovis, Folsom and Midland. The Clovis culture is also characterized by well-made prismatic blades (Collins 1995; Green 1964). The Early Paleoindian stage is generally characterized by nomadic cultures that relied heavily on hunting large game animals (Black 1989). However, recent research has suggested that early Paleoindian subsistence patterns were considerably more diverse than previously thought and included reliance on local fauna, including turtles (Black 1989; Bousman et al. 2004; Collins and Brown 2000; Hester 1983; Lemke and Timperley 2008). Folsom cultures are considered to be specialized bison hunters, as inferred from the geographic location and artifactual composition of sites (Collins 1995).

The Late Paleoindian substage occurred from ca. 10,200 to 8800 BP. Reliable evidence for these dates was recovered from the Wilson-Leonard site north of Austin (Bousman et al. 2004; Collins 1998). At Wilson-Leonard, archaeologists excavated an occupation known as Wilson, named for the unique corner-notched projectile point. The dense occupation also included a human burial (Bousman et al. 2004; Collins 1998). In addition to the Wilson occupation, Golondrina-Barber and St. Mary's Hall components, dating between 9500 and 8800 BP, were excavated. Collins (1995) suggested the Wilson, Golondrina-Barber, and St. Mary's Hall components represent a transitional period between the Paleoindian and Archaic Periods due to the subtle presence of notched projectile points and burned rock cooking features.

Archaic

The Archaic stage follows, extending from ca. 8800 to 1250 BP, and is generally seen as a time during which humans made successful adaptations to changing environmental conditions. According to Collins (1995, 2004), the Archaic stage in Central Texas lasted approximately 7,500 years, from 8800 to 1200/1300 BP. He has divided the stage into Early, Middle, and Late Archaic based on Weir's (1976) chronology. The Archaic stage is characterized by several transitions including a shift in hunting focus from Pleistocene megafauna to smaller animals, the increased use of plant food resources and use of ground stones in food processing, increased implementation of stone cooking technology, increased use of organic materials for tool manufacturing and an increase in the number and variety of lithic tools for woodworking, the predominance of corner- and side-notched projectile points, greater population stability and less residential mobility, and systematic burial of the dead. The markedly increased emphasis on organic materials in tool technologies and diet is likely a reflection of preservation bias. Traditionally, scholars define the end of the Archaic period by the appearance of bow and arrow technology around 1200 BP. However, Lohse and Cholak (2013) argue that this shift, while important, was relatively insignificant in comparison with other evidence for strong cultural continuity until approximately 650 years ago (Figure 3-1). Accordingly, the current project considers the Archaic period as the 5,000 years encompassing the end of the Early Archaic to the beginning of the Late Prehistoric Toyah interval (Table 3-1). As discussed in later chapters, this range is based on the timing of projectile point styles, sporadic periods of bison hunting, and, to a lesser degree, some environmental conditions in the region. The Archaic starts with the Calf Creek horizon (including Bell and Andice types), representing the terminal Early Archaic, and ends with Scallorn.

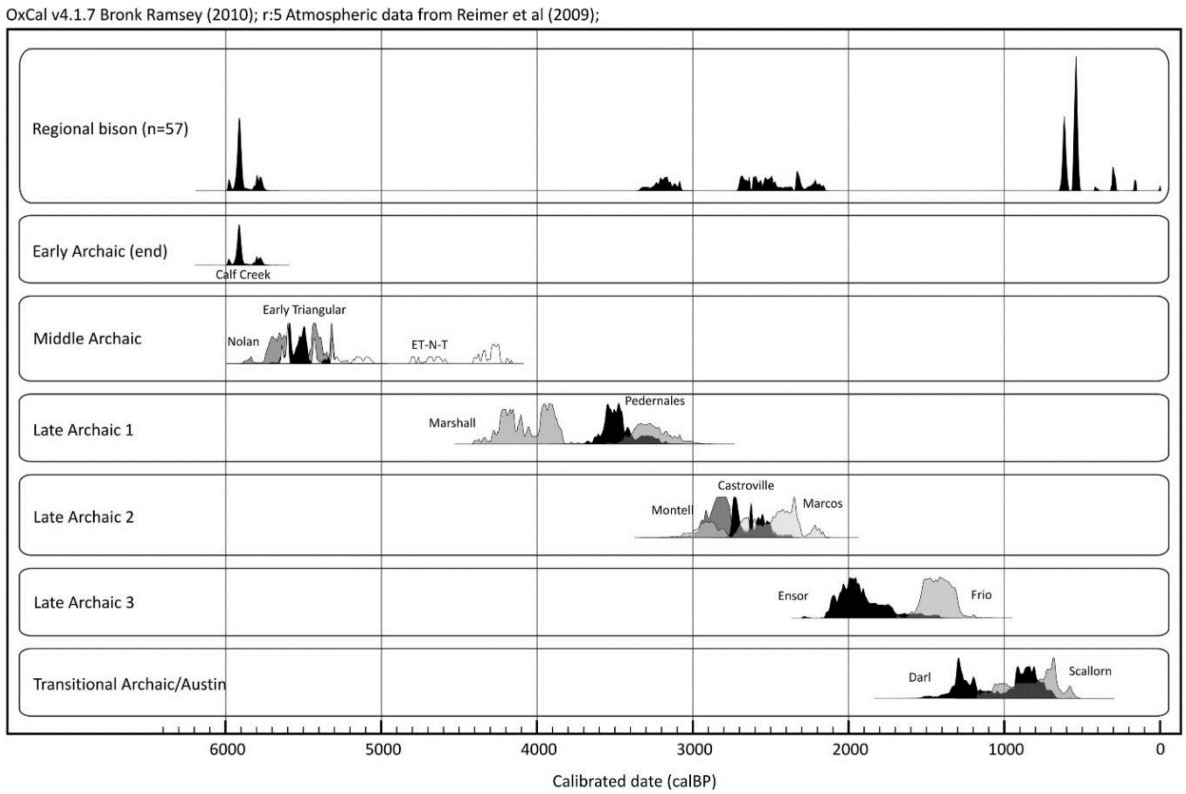

Figure 3-1. Cultural chronology, shown as published radiocarbon probability distributions for some key point types, for Central Texas for the period from the end of the Early Archaic (Calf Creek horizon) to the end of the Archaic, called the Transitional Archaic/Austin period.

Table 3-1. Cultural chronology for Central Texas (from Lohse et al. 2013).

Epoch	Period	Certain Diagnostic Types	Age (Years Before Present)
Holocene	Historic		~AD 1550
	Late Prehistoric/Toyah	Perdiz	650- ≤300
	Transitional Archaic/Austin	Darl, Scallorn, Edwards	1270-650
	Late Archaic III	Ensor, Fairland, Frio, Ellis	2150-1270
	Late Archaic II	Montell, Castroville, Marcos	3100-2150
	Late Archaic I	Bulverde, Pedernales, Marshall, Lange, Williams	4200/4100-3100
	Middle Archaic	Early Triangular (Baird, Taylor), Nolan, Travis	5750-4200/4100
	Early Archaic III	Calf Creek (Bell, Andice), Martindale, Bandy	6000(?)-5750
	Early Archaic II	Uvalde, Gower, Hoxie, Jetta	8000-6300 (?)
	Early Archaic I	Angostura	8800-8000
Pleistocene	Late Paleoindian	Golondrina, St. Mary’s Hall	10,200-8800
	Early Paleoindian	Clovis, Folsom	13,500-10,200

Early Archaic

The Holocene marked a significant climate change associated with the extinction of megafauna, which stimulated a behavioral change in land use. Early Archaic groups focused more intensively on the exploitation of local resources such as deer, bison, fish, and plant bulbs. This dietary adjustment is evidenced by the increased number of ground stone artifacts, burned-rock middens, and wood-working tools such as Clear Fork gouges and Guadalupe bifaces (Turner and Hester 1993:246–256). Projectile points are dominated by bifurcated or split-stem morphologies that often grade into one another in terms of style and design. Dillehay (1974) argued that bison were widely available across Texas, although confirming data are often lacking.

The end of the Early Archaic dates to ca. 5750 BP (Lohse and Cholak 2013). This date places the wide-spread Calf Creek horizon, a brief period closely associated with bison exploitation across the Southern Plains (Wyckoff 1994, 1995) at the very end of the Early Archaic. This placement reflects the close stratigraphic association at Spring Lake of Calf-Creek-related point types (Bell and Andice) with bison remains as well as immediately preceding types in the regional sequence, including Merrell and Martindale. These two types are typical Early Archaic forms in Central Texas, while the Calf Creek horizon is very poorly dated here; this component at Spring Lake may represent the best-known instance in the entire state.

Middle Archaic

The Middle Archaic in Central Texas dates from 5750-4200/4100 BP and is generally associated with the Altithermal, a prolonged period during which the climate fluctuated from arid to mesic, then back to arid in Central Texas. Vegetation and wildlife regimes all fluctuated in response to these environmental oscillations, with human groups responding accordingly. Large ungulates (bison) are absent from the record during this time. The Middle Archaic is characterized by two primary projectile point style intervals: Early Triangular (Taylor and Baird types), and Nolan and Travis. Taylor bifaces are broad and triangular, similar to the earlier Calf Creek Styles, but lacking any basal notches. By the latter part of the Middle Archaic, Nolan and Travis points predominate; both are technologically and stylistically dissimilar to the preceding styles (Collins 1995, 2004). The Nolan-Travis interval was also a period when temperature and aridity were at their peaks. Prehistoric inhabitants acclimated themselves to peak aridity as seen through increased utilization of xerophytes such as sotol (Johnson and Goode 1994). These plants, typically baked in earthen ovens, also reflect the development of burned rock middens. During more arid episodes, the aquifer-fed streams and resource-rich environments of Central Texas were extensively utilized (Story 1985:40; Weir 1976:125, 128).

Late Archaic

The Central Texas Late Archaic spanned the period of ca. 4200/4100-1270 BP. Bison returned episodically to the southern Plains (Dillehay 1974), strongly influencing subsistence during periods of visibility. Cemeteries at sites such as Ernest Witte (Hall 1981) and Olmos Dam (Lukowski 1988) provide some evidence that populations increased and that groups were becoming territorial (Story 1985:44–45), although this pattern had begun by ca. 6,500-7,000 BP (Hard and Katzenberg 2011; Ricklis 2005). Numerous projectile point styles during this period suggest increases in population pressure and social and technological divisions between bands. Common styles include Bulverde, Pedernales, and Marshall (Late Archaic 1); Montell, Castroville, and Marcos (Late Archaic 2); and Ensor, Fairland, and Frio (Late Archaic 3). The Transitional Archaic and Austin periods, together, represent the last phase of Archaic lifeways in the region. Except for the gradual (and poorly dated) appearance of the bow and arrow, subsistence practices, settlement patterns, and technological behaviors appear to change slowly throughout this period (see Black and Creel 1997; Houk and Lohse 1993). Point styles that define this final transitional interval include Darl and Scallorn. Burials from this time reveal a high proportion of arrow-wound deaths (Black 1989; Prewitt 1974), perhaps suggesting some disputes over resource availability.

Late Prehistoric

The Late Prehistoric stage begins ca. 1250 BP and is characterized by a resurgence of grassland habitats and the development of bow and arrow and ceramic technologies. Historically, following J. Charles Kelley (1947), archaeologists divide the Late Prehistoric into two phases, Austin and Toyah. However, the present authors consider the Central Texas Late Prehistoric to be limited to the Toyah interval beginning at approximately AD 1300 based on a sudden appearance of bison in the regional record (see Table 3-1 below). Dating the end of Toyah is complicated, since material traits clearly extend into the early part of the Historic period (Arnn 2012). In general, this period is marked by the (apparently) complete shift away from the dart and atlatl to the bow and arrow, and by the incorporation of pottery throughout the region (Black 1989:32; Story 1985:45–47). Importantly, Toyah peoples were interacting in a broad network of exchange focused on bison and bison by-products. This network appeared in Southern Plains areas to the north (Spielman 1991), stretched from Pueblo areas to the west to Mississippian villages in the east, and involved agricultural goods, people (especially women), exotic materials like obsidian, ceramics, and other resources. Evidence for the movement of peoples into the study area comes from stable isotope values from a human burial from the University campus; data show this woman from coastal regions had moved to Central Texas as an adult (Muñoz et al. 2011).

The beginning of the Toyah period (650 BP) in Central Texas is marked by contracting stem points and flaring, barbed shouldered points. Perdiz is the most common example (Black 1989:32; Huebner 1991:346), and this type occasionally occurs on glass in mission contexts (Lohse 1999:268). Toyah is also characterized by its tools, like prismatic blades and blade cores, which are considered part of a specialized bison hunting and processing toolkit (Black and McGraw 1985; Huebner 1991; Ricklis 1994). However, wide technological variability is present, including both lithics and ceramics, suggesting a diverse social landscape (Arnn 2012).

Protohistoric (Spanish Entrada Period)

In Texas, the Protohistoric period was marked by Spanish entradas, the formal expeditions from established forts and missions in Northern Mexico into Central, Coastal, and East Texas in the late seventeenth and early eighteenth centuries. These encounters began with the venture into Texas by the Spanish explorer Cabeza de Vaca and the Narvaez expedition in 1528. The period is generally dated between AD 1500 and 1700 (or 1528, the date of the Cabeza de Vaca/Narvaez expedition, to the establishment of Mission San Antonio de Valero in 1718).

With Alonso de León's expedition of 1680, El Camino Real (the King's Road) was established from Villa Santiago de la Monclova in Mexico to East Texas. This roadway followed established Native American trade routes and trails and became a vital link between Mission San Juan Bautista in Northern Mexico and the Spanish settlement of Los Adaes in East Texas (McGraw et al. 1991). Spanish priests accompanying entradas provided the most complete information of indigenous cultures of early Texas. Those documented during the early entradas include the Cantona, Muruam, Payaya, Sana, and Yojuane, who were settled around the springs at San Marcos and described as semi-nomadic bands. Other tribes encountered at San Marcos included mobile hunting parties from villages in South and West Texas, including Catequeza, Cayanaaya, Chalome, Cibolo, and Jumano, who were heading toward bison hunting grounds in the Blackland Prairies (Foster 1995:265–289; Johnson and Campbell 1992; Newcomb 1993). Later groups who migrated into the region and displaced the earlier groups or tribes included the Tonkawa from Oklahoma and Lipan and Comanche from the Plains (Campbell and Campbell 1985; Dunn 1911; Newcomb 1961, 1993).

Archaeological sites dated to this period often contain a mix of both European imported goods, such as metal objects and glass beads, and traditional Native American artifacts, such as manufactured stone tools.

Historic

Spanish settlement in Central Texas first occurred in San Antonio with the establishment of Mission San Antonio de Valero (the Alamo) in 1718, and the later founding of San Antonio de Béxar (Bolton 1970; de la Teja 1995; Habig 1977). Some researchers have demarcated the transition in Texas between the Entrada (Protohistoric) and Historic periods by the construction of the first Spanish missions in Texas. Most knowledge of this period has been gained through the written records of the early Spanish missionaries.

Besides the mission town of San Antonio, the only other Spanish settlement in the region was San Marcos de Neve, established in 1808, four miles south of present-day San Marcos. San Marcos de Neve was abandoned in 1812 as a result of constant raids by local tribes (Dobie 1932). During this time, massive depopulation occurred among the Native Americans, mostly due to European diseases to which the indigenous people had little resistance. Those few indigenous people remaining were gradually displaced to reservations by the mid-1850s (Fisher 1998).

European presence in the region increased as settlers received land grants from the Mexican government until 1835. Settlement was difficult, however, due to continuation of hostilities with and raids by Native American tribes. The Texas Rangers provided protection from these conflicts after Texas secured independence from Mexico in 1836. Settlement in the region increased until 1845, when Texas gained admission to the United States, resulting in the formation of Hays County three years later (Bousman and Nickels 2003).

Previous Archaeological Investigations

Six archaeological sites have been recorded within the vicinity of the 2001-2006 field school excavation block. These sites include 41HY37, 41HY147, 41HY161, 41HY165, 41HY306 and 41HY160. Work has been conducted intermittently at these sites for a number of years (Table 3-2 and Figure 3-2), and brief summaries of these investigations are presented below.

Table 3-2. Previously Recorded Archaeological Sites.

Site	**Years Investigated**	**Components**	**Citations**
41HY37	1970, 1979, 1983, 2000	Historical Burleson homestead; Late Prehistoric and Late Archaic (Late Archaic: Pedernales and Edgewood points)	Bousman and Nickels 2003; Garber and Orlof 1984
41HY147	1979, 1990, 1990, 2013	Archaic, late and early Paleoindian, Pleistocene fauna	Shiner 1983; Takac 1990, 1991a, 1991b; Hooge 2013
41HY160	1982, 1983, 1991, 1997, 1998, 2001, 2002, 2003, 2004, 2006, 2010-2012, 2014	Discrete components from Late Prehistoric through Early Archaic, domestic features	Garber *et al.* 1983; Ramsey 1997; Oksanen 2006; Aery 2007; Nickels and Bousman 2010; Leezer *et al.* 2011, Lohse *et al.* 2013; Reid *et al.* 2018
41HY161	1978, 1997, 1998, 2000, 2004, 2008, 2009, 2011-2012	Mixed Historic and Archaic, Late Archaic, late and early Paleoindian, human remains, Pleistocene fauna	Shiner 1979, 1981, 1984; Garber and Glassman 1992; Ford and Lyle 1998; Lyle *et al*. 2000; Jones 2002; Oksanen 2008; Yelacic *et al.* 2008a, 2008b; Stull 2009; Leezer *et al.* 2010; Reid 2013; Laurence et al. 2013
41HY165	1984, 1988, 1996–1998, 2000–2001, 2013	Prehistoric, Middle Archaic, bison, historic, mixed historic and prehistoric	Giesecke 1998; Ringstaff 2000; Soucie and Nickels 2003; Soucie *et al*. 2004; Leezer *et al*. 2011; Leezer 2013
41HY306		Late Archaic, Paleoindian	Arn and Kibler 1999

Sensitive Material Restricted Access Only

Figure 3-2. Previously recorded archaeological sites adjacent to 41HY160. Dashed line boundaries are recent updates resulting from the SLAERP survey and testing project (Leezer 2013).

In 1979, Joel Shiner (1983) began underwater excavations at archaeological site 41HY147. This site, a State Antiquities Landmark (SAL), was recorded by John W. Clark in 1979 and is composed of several areas of archaeological debris located along a large terrace under Spring Lake, adjacent to the western bank of the lake. Primary excavations uncovered lithic materials of various ages and faunal remains, mainly consisting of mammoth, mastodon, and bison tooth fragments (Shiner 1983).

In 1840, the settlers of San Marcos had constructed a large log and earth dam across the San Marcos River to impound the waters for a flour mill. This dam resulted in the creation of Spring Lake, 3–4 m above the natural river edge (Shiner 1981). In 1979, Dr. Joel B. Shiner of Southern Methodist University began investigations immediately below the falls of this dam, known as the Ice House Falls, and recorded archaeological site 41HY161. Shiner originally characterized this SAL as consisting of Middle Archaic lithic deposits occurring in the sand and gravel at the foot of the Ice House Dam Falls (Shiner 1979). As further archaeological investigations were conducted adjacent to this location, the site boundaries of 41HY161 were expanded to include the locations of additionally encountered archaeological deposits. These deposits included Late Paleoindian and Late Archaic lithic materials, in addition to two human burials.

Recorded by James Garber in 1984 (Garber 1984), SAL 41HY165 was the site of field school investigations conducted briefly in 1984, and then was investigated more thoroughly in 1996, 1997, and 1998 (Ringstaff 2000). Field school investigations conducted in 1996 and 1997 recorded 18 features (hearths, basins, burned limestone scatters) and collected numerous projectile points, lithic tools, and faunal remains.

Archaeological site 41HY160, a SAL, was originally recorded by James Garber in 1983 during archaeological field school investigations of Tee Box 6 of the Aquarena Golf Course (Garber *et al.* 1983). These investigations encountered Early Archaic to Late Prehistoric deposits that extended to a depth of 2.4 mbs. Encountered artifacts and features included lithic tools, lithic projectile points, faunal remains, stone alignments, a posthole, a trash pit, hearths, small burned rock middens, and an area possibly associated with ceramic production. Additional field school investigations took place across the peninsula during the following years, and the encountered cultural deposits in this area were attributed to archaeological site 41HY160.

41HY37 Investigations

Site 41HY37, a State Archeological Landmark, was first recorded in 1970 by W.L. McClure as a prehistoric site of unknown age consisting of “arrow point fragments, miscellaneous bifacial tools, and worked flint” (State of Texas Archeological Site Survey Record, Texas Archeological Sites Atlas). At that time, the site location was described to be on the hill behind (west of) the Aquarena Springs Inn and overlooking the golf course to the east. A historic component was added in 1979, when John Clark Jr. recorded the reconstructed two-room log home of Edward Burleson. The building was originally constructed in 1848, but had fallen into disrepair and in 1964 was restored with the original chimney stones and logs from different structures dated to original time period. Clark also noted that the structure had most likely been moved from its original location.

In 1983, the Southwest Texas State University archeological field school excavated seven 1 x 1-m units and one 1 x 2-m unit in addition to collecting numerous surface artifacts at 41HY37. More than 700 artifacts were recovered (Garber and Orloff 1984). Investigations were conducted west of the floodplain on the slope of the escarpment. Soils were shallow with bedrock encountered between 8 and 40 cm. Most of the artifacts were recovered from the surface (Garber and Orloff 1984). Excavations were conducted in areas of noted surface artifact concentrations which included a large pile of unburned rocks. Collected artifacts included sandstone manos, bifaces, performs, reworked broken performs, scrapers, a Clear Fork gouge, choppers, cores, 682 lithic fragments and 4 diagnostic projectile points dating from the Middle Archaic to the Late Prehistoric period. Garber and Orloff (1984) concluded that the area represented a special activity zone, most likely for inhabitants of 41HY160 located approximately one-quarter of a mile to the south of 41HY37. 41HY37 reflected multiuse activities ranging from hunting, hide processing to woodworking and plant processing (Garber and Orloff 1984).

In the summer of 2000, Southwest Texas State University conducted an additional field school at 41HY37. The field school was conducted at the request of Dr. Michael Abbott, Special Assistant to the President at Southwest Texas State University, to study the original Edward Burleson Homestead. The objectives of the study were to determine if the original site still contained intact archaeological deposits, if the replica constructed in the 1960s was placed on the original site and foundation, and if the information provided by the excavation could be used for the accurate representation and interpretation of the site (Bousman and Nickels 2003). Archival and archaeological investigations indicated that the original location of the Burleson cabin was on the ridge above Spring Lake and that the replica structure was erected in the general location of the original cabin. An oral history in addition to the archaeological investigations indicated that replica structure was not constructed on the original foundations, but the original foundation and chimney were used in the reconstruction (Bousman and Nickels 2003). Collected historical artifacts indicate that the excavation area was the general location of a mid-nineteenth century residence. In addition to the historical component, four fire-cracked rock features were uncovered. These features were interpreted to represent prehistoric cooking ovens and/or hearths (Bousman and Nickels 2003). A total of 2,265 lithic artifacts were also recovered consisting of projectile points, bifaces, unifaces, flakes, and cores. The identification of the burned rock features in addition to the recovery of a large quantity and wide variety of stone tools imply that the site was utilized as an open campsite occupied during the Late Archaic and Late Prehistoric period (Bousman and Nickels 2003).

41HY147 Investigations

Investigations at the Spring Lake Site (Shiner 1984) or Terrace Site (Takac 1990) were carried out by Shiner intermittently from 1979 until his death in 1988. The site consists of several areas of archaeological debris located along a large underwater terrace of Spring Lake adjacent to the western bank of the lake. Initial excavations uncovered lithic materials of various ages within a mixed, deflated, 20-cm stratum (Shiner 1983); Clovis, Plainview, Angostura, and Golondrina points were mixed with Archaic points. Additionally, faunal remains, mainly consisting of mammoth, mastodon, and bison tooth fragments were also recovered (Shiner 1983). Subsequent excavations revealed three distinct strata levels. The uppermost gray clay matrix level varied from 20 to 30 cm in depth, and contained Archaic shouldered and notched projectile points. The second layer, red sand, varied from 10 to 20 cm in thickness, and artifacts recovered consisted of shouldered projectile points and lanceolate points. The last layer, consisting of red clay, contained the majority of the megafauna remains in addition to Clovis, Plainview, and other lanceolate points (Shiner 1983). Among the artifacts collected were a few “exotic” or non-local materials consisting of red-colored quartzite and quartz crystals and chert from 50 to 75 miles away. In addition, several scales of alligator gar were recovered, a species far different from the local spotted gar (Shiner 1981). Shiner (1983) postulates that the presence of scrapers, large amounts of lithic “chipping” debris, preforms, and the broken bones of many animal species indicates that the site was a Paleoindian base camp supporting an almost sedentary hunting and gathering existence. In rebuttal, Johnson and Holliday (1984) postulate that the large numbers of lithic artifacts were a direct result of the availability of localized chert outcrops in the area.

In October of 1989, following Shiner's death, Paul R. Takac, a graduate student at Southern Methodist University, attempted to complete the analysis of Shiner's collection, conducted additional excavations in 1990 and 1991, and sought to publish these results (Takac 1990). Takac (1990), like Shiner, contends that the paleoenvironment of the Spring Lake area, the abundance of raw lithic materials, and a permanent and reliable water source may have supported limited mobility hunter-gatherer groups in the past. Takac compared the Spring Lake material to the Early Archaic and Late Prehistoric remains recovered by Garber *et al.* (1983) at the Tee Box 6 area of 41HY160. There, Garber noted a high incidence of usable flakes that were not utilized or modified. Takac's primary analysis of the Spring Lake materials indicated a similar occurrence. Also similar to Tee Box 6, 41HY147 contained a wide range of tool types, including projectile points, scrapers, knives, drills, perforators, burins, and gouges in addition to bifacial and discoidal cores at various stages of reduction (Takac 1990). Takac's project was eventually abandoned due to the difficulty of doing careful underwater investigations. Combined, Takac's and Shiner's excavations recovered a total of 46 Paleoindian projectile points, most dating to the Late Paleoindian period. Site 41HY147 was designated an SAL on July 23, 1999 (Texas Historical Commission [THC] 1999a).

41HY161 Investigations

In 1840, the settlers of San Marcos constructed a large log and earth dam across the San Marcos River to impound the waters for a flour mill. This dam resulted in the creation of Spring Lake, three to four meters above the natural river edge (Shiner 1981). In 1979, Shiner began investigations immediately below the falls of this dam, known as the Ice House Falls. Spring Lake is fed by five to six major springs that flow from the Edwards Plateau Limestone approximately 600 m north of the Ice House Dam. Shiner documented the presence of stone artifacts, mostly from the Middle Archaic, occurring in the sand and gravel among large cobbles at the foot of the Ice House dam falls (Shiner 1979). A clay stratum approximately 1 m below the water level was identified on the west bank that appears to be a relict portion of a prehistoric site (Shiner 1979). Approximately 40 man-hours of underwater diving resulted in the random collection of 2,513 artifacts. Collected artifacts consisted of 1,762 pieces of lithic chips, 29 lithic cores, 201 biface thinning flakes, 141 cortex fragments, 234 flakes, and 146 tools that included: seven endscrapers, six side scrapers, two scrapers, six notched tools, an arrow point, 31 dart points, 51 preforms, five burins, six gravers, four borers, a drill, three scaled pieces, six gouges, 12 retouched flakes, a chopper, three hand axes, and a hammer (Shiner 1979). Projectile points included 10 Pedernales, five Bulverdes, six Nolan, three unidentified notched points, and four unidentified triangular points. Almost half of the collected tools consist of broken or incomplete bifaces (Shiner 1979). Shiner contends that the assemblage is reflective of hunter-gatherer groups between 2950 and 5450 BP that occupied the site for a lengthy period of time. The amount of lithic manufacturing debris and the presence of tools, in addition to a lush environment, support the contention of a lengthy occupation (Shiner 1979).

In the fall of 1982, Southwest Texas State University (SWT; presently Texas State University) maintenance operations uncovered two burials in the area of the Fish Ponds on the university campus, across Sessoms Drive from the Ice House Falls; the boundaries of 41HY161 were extended to include these deposits. Garber conducted an emergency recovery project (Garber and Glassman 1992). Burial 1 was encountered in the sidewall of a narrow water pipeline trench at 65 cmbs. The burial consisted of a small sample of fragmentary remains that prohibited the assessment of a basic osteobiographical profile. Five nonhuman bone fragments, one burned nonhuman bone fragment and one nonhuman tooth were recovered in association with the burial. No skeletal pathologies or cause of death were identifiable (Garber and Glassman 1992). Burial 2 consisted of 45 percent of the skeletal remains of a single individual. The cranium was not represented except for four cranial fragments and the left petrous portion of the temporal bone (Garber and Glassman 1992). Nine nonhuman bone fragments, four nonhuman teeth, and one metal bolt were recovered in association with the burial. Two of the recovered bones had been burned, including the right humeral fragment. The individual was identified as an adult female between 64 and 66 inches in height. No skeletal pathologies or cause of death were noted (Garber and Glassman 1992). Archaeological site 41HY161 was designated an SAL on March 13, 1987 (THC 1987).

Additional analyses of the burials recovered from 41HY161 were conducted as a part of the data recovery program of archaeological site 41HY163. These remains were included to enlarge the bioarchaeological population of the San Marcos area for comparative analyses. Analyses consisted of descriptive and isotopic analysis. These recent analyses confirmed and slightly revised the prior stature and age estimates for these individuals and should be considered the most accurate and current reconstruction.

Archaeological data collected with the 41HY161 burials, in addition to biological indicators and overall taphonomic conditions, indicate that the remains are culturally and biologically affiliated with prehistoric Native American populations. Individual 1 displayed premolar wear consistent with prehistoric hunter-gatherer populations. Less than 25 percent of the skeletal remains were recovered, and the remains displayed significant postmortem trauma, most likely the result of heavy equipment used during excavation. The remains of Individual 2, specifically, provided limited biological profile information. A metric analysis of the recovered skeletal elements indicate that Individual 1 was a female, aged between 25 to 45 years, and stood between 61 and 66 inches tall (Stull and Hamilton 2011). These remains were dated to 515±20 BP. Due to the condition of the remains from burial two, it can only be determined that Individual 2 was an adult of indeterminate sex and stature. These remains, however, were dated to 3510±20 BP (Stull and Hamilton 2011).

Stable carbon and nitrogen isotope analysis of bone collagen collected from the 41HY161 burials were also conducted as part for the 41HY163 data recovery program (Lohse 2011). This analysis was conducted in order to reconstruct paleodietary histories of the individuals in an attempt to determine their point of origin and possible cultural affiliation (Munoz et al. 2011). The dietary values from Individual 2 indicated a subsistence strategy focused on terrestrial plants and animals, with a minor contribution from riverine resources. In contrast, Individual 1 displayed dietary values suggesting a marine-based diet. This suggests that Individual 1 may have migrated inland from a coastal region (Munoz *et al.* 2011).

In August of 1997, the Center for Archaeological Research (CAR) conducted an intensive archaeological survey within 41HY161 for cultural resources at the proposed location of a parking lot at the current location of the Saltgrass Steak House (the Ice House building adjacent to the Ice House Falls; Ford and Lyle 1998). Pedestrian survey, backhoe trenching, and shovel test (ST) excavations determined the presence of prehistoric and historic cultural remains and the degree of potential contextual disturbance. Two backhoe trenches were excavated to depths of 1.2 m. and 1.8 m. Eleven shovel tests were excavated; six shovel tests were excavated at 13 m. intervals in the area of the proposed parking lot, two were placed along the river bank, and three shovel tests were excavated to define the boundaries of a lithic material deposit. Shovel tests were excavated to a depth of 50 cm whenever possible (Ford and Lyle 1998). The majority of the shovel tests encountered modern construction remains or were terminated due to natural disturbances. A large number of prehistoric materials in a disturbed context were encountered in ST 2 and included lithic flakes and faunal remains. Three shovel tests were excavated in order to define the boundaries of this deposit; only one, ST 9 produced similar materials. CAR determined that modern and historic construction has disturbed this portion of 41HY161, and that the construction of a parking lot would not critically impact undisturbed cultural remains. Concurrence with this finding was sought from the THC and was granted, resulting in clearance for the proposed parking lot construction (Ford and Lyle 1998).

In the spring and early summer of 1998, CAR returned to 41HY161 to conduct subsurface testing for cultural resources along the proposed route of a water pipeline for SWT. The proposed pipeline included a tract along the banks of the San Marcos River and tracts adjacent to the Aquatic Biology Building. Investigations included the excavation of 27 shovel tests, two backhoe trenches, and three test units, and monitoring of the pipeline installation (Lyle et al. 2000). Twenty-six shovel tests were excavated in three sections; Section 1 (the lawn area south of the Aquatic Biology Building), Section 2 (the breezeway of the Aquatic Biology Building), and Section 3 (the west lawn of the Aquatic Biology Building). The richest artifact recovery was from Section 3, the west lawn of the Aquatic Biology Building. Shovel tests in this location indicated an upper layer of disturbed soils over lower intact soils containing prehistoric material remains (Lyle et al. 2000). Backhoe trenches in Section 1 and Section 2 also revealed disturbed soils. The Section 1 trench revealed an area highly disturbed by construction and the demolition of historic buildings, while the Section 2 trench displayed disturbed soils over intact soils encountered at 100 to 120 cmbs. Backhoe trenches were excavated to a depth of 140–170 cmbs. As Section 3, the west lawn of the Aquatic Biology Building, possessed a high potential for intact prehistoric cultural remains, three test units were excavated in this location. The three test units were excavated to a depth between 70 and 100 cmbs. Investigations indicated that the upper 30 cm of deposits were disturbed and contained a mixture of modern, historic, and prehistoric cultural remains. Deposits located between 30 and 80 cm appeared to contain intact Early Archaic remains. While Paleoindian remains were encountered below 80 cmbs, the nature of the deposits was not determined. CAR recommended to the THC that construction proceed, as impacts would be contained to the upper disturbed 30-cm levels. The THC concurred with this recommendation, and construction proceeded (Lyle *et al.* 2000).

In the spring of 2000, CAS conducted archaeological monitoring of a 200-m-long irrigation trench located adjacent to 41HY161 (Jones 2002). The area was once the location of a U.S. Federal Fish Hatchery that was established in 1893. Monitoring was conducted to ascertain if intact deposits were present, and if so, if they would be impacted by the construction of an irrigation trench. Evidence of extensive disturbance that possibly dated from the time of the U.S. Federal Fish Hatchery in 1893 was noted during the monitoring of trench excavations. CAS recommended to the THC that no intact deposits would be impacted, and that the project be cleared to proceed; THC concurred with these recommendations (Jones 2002).

Between May and September of 2004, CAS conducted data recovery excavations at 41HY161. The excavations were conducted as partial mitigation for the installation of flood control measures on Sessom Creek on property owned by Texas State (Oksanen 2008). Investigations began with the excavation of three backhoe trenches to the depth of expected impact within the footprint of the proposed construction (Oksanen 2008). The excavation of Backhoe Trench 3 revealed potential intact soil deposits at 180 to 190 cmbs. A 3 x 4-m excavation block was then established incorporating Backhoe Trench 3. Eight 1 x 1-m units were excavated by hand to a depth of 260 cmbs. Unit profiles indicate the development of a terrace in a slowly aggrading environment. A series of occupation zones dating from 7700 BP were identified during investigations, consisting of three distinct Early Archaic occupation zones and a fourth zone containing a mixture of Early and Late Archaic materials (Oksanen 2008). The lithic assemblages indicate the use of locally available chert sources from stream beds, eroded upland nodules, and weathered nodules on upland terraces to the west of the site. Based on lithic totals, the dense occupations occurred in Occupation Zone 1, followed by Occupation Zone 2 and 3 (Oksanen 2008).

The project was significant in that it provided information about the little-known Early Archaic period in Central Texas. Only one style of projectile point, Gower, was recovered. This point type has been rarely dated and is usually recovered from mixed deposits. The estimated age of deposits spans 1,000 years, from ca. 7700 BP to 6650 BP, and three distinct occupational zones were identified. The site was most intensively used during the earliest occupation. The assemblages from the earliest occupation, ca. 7700 BP, indicated that the area was utilized for processing large game animals, projectile points refitting, and new lithic supplies were procured, possibly from nearby chert outcrops (e.g., 41HY37; THC 1999c). The third occupation zone, ca. 6650 BP, indicated a shift away from large game coupled with a decline in projectile points and other big game processing tools (Oksanen 2008). The decline in locally available large game may be indicative of increasing population pressures and climate changes that resulted in depleted local resources.

In spring of 2008, CAS again conducted archaeological monitoring of a shallow trench excavation to the southwest of 41HY161 (Yelacic et al. 2008a). The trench was excavated in order to bury waterlines supplying water to the decorative ponds around the University’s Theatre Center. The trench was approximately 50 m long, 20 cm wide and 50 cm at its deepest point. No cultural remains or features were noted during excavations. The soil appeared to be disturbed by construction of the U.S. Federal Fish Hatchery Ponds in 1893 (Yelacic et al. 2008a). CAS recommended regulatory clearance for the project, as no intact cultural remains were noted or would be impacted. THC concurred, and the construction was allowed to proceed.

CAS conducted additional investigations in the area of 41HY161 in 2008 (Yelacic et al. 2008b). Investigations consisted of the monitoring of the excavation of a shallow trench as part of construction of a new fence and visual barrier fronting the University-owned Clear Spring Apartments. Monitoring of the trench excavation revealed recent sediments overlying an old paved surface. No archaeological deposits were present or were impacted. Based on these results, CAS concluded that no intact and/or significant cultural properties would be impacted, and requested that permission be granted to proceed with the proposed development. THC concurred, and the construction project advanced.

CAS conducted cultural resources investigations during September 2009, in advance of the construction of a boiler station to be placed adjacent to the Jowers Center on the campus of Texas State. Investigations consisted of excavation of two test units within the proposed foot print of the building. While excavations encountered mixed historic and prehistoric deposits, these deposits were perceived as a continuation of nearby archaeological site 41HY161, and the boundaries of this site were extended to encompass these newly uncovered cultural remains (Leezer et al. 2010).

41HY165 Investigations

Site 41HY165 is located at the confluence of Sink Creek and Spring Lake on a small peninsula that extends out into the eastern half of the lake, and also extends around the lake margins to the southwest. The first investigations at 41HY165 were conducted in 1984 by Dr. James Garber as part of a field school for SWT (presently Texas State University). A second field school was conducted on the site in 1988 by David Driver, along with Garber, and focused on testing and recording the site. Finally, three field schools were conducted on the site between 1996 and 1998 by Garber and Mary Kathryn Brown that involved intensive testing of the site. During the 1996, 1997, and 1998 field schools, 11 test units were excavated over the eastern portion of the site.

The results of the 1996, 1997, and 1998 field investigations were used as the basis for Christopher Ringstaff's masters' thesis dated 2000. While Ringstaff's thesis offers a relatively comprehensive study of the three field school seasons, the focus of his research is on the geoarchaeological properties of the site and thus the attention given to the artifact assemblage and features at the site is limited to that scope of his research.

Cultural materials recovered from the 1996 and 1997 field school were also used in a preliminary faunal analysis by Giesecke (1998). Though she clearly states that her report is only a preliminary analysis, Giesecke identified changes in bison concentrations through time, with the greatest concentration occurring during the Middle Archaic. These findings should be verified.

Between 2000 and 2001, CAS conducted archaeological monitoring of a tree-planting project undertaken by the Department of Biology and archaeological monitoring of the construction of the Campus Map Board along Aquarena Springs Drive for Texas State. While numerous prehistoric and historic artifacts were uncovered during these projects, the majority of the encountered deposits appeared in a mixed context. Despite these findings, discrete areas of intact prehistoric deposits were noted. It was recommended that the site boundaries of 41HY165 be extended to incorporate the areas of these projects, as the newly encountered prehistoric deposits may be part of this well-stratified, prehistoric open campsite (Soucie and Nickels 2003). While the recommendation for the extension of the site boundary of 41HY165 was made, no site update form or redrafting of the site boundaries were submitted to the Texas Archaeological Site Atlas.

Additional prehistoric deposits associated with site 41HY165 were encountered again in 2003 during trench excavations conducted in advance of the installation of a new irrigation system on the Texas State University Golf Course. A dense deposit of lithic artifacts was recovered from an area that extends from the boundary of site 41HY165 established during the Front Door Project through the eighth green and fairway. It was recommended again that the boundaries of site 41HY165 be extended to encompass these newly uncovered deposits (Soucie *et al*. 2004). Again, no site update form was filed, nor was the site boundary redrafted to include this recommended extension of the site.

41HY160 Investigations

Site 41HY160 was initially investigated during a field school by Garber (Garber 1983) in 1982. 41HY160 occupies the peninsula between Spring Lake and Sink Creek upon which Aquarena Center and a portion of the Texas State University Golf Course are situated. As described by Garber (1983), the site is located near Tee Box 6 of the Texas State University Golf Course, adjacent to Spring Lake. Prehistoric materials were noted on the surface of an area approximately 300 x 200 m. In total, 34 m^2 of soil were excavated to varying depths, with the deepest unit excavated to 2.4 mbs. Intact Late Prehistoric through Early Archaic occupations were exposed (Garber et al. 1983). The terminus of cultural deposits was not determined due to the nature of the water table. Garber et al. (1983) speculate that cultural remains are present beneath the water table level based on Shiner's recovery of artifacts from approximately 10 feet below the water surface of Spring Lake. Excavations indicated that only the upper 15 cm of soil were disturbed by historic processes, and that the remaining deposits were intact.

Seventy-five projectile points (53 of which were identifiable) were recovered and can be placed in the Late Prehistoric, Late Archaic to Late Prehistoric transition, the Archaic, and the Paleoindian periods. Late Prehistoric projectile points such as Perdiz, Scallorn, Cliffton, and Alba were found between 0 and 20 cmbs. Points characteristic of the Transitional Archaic Period (Darl, Fairland, and Edgewood) were recovered between 20 and 40 cmbs. Late Archaic projectile points (Ensor, Frio, Marshall, and Castroville) were excavated between 30 and 50 cmbs, while early Late Archaic points (Pedernales) occurred primarily between 50 and 70 cmbs. Nolan and Early Stemmed points representing the Middle and Early Archaic intervals were found between 70 and 190 cmbs. No projectile points that are characteristic of the Paleoindian to Archaic transition phase were noted (Garber et al. 1983). In addition, 429 stone tools representing choppers, scrapers, cores, fine bifaces, moderately worked bifaces, crude bifaces, used-retouched flakes, and intentionally retouched flakes were also collected. Garber et al. (1983) stated that the source of the chert cobbles is a limestone chert outcrop approximately one kilometer to the north of the site. It appears that tool finishing was an important activity at the site, due to the presence of over 35,000 pieces of lithic debitage (Garber et al. 1983). The majority of the lithic debitage has been classified as interior flakes representing the final stages of reduction. In addition to the above, three bone tools were also recovered, consisting of two bone awls and one flesher. Three sandstone grinding slabs were recovered from the Late Prehistoric zone and the Late Archaic to Late Prehistoric transition zone. Twenty-six ceramic sherds were also recovered from this zone, representing Leon Plain ware and Caddoan type vessels (Garber et al. 1983). Faunal remains consisted of bison, deer, and antelope. Thirteen features were encountered and included: five hearths, three stone alignments, two small burned rock middens, a posthole, a trash pit, and an area containing charcoal and pieces of fired, shell-tempered clay possibly indicating ceramic production (Garber et al. 1983).

Garber et al. (1983) summarized their report by stating that preliminary analysis indicates cultural occupations exist at the site from the Early Archaic through to the Late Prehistoric. The presence of Paleoindian projectile points suggests earlier occupations; however, the nature of these deposits is not yet fully understood. Garber et al. (1983) recommended additional investigations at the site to better understand the nature of these earlier deposits. The field school returned to 41HY160 in 1983, but these excavations have not been analyzed or reported.

SWT field school participants returned to the 41HY160 area under the direction of David Driver in 1991. During this field school, three additional units were excavated in the Tee Box 6 area, three in the vicinity of the swimming pool in front of the Spring Lake Hotel (now the Meadows Center for Water and the Environment), and a seventh unit northeast of the previous anthropology field laboratory building (now biology field laboratory building) on the edge of the golf course. Units in the Tee Box 6 area were excavated to a depth of 70 cmbs. Units in the area of the swimming pool were excavated to a depth between 50 and 160 cmbs. Most of the upper deposits near the swimming pool were believed to be mixed (James Garber, personal communication 1999), but some of the lower deposits appeared to be intact. The unit next to the anthropology lab was excavated to a depth of 100 cmbs. While field notes report the recovery of cultural remains from these units, excavations have not been cataloged, analyzed, or reported.

A 1993 SWT field school was conducted at Tee Box 6 area of 41HY160 under the direction of David Driver. During this field school, an additional six units were excavated and varied in depth from 80 to 160 cmbs. Collected artifacts include ceramic fragments, shell, lithic cores, bone, lithic debitage, points, and point fragments. These excavations have also not been fully catalogued, analyzed, or reported.

In 1997, Dawn Ramsey (1997) conducted a pedestrian and shovel-testing survey at Aquarena Center. She excavated 10 shovel tests on the east side (left bank) of Sink Creek and northeast of the entrance road immediately east of the escarpment. All but one shovel test produced prehistoric artifacts.

In 1998, under the direction of Mary Kathryn Brown, participants in the SWT field school excavated six units at 41HY160 in the vicinity of the Aquarena Center offices. Units were excavated to depths between 20 and 148 cmbs. Excavations were halted in most of the units due to invasion of the water table. Intact deposits were found immediately below the present surface in two of the units. Artifacts collected included bifaces, shell, bone, lithic debitage, and points. This collection has also not been fully catalogued, analyzed, or reported. Archaeological site 41HY160 was designated an SAL on July 23, 1999 (THC 1999b).

In 1999, Prewitt & Associates conducted a geological assessment of the Aquarena Center peninsula through the extraction of 17 30-foot (9-m), 3-inch-diameter cores in preparation for potential limited development by TPWD (Goelz 1999). The cores were drilled by Trinity Engineering Testing Corporation and interpreted by Melinda Goelz (1999). The primary result of this work was to provide an outline of the late Quaternary geological history of the valley and the potential for prehistoric occupations. Goelz's (1999) geological assessment indicated that soil deposits are shallow near the escarpment, but quickly thicken to an average depth of 8.4 m in the central portion of the peninsula. The recovery of cultural materials in such small cores is not common, and recovery usually indicates reasonably dense occupation. The majority of the core samples produced prehistoric artifacts, indicating a dense concentration of artifacts in the area. Cultural materials were recovered up to a depth of 6.5 m. The estimated age for cultural materials at 6.5 mbs is 10,000 BP (Nickels and Bousman 2010).

In 2001, an archaeological testing project was conducted as part of a master plan and partnership between TPWD and Texas State to develop a public interpretive and educational center on the peninsula (Nickels and Bousman 2010). The purposes of this project were 1) to determine the presence or absence of cultural remains in the areas to be impacted; and 2) to evaluate the integrity of any discovered cultural materials and determine their potential for providing significant archaeological information. Additional geological coring was conducted by the Bureau of Economic Geology of The University of Texas at Austin in order to document the Late Pleistocene and Holocene depositional history of the valley. This produced another set of 22 cores that were extracted in two valley cross-sections from east to west. Six 1 x 1-m test units were also excavated to an average depth of 1.7 m before reaching the water table. Two units were placed in the footprint of a proposed pavilion and restrooms, and four units were placed in the area of the Spring Lake Hotel swimming pool and surrounding parking lot. A number of special samples were collected from the test excavations, including radiocarbon, archaeomagnetic samples of burned rock from features, and macrobotanical samples. During the excavations, over 18,380 pieces of lithic material were collected including: 18 projectile points, 82 bifaces, 19 cores, two groundstones, one hammerstone, 213 unifaces, and 18,046 pieces of lithic debitage (Nickels and Bousman 2010). In addition, 2,650 fire-cracked rocks from 12 thermal features were analyzed in the field, and 4,388 faunal remains and 37,672 snail shells were collected. No ceramic remains were encountered. The testing investigation documented the presence of intact and well-stratified archaeological deposits within the upper 1.7 m. Nickels and Bousman (2010) contented that based on geological core samples and results from previous investigations in addition to their testing investigations, intact alluvial deposits in the floodplain adjacent to the San Marcos Springs contain evidence of human occupations extending from Paleoindian to Late Prehistoric.

Data recovery excavations at 41HY160 began after the 2001 testing project determined the potential for stratified and intact buried deposits at the site in the pecan grove area adjacent to the Texas River Center Parking lot (Aery 2007). Excavations were conducted during four field schools in 2001, 2002, 2003, and 2006. In 2010, CAS began a detailed analysis of the artifact assemblage collected during these field schools; the results are the subject of the present report.

In August of 2006, CAS conducted monitoring and trench inspection of 1,600 linear feet of proposed fiber optic line conduit to be placed through the Aquarena Springs Golf Course (Oksanen 2006). A segment of the line passed through the area of Tee Box 6. The remains of three small thermal features were recorded within the localized area of Tee Box 6. The impacts to the archaeological deposits were minimal, and no significant cultural deposits were encountered or disturbed. CAS recommended clearance for the conduit installation to the THC, and the THC concurred.

From 2011-2012, Texas State University built a new ticket kiosk and restroom facility at Spring Lake within the boundaries of 41HY160. The facility replaced the former visitor center at Aquarena Springs, which was demolished during the comprehensive Spring Lake Aquatic Ecosystem Restoration Project (SLAERP). The new ticket kiosk is located immediately adjacent to but outside the SLAERP project area. According to University plans, the ticket kiosk was designed as a two-part structure with an open-air walkway between the two buildings. The construction was designed to take place on a pad of fill that was brought in specifically to minimize impacts to archaeological resources. Initially, all impacts were to result from the installation of a lift station to a depth of approximately eight feet to supply head pressure to the restroom facilities, and some utility installation to bring water and electricity to the building. Following a geotechnical assessment of the project area, however, planners determined the need for 36 deep piers to be driven into the ground to a depth of over 20 feet to anchor the structure in place.

Since the construction (with associated utility installations) was carried out entirely on Texas State property, and using University funds, the university was required to comply with provisions of the Antiquities Code of Texas, which requires that such undertakings be coordinated with the Texas Historical Commission (THC) and evaluate their impact on important archaeological resources that may be impacted by the development. Working with the University's Office of Facilities Planning Design and Construction (OFPDC) at Texas State University, the Center for Archaeological Studies (CAS) designed and carried out a plan for data recovery and archaeological monitoring in order to recover information representative of the archaeological record in the immediate area and that would offset the loss of additional information stemming from the construction of the ticket kiosk. All excavations and monitoring were carried out under Antiquities Permit 5938 (Jon C. Lohse, Principal Investigator).

CAS submitted a proposal to the OFPDC and the THC to perform controlled hand excavation of a single 1 x 2-m unit in the location of the lift station to a depth of three meters. The size of the unit was roughly one-half the overall size of the lift station and therefore sufficient to recover enough information to mitigate the impact of the construction. Additionally, all utility work involving disturbance of the ground was monitored by on-site archaeologists

The initial excavation unit, beginning in the fall of 2011, was laid out with the assumption that all existing utilities had been marked and that none would be encountered. At approximately 60 cm below surface, however, an active gas line was encountered running diagonally through one of the one-meter squares (Unit 1) and partially through the other (Unit 2). In response, the excavation was relocated a meter to the west and a meter to the north. The relocated excavation extended to a depth of 3.0 m below the current ground level. Monitoring, which continued into the late spring of 2012, was conducted based on where utilities were to be installed.

Excavations documented the record of prehistoric occupation at Spring Lake continuously, or nearly so, from the end of the Late Prehistoric period, called Toyah in the regional cultural chronology, well into the Early Archaic. Of particular importance in this sequence is what appears to be an intact terminal Early Archaic Calf Creek component, just under 6000 years old, first recognized in the 2001-2006 excavations conducted nearby but never completely sampled. Considering the continuous nature of deposits here, the emphasis of the analysis was placed on generating a robust record of radiocarbon dates for certain key intervals and components.

In addition to securely placing Calf Creek in the regional chronological sequence, monitoring efforts resulted in the discovery, documentation, and removal of a single human burial. This interment represents the third human burial to have been recovered from the Texas State campus and is the seventh individual recovered by CAS from the general San Marcos area. An important aspect of the project involved plans for the ultimate disposition of these remains, along with others presently under the control of CAS. Prior to the removal of these remains, Texas State was obligated to comply with the Texas Health and Safety Code, which requires either a signed permit to disinter remains from the State

Registrar's Office or a signed order from the district court before the remains can be removed. After discussing the project design and circumstances with the OFPDC, CAS recommended that the remains be removed, as their former location would be in an area of high traffic and was considered inappropriate for the location of a cemetery (under the Health and Safety Code, even a single interment is defined as a cemetery). Since removal, Texas State and CAS was required to comply with the Native American Graves Protection and Repatriation Act (NAGPRA) in order to determine cultural affiliation and, ultimately, negotiate or find arrangements for the final disposition of the remains. CAS qualifies as a museum, under NAGPRA, and was obligated to consult with federally-recognized tribes and other potentially interested parties federally recognized, in order to determine the cultural affiliation of these remains.

This investigation presented an opportunity to consider how Texas State and CAS will or should approach the study of recovered human remains from the Spring Lake area. Certain minimal data ought to be recorded in order for scholars and others to make informed assessments concerning cultural affiliation, needed for ultimate disposition of the remains under state and federal law. These data can easily be augmented, through additional kinds of analyses, in order to recover all possible information about the people who inhabited Spring Lake in prehistoric times and technological advances may make it possible to learn more from these remains than possible today. Full compliance with NAGPRA requires that the views of Native Americans, too, be taken into consideration. Often, this means that destructive analyses capable of yielding a more complete understanding of human remains are not undertaken. This project resulted in the clarification of CAS's policy for dealing with Native American human remains from Spring Lake and the greater San Marcos area.

Recent Investigations at Spring Lake (41HY160 and 41HY165)

CAS conducted an intensive archaeological survey, subsurface testing, and underwater investigations in advance of the SLAERP. This work fulfilled the required development and implementation of a subsurface testing program to determine the extent of intact cultural deposits within the project area as presented by the Memorandum of Agreement between the U.S. Army Corps of Engineers (USACE), Texas State, and the THC. This testing program, developed and implemented by CAS, included both terrestrial and underwater investigations. Terrestrial investigations consisted of pedestrian survey, shovel test excavation, test unit excavation, auger pit excavation, and backhoe trench excavation. Underwater investigations included a limited reconnaissance survey, test unit excavation, and extraction of sediment cores. Investigations were conducted within or adjacent to SALs 41HY160 and 41HY165. As a result of these investigations, six areas were identified as "Archaeologically Sensitive" as they contained or possessed a high probability to contain cultural deposits that would be negatively impacted by proposed demolition, modifications, and construction. These investigations are reported in detail in *Results of Cultural Resources Survey for the Spring Lake Section 206 Aquatic Ecosystem Restoration Project* (Leezer *et al.* 2011). CAS recommended the development of mitigation efforts to offset the loss of important information from areas to be negatively impacted.

CHAPTER 4: RESEARCH QUESTIONS AND DATA RECOVERY STRATEGY

Research Questions

A number of major questions were addressed by the investigations for the proposed Texas Rivers Center. As discussed in Chapter 1, the objectives of the data recovery and subsequent analyses were aimed at addressing issues regarding how humans adapted to natural changes in the environment, as well as the availability of or fluctuating food resources.

Economy

What economic changes occurred during the prehistoric period? The only nearby site that can compare to 41HY160 at Spring Lake is Wilson-Leonard (41WM235) in southern Williamson County (Collins 1998). Both sites have evidence of quasi-continuous occupation from the Early Paleoindian through the Late Prehistoric periods. The faunal record at Wilson-Leonard (Baker 1998, Balinsky 1998) suggests that dramatic changes in prehistoric faunal exploitation occurred during the same periods of occupation as represented at 41HY160, and that these changes were related to major environmental shifts. Giesecke (1998) tentatively identifies shifts between deer and bison at 41HY165, but these results must be confirmed with more detailed analysis. The use of plant foods can also be expected to change, but too little is known about what type of plants were used and how these were processed.

Environment

How has the local and regional environment changed? How have environmental changes influenced the exploitation of plants and animals in the area? Was the resource base stable during this 12,000-year period or did the prehistoric inhabitants respond to regional fluctuations in the plant and animal populations (Dillehay 1974; Bousman 1998)? Were the changes great enough that prehistoric inhabitants had to alter their economic, mobility, or technological exploitation patterns?

Technology

How have prehistoric technological strategies responded to changes in economic exploitation patterns? A shift from formal and curated tools to a greater use of informal expedient tool using strategies is evident in the flake tools at Wilson-Leonard (Prillman and Bousman 1998). Are changes in cooking technology a response to economic changes and availability of foodstuffs (Wandsnider 1997)? Are similar shifts present at 41HY160? Did the prehistoric inhabitants alter their technological strategies to match the exploitation patterns?

Mobility

How did changes in hunter-gatherer mobility influence technological patterns? According to Shiner (1983), we should expect to encounter evidence for semi-sedentary settlement patterns, even in the paleoindian period. McKinney (1981) and others have remarked on the intensive exploitation and occupation of spring related sites along the Balcones escarpment, but does this occupation intensity translate to sedentary mobility patterns? Did shifts in mobility patterns influence the use of curated and expedient tools? How are non-local raw materials incorporated into the technological system? Are different resources from differing areas used in specific periods?

Habitation Structures

Two possible structures have been recovered from previous excavations at 41HY160 and the nearby site of 41HY163 (Garber et al. 1983; Garber 1987). Other investigations in Texas demonstrate the construction of habitation structures; four structure types have been identified (Lintz et al. 1995). Ethnoarchaeological investigations of hunter-gatherer sites demonstrate the unorganized nature of sites occupied by highly mobile foragers and the more organized nature of sites occupied by semi-sedentary collectors (Binford 1986; Fisher and Strickland 1989; O'Connel 1987; Yellen 1976). Both foragers and collectors are known to construct habitations, but artifact distributions differ between these different hunter-gatherer adaptations. Recent intra-site spatial analysis of Late Archaic occupations at 41MV120 in Maverick County suggests a highly repetitive but informal use of space as would be expected on forager sites (Vierra 1998). Intra-site analysis of artifact distribution can be used to shed light on hunter-gatherer mobility patterns. If additional structures can be identified, then their use in detailed intra-site analyses of hunter gatherer camps would be extremely informative, particularly if investigators can gain an understanding of how site structure relates to mobility patterns. Does the internal structure of prehistoric occupations at the springs support the argument for semi-sedentary occupation?

Site Preservation

Site preservation has been addressed in the Texas Rivers Center Testing project; three major questions related to site preservation are further explored herein. How has the nature of sediment accumulation affected the presence of archaeological evidence at 41HY160? Did erosion and different facies deposition inhibit the preservation of archaeological remains in specific periods? Could these different patterns of erosion and deposition account for the cultural historical record preserved at 41HY160?

Data Recovery Strategy

The Center for Archaeological Studies proposed to excavate a block of 1x1 meter units surrounding Unit 6. The purpose of these investigations was to obtain a statistically reliable sample of Late and Middle Archaic faunal remains in a controlled context in order to address the first research question discussed above. Furthermore, it was anticipated that the number of excavated units should also provide a suitably sized sample of lithic artifacts.

Units were excavated in arbitrary 10-cm levels and approximately 10 levels were to be excavated in each unit. The units were contiguous and adjoining. Field notes, level forms, feature forms and stratigraphic profiles were recorded and curated. All excavated sediment was screened through ¼-inch mesh, and all artifacts, bone and any other significant materials were collected and curated. Special samples were collected from the excavation units, including radiocarbon, archaeomagnetic samples of burned rock from features, and macrobotanical samples.

Laboratory Analyses

Under the direction of Dr. Jon Lohse (Principal Investigator in 2010), CAS conducted detailed analyses and syntheses of the artifact assemblage from the 2001, 2002, 2003, and 2006 field schools. The analyses of artifacts and features were designed to provide information regarding the above described research questions. A database was compiled using existing specimen inventory forms. In this database, materials were categorized according to a standardized list of analytical categories (artifact classes and types); the physical collection was rearranged accordingly. Quality control checks were then conducted to ensure accuracy. The resulting database, along with field notes and photographs, was used to reconstruct the distribution of artifacts and features unearthed during the field school excavations. These reconstructions, supplemented with new radiometric dates, provide the basis for the present analysis. Analytical units were assigned to unit-levels containing diagnostic artifacts and/or dated samples that were determined to have good contextual integrity. These AUs, representing a series of excavated proveniences that can be associated with a given time period, provided the basis for all detailed, context-specific analyses that were conducted. The largest analytical category was the lithic artifacts, which were categorized by class (tool, flake or core) and by raw material. More detailed analysis consisted of type classifications as well as recording observations related to manufacturing techniques and skill. Ceramics were examined macroscopically and then sub sampled for petrographic analysis. Radiocarbon and archaeobotanical samples from features were analyzed and used to identify feature dates and types. Features were studied through available documentation and described using standardized descriptors. Methods utilized to address questions of site formation and artifact context within the field school excavation pit will combine a synthesis of literature resulting from previous geoarchaeological investigations at various sites in the vicinity of Spring Lake, and limited analysis of profile illustrations from both the field school excavation block and from an adjoining excavation block excavated more recently during the 2014 Spring Lake Data Recovery Project (SLDR). Finally, faunal remains were subject to special analysis to the taxa level as well as considerations regarding temporal trends.

CHAPTER 5: ANALYTICAL UNITS AND APPROACHES

By Amy E. Reid

Analytical Units

Investigations during the 2001, 2002, 2003 and 2006 University field school seasons resulted in a total of 12 excavation units (Figure 5-1). Upon completion in 2006, all units were excavated to a final depth of 170 cm below datum. Approximately 24 cubic meters of sediment was excavated over four discontinuous summer session field schools.

In general, units were excavated in ten-centimeter levels. However, in some cases this interval was reduced to five centimeters to increase resolution in areas of relatively high artifact density. Unless stated otherwise, all depths provided are relative to a datum established on a palm tree at 1.00-meter arbitrary elevation.

Over 151,000 artifacts were recovered from the 2001, 2002, 2003 and 2006 field school investigations at 41HY160 including projectile points, formal and informal stone tools, debitage, prehistoric and historic ceramics, bone, shell, burned rock, and various historic artifacts. These artifacts represent continuous, multiple episodes of occupation dating from the Early Archaic to the Late Prehistoric.

In preparing for the analysis of the collection, a series of analytical units (AU) were established based on temporally diagnostic projectile points and radiometric dates, including those run on bison bone as well as charred plant material. AUs are a set of discrete, intact cultural deposits that represent recognizable periods in the occupational history of the site. They are chronological in nature, and therefore rely on the law of superposition, cross-dating principles, typology, and context. AUs are utilized here as a series of excavated proveniences that can be associated with a given time period; that provide the basis for all detailed, context-specific analyses conducted. This step is vital for assessing behavioral changes through time.

Sensitive Material
Restricted Access Only

Figure 5-1. Site Map of 41HY160 showing location and orientation of the fieldschool excavation units.

Projectile point types were typed according to definitions of regionally occurring styles presented by Turner and Hester (1999), Prewitt (1995), Bell (1993; 1996), and Perino (1996a; 1996b). Analytical units were established based on the contexts of diagnostic artifacts within unmixed and undisturbed deposits, to the extent that this could be determined. Table 5-1 lists the AUs with associated diagnostic projectile points. Deposits are considered to be mixed or disturbed if younger points or absolute dates occur below older points or dates. Older temporal markers occurring above or in association with younger ones are not necessarily considered indicative of disturbed contexts given the potential for post-depositional collection and curation by subsequent occupations. Equally, when mixed deposits contain projectile points from two different but consecutive time periods, they are considered transitional zones representing the time in between the major time periods when point styles gradually phase out and new ones are favored. Table 5-2 illustrates spatial and temporal relationships of the excavation units and the assigned analytical units, including transitional AUs assigned to unit-levels containing time diagnostic projectile points from multiple, but contiguous (neighboring) major time periods.

Table 5-1. Analytical Units Associated with Diagnostic Projectile Points

AU	**Type**	**Unit**	**Level**	**Top Depth (cmbd)**	**Bottom Depth (cmbd)**	**Period**	**Lot-Specimen #**
1C	Marcos	14	6	80	90	Late Archaic/Late Prehistoric	110-4
	Ellis	14	6	80	90	Late Archaic/Late Prehistoric	110-1
	Montell	16	6	80	95	Late Archaic/Late Prehistoric	139-1
2B	Bulverde	14	7	90	100	Late Archaic I	111-1
	Bulverde	17	7	90	100	Late Archaic I	154-1
	Pedernales	15	8	102	105	Late Archaic I	126-1
	Pedernales*	8	5	71	81	Late Archaic I	20-1
	Lange*	17	7	90	100	Late Archaic I	154-3
	Nolan*	13	8	105	115	Late Archaic I	97-1
2C	Bulverde	8	7	91	99	Late Archaic/MA	22-3
	Bulverde	8	7	91	99	Late Archaic/MA	22-4
	Bulverde	8	8	100	110	Late Archaic/MA	23-1
	Bulverde	12	9	113	121	Late Archaic/MA	84-2

Table 5-1. Analytical Units Associated with Diagnostic Projectile Points

AU	Type	Unit	Level	Top Depth (cmbd)	Bottom Depth (cmbd)	Period	Lot-Specimen #
	Travis	8	7	91	99	Late Archaic/MA	22-5
	Travis	8	7	91	99	Late Archaic/MA	22-6
	Nolan	12	8	103	113	Late Archaic/MA	83-2
	Nolan	12	9	113	121	Late Archaic/MA	84-4
	Pedernales	12	8	103	113	Late Archaic/MA	83-1
	Pedernales	12	9	113	121	Late Archaic/MA	84-3
	Andice Barb*	14	8	100	110	Late Archaic/MA	112-2
	Langtry*	14	8	100	110	Late Archaic/MA	112-1
3	Andice	12	13	150	159	Middle Archaic	88-5
	Early Triangular	16	10	120	129	Middle Archaic	143-1
	Early Triangular	17	12	140	149	Middle Archaic	159-1
	Early Triangular	17	12	140	149	Middle Archaic	159-2
	Travis	16	11	130	139	Middle Archaic	144-1
	Travis	17	11	130	139	Middle Archaic	158-1
3A	Nolan	8	9	111	120	MA Clear Fork	24-2
	Nolan	10	10	123	132	MA Clear Fork	56-1
	Nolan	10	10	123	132	MA Clear Fork	56-2
	Nolan	11	10	120	129	MA Clear Fork	71-2
	Nolan	14	9	110	119	MA Clear Fork	113-1
	Travis	13	9	115	123	MA Clear Fork	98-1

Table 5-1. Analytical Units Associated with Diagnostic Projectile Points

AU	Type	Unit	Level	Top Depth (cmbd)	Bottom Depth (cmbd)	Period	Lot-Specimen #
3B	Early Triangular	8	11	133	133	MA Oakalla	26-2
	Early Triangular	8	14	150	159	MA Oakalla	29-2
	Early Triangular	12	12	140	149	MA Oakalla	87-1
	Early Triangular	12	12	140	149	MA Oakalla	87-2
3C	Andice	9	14	150	159	MA Jarrel	44-1
3D	Lerma	16	14	160	170	Middle Archaic/Early Archaic	147-1
	Early Triangular	16	14	160	170	Middle Archaic/Early Archaic	147-2
	Early Triangular	17	10	120	129	Middle Archaic/Early Archaic	157-1
4	Martindale	11	14	160	170	Early Archaic	75-3
	Merrell	13	15	160	170	Early Archaic	104-1
	Merrell	13	15	160	170	Early Archaic	104-1
	Merrell	15	15	160	170	Early Archaic	133-1

Table 5-2. Spatial and temporal chart of the excavation units and the assigned analytical units, including transitional AUs.

North Tier				
XU	**11**	**9**	**6**	**7**
LV				
1	**62**	**31**	*	**1**
2	**63**	**32**	*	**2**
3	**64**	**33**	*	**3**
4	**65**	**34**	*	**4**
5	**66**	**35**	*	**5**
6	**67**	**36**	*	**6**
7	**68**	**37**	*	**7**
8	**69**	**38**	*	**8**
9	**70**	**39**	*	**9**
10	**71**	**40**	*	**10**
11	**72**	**41**	*	**11**
12	**73**	**42**	*	**12**
13	**74**	**43**	*	**13**
14	**75**	**44**	*	**14**
15		**45**	*	**15**

Middle Tier				
XU	**10**	**12**	**8**	**13**
1	**46**	**76**	**16**	**90**
2	**47**	**77**	**17**	**91**
3	**48**	**78**	**18**	**92**
4	**49**	**79**	**19**	**93**
5	**50**	**80**	**20**	**94**
6	**51**	**81**	**21**	**95**
7	**53**	**82**	**22**	**96**
8	**54**	**83**	**23**	**97**
9	**55**	**84**	**24**	**98**
10	**56**	**85**	**25**	**99**
11	**57**	**86**	**26**	**100**
12	**58**	**87**	**27**	**101**
13	**59**	**88**	**28**	**102**
14	**60**	**89**	**29**	**103**
15	**61**		**30**	**104**

South Tier				
XU	**14**	**16**	**15**	**17**
1	**105**	**134**	**119**	**148**
2	**106**	**135**	**120**	**149**
3	**107**	**136**	**121**	**150**
4	**108**	**137**	**122**	**151**
5	**109**	**138**	**123**	**152**
6	**110**	**139**	**124**	**153**
7	**111**	**140**	**125**	**154**
8	**112**	**141**	**126**	**155**
9	**113**	**142**	**127**	**156**
10	**114**	**143**	**128**	**157**
11	**115**	**144**	**129**	**158**
12	**116**	**145**	**130**	**159**
13	**117**	**146**	**131**	**160**
14	**118**	**147**	**132**	**161**
15			**133**	**162**

Prehistoric
Late Archaic/Prehistoric
Late Archaic
Middle Archaic/Late Archaic
Middle Archaic

Early Archaic

Based on the recovery of chronologically diagnostic materials and radiocarbon dates of bison bone and charcoal, seven AUs were identified: AU 1, Late Prehistoric (Toyah and Austin); AU 2A, Late Archaic II; AU 2B, Late Archaic I; AU 3, Middle Archaic; AU 4, Early Archaic.

A Note about Radiocarbon Dating

A total of 20 charcoal samples were submitted to PaleoResearch Institute for identification and AMS radiocarbon dating. Additionally, 11 bison bone samples were submitted to the University of California Irving for AMS dating. Samples were selected to address several questions. Most important was establishing chronological control for the excavations. The previous testing phase of the Rivers Center project yielded three radiocarbon dates from wood charcoal samples and concluded that early Late Archaic and late Middle Archaic occupations were present (Nickels and Bousman 2010). Temporally and culturally diagnostic artifacts recovered during the testing documented Late Prehistoric to Middle Archaic components. Therefore, emphasis was placed on precisely dating all the cultural sequences present. All radiometric data from the 41HY160 field school collection are presented by context in Table 5-3.

AU 1: Late Prehistoric

This AU represents the Late Prehistoric assemblage and includes all arrow points and ceramic artifacts overlying the earlier Archaic components. With ideal contextual resolution, this AU can sometimes be sub divided into two phases: Toyah (AU 1a) and Austin (AU 1b). The Toyah phase, distinguished by the Perdiz arrow point style, extends from around 800 BP to as late as 350 BP in Central Texas (Johnson 1994:257-258; Johnson and Goode 1994:41). Perdiz points were recovered between 51 – 64 centimeters below datum (cmbd). However, these levels also contained a Scallorn point from the Austin phase, as well as younger, Historic materials suggesting a disturbed context. AU 1b represents the Austin phase, characterized by the Scallorn and Edwards arrow point styles. The Austin phase extends from 1200 BP up to the onset of Toyah (Collins 2004: 122). At the 2001-2006 41HY160 field school location, two Scallorn points were located. One, from a disturbed fill deposit (Specimen 164-2), and another from level 3 of Unit 7 (Specimen 3-5). No Edwards points were found in this assemblage. Due to the uncertain context of the Perdiz and Scallorn points in this assemblage, researchers were not able to distinguish Toyah deposits from Austin deposits. However, a charcoal sample (Specimen 19-2) dating to 730-760 cal BP, was used to establish a general Late Prehistoric AU (AU 1) within level 4 of Unit 8 at 65.50 cmbd. The Late Prehistoric AU was also established based on six additional lots containing prehistoric ceramic sherds: 109, 18, 79, 122, 151, 152.

Table 5-3. Analytical Units Associated with Charcoal and Bison Bone Dates

Laboratory Number	Field Sample Number	Analytical Unit	Unit	Level	Depth	Material	^{14}C age	±
PRI-10-88-19.2	160-19-2	LP	8	4	65.50	*Quercus*-Leucobalanus charcoal	765	20
PRI-10-88-49.4	160-49-4	LA/LP	10	4	75.50	*Quercus*-Leucobalanus charcoal	1245	20
PRI-10-88-20.2	160-20-2	LA	8	5	75.50	*Prosopis* charcoal	1790	20
UCIAMS-80135	160-94-2	LA	13	5	82.00	Bison, M 1/ or 2/	2255	20
PRI-10-88-124.5	160-124-5	LA	15	6	94.00	*Quercus*-Live oak charcoal	2880	20
PRI-10-88-153.5	160-153-5	LA	17	6	84.50	*Quercus*-Live oak charcoal	2485	20
UCIAMS-80137	160-53-4	LA	10	7	105.50	Bison, rib fragment	2210	20
PRI-10-88-68.1	160-68-1	LA	11	7	97.50	*Condalia* charcoal	2690	20
PRI-10-88-82.4	160-82-4		12	7	100.50	*Quercus*-Live oak charcoal	1980	20
PRI-10-88-140.3	160-140-3		16	7	100.00	*Condalia* charcoal	3405	20
PRI-10-88-140.4	160-140-4		16	7	104.00	*Condalia* charcoal	2080	20
PRI-10-88-69.3	160-69-3	LA	11	8	107.50	*Quercus*-Live oak charcoal	3320	20
UCIAMS-80138	160-97-9	LA	13	8	109.50	Bison, atlas or axis	2955	20
UCIAMS-80140	160-97-8	LA	13	8	109.50	Bison, rib fragment	2985	20
UCIAMS-80997	160-9-9		7	9	115.50	Bison, 1st phalanx	5180	15
UCIAMS-87170	160-24-4	MA	8	9	115.50	single charcoal (hardwood)	4880	15
PRI-10-88-55.5	160-55-5		10	9	118.00	*Condalia* charcoal	3840	20
PRI-10-88-127.2	160-127-2	MA	15	9	109.50	*Condalia* charcoal	3900	20
UCIAMS-87173	160-142-3		16	9	124.50	single cf. *Condalia* sp.	3865	15
UCIAMS-87174	160-157-4	MA	17	10	124.50	single cf. *Condalia* sp.	4140	15
PRI-10-88-57.6	160-57-6	MA	10	11	102.00	*Quercus*-Live oak charcoal	4295	20
PRI-10-88-86.4	160-86-4	MA	12	11	134.50	*Quercus*-Live oak charcoal	4205	20
UCIAMS-87172	160-129-3	MA	15	11	127.50	single cf. *Condalia* sp.	3855	15

Table 5-3. Analytical Units Associated with Charcoal and Bison Bone Dates

Laboratory Number	Field Sample Number	Analytical Unit	Unit	Level	Depth	Material	^{14}C age	±
UCIAMS-87175	160-158-2	MA	17	11	134.50	single charcoal	4520	20
UCIAMS-87171	160-28-1	MA	8	13	143.00	single cf. *Condalia* sp.	4615	20
UCIAMS-81000	160-146-7	MA	16	13	154.50	Bison, metapodial keel fragment	5155	15
UCIAMS-81001	160-146-9	MA	16	13	154.50	Bison, limb fragment, humerus or femur	5165	15
UCIAMS-80139	160-14-5	EA/MA	7	14	154.50	Bison, limb diaphysis fragment, tibia?	5115	20
UCIAMS-80998	160-14-4	EA/MA	7	14	154.50	Bison, limb diaphysis fragment, indet.	5120	20
UCIAMS-80999	160-44-5	EA	9	14	165.00	Bison, bone fragment	5060	40
UCIAMS-80136	160-15-17	EA/MA	7	15	165.00	Bison, limb diaphysis fragment, indet.	5120	20

AU 2: Late Archaic

The late Archaic is a very long period that is believed to incorporate a large volume of meaningful cultural variation in terms of adaptive behaviors. Recognizing this variation is problematic though, and implementing more refined chronological schemes is dependent on the degree to which remains from the different Late Archaic intervals are often found compressed, mixed or otherwise poorly resolved. Much of this is related to climatic processes that are unfavorable to stratigraphic resolution and clarity. Johnson and Goode (1994), for example define the very dry Edwards interval as beginning at this time. This xeric period would have been associated with soil erosion or reduced rates of sedimentation. Coupled with cultural processes involving digging shallow pits for earth ovens, strata from this period are commonly mixed or altogether absent. Still, given long enough spans of time, the Late Archaic can be subdivided into more refined chronological units.

In this collection, point styles diagnostic of the Late Archaic II subperiod (AU 2A) were recovered, including Ensor, Ellis, Marcos and Montell. However, these were found in lots also containing Late Prehistoric point styles. Therefore, these contexts were labeled as a LA/PH analytical unit (AU 1C) and were examined as transitional zones that are not necessarily indicative of compromised contextual integrity.

AU 2B represents a Late Archaic I component at the site, which dates from 4300 BP to 2550 BP (Johnson and Goode 1994:34). This AU consists of two Bulverde points, one Pedernales point and nine dates obtained from samples of charcoal and bison bone fragments.

AU 2C was established as a transitional AU for unit-levels containing point styles diagnostic of both the Late Archaic I (4 Bulverde; 1 Pedernales) and Middle Archaic (2 Travis; 1 Nolan).

AU 3: Middle Archaic

The Middle Archaic at the 41HY160 field school block location is categorized as AU 3, and is represented by the largest number of diagnostic projectile points, including Nolan, Travis, Early Triangular, and Andice. This AU was also established based on dates obtained from eight samples of charcoal and two samples of bison bone. The Middle Archaic is by far the best represented cultural period in the block, and the greatest concentration occurs between 110 and 170 cmbd, though in some units this can be as shallow as 90 cmbs.

Travis points are considered part of the latter part of the Middle Archaic and are generally associated with Nolan style points stylistically and temporally (Collins 2004:120). Collins (2004) dates the Middle Archaic period to around 6000 BP to 4000 BP, and subdivides the period into three projectile point intervals: Nolan and Travis, Taylor (also includes Baird and Early Archaic), and Bell-Andice-Calf Creek. Following this chronology, the 41HY160 field school assemblage can be divided into 3 subperiods: The Nolan and Travis (AU 3A), Early Triangular (AU 3B), and Bell-Andice-Calf Creek (AU 3C).

Editor's Note: The 2001-2006 excavations can be credited as the first investigations to identify an intact Calf Creek component at the Spring Lake Site. The Calf Creek component was evidenced by the recovery of three Calf Creek artifacts (Andice) within well stratified and datable contexts. Following the popular Central Texas chronologies of the time, the present analysis was conducted according to the belief that the Calf Creek horizon occurred during the Middle Archaic. Today, based on the sharply defined period of bison exploitation and a marked disjunction of Bell/Andice material with later Middle Archaic deposits, the authors consider the Calf Creek horizon to represent the terminal Early Archaic period at 41HY160 (Lohse et al 2014).

AU 3D represents the MA/EA; was assigned to unit-levels containing point styles diagnostic to both the Middle Archaic and the Early Archaic. This AU was examined as a transitional period when Early Archaic point styles gradually became superseded by Middle Archaic styles. The transition between the Early and Middle Archaic occurs between 150 and 170 cbmd. Three bison dates are associated with this transitional period (Table 5-3).

AU 4: Early Archaic

AU 4 represents the earliest deposits recorded from the 2001-2006 excavations, the Early Archaic period. This AU was established based on three Merell points, one Martindale point, and one date obtained from a Bison bone fragment. The Early Archaic period appears to roughly correspond with the B-2 soil horizon at 41HY160, and is found below 160 cmbd. The depth of this cultural period is unknown because it is located below the termination of the excavation.

Analytical Approaches

The focus of the analysis for 41HY160 is on material contained within the analytical units described above. These AUs represent only a portion of the overall collection; however, they are the only samples of the assemblage that can be confidently described as being from non-disturbed deposits based on the spatial distribution of diagnostic projectile points or radiocarbon dates. The remainder of the collection, items not recovered from within these AUs, has been sorted and cataloged but were not subjected to analyses.

The first task prior to the current analysis involved re-organizing the entire collection by provenience. Lot numbers were assigned to the smallest definable unit of excavation. In most cases, lot numbers represent a single level of one quadrant of an excavation unit. Artifacts from a specific lot were assigned specimen numbers based on the class and type of the artifact.

All of the artifacts were sorted and bagged according to the class and type of artifact. Artifact class is a general category such as lithic, ceramic, metal, etc. and type is more specific description such as biface, stoneware, nail, etc. Table 5-4 lists the artifact classes and types used for this project. In some cases, a description was given that related the specific species, raw material, or function of the object. During the sorting, most artifact categories were counted and weighed. Materials that were not counted included microdebitage, miniscule objects recovered from flotation samples, and small fragments of shell.

Table 5-4. Artifact classes and types used for this project.

Artifact Class	Artifact Types
Bone	fauna, Homo Sapiens, unknown
Building Material	brick, cement, concrete, mortar, other, plaster, wattle/daub
C14	charcoal
Ceramic	creamware, other, pearlware, pipe, porcelain, prehistoric, Spanish Colonial, stoneware, terra cotta, unknown, white earthenware
Float Sample	<0.5mm, 0.5 to 1.0 mm, 1 to 2 mm, >2 mm, combined, other
Glass	Bottle, unknown, window
Lithic	debitage, biface, blade, broken flakes, burned non-flake debitage, burned rock, complete flakes, core, Distinctive Expanding Billet (DEB), exotic material, ground stone, mica, microdebitage, notching flakes, ochre, other, projectile point, proximal flake, R-flake, uniface, unknown, unsorted
Metal	bottle cap, firearms and munitions, hardware, household, other, round nail, scrap, square nail, tools, unknown
Organic	nutshell, other, plant, rhizolith, seed, wood
Other	-
Other Prehistoric	burned clay, unknown
Personal Items	bead, button, clothing related, other
Sediment	non-cultural, other, soil sample, unsorted
Shell	bivalve, fossil, snail, unknown

Detailed analytical approaches for each of these categories are discussed in the appropriate chapters. They are briefly summarized here, however, for ease of reference. Lithics included all chipped stone and ground stone artifacts recovered during the 2001, 2002, 2003 and 2006 field schools. In addition to being counted and weighed, all the lithics in the assemblage were sorted into categories based on artifact form, function, and material type. Only lithics recovered from AUs were carefully analyzed with the overall research design for this project kept closely in mind. Specific approaches used in this analysis, and the results are presented in Chapter 6.

Ceramics in the collection were initially sorted according to prehistoric or historic origin. The historic ceramics were further subdivided according to type (see Table 5-3). All of the prehistoric ceramics were submitted for analysis to the Center for Archaeological Research at the University of Texas at San Antonio; the result of this analysis is presented in Chapter 7.

The analysis of plant remains is one avenue of research into a group's foodways – the procurement, production, preparation, consumption, display, storage, and discard of food. These practices vary by economic, social, and political situation, and, hence, cultural traditions of a group (Johannessen 1993). Plant remains were analyzed from 11 floatation samples collected from 11 features, and 126 bulk samples collected from 74 unit/level contexts at the site. Floatation samples were submitted to Dr. Kandace Hollenbach for analysis. Results are presented in Chapter 8.

All features discussed in the present report were those that were identified during the four field school seasons; the present analysis was limited to a review of the original documentation and photography. The results of the feature analysis are presented in Chapter 9.

Collected faunal remains were identified to taxon and element, and were weighed, tagged and bagged individually. Within a given lot, individual specimens identifiable by element and taxon were also assigned specimen numbers. In total, faunal material from 32 lots from four excavation units were examined. Lots were selected for study based on associated temporal data; material not from AUs was not carefully examined. The relative frequencies of faunal material, standardized across AU for consistency in occurrence, were compared. Patterns of taxonomic occurrence through time at 41HY160 were examined for clues to procurement and utilization of faunal resources at Spring Lake. Results of the faunal analysis are presented in Chapter 11.

CHAPTER 6: LITHIC ANALYSIS

Drew Sitters, Antonio Padilla and Amy E. Reid

Editor's Note: This chapter describes the culturally altered lithic material (chipped stone tools and debris) recovered from investigations at 41HY160 during the 2001, 2002, 2003 and 2006 field school seasons. Lithic materials from 41HY160 were organized into the following categories: projectile points, bifaces, unifaces, flake tools, cores, debitage, hammerstones and groundstone artifacts.

The analysis of each of these categories is described in the methodology of each section. Lithic analyses were designed to address the interrelated research domains that consider prehistoric economy, technology, and mobility within the context of environmental change through time at Spring Lake (see Chapter 4). Detailed analyses on raw material types were not conducted as the vast majority of lithic material found at 41HY160 is of the Edwards Chert variety.

First, a complete descriptive analysis of the projectile points was conducted by Drew Sitters. The projectile point analysis was also designed to examine the function(s) projectile points may have served within a prehistoric society and what implications this may have on interpreting group behavior. The analysis intends to address Central Texas hunter gatherer behavior in terms of projectile point tool use, task specialization, skill, and style. Projectile point frequencies and temporal patterns identified within the established analytical units are also discussed.

The theoretical perspective behind the analyses conducted on the non-projectile categories (bifaces, unifaces, flake tools, cores and debitage) mirrors that of previous investigations of 41HY160 and nearby sites and assumes that the tool assemblage can provide the foundation for differentiating between foraging and collecting strategies. In other words, the work presented below attempts to reconstruct the contexts within which tools were made, used and discarded by identifying and exploring patterns of curated technologies and tool systems that emphasize expediency at 41HY160. It is typically believed that if an assemblage is characterized by mostly expedient tools, then it could be said that the people associated with that assemblage lived in a resource-rich environment (Binford 1979, Andrefsky 2005, Weinstein 2005). It is also hypothesized that expedient tools characterize a "forager" society that is somewhat mobile and extracts foods from a variety of resources (Binford 1979, 1980, Lohse 2011, Weinstein 2005). Conversely, if an assemblage is made up of mostly curated and highly specialized tools, then the society occupied sites for longer periods, made relatively fewer residential moves, and commonly sent out task groups on logistical forays to procure a small number of predictable resources (Binford 1980, Lohse 2011). This type of economic activity is believed to be characteristic of "collector" societies and would require reliable and maintainable tools (Binford 1979, 1980; Lohse 2011). It is our understanding that the concepts of expediency and curation cannot be truly understood by studying associated tool types. Rather, in the present study, we explore how these processes may have influenced tool use.

The debitage recovered from within analytical unit lots was separated into the following categories for analysis by Antonio Padilla: complete flakes, proximal flakes, broken flakes, r-flakes, distinctive expanding billet (DEB) flakes, notching flakes and burned non-flaked debitage. Billet flakes (r-flakes and DEBs) were sorted from the complete flakes in order to identify general flaking technologies. However, after reviewing the available data and analysis notes, it was determined that the assemblage was not initially sorted into non-thinning and thinning flakes before the billet flakes were sorted. Therefore, the total number of general thinning flakes is not known (as they are still mixed in with the complete flakes). Unfortunately, this impedes comparisons between non-thinning flakes and thinning flakes and makes it difficult to reach meaningful conclusions about specialized billet technology as it compares to other thinning techniques at the site. The debitage analysis was focused on the Middle Archaic lots; so, the different flake types within other AUs may not have received the same level of detailed analysis.

The results of each analysis are presented below followed by a brief discussion of their temporal patterns and implications for lithic technological change through time (when data quality and sample sizes permitted).

Projectile Points

by Drew Sitters

Projectile points are relied upon in Central Texas as an indicator of time periods, and as a reflection of the distribution of cultures (Prewitt 1981:65). Variation among projectile point technology has been recognized and is commonly associated with geographical and temporal distribution, group mobility, subsistence preference, and hafting techniques (Turner and Hester 1993:4). The variation described above is characterized by morphological similarities and differences. Projectile point variation is most often considered between point types, but is rarely addressed within a point type. In the current report, projectile points and the vast amount of variation found within and between point types are used to address several inter- and intra-site questions. The analysis was designed to examine the function(s) projectile points may have served within a prehistoric society and what implications this may have on interpreting group behavior. The analysis intends to address Central Texas hunter gatherer behavior in terms of projectile point tool use, task specialization, skill, and style.

Archaeologists commonly associate projectile points with hunting, more specifically the piercing implement used to bring down game. Use-wear and functional analysis, ethnographic data, the sexual division of labor, and the context in which the artifacts are found all contribute to the classification of projectile points as hunting related tools. There is no doubt that many projectile points were made to be used as piercing and hunting implements. However, it is important to explore the alternate uses projectile points may have served within social groups. One type of variation, called functional variation, involves the various uses a tool may have served and may be useful when attempting to explain point variation. Macro- and microscopic studies have demonstrated that stone points were used for tasks other than piercing. For example, Glen Goode’s analysis of Pedernales and Bulverde points from the Anthon site in Uvalde County, Texas, revealed macroscopic use-wear associated with activities other than piercing within the same class of projectile points. (Goode 2002:51). Stanley Ahler

(1971) concluded that projectile points from Stratum 2 at Rodgers Shelter, in Benton County, Missouri, displayed various functional applications other than piercing. One last example comes from the Gault site, located approximately 74 miles north of site 41HY160. Projectile points belonging to the Calf Creek complex, which includes Bell and Andice points, were analyzed microscopically for the presence of identifiable use-wear. It was concluded that many of the Calf Creek points reflected cutting wear. Only one of the points analyzed reflected use solely as a piercing implement (Prilliman 1998: 13). Projectile point variation or the lack thereof may help interpret task group behavior. Another form of variation not discussed within this report, but worthy of mentioning is raw material variation. Raw material variation can include the quality of the stone used in point production, as well as the type of raw material chosen for point production. For example, projectile points are typically made from stone, but can also be made out of other raw materials such as mussel shell, bone, or petrified wood. A Perdiz-like projectile point was excavated from the Lower Pecos in South Texas composed of mussel shell (Personal Communication Steve Black).

Quantifying the degree of variation among point types may indicate task group specialization, such as master-craftsman knapping tools and other task groups (hunting, hide working, etc) with differing level of knapping knowledge crafting more daily tools and/or modifying tools made by others. Point type homogeneity, which includes metric standardization, coupled with consistent observable traits such as flaking patterns, can help distinguish between specialized and non-specialized point manufacturers and users. A high degree of craftsmanship or skill among a point type may reflect some degree of specialization as well, and variation within a point type can reveal uneven skill levels of the knappers involved. Recognizing skill in lithic assemblages is complex, subjective, and is a relatively new inquiry in North American archaeological studies (Bamforth and Finlay 2008; Lohse n.d.). Still, based on numerous studies of well-contextualized assemblages reflecting uneven skill and replication studies involving both experienced and beginner knappers (e.g., Finlay 2008; Nichols and Allstadt 1978), several traits are identified that indicate poorly-skilled flint working. A few of these traits were described by Kathryn Weedman (2010) following her ethnographic research with the community of Gocha, Konso district, Ethiopia. Weedman suggests that age and skill are evident through the knapper's ability to maintain a sharp working edge. Weedman notes that the reduction of the stone tools length through edge rejuvenation requires skill and strength. Less skilled and/or weaker knappers tend to produce unintentional spurs along the working edge and often break their tools during re-sharpening.

Style, as seen as a form of communicating identity, will also be explored. Projectile points recovered from 41HY160, as well as from other sites, provide information about the relationships of site inhabitants in other regions. Projectile point style is thought to have conveyed different kinds of information to prehistoric peoples (e.g., Sackett 1982; Wiessner 1983, 1984). Among these is membership in ethnic or regional groups that shared any number of possible traits and features that enjoin them in a cultural entity, however broadly defined. Joanna Casey (1998) stated that, "men travel to hunt, but their tools have a life and mobility independent of the men to whom they belong…. they are lost... or break and are abandoned by their owners, are in a sense calling cards…exquisitely designed projectile points is the material expression of symbolic behavior for social or supernatural protection". Style not only transmits information between ethnic or regional groups, but between task groups within the same ethnic group. Using similar techniques used for assessing specialization, such as identifying flaking patterns and standardization within and between point types, style will be evaluated.

Methodology

A total of (96) projectile points and point fragments were recovered from 41HY160. Of these, 65 are typeable dart points while 7 are typeable arrow points. Seventeen different point types were recovered, including 10 Early Archaic points: Lerma (n=1), Early Stemmed (n=1), Early Split Stemmed Variety (n=4), Martindale (n=1), and Merrell (n=3); 35 Middle Archaic points: Andice (n=3), Nolan (n=14), Early Triangular (n=9), and Travis (n=9); 21 Late Archaic points: Bulverde (n=8), Pedernales (n=8), Marcos (n=1), Montell (n=1), Ensor (n=1), and Ellis (n=2); 2 Austin phase points: Scallorn (n=2); and 5 Toyah phase points: Perdiz (n=5) (Figure 6-1). Additionally, 10 unidentifiable dart points, 7 unidentifiable projectile point base fragments, 6 unidentifiable dart point barbs, and 1 unidentifiable arrow point were recovered. Four projectile points, morphologically similar to the Pedernales point style, were recovered from an Early Archaic context. These points are referred to as an Early Split Stemmed Variety. It is not to be assumed that these points are a new point type or are out of context Pedernales points, yet rather reflect variation within an existing point type, such as Gower and/or Hoxie.

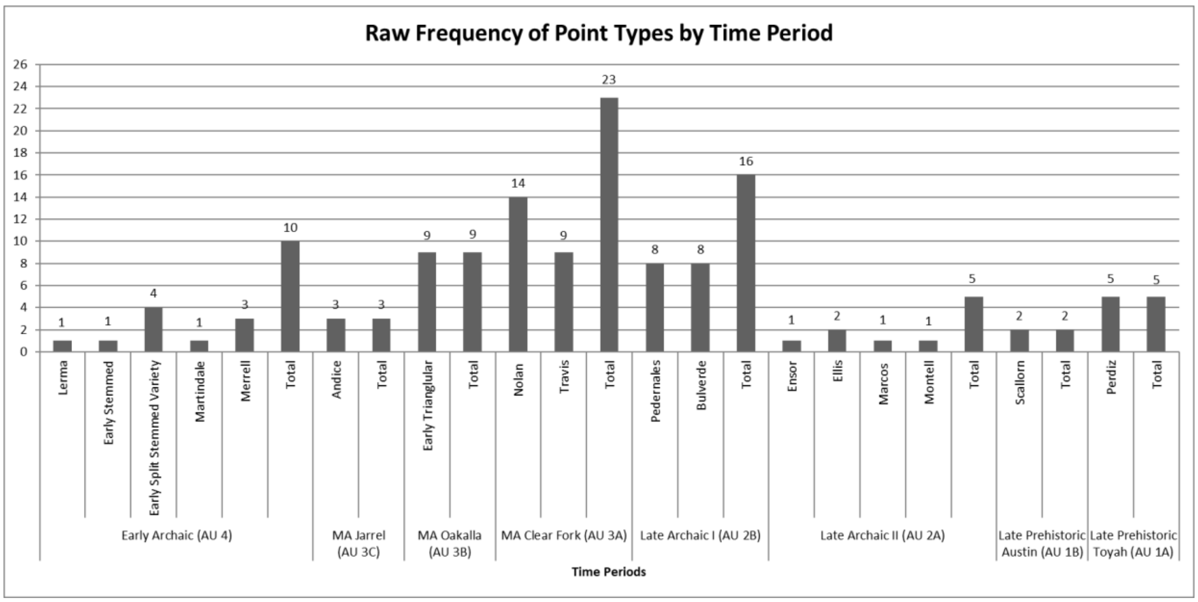

Figure 6-1. Raw Frequency of Point Types by Time Period.

After the projectile points were identified and sorted into their respective typological categories, metric dimensions were attained. Projectile points were divided into two components: the blade and the stem. When compared against the blade, projectile point stems are least affected by re-sharpening and impact damage. Stems can be un-hafted and re-sharpened, as well as damaged while in the haft element, but not as often as the blade portion of the point. Focusing on the stem may provide insight into the point manufacturers' skill, as well as any standards associated with point production. Using sliding calipers the total point length, blade length, stem length, blade width, stem width basal, stem width distal, basal concavity depth, stem thickness, blade thickness proximal, and blade thickness distal for each point were taken to the nearest tenth millimeter and weighed to the nearest tenth of a gram. Basal concavity depth was only measured for Pedernales points which displayed a considerable amount of variation within this category. Nearly complete dimensions were reconstructed and measured. The locations for each measurement are illustrated in Figure 6-2. Metric measurements for each point type are provided in Appendix A.

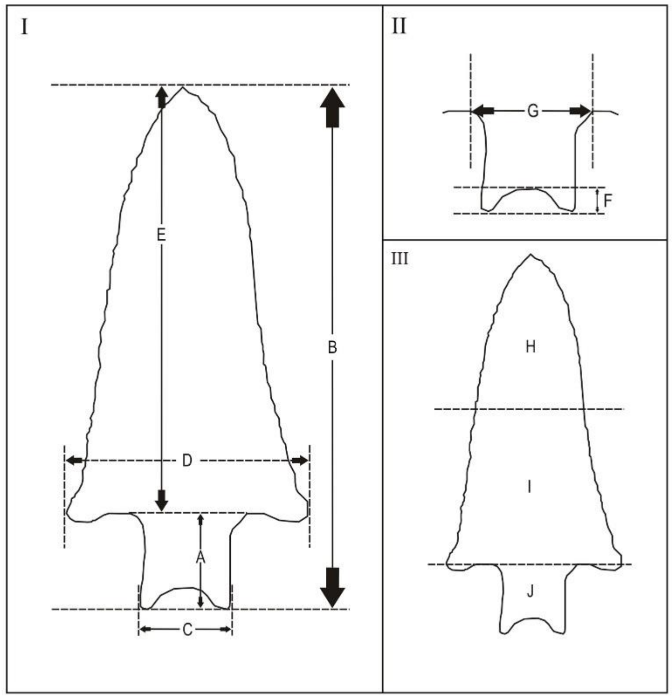

Figure 6-2. Locations of metric measurements: a.) stem length; b.) total length; c.) stem width basal; d.) blade width; e.) blade length; f.) basal concavity depth; g.) stem width distal; h.) location of blade thickness distal; i.) location of blade thickness proximal; j.) location of stem thickness.

One method employed by Texas archaeologists attempting to attain metric measurements was developed by Elton Prewitt (Prewitt 2005). His method allows for slightly greater control of where measurements can be taken, by using a pencil to trace the outline of the point. Despite this advantage, using a pencil will cause damage to the edges in the form of polish when viewed microscopically. The same can be said of metal calipers when taking metric measurements directly off the specimen. Anyone attempting to perform microscopic use-wear analysis should take both of these issues into account. One way to avoid creating false polish and there for obscuring wear polish is to perform microscopic use-wear analysis before attempting to attain metric measurements.

Following the acquisition of metric measurements, impact damage was assessed. Impact damage was evaluated in order to confirm a projectile's use as a projectile. Specific types of fractures associated with impact damage outlined by John Dockall (1997) were used in this analysis. These fractures include, but are not limited to, longitudinal macro-fractures, lateral macro-fractures, distal or transverse fractures, crushing or multiple step-fractures, and spin-off fractures. Damage to the distal end of a projectile is commonly associated with impact, although point damage can be the result of other functional activities including the disarticulation of an animal during butchering (personal communication Marilyn Shoberg). The frequency, type, and location of fractures were all considered together when associating the recorded damage with impact.

Basic descriptive attributes and technological aspects of each point were noted. These attributes include patina, heat treatment, beveling on the blade and/or stem, symmetry, flake terminations, blade serration, and flaking patterns. Flaking patterns are a technological method of finishing a projectile point and are described following Crabtree's (1972) descriptions. Six methods were identified by Crabtree. "Very regular parallel flaking" or "parallel" refers to flake scars that are similar in size and are perpendicular to the lateral edges of the point. They traverse inward and create a straight mid-line that extends along the longitudinal axis of the point. "Less regular parallel" is similar to the previous method, but flake length is controlled to a lesser degree, creating a sinuous mid-line along the longitudinal axis. "Collateral flaking" refers to irregularly sized flakes that are perpendicular to the lateral edges. Because of their size variations, there is no ribbon effect, but a sinuous mid-line exists similar to less regular parallel flaking. "Oblique parallel" flaking refers to similar sized, ribbon-like flakes that are not perpendicular to the lateral edges. However, flake scars meet in the middle and are parallel to one another, creating a diagonal ribbon. "Chevron" flaking refers to similar sized flakes that extend toward the proximal edge and meet in the center. This creates a fairly straight mid-line on the longitudinal axis with flake scars that are perpendicular to one another. Random or non-patterned includes any flaking pattern that could not be placed into one of the more specific categories described above (see Crabtree 1972:87). A seventh form of flaking not described by Crabtree is "Transverse flaking". Transverse flaking refers to flake scars that are perpendicular to the long axis and extend from one blade edge to the other, eliminating the presence of a mid-line. The basic descriptive attributes listed above can assist an analyst when assessing for skill and point standardization.

Finally, the specimens underwent macro- and microscopic analysis to identify areas of potential use. Once the location or locations of macroscopically observable traits were acquired, a sample of the projectile points were analyzed microscopically using an Olympus BH2 – UMA microscope with an objective range of 50X to 200X. The sample to undergo microscopy was chosen based on the number of specimens within each point type. A minimum of 5 specimens were required to be considered for microscopic analysis. The point types analyzed include Early Split Stemmed Variety, Early Triangular, Nolan, Travis, Bulverde, and Pedernales points. Each of these point types contained more than 5 specimens. Two specimens (44-1 and 89-3) were analyzed microscopically despite their lack of a robust sample size. The 2 points considered retained obvious edge modification with the potential for observable use-wear on a portion of the blade element. First the specimens were cleaned in an ultra-sonic bath. The artifacts were placed into bags individually filled with water and ammonia. The bags were then placed into the ultra-sonic device, where the specimens stayed for fifteen minutes. After being cleaned and rinsed, the points were laid out to dry. Alcohol and cotton swabs were used to clean the surface of each artifact after drying and before undergoing microscopic analysis. The location of polish and striations were recorded on a digitally traced outline of each projectile point within the sample and a photograph was taken using a Coolsnap^{TM}-Pro camera attached to the microscope. An example of the analysis sheet is illustrated in Figure 6-3. All complete points were sorted into six analytical sections and incomplete points were divided into as many analytical sections that were represented with both the ventral and dorsal sides illustrated. The division of the points into various sections will allow for a more controlled assessment of use-wear in relation to its location. It should be noted that due to the small and fragmented arrow point sample, no arrow points were analyzed microscopically.

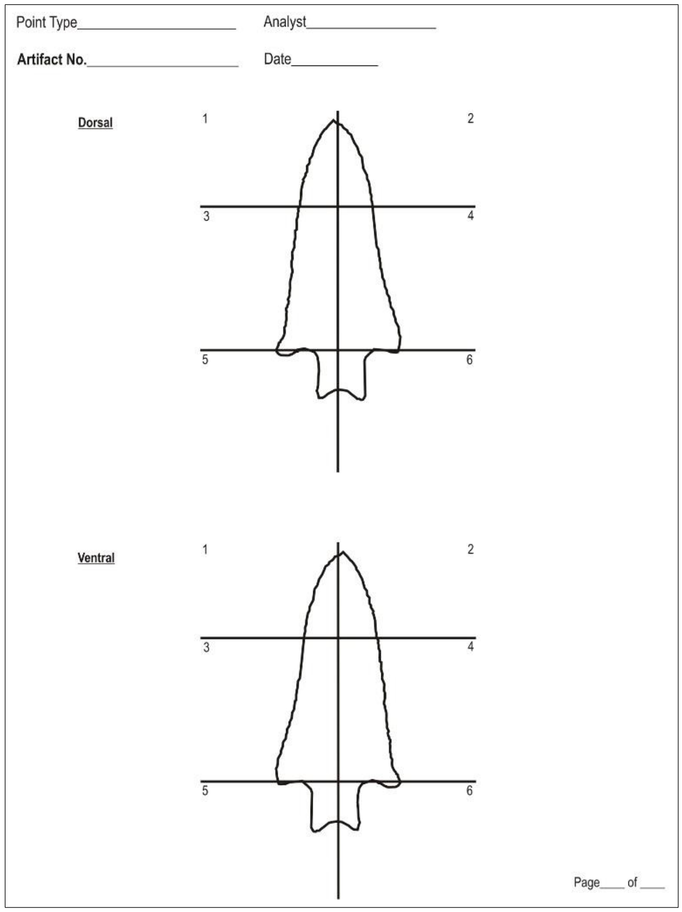

Figure 6-3. High magnification projectile point analysis sheet.

Point Type Descriptions by Time

Late Prehistoric

Perdiz

Phase: Toyah
Series: Blum
N= 5 (Specimen 3-1, 3-2, 3-3, 3-4, 64-1)
Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
3-1	-	-	-	2.74	-	-	8.26	-	1
3-2	-	34.9	12.66	2.54	1.92	-	-	-	1
3-3	29.82	20.48	18.8	2.4	2.14	9.34	7.84	2.5	1.1
3-4	-	-	-	-	-	17.14	3.66	2.76	.2

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
64-1	32.2	18.92	12.92	2.78	2.08	13.28	6.26	2.84	1

Morphology/Style: Morphological and style assessment of the Perdiz arrow points (Figure 6-4) revealed collateral and random flaking patterns. A beveled stem, serrated lateral edges, and the use of flakes for point production were frequent observable traits found within the Perdiz point type. Re-sharpening is common among these Perdiz points. The specimens are asymmetrical, although this may be due to damage and re-sharpening rather than a lack of skill. Variation in stem morphology is evident in specimens 64-1 and 3-3. Corner-notching appears to be the preferred style of stem and barb formation. Specimen 3-4 (not photographed) is a proximal fragment representing only the contracting stem portion of a Perdiz arrow point.

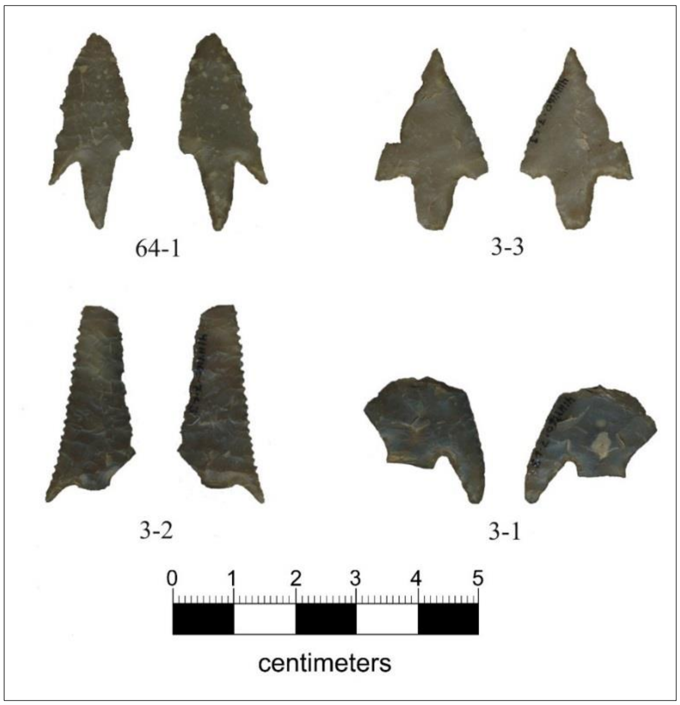

Figure 6-4. Perdiz points from 41HY160.

Macroscopic Use: Macroscopic analysis of the Perdiz arrow points revealed multiple forms of damage. Transverse fractures, crushing, and lateral macrofractures were identified on three of the specimens. The macroscopic damage is located on the stems, barbs, lateral edges, and the medial portions of the points. The types of damage present and its respective location on the specimens infers that the arrow points were damaged during impact on at least 3 of the points (3-1, 3-2, 64-1).

Scallorn

Phase: Austin

Series: Austin

N= 2 (Specimen 3-5, 164-2)

Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
3-5	-	-	13.46	2.58	-	5.12	8.06	6.38	1.94
164-2	-	-	17.12	3.84	3.04	6.42	-	7.18	2.6

Morphology/Style: The morphological and style assessment of the Scallorn points (Figure 6-5) reflected a less-regular parallel-like flaking trajectory on one of the points. The other specimen was clearly made on a flake with no evidence for bifacial flaking. The lateral edges of one specimen are serrated. Re-sharpening is not evident among the Scallorn point sample. Damage has obscured the symmetry of the points, although the remnants of Specimen 164-2 are symmetrical. Corner-notching is the preferred style of stem formation resulting in an expanding stem.

Figure 6-5. Scallorn points from 41HY160.

Macroscopic Use: Macroscopic analysis of the two Scallorn points revealed damage in the form of transverse fractures and crushing. The damage was restricted to the blade and stems of both specimens inferring that the damage was a result of impact.

Untyped Arrow Points

Phase: N/A
Series: N/A
N= 1 (Specimen # 137-1)
Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
137-1	-	23.92	16.5	2.16	1.9	-	-	-	-

Morphological/Style: The morphological and stylistic assessment revealed that the specimen (Figure 6-6) had been made on a flake with slight edge modification. The edge modification reflects a patterned form of flake removal similar to less-regular parallel flaking. The specimen is beveled although it does not appear to be a result of re-sharpening. The original flake morphology may have given the point its beveled look after slight edge modification. Despite the lack of a stem it appears as though the stem and barbs were formed through corner-notching.

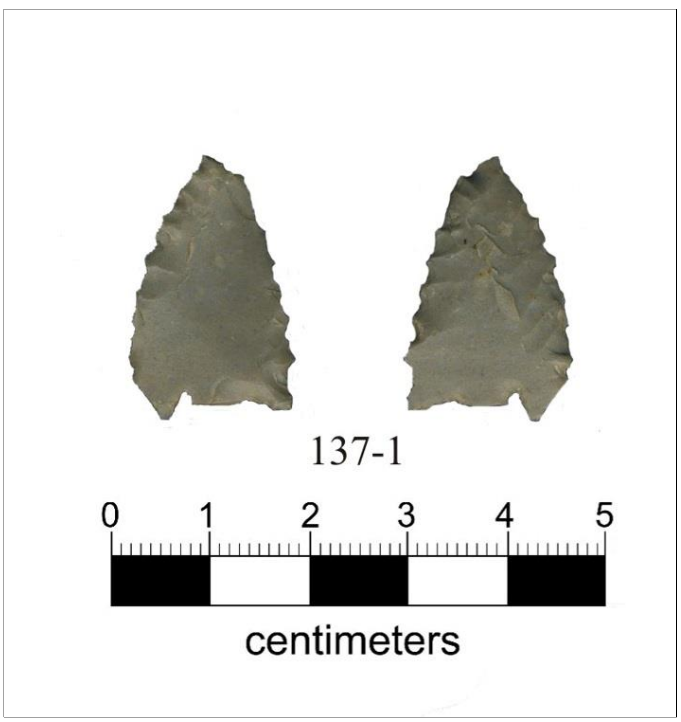

Figure 6-6. Unidentified Arrow point from 41HY160.

Macroscopic Use: The macroscopic assessment of the point exhibits a transverse fracture at the proximal end where the stem meets the blade element. It is not clear if the fracture was a result of impact. Some of the damage appears to be the result of poor craftsmanship. The poor symmetrical features and the expedient flaking approach suggest the manufacturer was not a highly skilled arrow point manufacturer.

Late Archaic

Ellis

Phase: Twin Sisters
Series: Rio Bravo
N=2 (Specimen #s 8-1, 110-1)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
8-1	55.32	45.36	24.47	5.77	4.71	9.96	21.07	15.85	4.47
110-1	45.79	34.09	29.15	6.7	5.8	11.73	21.19	16	5.51

Morphology/Style: The morphological and style assessment of the Ellis point type (Figure 6-7) revealed a random flaking pattern. One specimen (8-1) reflects a patterned form of flake removal along one blade edge on both faces. This patterned flake removal is obscured through re-sharpening. The morphology of the stem base varies from convex to straight. Both specimens have been reworked along at least one lateral edge. The re-touch present on both points resulted in the formation of obtuse edge angles. One barb was damaged during an attempt to re-sharpen the lateral edge. Blade beveling is present on at least one specimen as a result of re-sharpening. Specimen 110-1 was re-sharpened resulting in the removal of a burin along one lateral edge and multiple step terminations originating from the distal fracture plane. Corner-notching produced an expanding stem.

Figure 6-7. Ellis points recovered from 41HY160.

Macroscopic Use: Macroscopic analysis of the two Ellis points revealed damage in the form of transverse and lateral macro-fractures. The damage was restricted to the distal region, barbs, and lateral edges. The damage noted above appears to have been the result of impact.

Ensor

Phase: Twin Sisters
Series: Rio Bravo
N=1 (Specimen 41-2)
Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
41-2	39.75	26.25	22.88	7.08	6.35	13.5	25.05	18.87	4.53

Morphology/Style: The morphological and style assessment of the Ensor point type (Figure 6-8) was limited due to the re-sharpening of the lateral edges. The re-sharpening has obscured any evidence for patterned flaking. The point is fairly symmetrical, despite having been resharpened and damaged. The re-sharpening of this point resulted in the reduction of the point's length and in the beveling of the blade. The strong blade bevel suggests the point was re-sharpened while in the haft element. Both faces reflect the removal of basal thinning flakes. Side notching on this point produced an expanding stem and weak shoulders.

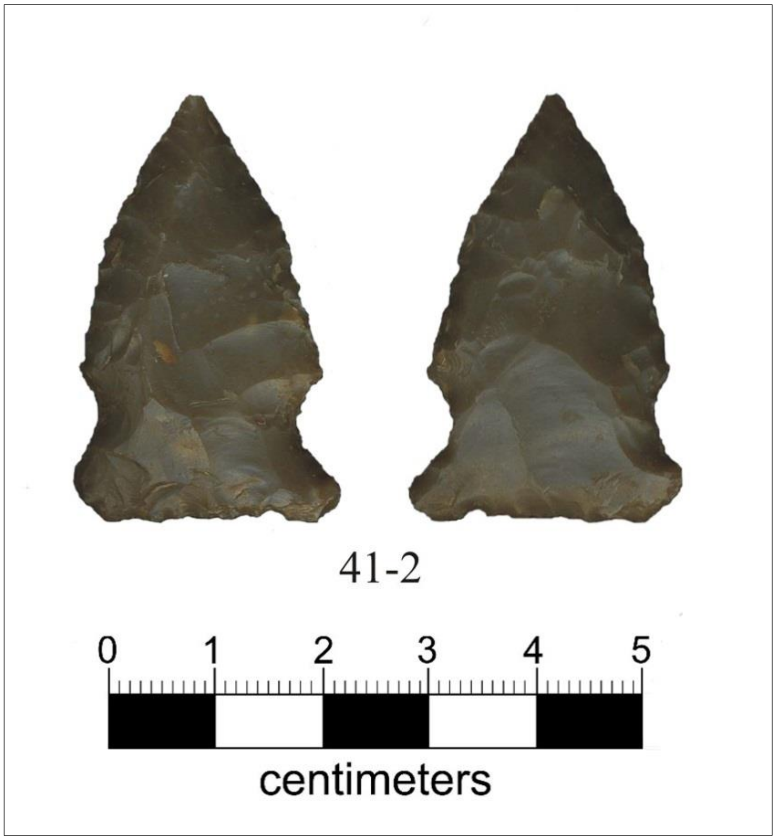

Figure 6-8. Ensor point recovered from 41HY160.

Macroscopic Use: Macroscopic analysis of the Ensor point revealed light crushing located at the base of the stem. The lack of and restricted location of the damage makes it difficult to attribute the visible damage with impact or piercing. Re-sharpening of the point appears to have resulted in the reduction of length, while maintaining the width.

Montell

Phase: Uvalde
Series: Nueces
N=1 (Specimen # 139-1)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
139-1	-	-	-	6.44	-	14.1	24.45	22.1	5.34

Morphology/Style: Due to the lack of a blade element it is difficult to assess the morphology and stylistic attributes of the blade (Figure 6-9). The remaining portion of the specimen, which consists primarily of the stem, reflects a random flaking pattern. The stem is expanding with a moderately deep, v-shaped basal notch. Together the basal and corner-notching caused the basal corners to flare outward. The deep corner notching produced a well pronounced barb. Re-sharpening is not apparent due to the lack of a blade. A flake was struck from the distal fracture plane, resulting in a deep bulb scar on one face.

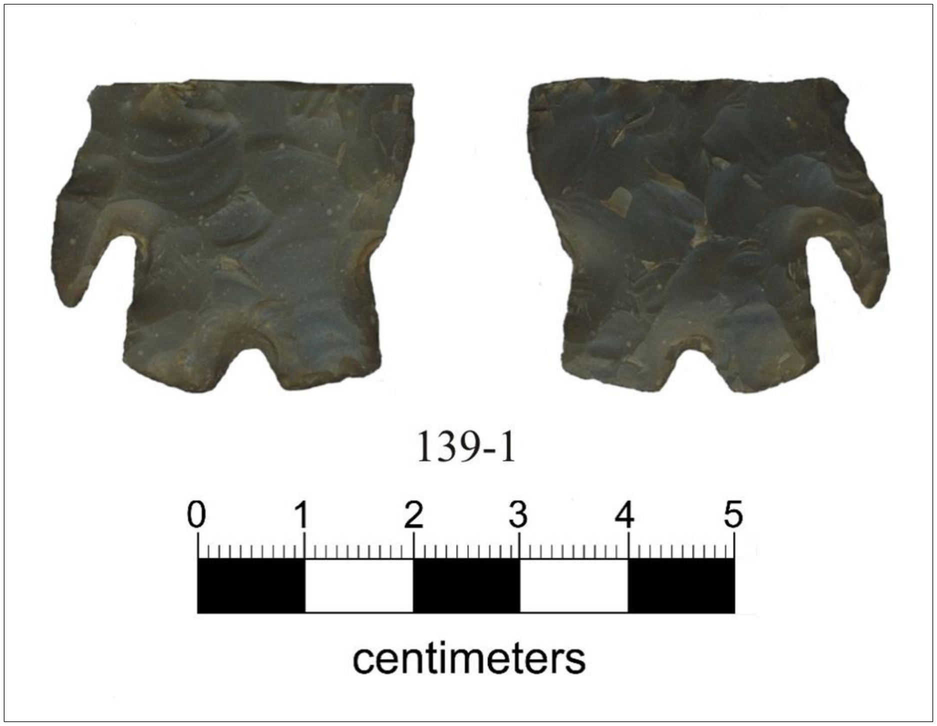

Figure 6-9. Montell point from 41HY160

Macroscopic Use: Macroscopic analysis identified damage in the form of transverse fractures. The damage resulted in the loss of half of the blade near the midpoint and one barb. The type and location of the fractures implies the damage was a result of impact.

Marcos

Phase: Uvalde
Series: Nueces
N=1 (Specimen # 110-4)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
110-4	-	-	-	7.76	-	13.15	30.66	21.95	6.37

Morphology/Style: The morphological and style evaluation exhibited a random flaking pattern with moderate symmetrical features (Figure 6-10). The stem base is slightly concave with prominent basal corners. Deep corner-notching has created a strong barb.

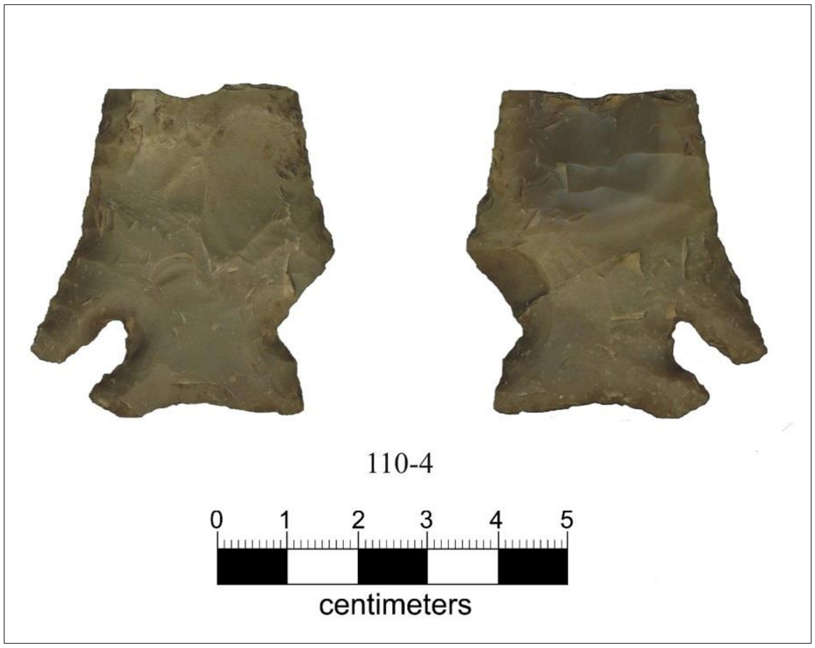

Figure 6-10. Marcos point recovered from 41HY160.

Macroscopic Use: Macroscopic analysis of the specimen identified damage near the distal end in the form of a transverse fracture. Slight crushing and flake scars running parallel to the long axis are present along the distal fracture plane. A barb has been fractured, yet the type of fracture causing the loss of the barb is unknown. Due to the location of the two fractures it may be presumed that the damage resulted from impact.

Pedernales

Phase: Round Rock
Series: Pecos
N= 8 (Specimen # 16-1, 54-1, 72-2, 83-1, 84-3, 96-1, 126-1, 164-3)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**	**Basal Concavity Depth**
16-1	81.46	61.6	36.76	6.36	5.06	19.86	18.63	19.96	6.48	7.02
54-1	-	-	-	5.31	-	15.72	15.87	17.66	5.41	3.54
72-2	55.86	40.72	31.1	5.84	4.49	15.14	15.2	16.07	5.82	2.08
83-1	54.68	39.26	29.5	7.79	4.91	15.42	-	18.73	6.58	2.78
84-3	-	-	-	-	-	18.08	20.06	23.25	5.78	5.73
96-1	53.91	37.2	30.06	7.83	5.61	16.71	17.61	19.28	6.27	2.94
126-1	57.1	34.69	27.9	8.54	5.79	22.41	20.06	22.33	9.11	6.94
164-3	-	-	38.03	6.78	6.58	21.27	21.82	22.88	6.74	5.34

After reviewing the metric data, it became apparent that a considerable amount of variation exists within the Pedernales point type. By using the standard deviation mathematical equation, a degree of variation was acquired for both blade and stem data. The standard deviations are presented in Table 6-1. After acknowledging the Pedernales point variation, an attempt to interpret the variation was first made by identifying morphological and stylistic attributes.

Table 6-1. Standard deviation for Pedernales dart point metric measurements.

Point Type	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thick-ness**	**Basal Concavity Depth**
Pedernales	11.722	10.809	4.156	1.176	.745	2.809	1.139	2.397	2.6	1.952
No. of Specimens	5	5	6	7	6	8	7	8	8	8

Morphology/Style: The morphological and style assessment revealed a random flaking pattern among the majority of Pedernales dart points (Figures 6-11, 12, 13). One Pedernales point (72-2) partially reflects a patterned form of flake removal, but is obscured by re-sharpening. Pedernales basal concavities vary in depth, ranging from deeply concave to shallow. Blade morphology also varies within this point type. It is presumed that the blade morphologies may reflect two different re-sharpening trajectories. These trajectories include re-sharpening in an attempt to maintain the length of the point, while the second trajectory maintains width over length. Corner-notching is the prevalent form of notching within this point type.

Figure 6-11. Pedernales dart points with shallow basal concavities (Group A).

Figure 6-12. Pedernales points with deep basal concavities (Group B).

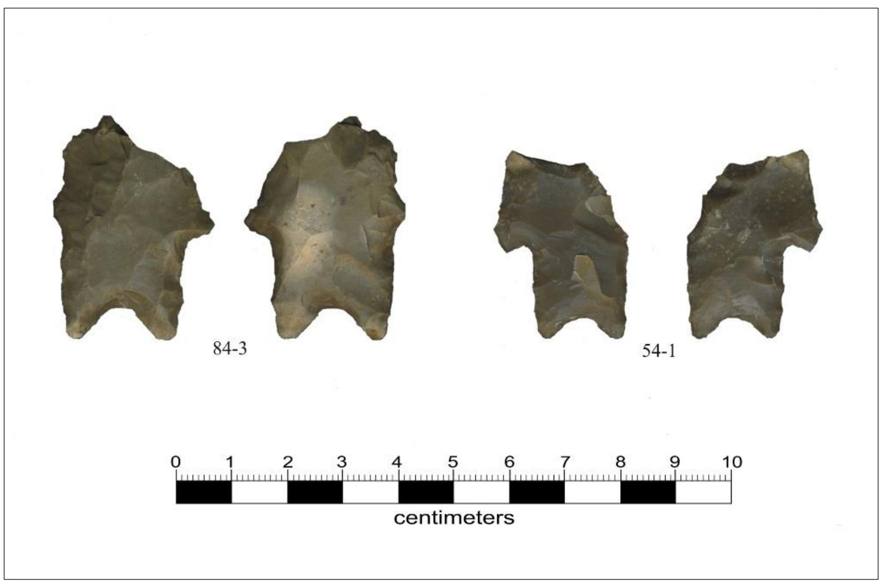

Figure 6-13. Pedernales dart point fragments.

In order to determine if a correlation between blade length and basal concavity exists, the ratio of blade length to basal concavity depth was calculated. Despite the small sample size, it does appear as though a correlation between blade length and basal concavity depth exists. Figure 6-14 illustrates this correlation. Cluster A represents the Pedernales points with shallow basal concavities and shorter blades. Cluster B, though loosely grouped, reflects Pedernales points with deep basal concavities and generally longer blades. Outlier 126-1 appears to have been heavily re-sharpened by someone other than the original manufacturer of the point, which possibly accounts for its shorter blade length. This assumption is supported by distinct differences in flaking skill between the stem and blade. Also, there is a lack of polish on the most recent flake scars, suggesting its discard after poorly being re-sharpened. It should be noted that the blade length of specimen 164-3 was reconstructed. The approximated blade length is supported by the specimen's blade width and remaining blade element. There were two specimens (Figure 6-13) not included in the Pedernales dart point blade length to basal concavity depth analysis due to the lack of a blade element.

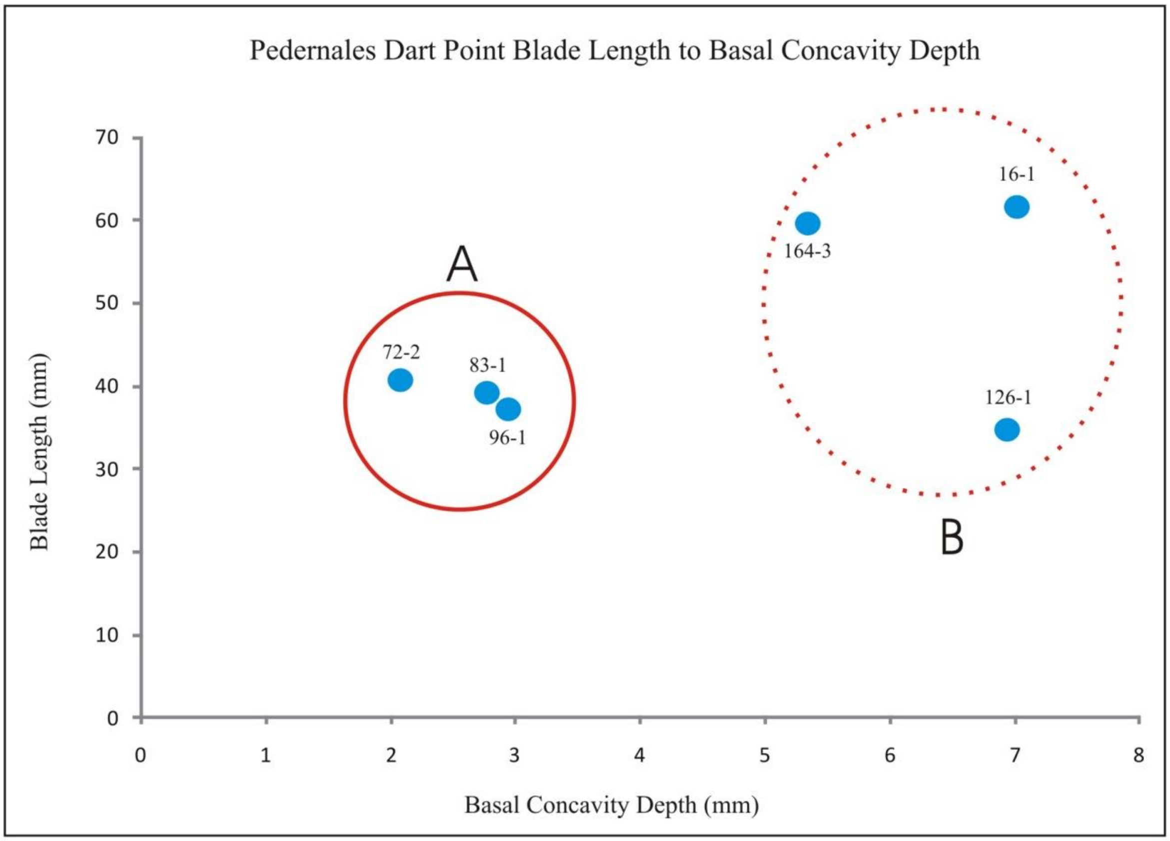

Figure 6-14. Plotted blade length to basal concavity depth for Pedernales Points from 41HY160.

A positive correlation also exists between basal concavity depth and stem length with the length of the stem increasing alongside the depth of the basal concavity. The correlation between the stem length and basal concavity depth is +.88. This correlation seems to support the presence of two separate stem manufacturing trajectories within this point type. Presented in Figure 6-15 are the plotted ratios. It should be noted that specimens within Cluster A from Figure 6-14 remain grouped together in Figure 6-15 and are labeled as Cluster A.

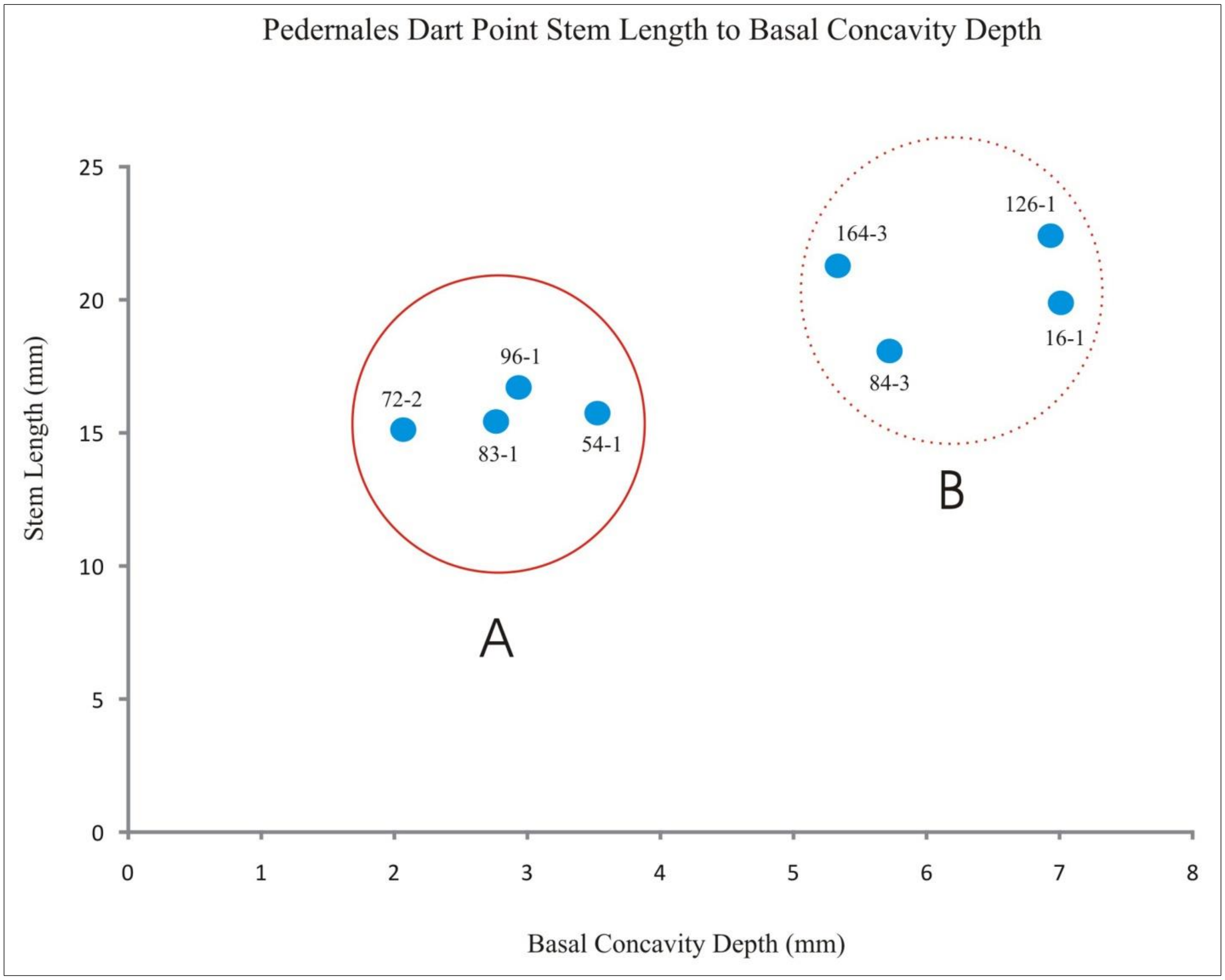

Figure 6-15. Plotted stem length to basal concavity depth for Pedernales Dart Points from 41HY160.

Macroscopic Use: Macroscopic observations revealed damage in the form of transverse fractures and crushing on the specimens from Group A. The damage is located at the distal end, base, and on the barbs. Only one specimen (72-2) retained multiple forms of damage with damage distributed across the point. Specimen 72-2 was likely damaged during impact. Specimens from Group B also retained damage. The damage is mainly restricted to the basal corners. One specimen (164-3) is fractured near the midline, but upon further inspection it appears to have been a result of re-sharpening due to flake removals deviating from the lateral edge. This specimen also sustained damage to a barb and basal corner.

Microscopic Use: Four of the specimens (16-1, 54-1, 83-1, 164-3) produced well developed forms of polish and striations. Figure 6-16 displays multiple types of wear at a magnification of 200X on Specimen 16-1. Image A is located near the distal tip along the midline. The polish is well developed and was most likely caused by contact with an abrasive and hard contact material. Striations are present in the polish traveling at a 45-degree angle from the midline. Image B is also located near the distal tip along the midline, but on the opposite face than that of Image A. Image B reflects less-developed polish consistent with hard soft contact material. Multidirectional striations on the polish are present traveling at an angle of 45 to 90 degrees from the midline. Image C is located near the distal tip along one of the lateral edges. The polish is well developed, reflecting contact with a hard contact material. Image D is also located near the distal tip along the midline. The polish is well developed and reflects contact with hard and soft contact materials. Polish is present on ridgelines near the midline suggesting use as a piercing implement. The hard, well-developed polish and multidirectional striations concentrated near the distal tip on both faces suggests the use of this specimen in activities other than piercing. Figure 6-17 reflects the type of wear present on Specimen 54-1 at a magnification of 200X. Image A is located near the midsection of the point. The polish present is consistent with an abrasive hard contact material. Striations present in the polish travel parallel to the long axis, suggesting its use as a piercing implement. Image B is located just above the stem of Specimen 54-1 and displays well developed polish likely caused by contact with a soft material. Multidirectional striations are visible in the polish. Due to the location of the polish and the multidirectional striations it is likely that the polish was caused by prolonged contact with the hafting element. Figure 6-18 displays multiple types of wear at a magnification of 200X on Specimen 83-1. Image A is located near the midsection of the point along the midline. The polish resembles contact with a hard material with what appears to be a striation running perpendicular to the long axis. Image B is located near the midline just below the distal end. Well-developed polish consistent with hard abrasive contact material is present. Striations are traveling roughly 25 degrees from the long axis. Image C is located near the distal tip along the midline. The polish reflects contact with an abrasive hard material. Multidirectional striations are present in the polish. Image D is located near the midsection just outside of the midline. This image reflects polish formed by contact with a hard and soft contact material. Striations in the polish are traveling at roughly 20 degrees from the long axis. The majority of polish is present on the ridgelines on both faces. The polish located on the ridgelines is concentrated near the midline. The presence of hard contact polish, striations, and concentration of polish along the midline suggests the use as both a piercing and non-piercing tool. Figure 6-19 displays multiple types of wear on Specimen 164-3 at 200X. Image A is located just below the midsection along a lateral edge. The polish reflects contact with a hard material. Multidirectional striations are present within the polish. Image B is located on the stem near the midline. The polish is consistent with an abrasive and hard contact material. Numerous striations are visible within the polished region. The striations are traveling at roughly a 45-degree angle from the long axis. Image C is located near the midsection just below the fracture plane. The polish reflects contact with an abrasive hard material with striations running roughly 15 degrees from the long axis. Image D is located below the fracture plane next to Image C. The polish appears to be a result of contact with an abrasive and hard material. The striations within the polish are traveling perpendicular to the long axis. The majority of the polish is present near the midline. The lack of striations running perpendicular to the long axis and the lack of polish along the blade edges suggests that this point was used primarily as a piercing tool.

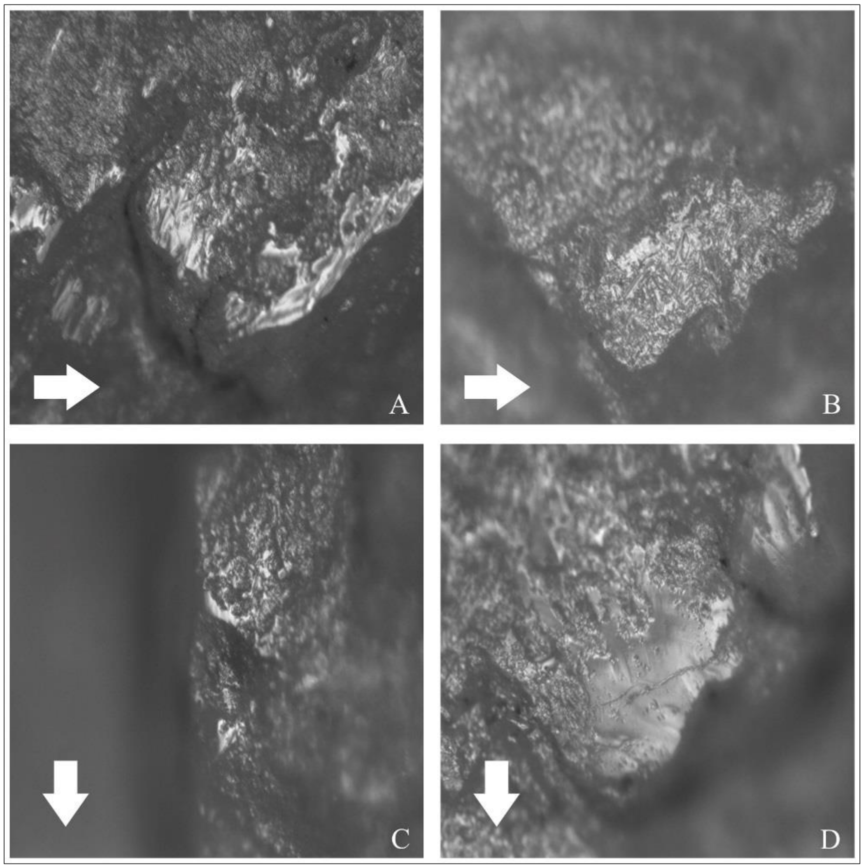

Figure 6-16. Use-wear present on Specimen 16-1. Arrows designate the location of the distal end of the point.

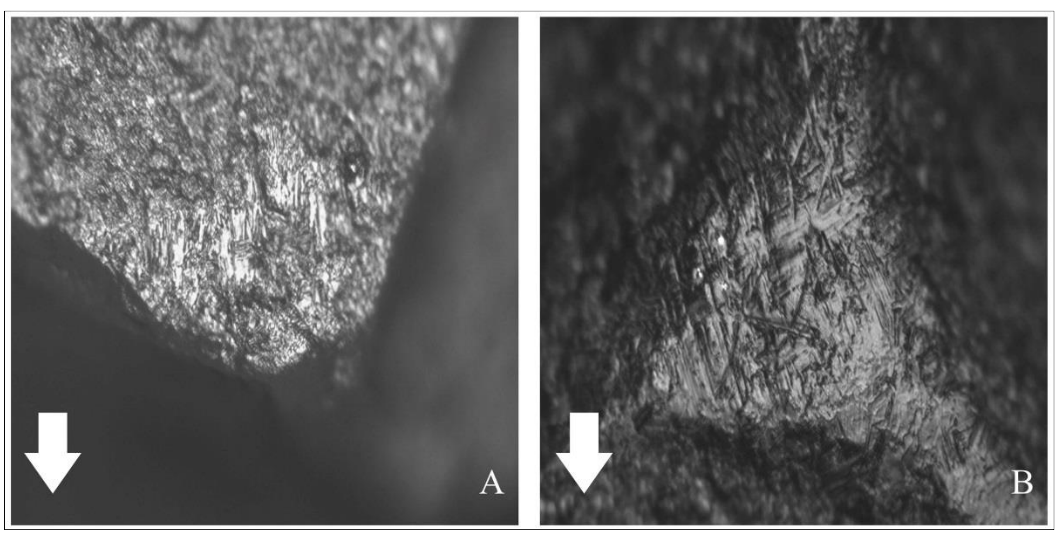

Figure 6-17. Use-wear present on Specimen 54-1. Arrows designate the location of the distal end of the point.

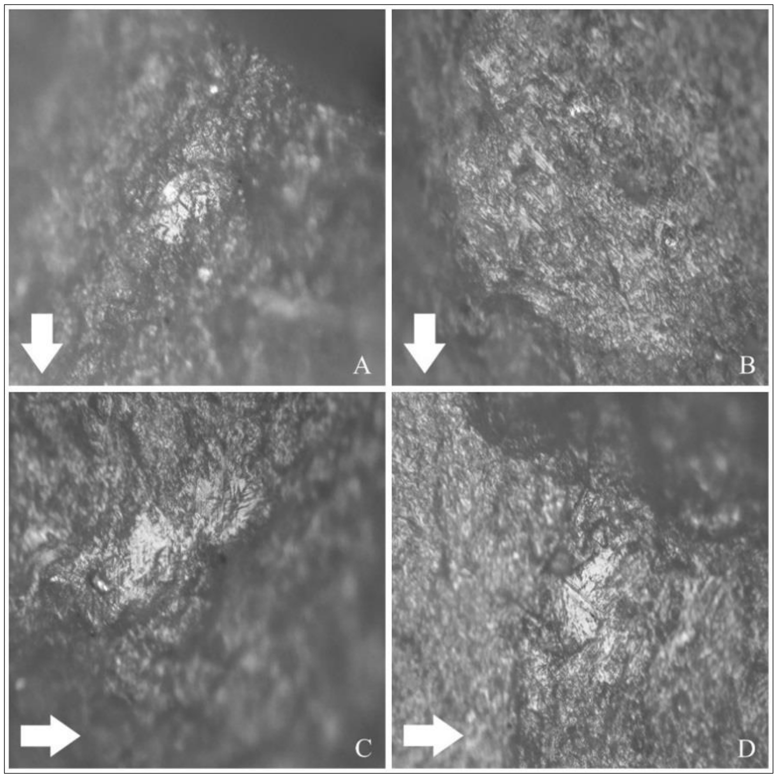

Figure 6-18. Use-wear present on Specimen 83-1. Arrows designate the location of the distal end of the point.

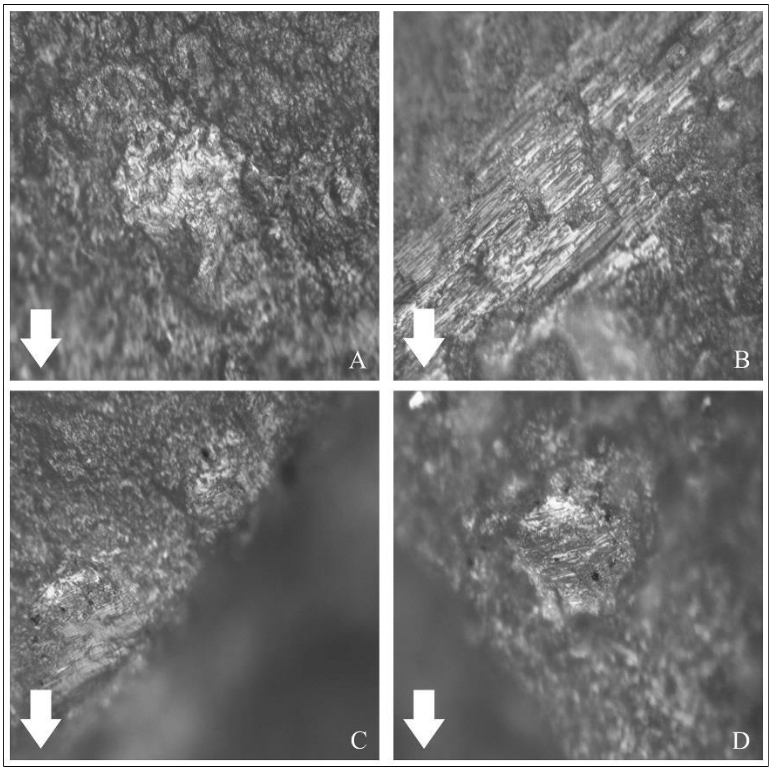

Figure 6-19. Use-wear present on Specimen 164-3. Arrows designate the location of the distal end of the point.

Bulverde

Phase: Marshall Ford
Series: Pecos
N=8 (Specimen # 8-4, 22-3, 22-4, 23-1, 84-2, 111-1, 154-1, 164-4)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
8-4	-	-	44.44	7.13	-	20.97	24.29	25.18	8.9
22-3	-	-	-	8	-	14.26	16.91	17.33	8.61
22-4	-	-	54.38	10.25	-	13.65	26.67	26.12	7.31
23-1	57.74	42.16	33.72	5.48	5.07	15.58	14.93	17.39	5.94
84-2	-	-	-	-	-	15.23	20.04	20.6	7.6
111-1	-	-	-	10.89	-	12.17	21.92	24.11	7.43
154-1	-	-	-	-	-	12.21	21.06	23.03	8.3
164-4	65.71	45.28	36.99	6.96	6.3	20.43	16.15	21.04	7.06

The majority of Bulverde points lack a complete blade making it difficult to assess the blade dimensions. All specimens retained the stem allowing for an accurate assessment of the stem and for any stem variation that may exist. A considerable amount of variation exists among the Bulverde dart point stems. This variation is reflected through the standard deviation of each metric stem category. Bulverde dart point standard deviation stem data is presented in Table 6-2.

Table 6-2. Standard deviation for Bulverde dart points stem metric data.

Point Type	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
Bulverde	3.404	4.093	3.345	.952
No. of Specimens	8	8	8	8

Morphology/Style: This point type exhibits a random flaking pattern (Figures 6-20 and 6-21). Variation in basal morphology is present within this point class. Specimens exhibit concave, convex, and straight stem bases. Two specimens have an irregular basal morphology as a result of damage and/or lack of skill. These specimens exhibit attempts at re-sharpening which resulted in the beveling of the remaining blade. A substantial amount of morphological and stylistic variation exists within this point type.

Figure 6-20. Bulverde points recovered from site 41HY160. Note the variation in stem morphology.

Figure 6-21. Bulverde points recovered from site 41HY160. Note the variation in stem morphology.

Macroscopic Use: Macroscopic analysis of this point type revealed damage in the form of transverse fractures. The damage is present on the midline, distal tip, and barbs. Specimens 22-3, 22-4, 84-2, 111-1, and 164-4 all have multiple forms of damage located on both the barbs and stem implying the damage was a result of impact.

Microscopic Use: Due to the lack of the blade element only one specimen (164-4) retained observable polish aside from haft wear. In Figure 6-22, various forms of wear present on Specimen 164-4 are presented. Image A is an under-developed polish created through contact with a soft material is located on a ridge. Image B is located at the midsection along one of the lateral edges. The polish reflects contact with an abrasive hard material. Striations within the polish are almost perpendicular with the long axis. Image C is located near the distal end along a lateral edge. The polish is consistent with soft contact material. Multidirectional striations are present suggesting the use of this projectile in a non-piercing activity. Image D is located near the midsection on the midline. The polish appears to be the result of contact with a hard material. The striations are parallel to the long axis. A considerable amount of polish is present on Specimen 164-4. The polish and striations present on Specimen 164-4 reflects the use of this tool in both piercing and non-piercing activities.

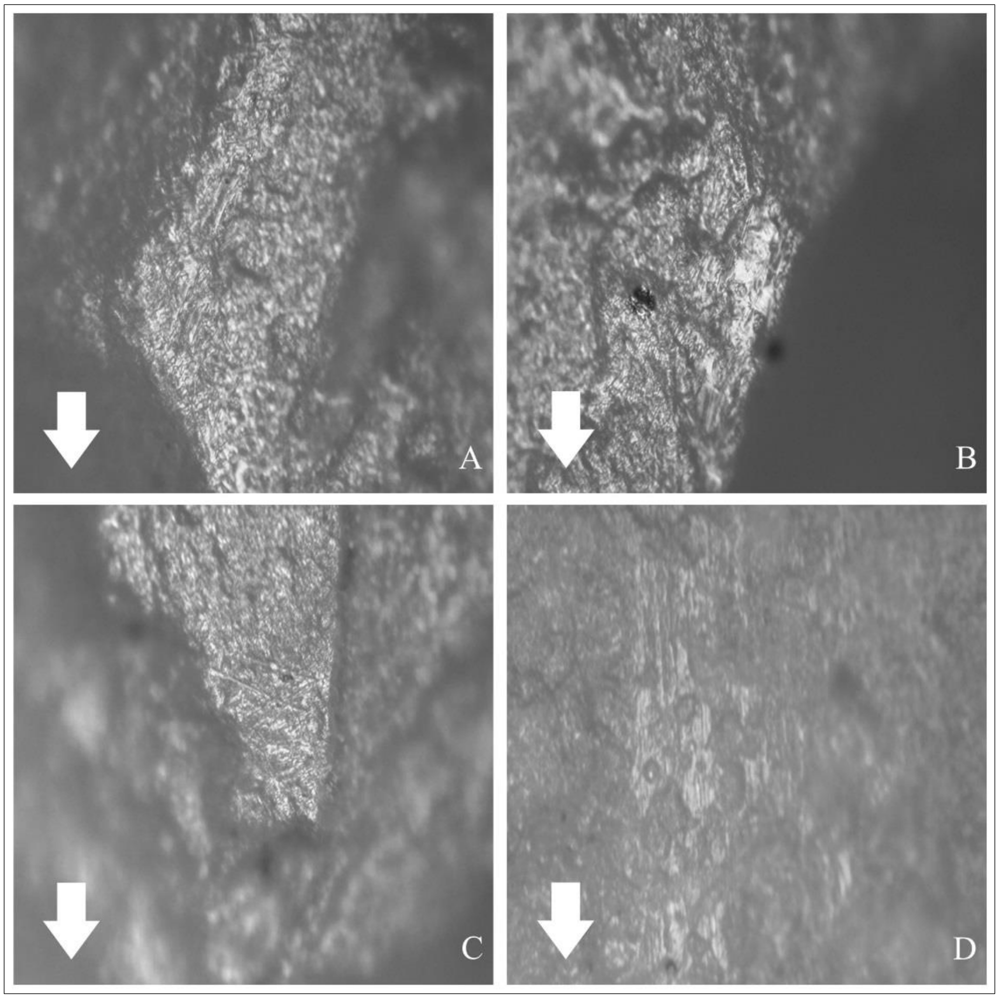

Figure 6-22. Use-wear present on Specimen 164-4. Arrows designate the location of the distal end of the point.

Middle Archaic

Travis

Phase: Clear Fork

Series: Parida

N= 9 (Specimen # 9-3, 22-5, 22-6, 42-1, 72-3, 98-1,144-1, 158-1, 164-1)

Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
9-3	79.28	60.35	21.14	7.67	5.71	18.93	15.99	13.4	6.74
22-5	80.64	60.25	28.95	10.16	7.35	20.39	19.06	17.35	6.9
22-6	63.45	44.61	26.89	6.08	4.8	18.84	15.93	16.54	5.59

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
42-1	60.85	45.89	20.56	8.95	9.33	14.96	13.33	15.78	7.61
72-3	56.64	41.09	18.21	8.46	8.05	15.55	14.25	13.17	7.42
98-1	48.56	31.17	18.6	8.01	7.16	17.39	15.24	15.42	6.19
144-1	83.22	63.24	29.6	9.89	9.06	19.98	20.81	20.89	7.06
158-1	34.85	18.25	22.28	6.62	6.15	16.6	16.05	14.5	5.34
164-1	59.78	42.28	25.86	8.93	7.26	17.5	18.49	16.52	8.2

A considerable amount of variation exists within the Travis blade length category. The standard deviations of metric measurements acquired from the Travis point type are presented below (Table 6-3).

Table 6-3. Standard Deviation of the metric measurements; stem length, stem thickness, stem width basal, and stem width distal across four point types: Nolan, Travis, Bulverde, and Pedernales.

Point Type	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
Travis	15.975	14.709	4.354	1.372	1.493	1.892	2.412	2.337	.939
No. of Specimens	9	9	9	9	9	9	9	9	9

Morphology/Style: The specimens within this point type reflect a random flaking pattern (Figures 6-23 and 6-24). Various re-sharpening trajectories are visible. The re-sharpening trajectories range from attempts at curating a long yet narrow blade to maintaining the blade width while shortening the length of the point. Basal morphology varies from concave to slightly convex.

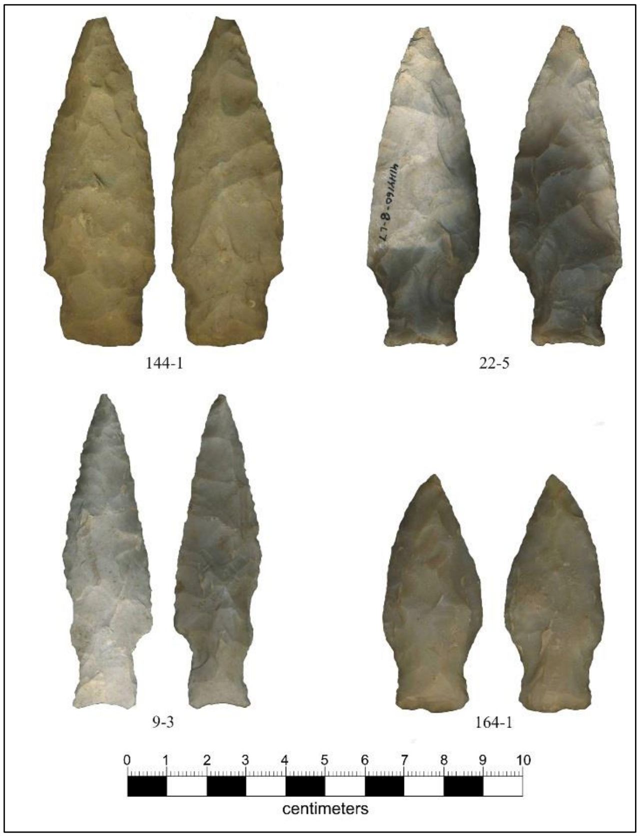

Figure 6-23. Travis points recovered from site 41HY160.
Note the lack of distal tip damage.

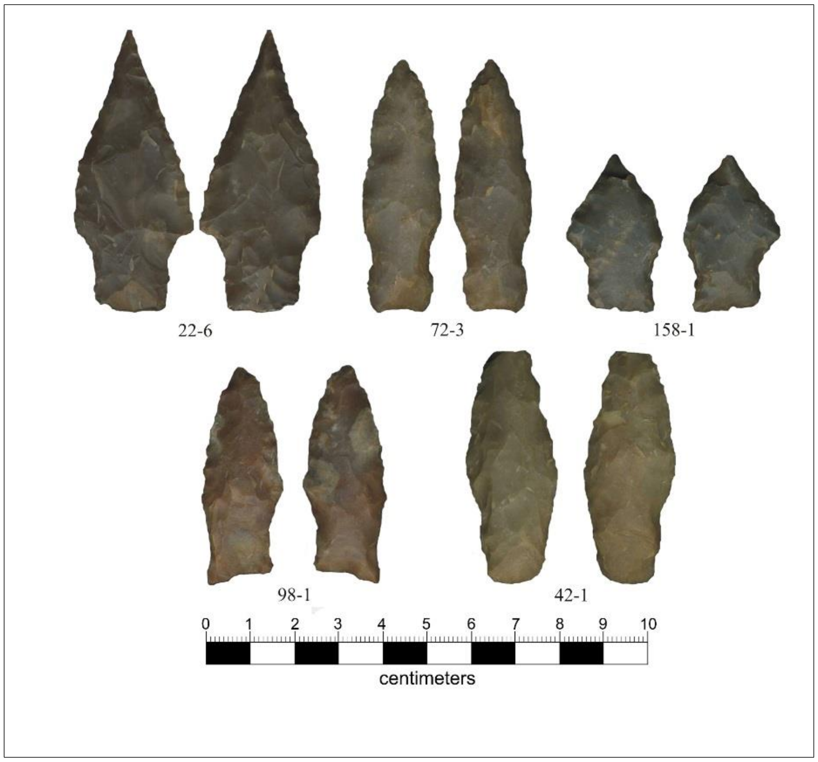

Figure 6-24. Travis points recovered from site 41HY160. Note the lack of distal tip damage.

Macroscopic Use: Macroscopic analysis of this point type revealed a lack of damage specifically to the distal region. All specimens within this point class reflect re-sharpening, which has resulted in the beveling of the blade on most specimens.

Microscopic Use: Polish and striation data was attained from two specimens (158-1 and 164-1). Figure 6-25 reflects multiple types of wear present on Specimen 158-1. Image A is located near the distal tip along the midline. The polish resembles contact with an abrasive hard contact material. Striations are present traveling in multiple directions. Image B is located just below the midpoint in between the midline and the lateral blade edge. The polish resembles contact with a soft material. Striations visible within the polish are traveling 45 degrees from the long axis. Image C is located along a lateral edge. The polish is in linear formations reflecting contact with a hard material. This type of polish may be consistent with contact between the stone being worked and the hard hammer. Image D is located on the opposite lateral edge from Image C. The polish is well developed and resembles contact with a soft material. Striations present along the edge are traveling perpendicular to the long axis. Polish is present along the ridgelines near the midline. The presence of polish alone the midline coupled with striations traveling perpendicular to the long axis suggests the use of this specimen in multiple activities including piercing. Figure 6-26 reflects the type of wear present on Specimen 164-1. Image A is located near the distal end along one of the lateral edges. The polish reflects contact with an abrasive soft material. The striations within the polish are traveling perpendicular to long axis. Image B is located just above the stem. The polish reflects contact with a moderately hard contact material, possibly wood. Polish is visible on both the midline and along the lateral edges. Striations are visible traveling both parallel and perpendicular to the long axis.

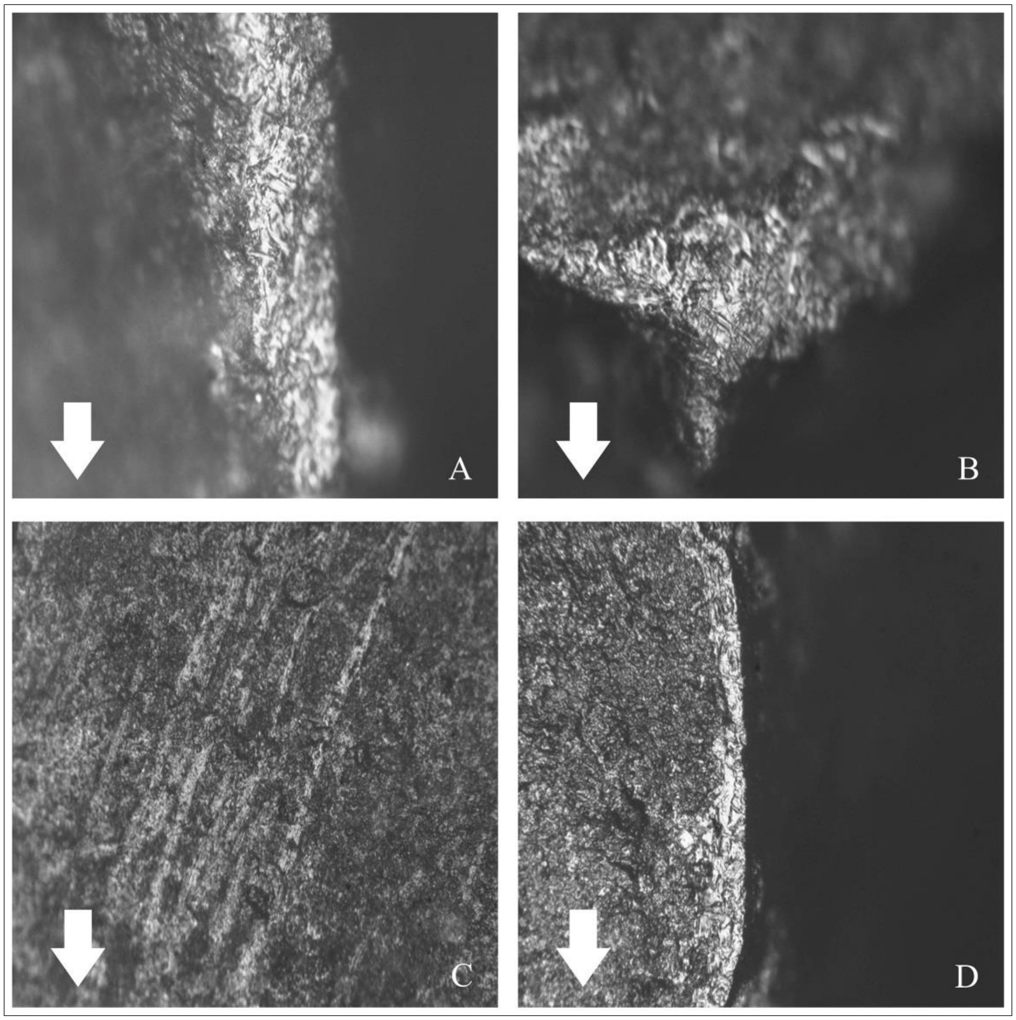

Figure 6-25. Use-wear present on Specimen 158-1. Arrows designate the location of the distal end of the point.

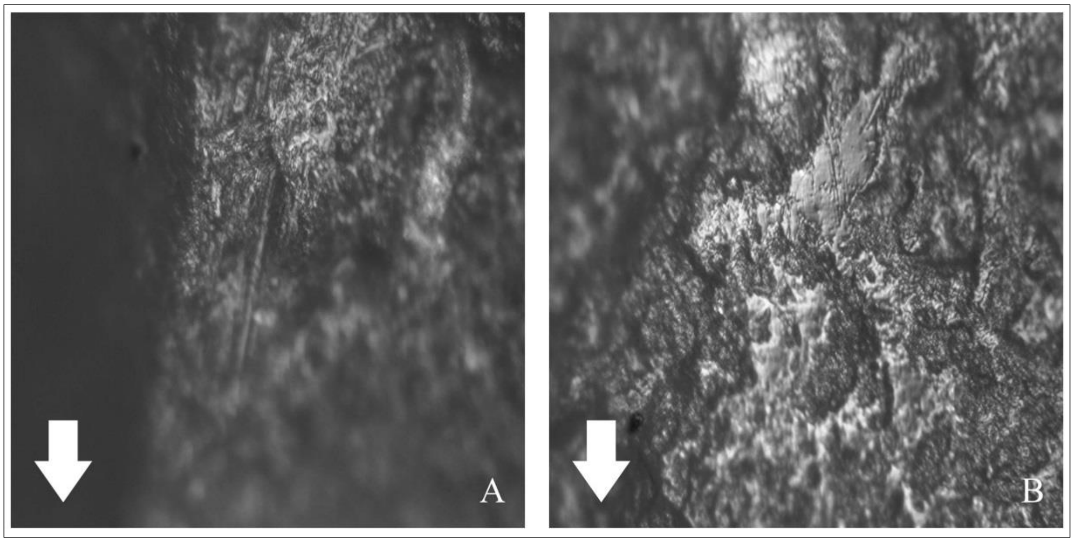

Figure 6-26. Use-wear present on Specimen 164-1. Arrows designate the location of the distal end of the point.

Nolan

Phase: Clear Fork

Series: Parida

N=14 (Specimen # 8-5, 8-6, 9-1, 24-2, 55-1, 56-1, 56-2, 71-2, 72-1, 83-2, 84-1, 84-4, 97-1, 113-1)

Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
8-5	-	-	32.67	-	-	22.59	21.7	20.37	7.77
8-6	-	-	-	-	-	21.39	17.41	18.92	6.96
9-1	67.44	42.65	28.28	6.9	6.54	24.79	18.61	16.45	6.7
24-2	82.68	65.23	26.67	8.66	6.8	17.45	18.4	17.02	7.8
55-1	81.77	64.07	27.81	8.92	8.28	17.7	18.43	15.41	7.9
56-1	69.6	51.71	23.57	8.33	6.42	17.89	18.21	16.51	6.41
56-2	90.12	66.73	29.37	7.72	7.28	23.39	19.55	18.41	7.48
71-2	78.37	57.84	29.55	6.78	7.44	20.53	20.37	17.4	6.05
72-1	69.44	50.73	26.94	7.67	6.37	18.71	16.29	16.1	6.16
83-2	-	-	30.35	7.87	-	-	-	17.73	6.41
84-1	-	-	-	7.96	7.31	17.87	-	17.93	7.38
84-4	64.92	47.58	26.57	6.54	8.61	17.34	17.57	16.25	8.45
97-1	-	-	-	-	-	17.2	16.07	16.61	7.08
113-1	-	-	28.27	8.7	-	18.01	18.79	16.79	7.57

After reviewing the metric data, it became apparent that the Nolan point type is the most homogenous when compared to the other point types within the assemblage. By using standard deviation, a degree of variation was acquired for both blade and stem data. The standard deviations are presented in Table 6-4.

Table 6-4. Standard deviation for Nolan point metric measurements.

Point Type	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
Nolan	8.954	8.975	2.366	.811	.8	2.624	1.61	1.305	.73
No. of Specimens	8	8	11	11	9	13	12	14	14

If one is to consider the stem as the least altered portion of the point when compared to the blade element it becomes clear that a high degree of standardization was adhered to during the production of the Nolan point. This can be illustrated when comparing the Nolan point stem standard deviation results to those of Pedernales, Bulverde, and Travis points. This is illustrated in Table 6-5.

Table 6-5. The stem standard deviations for Pedernales, Bulverde, Nolan, and Travis projectile points.

Point Type	**Stem Length**	**Stem Thickness**	**Stem Basal Width**	**Stem Distal Width**
Nolan	2.624	.730	1.61	1.305
Travis	1.892	.939	2.412	2.337
Bulverde	3.404	.952	4.093	3.345
Pedernales	2.809	1.139	2.397	2.6

M*orphology/Style:* Specimens within this point type reflect multiple types of flaking patterns (Figure 6-27, Figure 6-28, and Figure 6-29). Parallel oblique, less regular parallel, and random flaking patterns are common amongst this point type. A characteristic common to the Nolan point type is the beveled stem. The degree of stem beveling varies within the Nolan point type. Re-sharpening is common among the Nolan points, resulting in the beveling of the blade. Both prominent and weakly structured shoulders are visible on this point type. The shoulders are formed through corner notching. One interesting observation is the lack of shoulder damage. The preference for shoulders over barbs may be associated with controlling the amount of point damage a projectile can sustain. By eliminating barbs from the point morphology, the less breakage occurs during its use-life near the shoulder and barb region. Blade morphology also varies within this point type. Four of the nine specimens exhibit one straight blade and one convex blade. The variation in blade morphology has implications for the use of this point type in activities other than piercing.

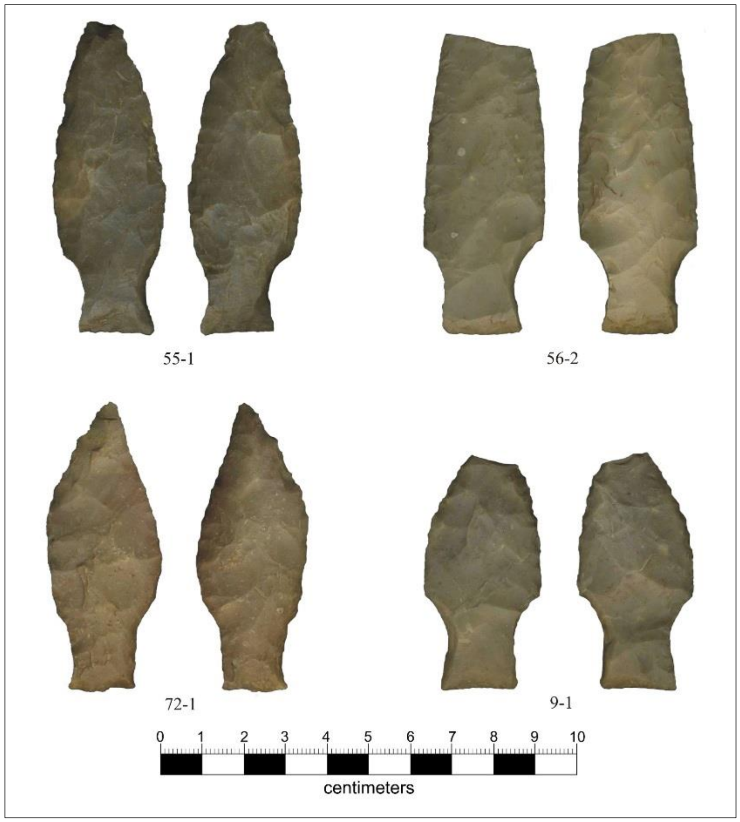

Figure 6-27. Nolan points recovered from site 41HY160. Note the asymmetry in blade design.

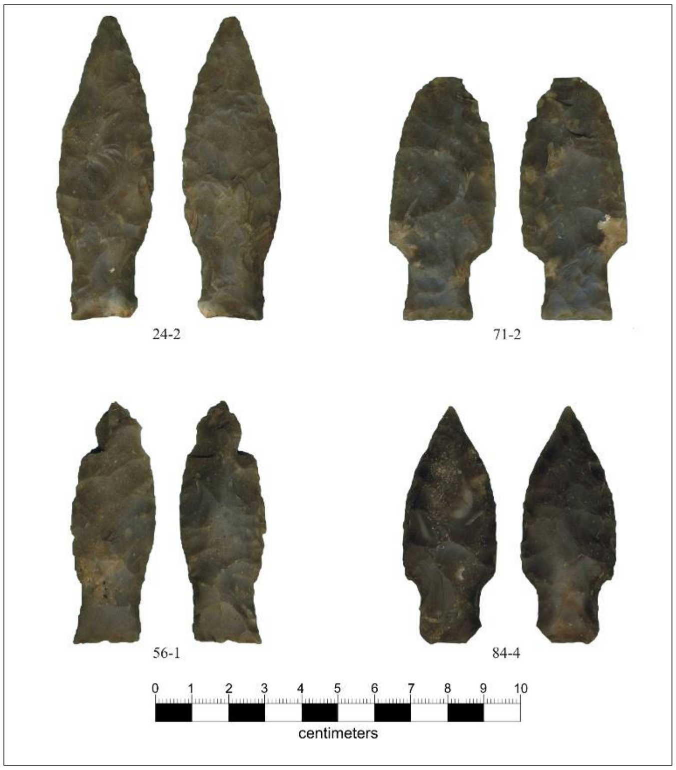

Figure 6-28. Nolan points recovered from site 41HY160. Note the asymmetry in blade design.

Figure 6-29. Nolan points recovered from site 41HY160. Note the asymmetry in blade design.

Macroscopic Use: Macroscopic analysis of the Nolan point sample exhibits a wide variety of fractures. The fractures observed are spin-off, transverse, longitudinal macro-, and lateral macro-fractures. The fractures are located at the distal and medial portions of the points. The majority of the damage is restricted to the distal ends of the projectile points. Despite the low frequency of fractures on any one specimen, the numerous distal fractures within this point type implies the use of this type as a piercing implement.

Microscopic Use: Microscopic use-wear data was acquired from one specimen (9-1). Figure 6-30 reflects polish consistent with abrasive and hard contact material. Striations overlaying the polish are traveling perpendicular to the long axis. The polish is located along the midline near the midsection of the point.

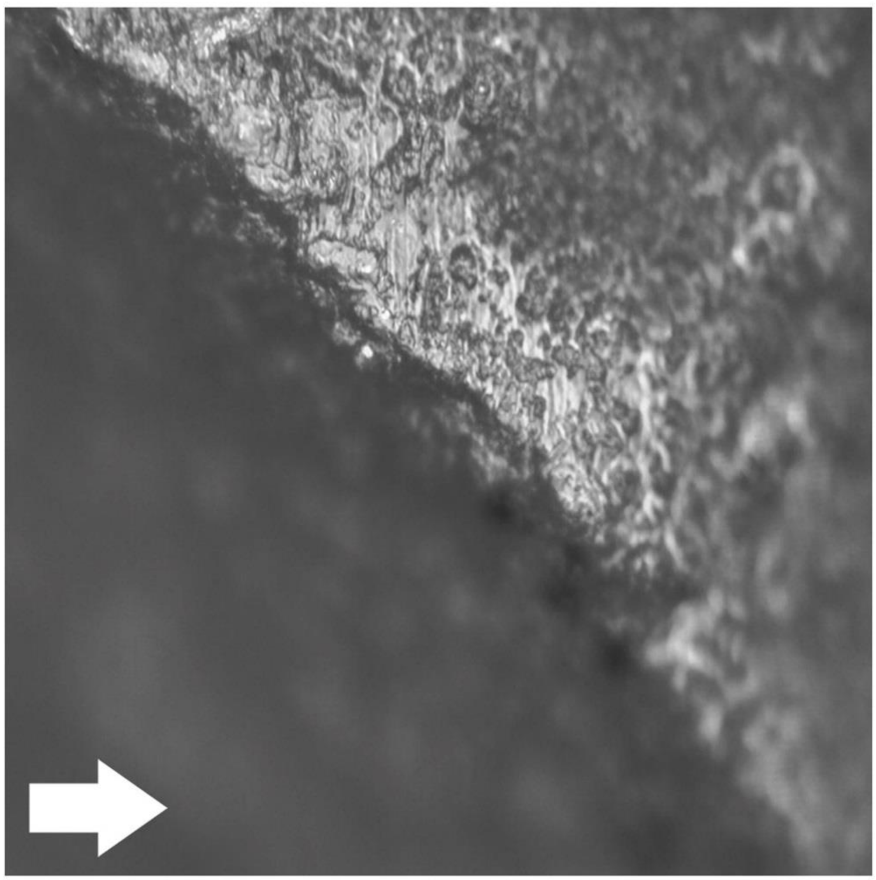

Figure 6-30. Use-wear present on Specimen 9-1. Arrow designates the location of the distal end of the point.

Early Triangular

Phase: Oakalla
Series: Falcon
N=9(Specimen # 26-2, 29-2, 87-1, 87-2, 143-1, 147-2, 157-1, 159-1, 159-2)
Metrics:

Lot-Specimen No.	**Length**	**Width**	**Thickness**
26-2	39.51	31.02	7.41
29-2	38.96	38.63	5.58
87-1	49.65	39.8	5.53
87-2	68.56	26.71	8.3
143-1	38.78	31.56	5.68
147-2	59.08	32	7.2
157-1	59.87	36.94	7
159-1	60.81	41.25	6.22
159-2	43.52	37.44	5.12

Due to the lack of a diagnostic stem it is difficult to separate the blade from the stem portion of the point. Due to this morphological deficiency total width, thickness, and length were the only metric measurements recorded.

Morphological/Style: The morphological and style assessment revealed a random flaking pattern (Figure 6-31, Figure 6-32, and Figure 6-33). Aside from the random flaking pattern two specimens exhibit a flaking pattern in the form of less-regular parallel. The stem base morphology varies from concave to convex to straight. The proximal ends of the lateral edges on one specimen have been serrated (29-2). Basal thinning appears to be a common trait among the Early Triangular points. The majority of Early Triangular points have been re-sharpened creating a strong beveled blade. This point type lacks any form of corner notching. Although, the serrated lateral edges on Specimen 29-1 may have supplemented for the lack of corner notching.

Macroscopic Use: Macroscopic use analysis revealed the presence of transverse and lateral macro-fractures. One specimen (87-2) exhibited manufacturing errors at both the proximal and distal ends resulting in the loss of both portions of the point. The same specimen has retained multiple flake failures, indicating poor skill on behalf of the manufacturer. The locations of the fractures include both the distal ends and basal corners. Specimens 157-1 and 29-2 retained impact damage at both the distal and proximal ends possibly as a result of impact.

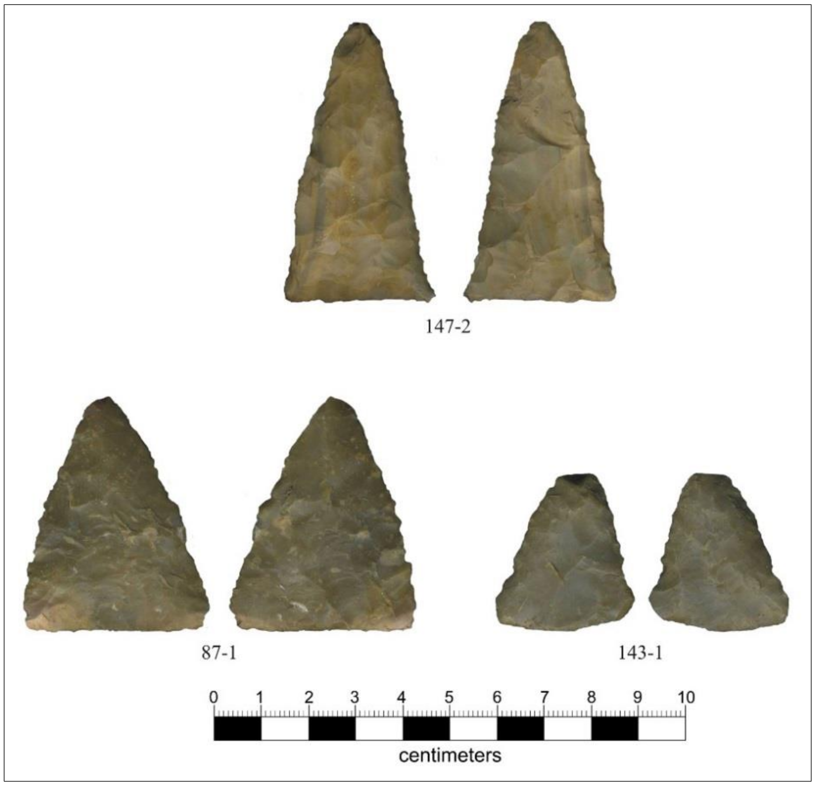

Figure 6-31. Early Triangular points recovered from site 41HY160.

Figure 6-32. Early Triangular points recovered from site 41HY160.

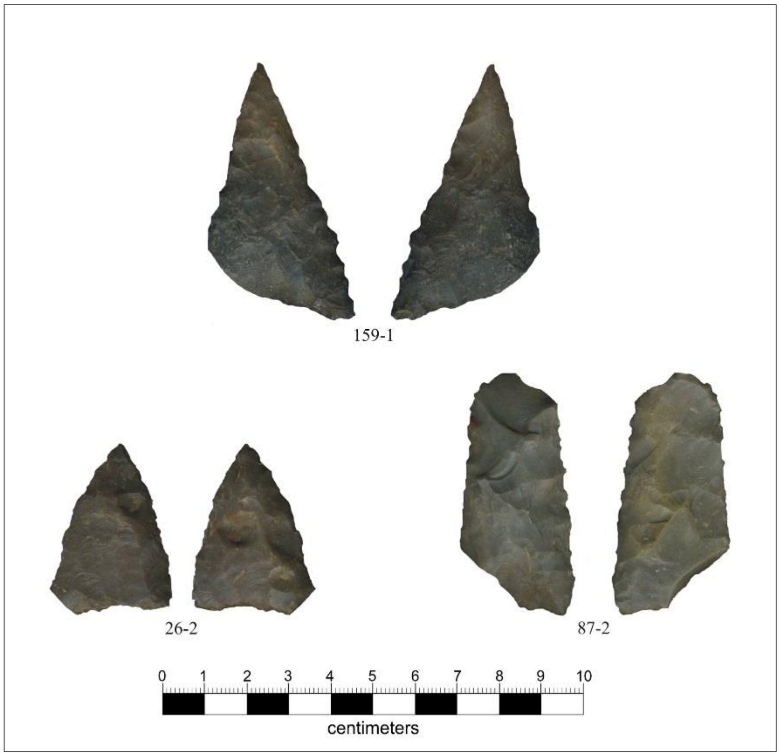

Figure 6-33. Early Triangular points recovered from site 41HY160.

Microscopic Use: Polish and striation data was attained from four specimens (29-2, 87-2, 143-1, and 157-1). Figure 6-34 displays the polish and striations present on Specimen 29-2. Image A is located at the proximal end along a basal corner. The polish resembles hard and soft contact material. Multidirectional striations are present within the polished region. Image B is located on the adjacent basal corner from Image A. The polish reflects contact with a hard material. The striations present within the polished region are traveling at a 45-degree angle from the long axis. Image A is located near the midline below the midsection of the point. The polish is consistent with contact with a hard material. Image B is located near the midline at roughly the midsection of the specimen. The polish resembles contact with a hard material. Striations present in the polished region are traveling roughly perpendicular to the long axis. Image C is located at the distal end near the midline. The polish resembles contact with a soft material. Possible striations within the polished region appear to be traveling perpendicular to the long axis. Image C was taken at 100X magnification. Image D is located near the base of the specimen. The polish resembles contact with both soft and hard contact material. Multidirectional striations are visible within the polished region. This form of wear may be associated with haft or shaft wear. Figure 6-35 reflects the polish present on Specimen 143-1. Image A is located near the distal end along a lateral edge. The polish resembles contact with a soft material. The striations visible within the polished region are traveling roughly perpendicular to the long axis. Image B is located on the proximal edge. The polish reflects contact with a hard abrasive material. The striations present within the polished area run parallel with the long axis. Figure 6-36 reflects the polish present on Specimen 157-1. Image A is located along the lateral edge near the midpoint. The polish resembles contact with a hard and soft material. The striations are traveling roughly 45 degrees from the long axis. Image B is located near the distal fracture plane. The polish resembles contact with soft material. The polish is well developed and within the polished region multidirectional striations exist.

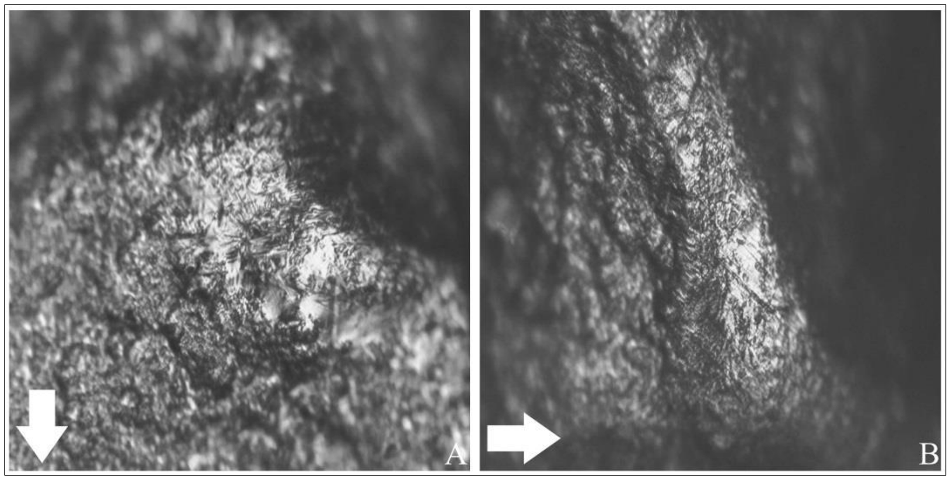

Figure 6-34. Use-wear present on Specimen 29-2. Arrows designate the location of the distal end of the point.

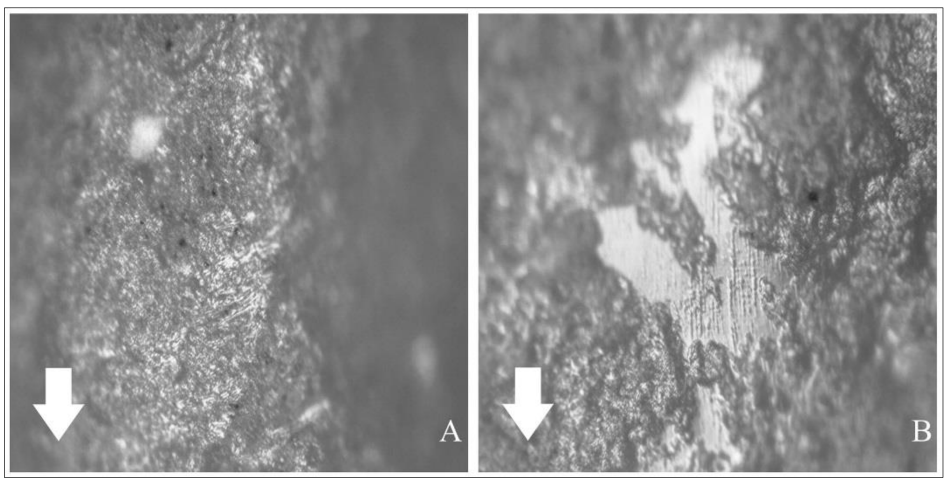

Figure 6-35. Use-wear present on Specimen 143-1. Arrows designate the location of the distal end of the point.

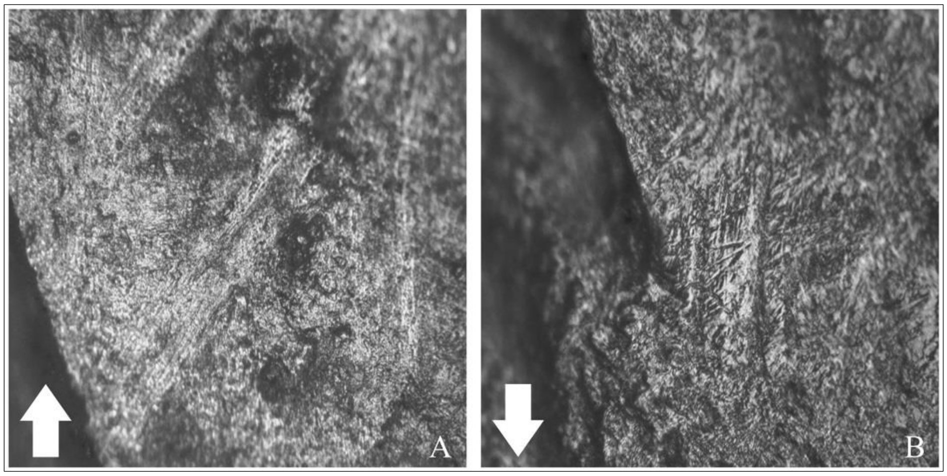

Figure 6-36. Use-wear present on Specimen 157-1. Arrows designate the location of the distal end of the point.

Andice

Phase: Jarrell

Series: Stillhouse

N=2 (Specimen # 44-1, 88-5, 112-2)

Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
44-1	48.39	30.21	50.07	6.76	5.33	15.68	29.47	19.53	4.3
88-5	-	-	-	-	-	-	-	-	-
112-2	-	-	-	-	-	-	-	-	-

Morphological/Style: Morphological and style assessment revealed a random flaking pattern with a patterned form of re-sharpening (Figure 6-37). The re-touch along the lateral edges is composed of narrow flake scars running parallel to one another in a systematic fashion. The specimen is symmetrical with a concave base thinned by basal thinning flakes. The distal tip of the specimen may have been fractured during its use-life, but due to heavy edge modification any sign of damage has been obscured. The modified distal tip has resulted in an obtuse edge angle. Strongly defined barbs were formed through basal notching. Specimens 88-5 (see Figure 6-37) and 112-2 (not pictured) are Andice barb fragments.

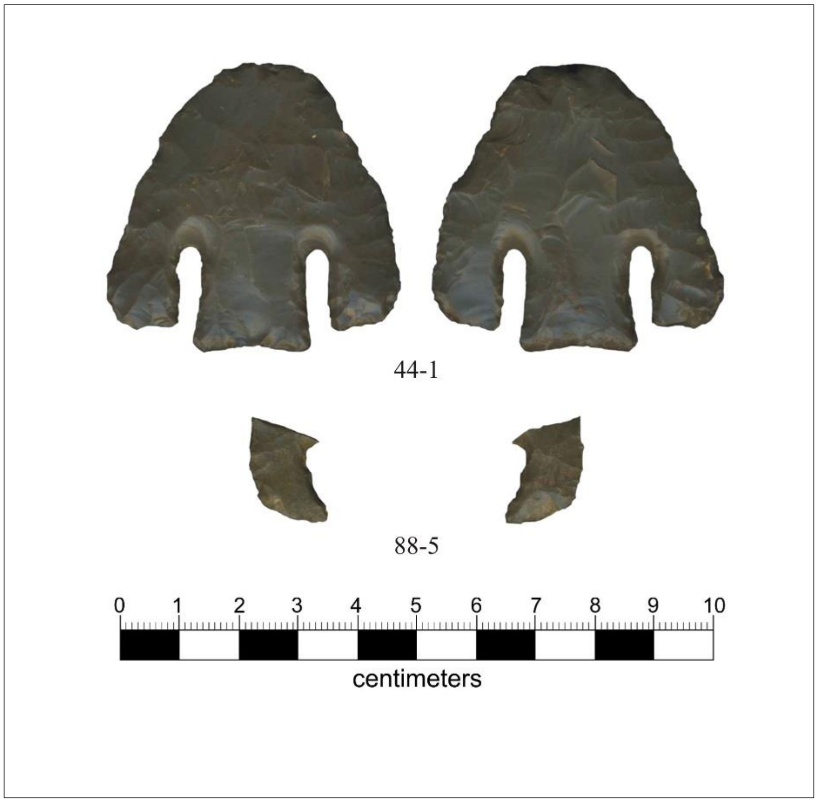

Figure 6-37. Andice point and barb recovered from site 41HY160.

Macroscopic Use: The macroscopic analysis revealed a small burin scar present at the base of one of the barbs running perpendicular to the long axis. The modified distal end may reflect the use of the point in tasks other than piercing.

Microscopic Use: Specimen 44-1 polish and striation data is presented in Figure 6-38. Image A is located along the lateral edge on one of the barbs. The polish represents contact with a soft and hard material. The striations within the polished region are traveling roughly perpendicular to the long axis. The polish and striations resemble contact with the haft or shaft element. Image B is located along the lateral edge just above the barb. The polish resembles contact with a hard material. The striations present within the polished region are traveling less than 45 degrees from the long axis. Image C is located just outside the midline near the distal end. The polish resembles contact with a soft material with striations traveling at 45 degrees from the long axis.

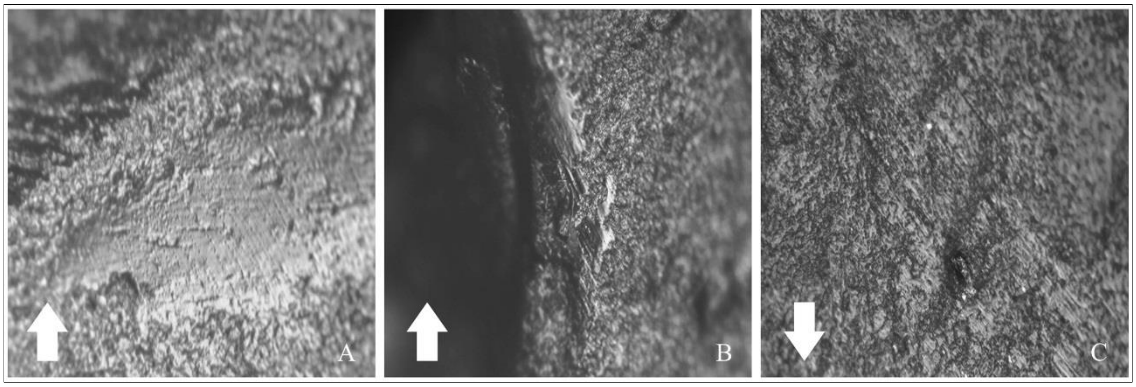

Figure 6-38. Use-wear present on Specimen 44-1. Arrows designate the location of the distal end of the point.

Early Archaic

Martindale

Phase: San Geronimo (Late)
Series: N/A
N=1 (Specimen # 75-3)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
75-3	42.18	26.57	32.69	6.72	5.33	15.68	29.47	19.53	4.3

Morphological/Style: The morphological and stylistic assessment of the point revealed symmetrical features with a random flaking pattern (Figure 6-39). The artifact has been re-sharpened along the lateral edges on alternating faces, resulting in the beveling of the blade. The stem and barbs were formed through corner notching.

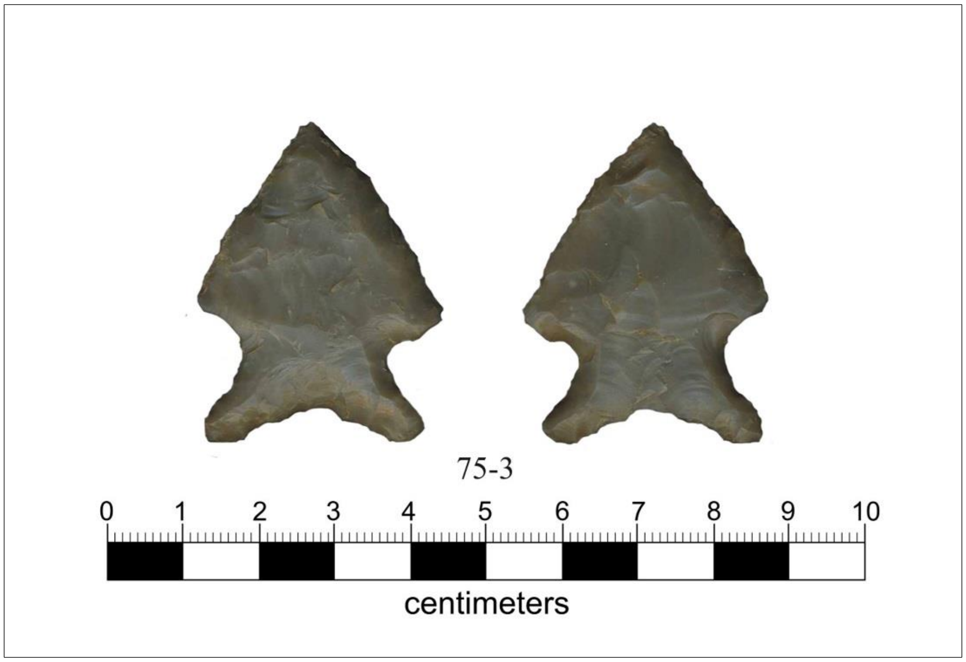

Figure 6-39. Martindale point recovered from site 41HY160.

Macroscopic Use: The macroscopic use analysis revealed transverse fractures present on both shoulders. The location and type of fracture may imply contact with the shaft during impact.

Merrell

Phase: San Geronimo (Late)
Series: NS
N=3 (Specimen # 104-1, 104-2, 133-1)
Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
104-1	-	-	-	-	-	13.19	26.4	18.58	5.54
104-2	48.55	35.57	35.22	5.76	-	12.83	24.89	16.39	4.05
133-1	-	-	-	-	-	14.3	-	18.69	6.34

Morphological/Style: Specimen 104-2 reflects a random flaking pattern (Figure 6-40). Aside from the fractures and lateral blade re-sharpening this specimen exhibits moderate symmetrical features. Specimens 104-1 and 133-1 lack the blade element making it difficult to discern flaking patterns and symmetry. Specimen 104-2 exhibits retouch along one lateral blade edge. The barbs and stems on two of the specimens have been formed through corner notching.

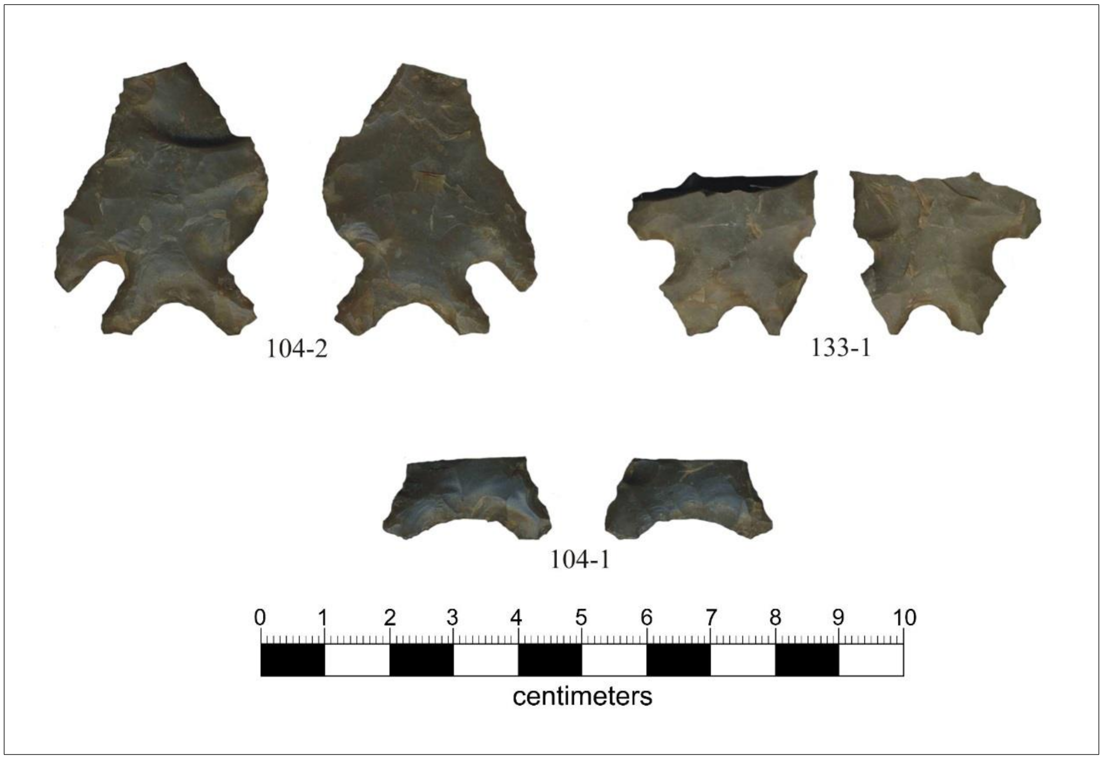

Figure 6-40. Merrell point and point fragments recovered from site 41HY160.

Macroscopic Use: Macroscopic use analysis revealed damage in the form of longitudinal macro-fractures, crushing, and transverse fractures. The damage is present at the distal end, the base of the stem, and along one of the barbs. The remaining two specimens (104-1 and 133-1) are stem fragments exhibiting transverse fractures. The type of fractures present and the location of the damage, on Specimens 104-1 and 133-1, imply that the points were fractured during impact.

Possible Early Stemmed

Phase: N/A
Series: NS
N=1 (Specimen # 60-1)
Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
60-1	-	-	-	-	-	*13.57*	*41.79*	*30.06*	*7.33*

Morphological/Style: The morphological and style assessment revealed a random-like flaking pattern, but due to the lack of a blade element it is difficult to accurately assess the flaking patterns, re-touch, and symmetry of this specimen (Figure 6-41). This specimen is a proximal fragment retaining only a small portion of the blade element. The stem has been thinned by two relatively wide flakes. This intentional or unintentional thinning of the base resulted in a curved stem perpendicular to the long axis. The stem and shoulders were created through side notching.

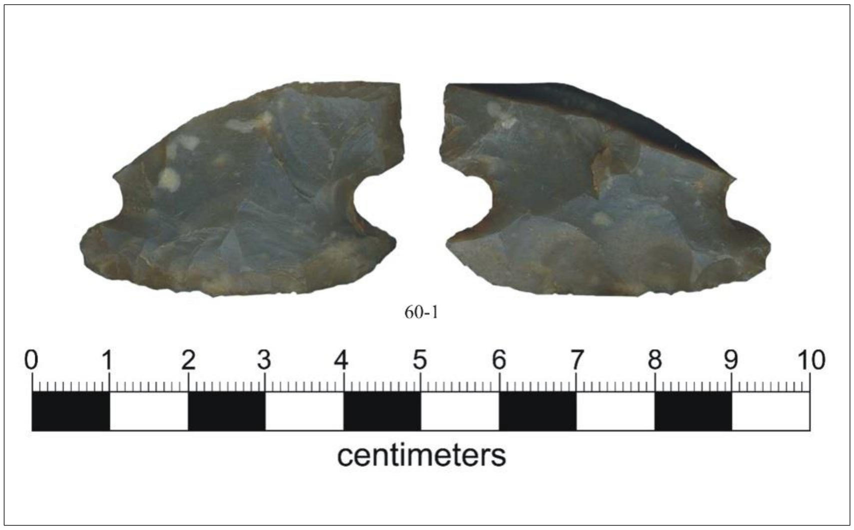

Figure 6-41. Possible Early Stemmed projectile point recovered from site 41HY160.

Macroscopic Use: The macroscopic use analysis revealed a transverse fracture near the stem, resulting in the loss of the blade element and one barb. The cause of the fracture is unknown. There is not enough evidence to associate the damage with impact.

Possible Lerma

Phase: N/A
Series: Lerma
N=1 (Specimen # 147-1)
Metrics:

Lot-Specimen No.	**Length**	**Width**	**Stem Width**	**Total Thickness**
147-1	*71.09*	*21.05*	*12.88*	*11.42*

Morphological/Style: The morphological and stylistic assessment of the point revealed a collateral flaking pattern and good symmetrical features (Figure 6-42). The specimen is lanceolate in form with no apparent stem notching.

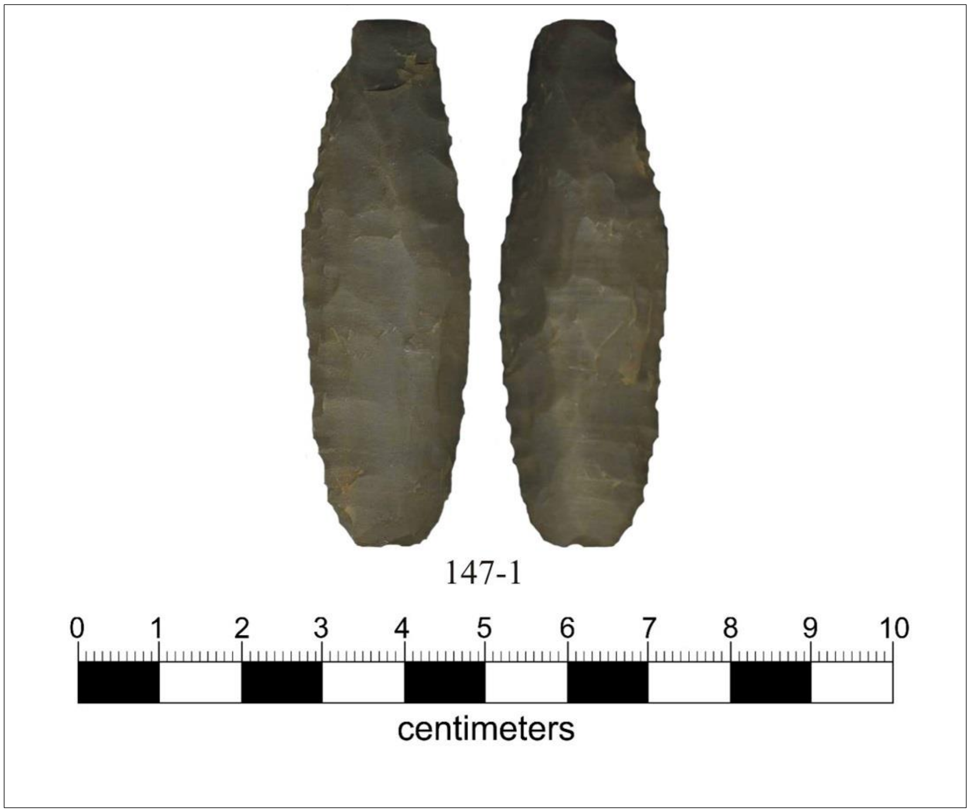

Figure 6-42. Possible Lerma point recovered from site 41HY160.

Macro- and Microscopic Use: The macroscopic assessment exhibited a nearly complete specimen with minor breakage at the distal and proximal ends of the point. A longitudinal macro-fracture removed the distal portion of the specimen. The proximal end appears to have been crushed. The location and type of fractures present infers the specimen was damaged during impact.

Early Archaic Split-Stemmed Variety

Phase: N/A
Series: N/A
N-4 (Specimen #s 14-1, 15-1, 25-1, 103-1)
Metrics:

Lot-Specimen No.	**Total Length**	**Blade Length**	**Blade Width**	**Blade Thickness Proximal**	**Blade Thickness Distal**	**Stem Length**	**Stem Width Basal**	**Stem Width Distal**	**Stem Thickness**
14-1	113.12	91.34	38.64	8.34	6.84	21.78	20.5	19.28	7.12
15-1	68.72	51.2	38.08	8.72	5.54	17.52	22.28	24.8	6.82
25-1	-	-	-	-	-	13.88	15.12	11.86	7.12
103-1	105.32	86.02	48.76	9.96	6.26	19.3	18.6	19.18	

Morphological/Style: These specimens were recovered from a context located 100cm below the surface. The morphological and stylistic assessment of all four specimens revealed common traits including ground stems and concave bases (Figure 6-43 and Figure 6-44). The degree of concavity varies from specimen to specimen. Specimen 103-1 has retained a bell-shaped blade, which is not consistent with the other specimen's blade morphology or with Pedernales point blade morphology. Specimen 14-1 reflects a weakly defined collateral-like flaking pattern, whereas the remaining specimens reflect a random flaking pattern. The stem and barbs have been shaped through corner notching.

Figure 6-43. Early Archaic Split Stemmed variety recovered from site 41HY160.

Figure 6-44. Early Archaic Split Stemmed variety recovered from site 41HY160.

Macroscopic Use: Specimens 14-1, 15-1, and 25-1 exhibit transverse fractures near the distal end. Dart point 25-1 has a burin scar originating at the distal fracture plane and traveling parallel to the long axis along one of the lateral blade edges. Specimen 15-1 was poorly re-sharpened, resulting in a stack formation near the midline of the dart point. Artifact 25-1 appears to have been reworked after sustaining impact damage.

Microscopic: Polish and striation data was attained from three specimens (14-1, 103-1, and 25-1). Figure 6-45 illustrates the wear found on Specimen 14-1. The polish reflects extensive use of the point on soft material. Striations within the polished region travel roughly 45 degrees from the midline. Figure 6-46 illustrates wear present on Specimen 103-1. This specimen is composed of a poor quality chert making it difficult to assess use-wear on the coarse surface. Image A illustrates polish is located near the distal tip. The polish reflects contact with a hard material. The striations appear to be traveling parallel to the midline. Image B is located near the distal tip along the midline on the opposite face of Image A. The polish present reflects contact with hard material. Overall this specimen did not retain very many examples of use-wear. Figure 6-47 illustrates the wear present on Specimen 25-1. Image A is located on the stem. The polish reflects contact with a hard material. The striations present within the polished region travel parallel to the long axis. This type of wear may have been the result of contact with the haft or shaft. Image B is located at the midpoint near the midline. The polish reflects contact with a hard material. The striations located within the polished region are running perpendicular to the long axis. Image C is also located along the midline near the midpoint of the specimen. The polish reflects contact with a hard abrasive material. Striations within the polished reagion are traveling parallel to the long axis. Image D reflects polish consistent with soft contact material. This specimen with the fractures it has sustained and the polish appears to have used specifically as a piercing implement.

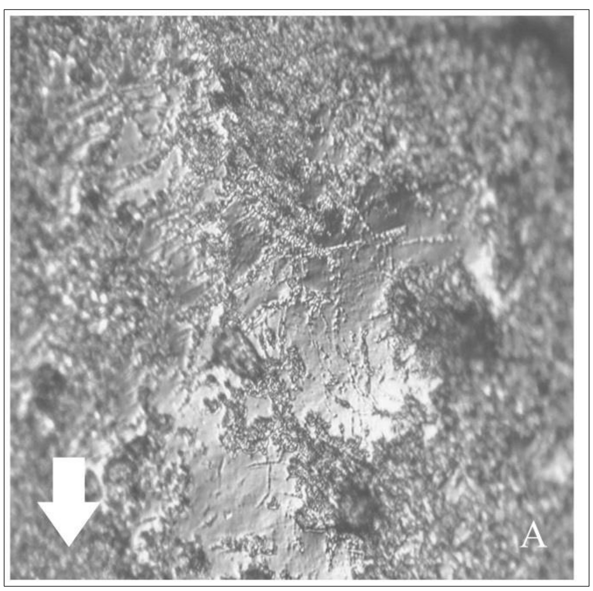

Figure 6-45. Use-wear present on Specimen 14-1. Arrow designates the location of the distal end of the point.

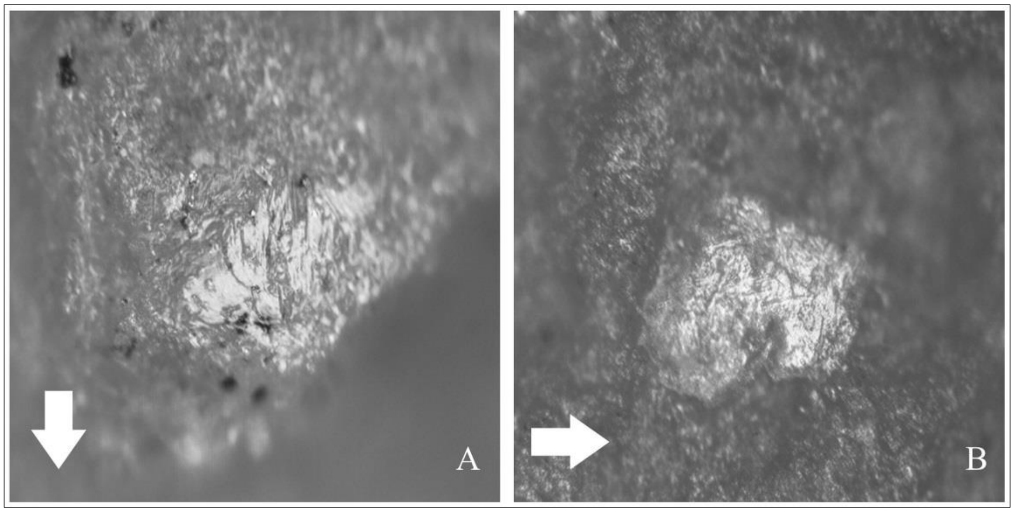

Figure 6-46. Use-wear present on Specimen 103-1. Arrows designates the location of the distal end of the point.

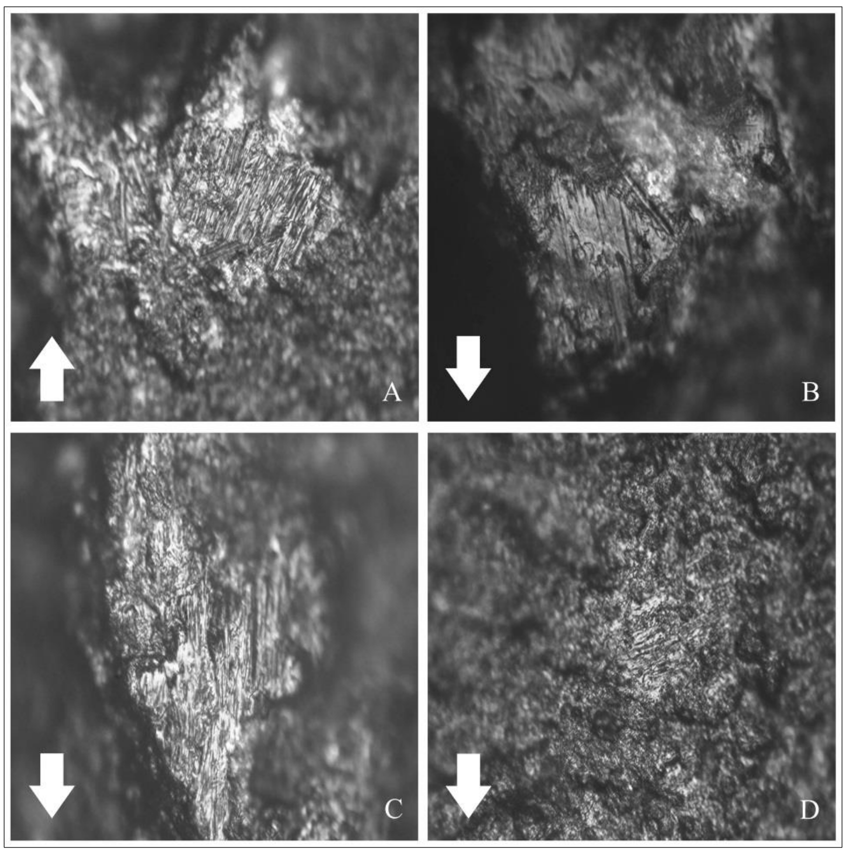

Figure 6-47. Use-wear present on Specimen 25-1. Arrows designates the location of the distal end of the point.

Untypable Dart Points, Barbs, and Stems

Phase: N/A

Series: N/A

N=23 (Specimen #s 10-1, 10-3, 11-1, 13-1, 15-6, 15-7, 20-1, 29-1, 45-2, 57-1, 66-1, 70-2, 71-1, 74-1, 75-2, 89-3, 112-1, 112-2, 116-1, 133-2, 140-1, 154-3, 163-1)

Metrics:

Lot-Specimen No.	Total Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal	Stem Length	Stem Width Basal	Stem Width Distal	Stem Thickness
163-1	-	40.14	37.77	6.31	5.32	-	-	15.26	-
140-1	-	-	33.62	5.89	4.8	-	-	19.04	-
45-2	-	-	20.4	7.32	8.51	-	-	-	-
29-1	44.99	31.88	33.72	5.43	5.26	10.61	25.62	18.67	5.24
133-2	38.58	26.06	-	7.02	5.67	12.52	14.44	11.81	4.61
10-1	51.13	36.83	31.87	7.63	4.99	14.3	19.48	18.47	4.75
66-1	-	-	-	5.89	-	10.22	18.38	13.3	5.15
75-2	-	-	-	6.07	-	10.12	-	14.1	4.79
154-3	-	-	28.19	5.95	-	11.46	19.88	17.99	4.96
89-3	-	64.21	-	8.89	5.69	-	-	-	-

Condition and Breakage: Specimen No.'s 10-1, 29-1, 45-2, 66-1, 75-2, 89-3, 133-2, 140-1, 154-3, and 163-1 are classified as untypable dart points (Figure 6-48, 6-49, and 6-50). All of the dart points exhibit some form of damage. Damage to these points consists of transverse fractures, crushing at the distal and proximal ends, and lateral macrofractures. The majority of the specimens reflect a random flaking pattern. Specimen 163-1 displays a systematic removal of flakes from the blade edge. Specimen 154-3 exhibits a collateral-like flaking pattern. The proximal end of specimen 89-3 appears to have been modified for use in an activity other than piercing. The re-working of the dart point resulted in the removal of the stem and one barb. The modified proximal end created an acute edge angle. Specimens 133-2 and 66-1 were recycled through the removal of burins originating at the distal fracture plane. Specimens 29-1 and 66-1 have been burned obscuring evidence for impact damage and re-sharpening. Specimens 11-1, 20-1, 57-1, 71-1, 74-1, 112-1, 116-1 are dart point stem fragments. Specimens 10-3, 13-1, 15-6, 15-7, 70-2, and 112-2 are untypable dart point barb fragments.

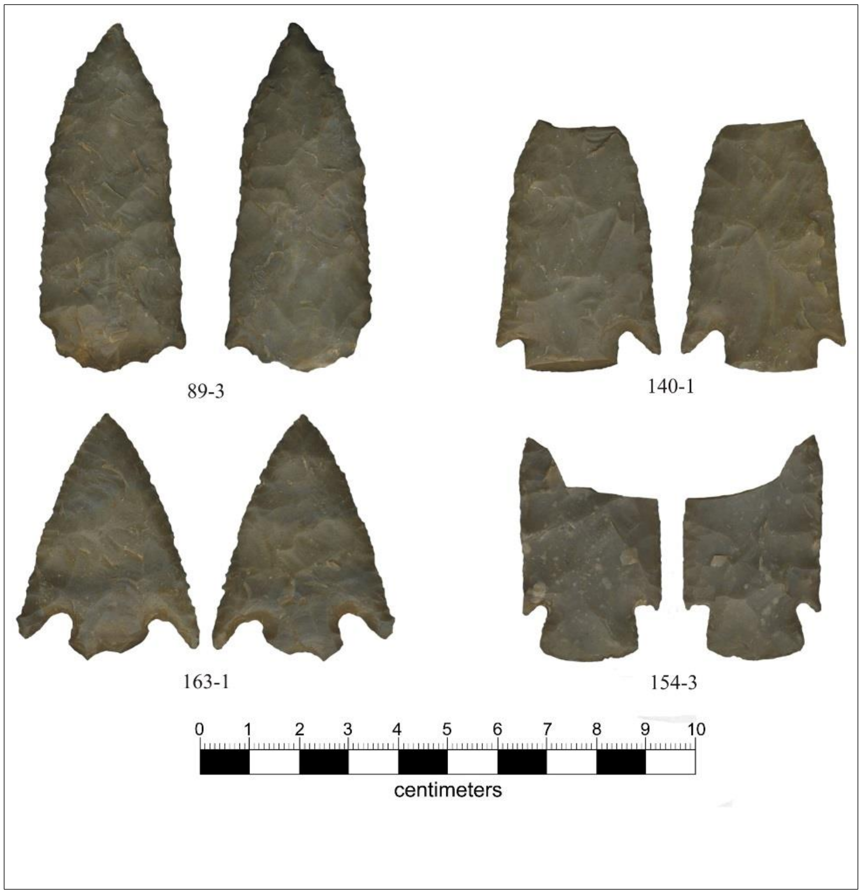

Figure 6-48. Untypable dart points recovered from site 41HY160.

Figure 6-49. Untypable dart points recovered from site 41HY160.

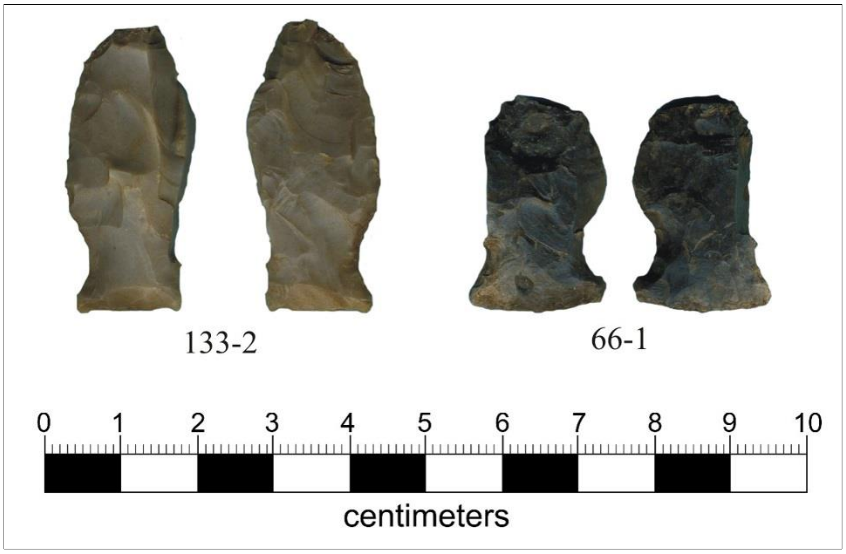

Figure 6-50. Untypable dart points recovered from site 41HY160.

Microscopic Use: Specimen 89-3 was examined for polish and other microscopic attributes. This specimen appears to have a reworked proximal end. The re-working of the edge created an acute angle. Figure 6-51 illustrates the type of wear present on Specimen 89-3. Image A is located at the proximal end along the lateral edge created by the re-working of the stem. The polish appears to have been created by a hard contact material. Striations are present within the polished region traveling 45 degrees from the long axis. Image B is located on the distal tip. The polish present reflects contact with a soft material. The modified proximal end appears to have been modified for use in an activity other than piercing (i.e. wood working), but due to the lack of polish it appears as though it was never used.

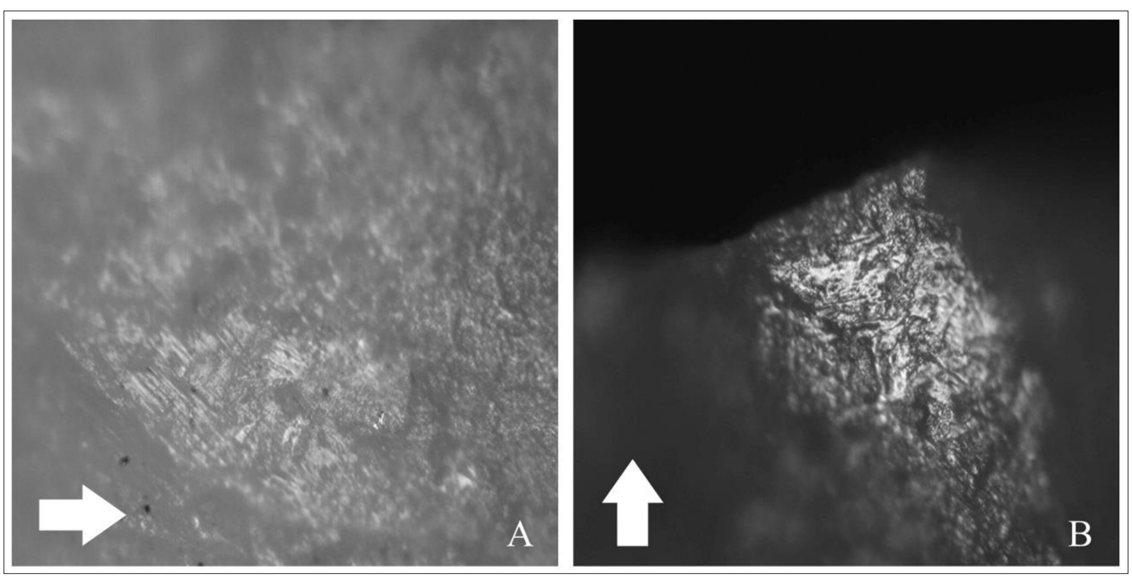

Figure 6-51. Use-wear present on Specimen 89-3. Arrows designates the location of the distal end of the point.

Summary of Results

Metric Data and Variation

The metric data was quantified in order to identify trends and determine differences in the degree of variation found within and/or among projectile point types. Metric data was only quantified and included within this analysis from the Pedernales, Nolan, Travis, Early Triangular, and Bulverde point types. The remaining points lacked enough specimens to support a meaningful assessment of the point type. The degree of variation expressed through metric measurements was the key focus when analyzing the available data. The standard deviation of various metric categories was used to determine the amount of variation within point types. Multiple factors must be considered when attempting to derive meaningful data from metric measurements. These factors include but are not limited to re-sharpening, damage, and the presence of more than one individual's workmanship on a single specimen. In order to account for the variation arising from re-sharpening and damage, stem data was weighed most heavily. Once assessing a point type's stem variation, blade variation must be considered. If stem variation is minimal, but blade variation is high one might conclude that the tools are being shared by the manufacturers within or between task groups who are responsible for re-sharpening the tool. If the stem variation is high and the blade variation is high one may conclude that many individuals of varying degrees of skill are producing points. This may signify a lack of adherence to standardization. Finally, if stem variation is minimal and blade variation is minimal within a robust sample size one may suggest the presence of a specialized group of point manufacturers small or large. Metric data associated with the stem element of the projectiles will be discussed first.

Stem metrics recorded include stem length, stem thickness, stem basal width, and stem distal width. Measurements for each specimen may be found in Appendix A. Nolan points, with the exception of stem length, appear to be the most homogenous point type among the four point types included in this study, followed by the Travis dart point. Bulverde and the Pedernales point types were the most variable point types overall when analyzing stem data, with Bulverde being the least homogenous. It should also be noted that Pedernales dart points are amongst the most abundant dart points recovered in Central Texas.

Next, blade measurements were acquired and quantified. Projectile point blades were often subjected to re-sharpening and damage making it difficult to accurately assess the manufacturing variation within point types. Despite the problems associated with assessing projectile point blade variation, important information may arise from re-sharpening and damage associated with projectile points. One must consider re-sharpening trajectories, which might provide insight into the use or uses the point was employed in. The blade may reflect a desire by the maker and or user to maintain a long yet narrow blade element or a short yet broad blade element. The degree of re-sharpening may also provide some insight into the curation of points and a desire to either save or waste raw material.

Pedernales, Nolan, and Travis blade data were compared against each other. The Bulverde dart point data proved to be insufficient due to the lack of a robust sample size pertaining to the blade element. Table 6-6 illustrates the standard deviation for each of the five recorded categories: Total Point Length, Blade Length, Blade Width, Blade Thickness Proximal, and Blade Thickness Distal. Among the three point types, the blade metrics are the most variable within the Travis sample. Comparatively, the Nolan point types appear to be the most homogenous when analyzing the blade data.

Combined, the metric data for blades and stems reveal several trends. The sample of Nolan points exhibits minimal variation in both the blade and stem measurements, which indicates that Nolan manufacturers were a highly specialized group. Travis points have minimal stem variation and high blade variation, suggesting the manufacturers may have been a specialized task group but were not the same individuals that were responsible for resharpening the tools. Pedernales points exhibit high variation in both stem and blade metrics. This suggests Pedernales point manufacturers were likely a group of many individuals with varying degrees of skill resulting in a lack of standardization in the overall production of Pedernales points.

Table 6-6. Standard deviation of the metric measurements Total Point Length, Blade Length, Blade Width, Blade Thickness proximal, and Blade Thickness Distal for point types Nolan, Travis, and Pedernales.

Point Type	Total Point Length	Blade Length	Blade Width	Blade Thickness Proximal	Blade Thickness Distal
Nolan	8.954	8.975	2.366	.811	.8
Travis	15.975	14.709	4.354	1.372	1.43
Pedernales	11.722	10.809	4.156	1.176	.745

Use-wear Analysis

A sample of Early Split Stemmed Variety, Early Triangular, Nolan, Travis, Bulverde, and Pedernales points underwent macro- and microscopic analysis to identify areas of potential use. Two additional specimens, an Andice (44-1) and a Bulverde (89-3) were analyzed microscopically despite their lack of a robust sample size as they retained obvious edge modification with the potential for observable use-wear on a portion of the blade element.

Impact damage was evaluated in order to confirm a projectile's use as a projectile. The frequency, type, and location of fractures were all considered together when associating the recorded damage with impact. 100 percent of the Pedernales, Bulverde and Travis samples exhibited macroscopic damage; approximately 93 percent of the Nolan sample was damaged. It was found that the highest occurrence of damage to Pedernales and Bulverde points was to the barbs. Travis points exhibited more damage to the stems (66.6 percent) than to any other portion of the artifacts. The highest occurrence of damage on the Nolan sample was found on the distal tips (77.8 percent) (Table 6-7). Damage to the distal end of a projectile is commonly associated with impact, although point damage can be the result of other functional activities including the disarticulation of an animal during butchering.

Microscopy revealed use-wear patterns that can help identify function within a sample of projectile points recovered from the 41HY160 field school investigations. Use-wear patterns recorded included presence of polish indicative of contact with hard, abrasive, or soft materials as well striations and their orientation to the mid-line of the point. Combined, these observations helped identify various wear and general use inferences such as hafting, piercing and functional applications other than piercing. Interestingly, microscopic use-wear consistent with uses other than piercing was observed within all types analyzed (Pedernales, Bulverde, Travis, Early Triangular, Andice and Early Archaic Split Stemmed). However, this small sample size precludes statistical evaluations or discussion of trends over time.

Table 6-7. Occurrence of damage observed macroscopically.

Point Type	No. of Specimens	Highest Occurrence of Damage	No. Distal Sample	% of Distal Tip Damage
Pedernales	8	87.5% - Barbs	5	40%
Bulverde	8	87.5% - Barbs	2	50%
Travis	9	66.7% - Stem	9	44.4%
Nolan	14	77.8% - Distal Tip	9	77.8%

Discussion of Projectile Point Frequency and Site Visitation Intensity

By Amy E. Reid

A total of (96) projectile points and point fragments were recovered from 41HY160. Of these, 73 (75 percent) can be identified by type. The most common types recovered include Nolan (n=14), Travis (n=9) and Early Triangular (n=9). Looking at the raw frequencies of point types by time period, we see a peak in the Clear Fork Series of the Middle Archaic (see Figure 6-1). In all, 58 projectile points were recovered from intact and undisturbed contexts that were designated as analytical units (AUs), 28 of which could be typed (Table 6-8). The highest frequency of projectile points from the established analytical units also occurs during the Middle Archaic (Figure 6-52). However, these raw counts represent the totals over each analytical unit which represents various volumes of excavated samples and different durations of time making them inadequate for an accurate comparison. Furthermore, when these raw frequencies are examined within the confines of the time periods defined by Prewitt (1985) for Central Texas, transitional periods between the major time periods are ignored. These transitions at 41HY160 are interpreted as periods when point styles gradually become superseded by new ones (Jon Lohse, personal communication 2015). This gradual phasing in and out of point styles leaves an archaeological record that is characterized by cultural strata containing projectile point types diagnostic of two or more different but consecutive time periods. Table 6-9 illustrates spatial and temporal relationships of the excavation units and the assigned analytical units, including transitional AUs assigned to unit-levels containing time diagnostic projectile points from multiple, but contiguous (neighboring) major time periods. This table also demonstrates how substantial the Middle Archaic occupation is at this location in terms of depth and contextual integrity with intact Early Archaic below and early Late Archaic above.

Site visitation intensity can be examined temporally by looking at the frequency with which all points, including those not found in AUs, were discarded (LeDoux and Lohse 2011). This is calculated by dividing the raw counts by the duration of each period and then multiplying the results by 100 (Table 6-8). According to these calculations, the Middle Archaic is indeed the most heavily occupied period with 1.889 points discarded per century. A sharp incline occurs from the Early Archaic to the

Middle Archaic, and then visitation declines during the Late Archaic and Austin phase of the Late Prehistoric period. Site occupation increases again during Toyah times.

Table 6-8. Site Occupation Intensity by Period as Determined by Discard Rate.

Period (AU)	**Date (Years BP)**	**Duration (*T*, Years)**	**Total Points**	**Points Found in AUs**	**Discard Frequency**
LP Toyah (AU 1A)	750-300	450	5	0	1.111
LP Austin (AU 1B)	1250-750	500	2	0	.400
LA II (AU 2A)	2200-1250	950	5	0	.526
LA I (AU 2B)	4000-2200	1,800	16	3	.889
MA (AU 3A,3B & 3C)	5800-4000	1,800	35	21	1.944
EA (AU 4)	8800-5800	3000	10	4	.333

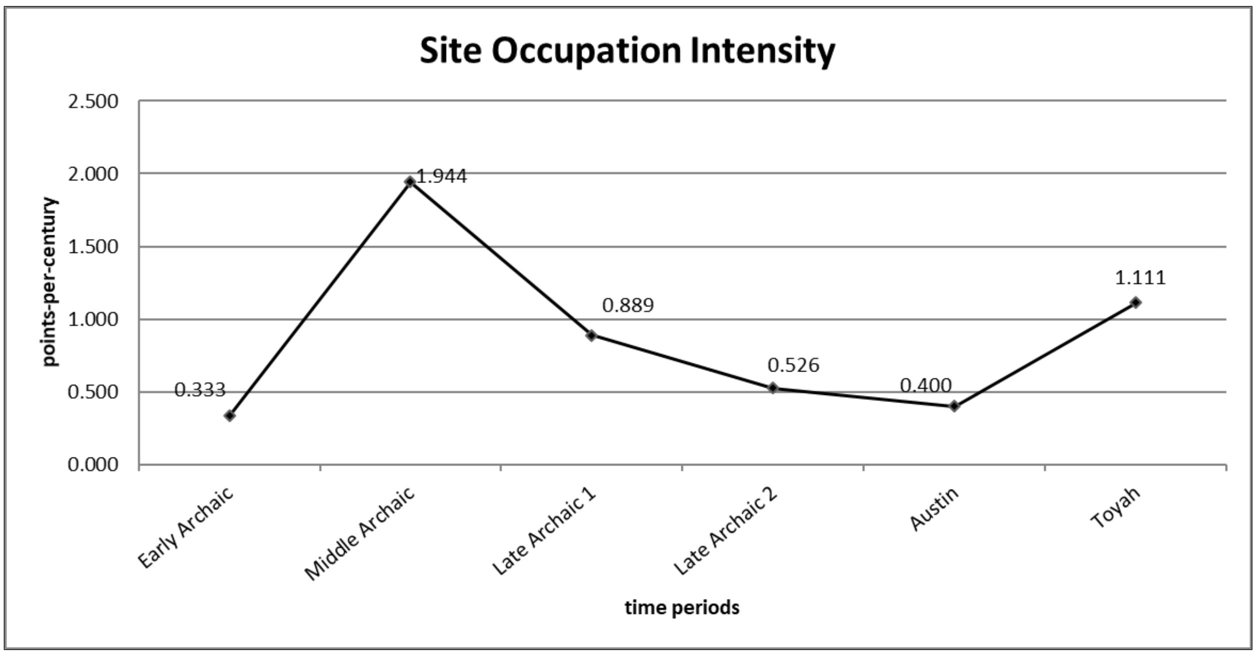

Figure 6-52. Relative intensity of site occupation by time period as indicated by frequency with which points were discarded per 100 years. Total point counts are divided by the length of each time period and the result is multiplied by 100.

Table 6-9. Assigned Analytical Units.

North Tier				
XU	11	9	6	7
LV				
1	62	31	*	1
2	63	32	*	2
3	64	33	*	3
4	65	34	*	4
5	66	35	*	5
6	67	36	*	6
7	68	37	*	7
8	69	38	*	8
9	70	39	*	9
10	71	40	*	10
11	72	41	*	11
12	73	42	*	12
13	74	43	*	13
14	75	44	*	14
15		45	*	15

Middle Tier				
XU	10	12	8	13
1	46	76	16	90
2	47	77	17	91
3	48	78	18	92
4	49	79	19	93
5	50	80	20	94
6	51	81	21	95
7	53	82	22	96
8	54	83	23	97
9	55	84	24	98
10	56	85	25	99
11	57	86	26	100
12	58	87	27	101
13	59	88	28	102
14	60	89	29	103
15	61		30	104

South Tier				
XU	14	16	15	17
1	105	134	119	148
2	106	135	120	149
3	107	136	121	150
4	108	137	122	151
5	109	138	123	152
6	110	139	124	153
7	111	140	125	154
8	112	141	126	155
9	113	142	127	156
10	114	143	128	157
11	115	144	129	158
12	116	145	130	159
13	117	146	131	160
14	118	147	132	161
15			133	162

Prehistoric
Late Archaic/Prehistoric
Late Archaic
Middle Archaic/Late Archaic
Middle Archaic
Early Archaic/Middle Archaic
Early Archaic

A Note about the Calf Creek Horizon and the Early Archaic

The 2001-2006 excavations can be credited as the first investigations to identify an intact Calf Creek component at the Spring Lake Site. The Calf Creek component was evidenced by the recovery of three Calf Creek artifacts) within well stratified and datable contexts. However, similar to chronologies for many Central Texas sites, the present analysis was conducted according to the belief that the Calf Creek horizon occurred during the Middle Archaic. Today, based on the sharply defined period of bison exploitation and a marked disjunction of Bell/Andice material with later Middle Archaic deposits, the authors consider the Calf Creek horizon to represent the terminal Early Archaic period in Central Texas (Lohse et al 2014). Furthermore, it is important to note that the Early Archaic is likely underrepresented in the field school excavations considering the excavation units were arbitrarily terminated at 170 cmbd. Recent investigations at Spring Lake have provided evidence for Early Archaic deposits extending below the field school termination depth to at least 295 cmbd (Lohse et al 2013). Therefore, the Early Archaic data presented here cannot be considered alone as a reliable sample for interpreting Early Archaic period occupation at Spring Lake. Future studies should compile and compare all available datasets for 41HY160 and should focus on developing radiocarbon assays from discrete "sealed" deposits containing both diagnostic artifacts and nearby datable organic material.

Bifaces

A total of 154 bifaces and biface fragments were recovered during the 2001, 2002, 2003 and 2006 field school seasons at 41HY160. Of those, 86 (55.6%) are associated with the established analytical units.

Methodology

All AU bifaces were sorted into one of seven categories: undiagnostic tools (n = 7), irregular and asymmetrical (n = 5), early-stage (n=0), intermediate-stage (n = 6), late intermediate-stage (n = 9), late-stage performs (n = 19), and pieces too small and fragmented to identify were categorized as indeterminate (n = 40). Selected samples of bifaces from each category are included in Figures 6-53 – 6-57. Measurements of length, width, and thickness to the nearest 0.1 mm as well as weight to the nearest 0.1 g were recorded for each biface. Weight/Thickness ratios were recorded for complete and relatively complete (widest point of specimen present). Specimens were inspected for evidence of heat treatment and use-wear. The above described attributes for all bifaces are included in Appendix B, Table B-1.

Results

Of all the identifiable bifaces, late-stage bifaces were more common than other reduction stages at this location during all time periods (Table 6-10). No early-stage bifaces were found within reliable contexts during the field school excavations.

A total of 13 bifaces were associated with the Early Archaic, 5 with the Early Archaic/Middle Archaic, 48 from the Middle Archaic, 9 from the Middle Archaic/Late Archaic, 8 from the Late Archaic, and 3 bifaces were found within the Late Archaic/Late Prehistoric AU. No bifaces were associated with either the Late Prehistoric Austin or Toyah AUs.

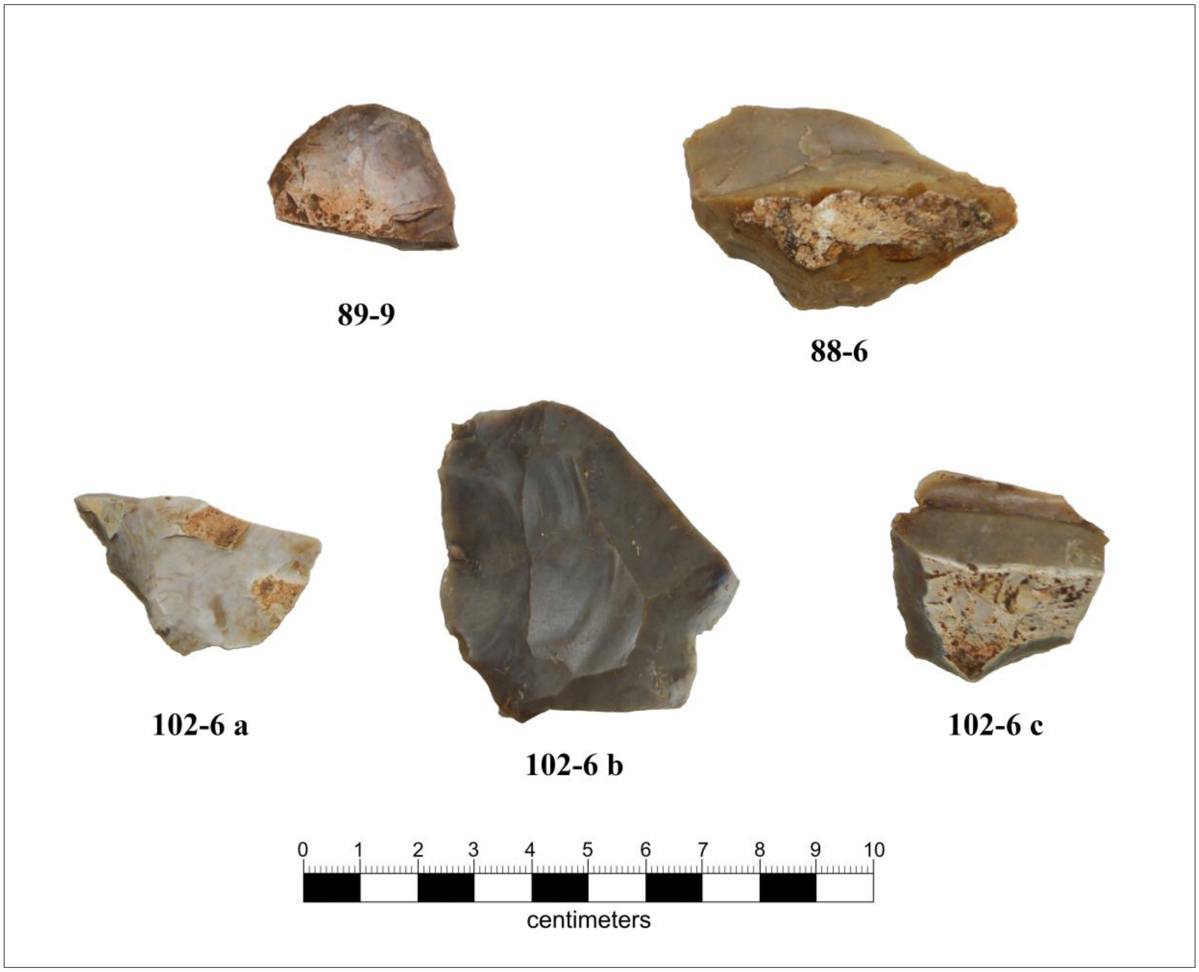

Figure 6-53. Selected examples of Intermediate State Bifaces.

Figure 6-54. Selected examples of Late Intermediate Stage Bifaces.

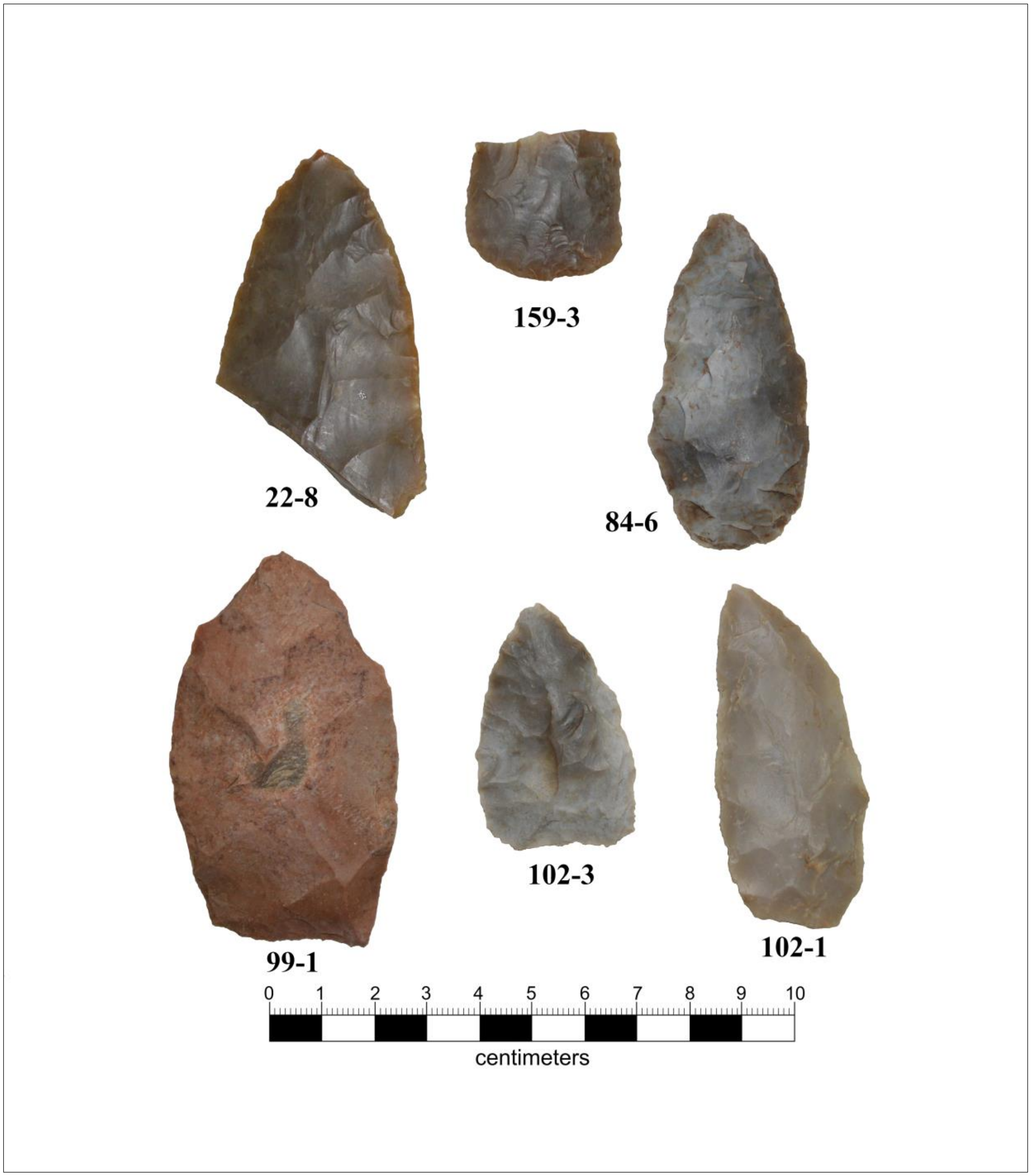

Figure 6-55. Selected examples of Late Stage Preforms

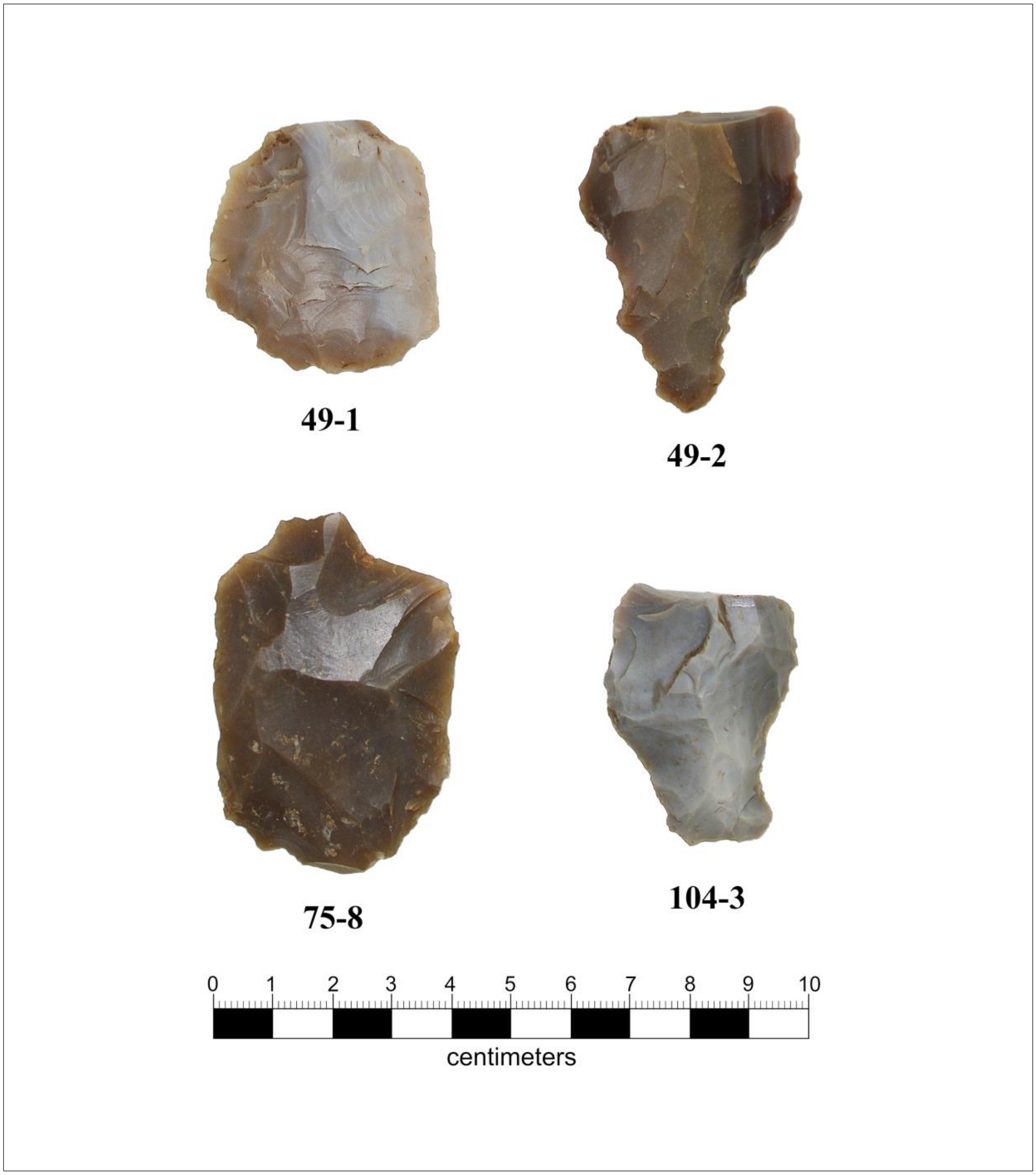

Figure 6-56. Selected examples of Irregular and Asymmetrical Bifaces.

Table 6-10. Raw Frequencies of Biface Categories by Period.

Period (AU)	**Biface Category**	**Count**
Early Archaic (AU 4)	Early Stage	0
	Intermediate Stage	0
	Late Intermediate	3
	Late Stage Preform	1
	Undiagnostic Tool	1
	Irregular & Asymmetrical	2
	Indeterminate	6
	Total	13
EA/MA (AU 3D)	Early Stage	0
	Intermediate Stage	0
	Late Intermediate	0
	Late Stage Preform	2
	Undiagnostic Tool	0
	Irregular & Asymmetrical	0
	Indeterminate	3
	Total	5
Middle Archaic (AU 3)	Early Stage	0
	Intermediate Stage	4
	Late Intermediate	3
	Late Stage Preform	13
	Undiagnostic Tool	6
	Irregular & Asymmetrical	0
	Indeterminate	24
	Total	47
MA/LA (AU 2C)	Early Stage	0
	Intermediate Stage	0
	Late Intermediate	0
	Late Stage Preform	3
	Undiagnostic Tool	0
	Irregular & Asymmetrical	1
	Indeterminate	6
	Total	9

Table 6-10. Raw Frequencies of Biface Categories by Period.

Period (AU)	Biface Category	Count
Late Archaic (AU 2)	Early Stage	0
	Intermediate Stage	0
	Late Intermediate	2
	Late Stage Preform	3
	Undiagnostic Tool	0
	Irregular & Asymmetrical	0
	Indeterminate	3
	Total	8
LA/PH (AU 1C)	Early Stage	0
	Intermediate Stage	0
	Late Intermediate	1
	Late Stage Preform	0
	Undiagnostic Tool	0
	Irregular & Asymmetrical	2
	Indeterminate	0
	Total	3

Flake Tools and Formal Unifaces

Formal unifaces are flaked only on one side and assume a standardized form. In the process of accomplishing this standardized form, prehistoric tool makers modified the original morphology of the flake to the extent that its initial size and shape cannot be determined (Hall et al. 1982:348). Nickels and Bousman (2010) also describe formal unifaces as “artifacts functionally classified as scrapers, gouges, or unifacial knives”. However, the present study avoids a functional classification system since inferences made regarding prehistoric use are best supported with microwear analysis.

Flake tools include any flake that is edge-modified or used and that has little to no modification on its ventral face. These tools are also flaked only on one side, but do not assume standardized forms; they are considered expedient tools that can be easily prepared but that have relatively low reliability. Expedient flake tools are infrequently maintained and often discarded and replaced with a new tool when they have acquired an undesirable amount of wear.

Methodology

All chipped stone from the defined AUs were scanned for unifaces and flake tools. Specimens were classified as flake tools if the original morphology of the flake could be determined and they showed evidence of macroscopic edge modification acquired through tool utilization but lacked regular and intentional flaking or shaping. A specimen was classified as a minimally retouched uniface (MRU) if regular and intentional flaking (retouch) was evident on one or more of its edges, but its original flake form was still distinguishable. A uniface was designated as formal if it exhibited significant shaping and deliberate patterning of unifacial flake removals on one or more edge. Table 6-11 lists the totals for flake tools, MRUs and unifaces from the defined AUs. These raw counts represent the totals over each AU, which represent various volumes of excavated samples and different duration of time. To account for this disparity, recoveries were standardized using the equation:

$$FS=((FR/T)/V) \times 100$$

In this equation, F_R represents the number of points found in the AU, which is divided by the duration of the AU (T). This value is then divided by the total volume (V) of excavated soil within the AU. Finally, the result is then multiplied by 100 to provide a standardized frequency (F_S) of the tool category.

Results

In total, 205 flake tools, MRUs and formal unifaces are present in the 41HY160 field school collection Analytical Units (Table 6-11).

Table 6-11. Flake tools, MRUs and Unifaces from Analytical Units.

AU	Category	Count
4	Flake Tools	5
	MRUs	0
	Formal Unifaces	0
3D	Flake Tools	0
	MRUs	1
	Formal Unifaces	0
3	Flake Tools	99
	MRUs	3
	Formal Unifaces	0
2C	Flake Tools	31
	MRUs	0
	Formal Unifaces	0
2	Flake Tools	46
	MRUs	2
	Formal Unifaces	2
1C	Flake Tools	0
	MRUs	0
	Formal Unifaces	0

Table 6-11. Flake tools, MRUs and Unifaces from Analytical Units.

AU	Category	Count
1	Flake Tools	15
	MRUs	0
	Formal Unifaces	1
Total		**205**

Flake Tools (n= 196)

196 flake tools were identified within the AUs established for the 41HY160 field school collection. Of those, 165 flake tools were associated with non-mixed (non-transitional contexts); can be compared temporally. Although raw counts show that the Middle Archaic (AU 3A, 3B, & 3C) contained the most flake tools, the adjusted numbers suggest that they were most frequent during the Late Archaic I (Table 6-12, see Figure 6-60).

Minimally Retouched Unifaces (n = 6)

Six MRUs were identified within the 41HY160 field school AU assemblage (Figure 6-57). Specimen 20-46 (not pictured) is an angular debitage fragment with intentional modification on one edge. Specimen 15-8 is a complete, wedge shaped flake with cortex. One edge has been unifacially modified. The flake scars are more invasive, and the edge angle is steeper towards the platform, perhaps in an attempt to thin the bulb of percussion and create a sharper edge. The third MRU, Specimen 115-1, exhibits edge modification and possible use-wear. In addition to intentional flaking, this specimen contains small notching on two different edges and one edge that was likely a graver. Two tools from lot 146 were classified as MRUs: 146-2, a triangular fragment with cortex and a sinuous latter edge from deep alternate flake removals and specimen 146-3, a crude uniface with cortex, steep edge modification with step fractures and small, uniform, retouch scars. MRUs were only found EA/MA, MA, MA/LA and LA contexts, with the highest frequency occurring during the Middle Archaic. Though, this sample size is too small to determine meaningful conclusions.

Figure 6-57. Minimally Retouched Unifaces

Formal Unifaces (n = 3)

Three formal unifaces were identified within the AUs (Figure 6-58). Specimen 96-2 is a fragment of an irregular uniface. It displays a curved modified edge with macroscopic use-wear and retouch on one face. The opposite edge and face exhibit irregular edge modification most likely from use rather than shaping. Specimen 153-3 is a small dome-shaped uniface with continuous and invasive flake scars. The shape is irregular; a small pointed edge is located on one end. Specimen 151-1 is a thick uniface with an extremely steep edge angle.

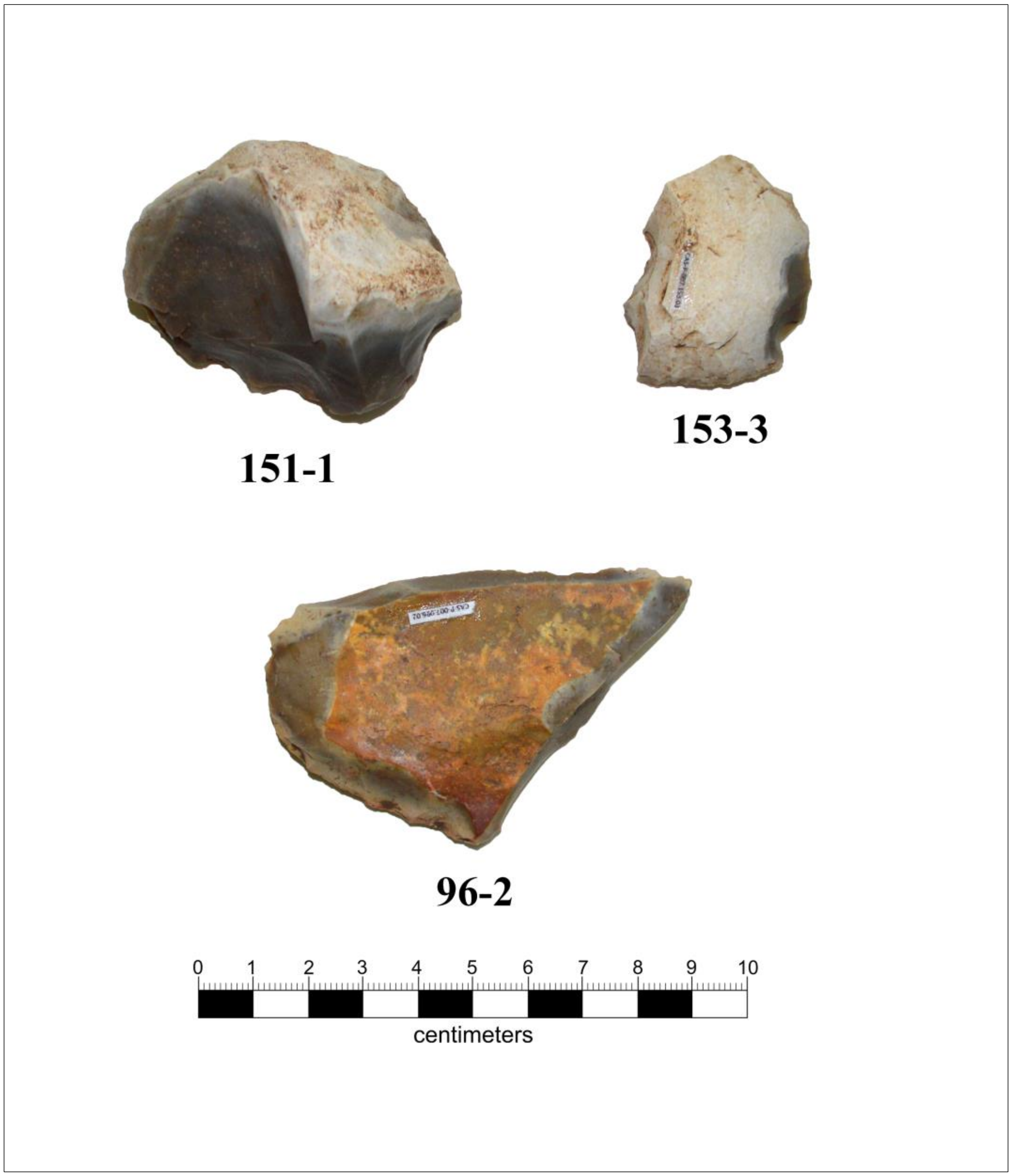

Figure 6-58. Formal Unifaces.

Non-AU Specimens

One Clearfork Gouge was recovered from Unit 7, Level 9 (Figure 6-59). This provenience (Lot 9) was also associated with a Nolan and a Travis projectile point from the Middle Archaic, though no absolute dating was conducted. A true blade specimen (70-7) was recovered from Unit 11, Level 9 (Figure 6-59). This specimen exhibits unifacial blade modification and thermal treatment; an unidentifiable dart point fragment and 2 barb fragments were found in the same unit-level (Lot 70).

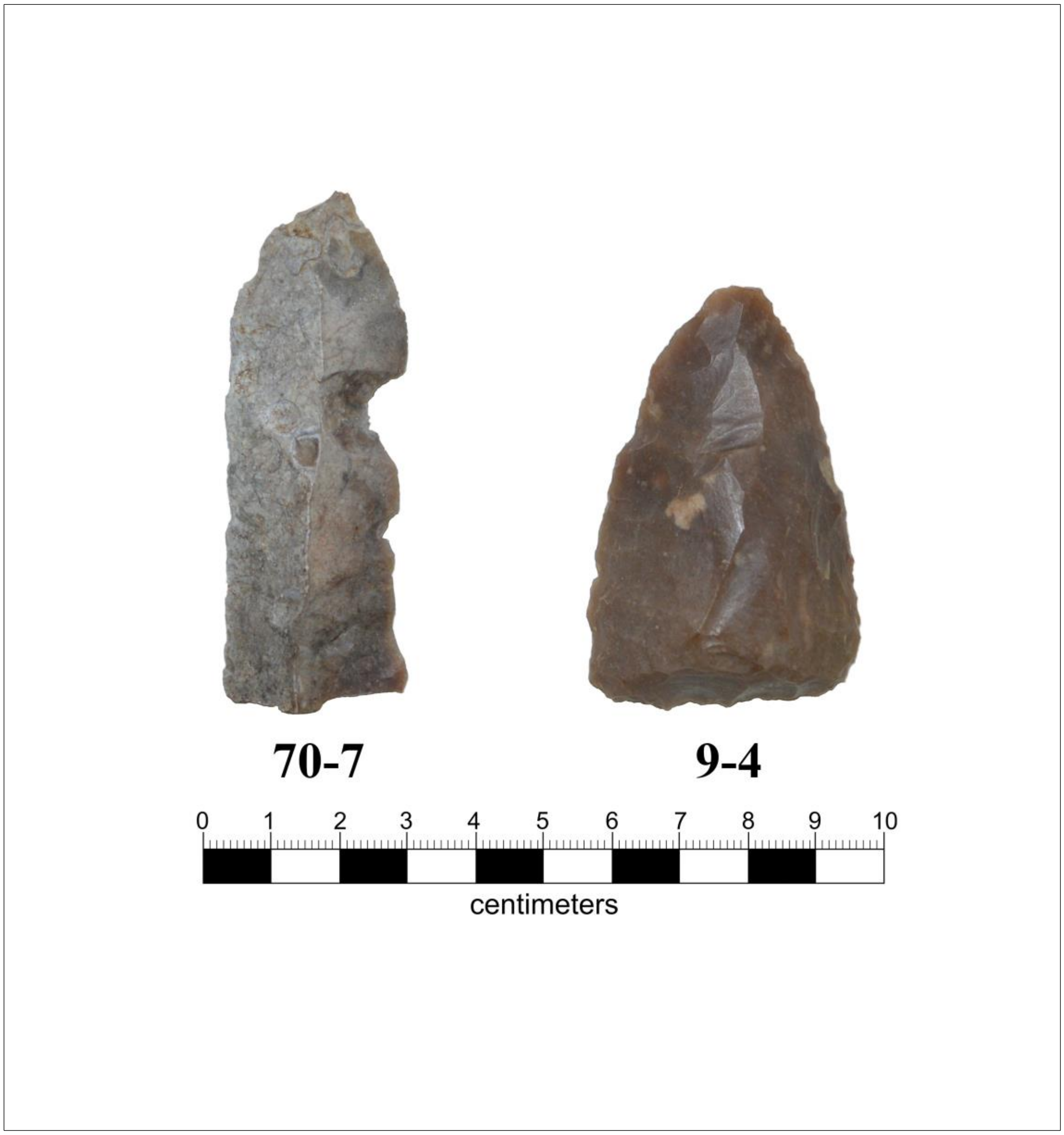

Figure 6-59. A true blade and a Clearfork Gouge.

Discussion

The data on flake tools from the 41HY160 field school assemblage suggests that more people were producing and using flakes as tools during the Late Archaic I, than in any other time period (Table 6-13, Figure 6-60). However, the Early Archaic was not fully sampled during these investigations; future analyses should look at the Early Archaic lithic artifacts recovered from more recent, deeper excavations (Reid *et al*. 2018). Additionally, the limited number of MRUs and formal unifaces from dated contexts prevents detailed temporal analysis. In general, this study realizes that minimally retouched unifaces are less expedient and more curated than the flake tool category. Furthermore, "curated" tools are often associated with collectors and "expedient" tools are often associated with foragers. However, it is our understanding that the concept of curation cannot be truly understood by relating it with any type of tool. Alternatively, we understand curation as a process associated with tool use. Therefore, future studies should look at the degrees of curation within both categories of tools by looking at the Total Edge Modification (TEM) and the Potential Edge Modification (PEM). This method would help to document how intensively flake tools and MRUs were used and facilitate an assessment of changes in expediency in different parts of the tool kits at 41HY160 over time (Leezer 2013, LeDoux 2011, Prilliman and Bousman 1998).

The same criteria Bousman and Nickels (2010) used for minimally retouched unifaces was used in our study. In some cases, flake edges that have been prepared or ground (similar to the way a platform is prepared) could be mistaken for use-wear. Furthermore, some use-wear could be mistaken for intentional edge modification/retouch. Experimental studies combined with microwear confirmation would be a valuable effort to differentiate between prepared/ground flake tool edges and utilized edges. It is also important to note that unidentified post depositional damage can cause single-flake random and irregular detachments on a flake edge. This type of edge morphology could also represent accretional chipping acquired during use. However, microscopic examination would be necessary to confirm this. Because of these subjective and complex issues, the total number of expedient flake tools is unknown for this assemblage.

Table 6-12. Raw and Adjusted Flake Tool Frequency

Period (AU)	**Duration (Years)**	**Flake Tool Total**	**Adjusted Frequency (Flake Tools/100 Years)**
Late Prehistoric (AU 1A & 1B)	950	15	0.23
Late Archaic II (AU 2A)	950	4	0.69
Late Archaic I (AU 2B)	1,800	42	2.16
Middle Archaic (AU 3A, 3B & 3C)	1,800	99	1.80
Early Archaic (AU 4)	3000	5	0.42

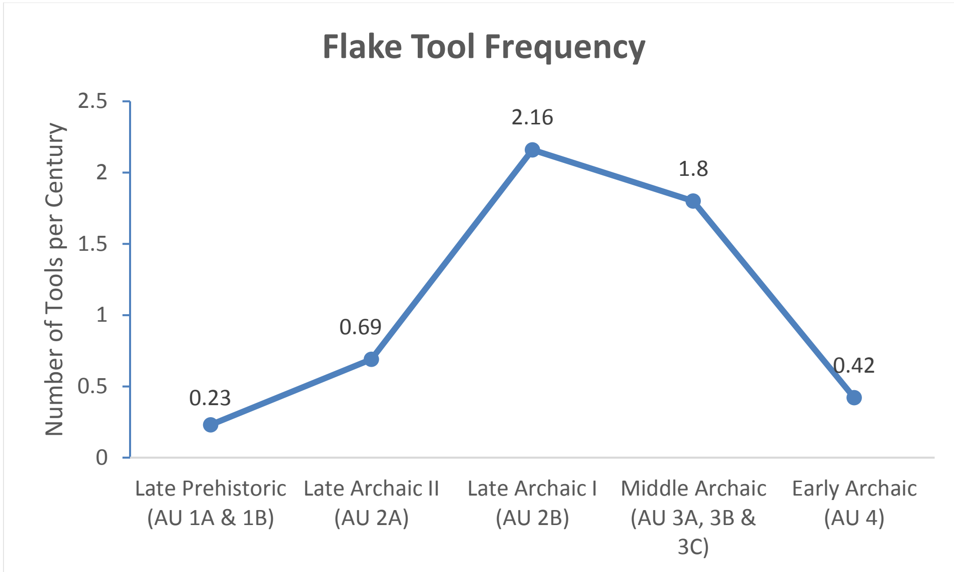

Figure 6-60. Line graph showing adjusted Flake Tool Frequency through time.

Cores (n=29)

29 cores were recovered from analytical units at 41HY160 (Table 6-13). The definition for a flake core follows Sitters et al. (2011:300) description: objects that show at least three flake removals or attempted removals from a discernable platform(s). Core specimens were sorted into one of 5 categories based on flake scar direction: unidirectional, bidirectional, multidirectional, ad hoc, or indeterminate (Table 6-12). Unidirectional cores exhibit flake removals aligned in approximately the same direction from a common platform (Figure 6-61). Cores with two opposing faces that both share the same platform edge are categorized as bidirectional cores (Figure 6-62). Multidirectional cores are characterized by flake removals from multiple directions and from more than one platform (Figure 6-63). Ad hoc cores are a subcategory of multidirectional flake cores that show some rotation, but no patterned faces or platforms have been developed (Figure 6-64). They also have little to no platform maintenance and some flake removals appear exploratory in nature.

Table 6-13. Flake Cores from AUs

AU	Category	Count
4	Multidirectional	1
	Ad Hoc	1
	Unidirectional	0
	Bidirectional	0
	Indeterminate	0
	Tested Cobble	0
	Total	**2**

Table 6-13. Flake Cores from AUs

AU	Category	Count
3D	Multidirectional	0
	Ad Hoc	1
	Unidirectional	0
	Bidirectional	0
	Indeterminate	0
	Tested Cobble	0
	Total	1
3	Multidirectional	11
	Ad Hoc	2
	Unidirectional	2
	Bidirectional	1
	Indeterminate	3
	Tested Cobble	2
	Total	**21**
2C	Multidirectional	0
	Ad Hoc	0
	Unidirectional	0
	Bidirectional	0
	Indeterminate	1
	Tested Cobble	0
	Total	**1**
2	Multidirectional	1
	Ad Hoc	0
	Unidirectional	0
	Bidirectional	0
	Indeterminate	1
	Tested Cobble	0
	Total	**2**
1C	Multidirectional	0
	Ad Hoc	0
	Unidirectional	0
	Bidirectional	0
	Indeterminate	0
	Tested Cobble	0

Table 6-13. Flake Cores from AUs

AU	Category	Count
	Total	**0**
1	Multidirectional	0
	Ad Hoc	0
	Unidirectional	0
	Bidirectional	1
	Indeterminate	1
	Tested Cobble	0
	Total	**2**
TOTAL		**29**

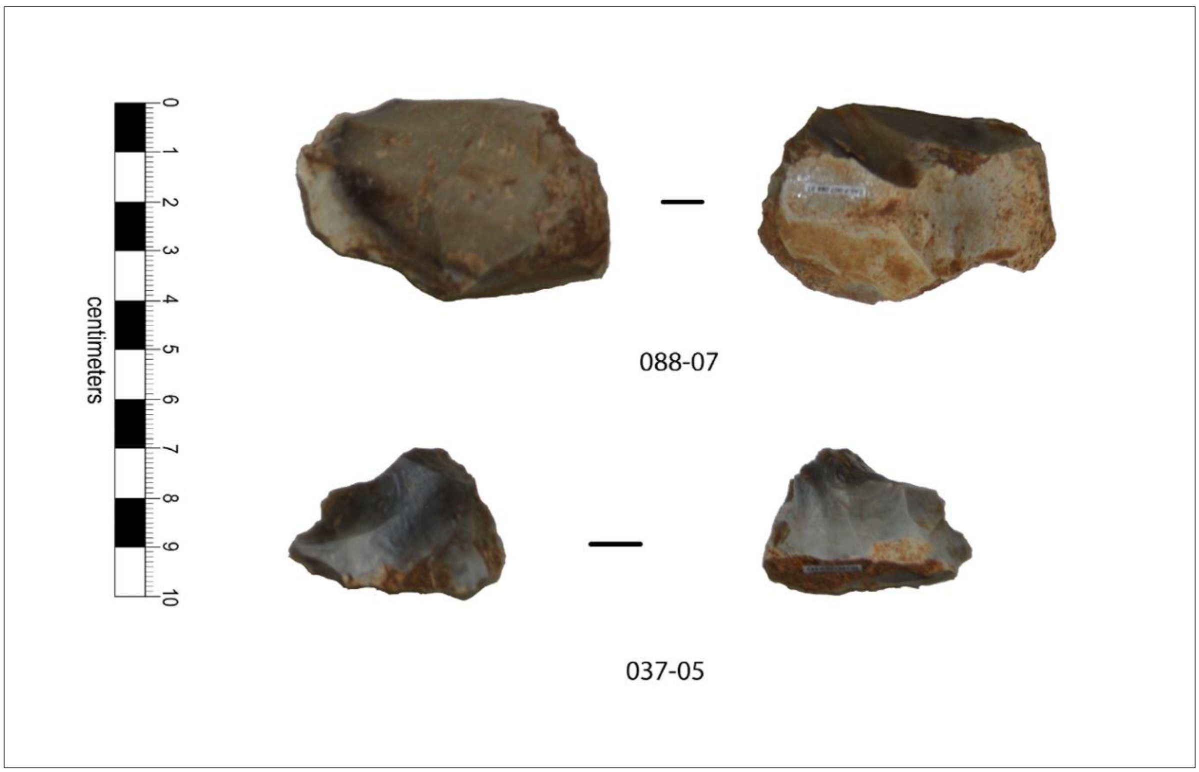

Figure 6-61. Selected Unidirectional cores from 41HY160 Field School collection.

Figure 6-62. Selected Bidirectional cores from the 41HY160 Field School collection.

Figure 6-63. Selected Multidirectional cores from the 41HY160 Field School collection.

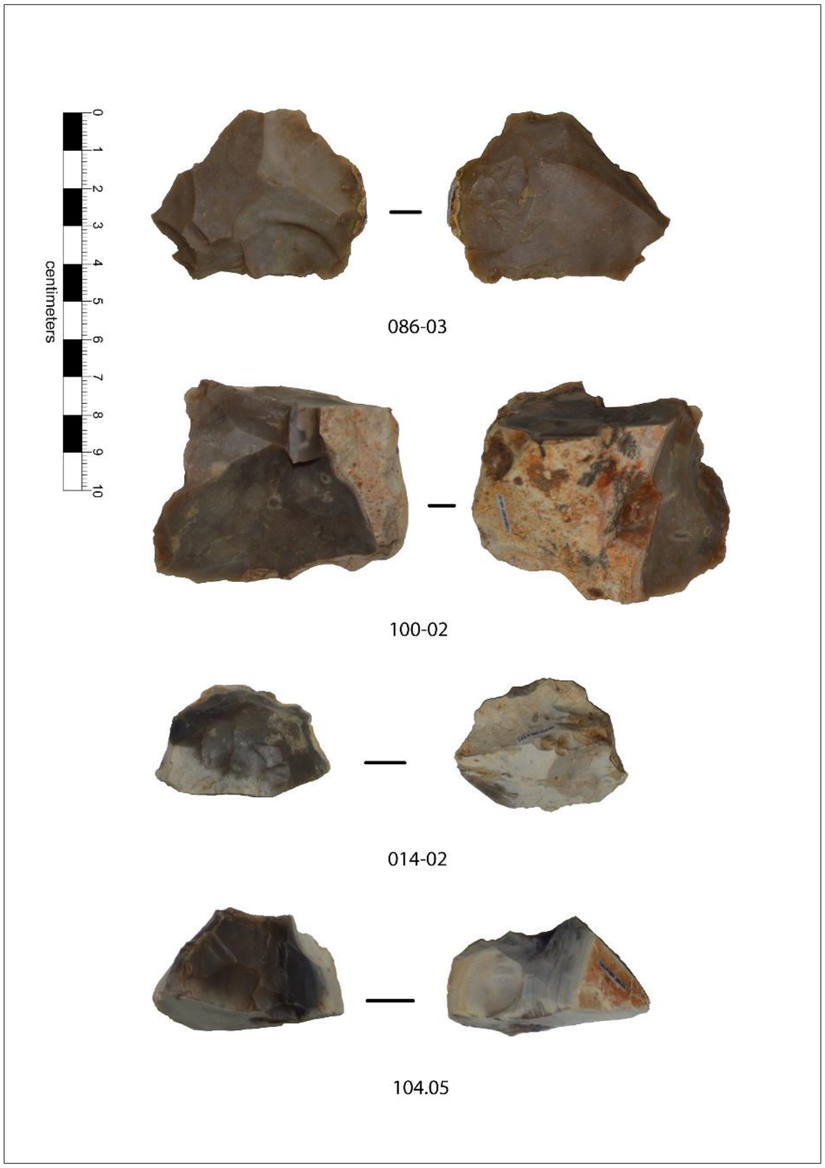

Figure 6-64. Selected Ad Hoc cores from the 41HY160 Field School collection.

Debitage (n=43,813)

Debitage is defined as waste material from lithic reduction including flakes and shatter that have not been used as cores or tools (Sullivan and Rozen 1985:755). As individual tools approach completion, the flakes produced become progressively smaller and the average amount of cortex on dorsal flake surfaces decreases. Thus, from the perspective of a flake population, a trend of smaller flakes with little or no cortex would indicate a later stage of core reduction (Andrefsky 2005). If cobbles with complete cortical surfaces are brought to the site and then reduced, the resulting flake assemblage would show greater amounts of dorsal cortex when compared to assemblages that exhibit primarily later reduction stages. However, if the raw materials were pre-reduced into flake blanks before they were brought to the site for tool manufacture, it is likely that the resulting flake component would have significantly lower percentages of dorsal cortex regardless of the reduction stage (Andrefsky 2005).

Flakes can also be analyzed to classify the type of load application used in its production. Some researchers believe that soft-hammer percussion flakes can be recognized by diffuse or no bulbs of force and pronounced lips. Although size is a difficult and unreliable measure for determining load application, pressure flakes are sometimes defined as being smaller, thinner and lighter in weight than percussion flakes. Flakes produced by hard-hammer percussion have "pronounced bulbs of force, no lipping and slightly crushed striking platform areas" (Crabtree 1972: 44).

The method of creating a technological typology based on flake morphology can be important in making behavioral interpretations and has its own theories. For example, flake types are often used to infer the use of specific tool types at a site. Bifacial thinning flakes are flakes removed to thin or trim a biface. They can vary in sizes and attribute values depending upon the size and shape of the biface as well as the trimming method. This flake type usually has pronounced lips and complex or faceted striking platforms, indicating platform preparation. Also, since the flake is removed from a biface, it will usually have ridges between flake scars on the dorsal surface. These flakes can be associated with both the production of and the resharpening of biface tools. Flakes produced from retouching or resharpening end scrapers are created by using the ventral surface as a striking platform. Therefore, they usually have flat striking platforms and rarely have dorsal cortex (Andrefsky 2008:123).

Overall, the different attributes associated with bifacial thinning flakes and striking platforms can be used to differentiate between biface production and core reduction as well as determine the relative amount of time invested in production. Flakes with single facets (flat striking platforms) are usually the result of detaching flakes from non-bifacial tools like unidirectional cores. Since bifacial thinning flakes usually have complex striking platforms and pronounced lips, which are produced by soft-hammer percussion on a prepared platform, a more time-consuming process can be associated with the production of biface tools. Additionally, some researchers believe that platform preparation is indicative of the knapper being more careful when removing flakes from an objective piece that is close to being finished or has had a large amount of investment put in its production (Andrefsky 2005). Some researchers have observed that a "trend with decreasing relative amounts of bifacial thinning flakes suggests that bifacial technology decreases with increased amounts of relative sedentism" (Andrefsky 2005). Thus, the relative amount of bifacial thinning flakes at a site could be used to infer the degree of sedentism at that site (Parry and Kelly 1987). Through consideration of the theoretical perspectives described above, debitage types and attributes were analyzed from the data recovered from site 41HY160 and are presented below.

Methodology

The present study includes only debitage that has not been modified through utilization or retouch. Debitage from the analytical units was sorted into the following categories: complete flakes, proximal flakes, broken flakes, burned non-flaked debitage and angular debris (shatter). Total counts are presented in Table 6-14. Proximal flakes, broken flakes, and burned non-flake debitage were counted and weighed and then excluded from further analysis. A complete listing of debitage counts and weights for each analytical unit is provided in Appendix C.

Complete flakes were the focal point of our analyses as they were believed to be most informative. Sub-categories of biface thinning flakes include r-flakes and distinctive expanding billet flakes (DEBs). R-flakes result from a manufacture error where the knapper strikes too deeply on the platform removing a wider section of the biface edge than intended. The platforms on r flakes are large and are usually the widest area of the flake. The ventral surfaces of r flakes are characterized by a bending fracture that often creates a profile resembling the shape of the letter “r”. DEBs are very thin, curved flakes that have extremely narrow platforms and lateral edges that expand for more than on half of the length of the flake. Both r flakes and DEBs can be reliably associated with a billet percussion method of flake removal (Hayden and Hutchings 1989).

The assemblage was also scanned for notching flakes. Notching flakes are flakes created during the notching of haft elements on bifacial tools by percussion, pressure flaking and/or indirect percussion. They are smaller, thinner and weigh less than thinning flakes removed by direct percussion flaking. Notching flakes were described by Crabtree (1972) as “lunate, resembling the quarter moon”.

Table 6-14. Counts for all AU debitage by category.

	Complete Flakes	**Proximal Flake Fragments**	**Flake Fragments**	**Burned**	**Shatter/Chunks**	**Total**
Count	4652	12421	21168	4424	1148	43813

Analysis

From the complete flakes, totals of each flake type were looked at temporally (Table 6-15). Billet flakes (r-flakes and DEBs) were sorted from the complete flakes in order to identify general flaking technologies. The raw frequencies of both r-flakes and DEBs were highest during the Middle Archaic AU. Ratios of billet flakes to the total number of complete flakes (per AU) were looked at in order to consider increased and decreased billet flaking technology over time (Figure 6-65). These ratios indicate that *as a percentage of all complete flakes per AU*, the biface thinning flake ratio is highest during the Early Archaic AU and decreases over time.

Frequencies of notching flakes were looked at temporally in order to understand trends in the notching of haft elements on bifacial tools by pressure flaking over time. According to the data, the Middle Archaic AU contained the highest raw frequency of notching flakes (N= 91). As a percentage of all complete flakes, the notching flake ratio is highest during the Late Archaic II (Figure 6-66).

Table 6-15. Totals of Complete, R-Flakes, DEB flakes and Notching Flakes per AU.

AU	**Category**	**Count**
Early Archaic	Complete Flakes	111
(AU 4)	Billet: r-flakes	5
	Billet: DEBs	0
	Notching Flakes	3

Table 6-15. Totals of Complete, R-Flakes, DEB flakes and Notching Flakes per AU.

AU	Category	Count
Middle Archaic	Complete Flakes	2698
(AU 3A, 3B, 3C)	Billet: r-flakes	58
	Billet: DEBs	21
	Notching Flakes	91
Late Archaic I	Complete Flakes	793
(AU 2B)	Billet: r-flakes	17
	Billet: DEBs	0
	Notching Flakes	51
Late Archaic II	Complete Flakes	244
(AU 2A)	Billet: r-flakes	5
	Billet: DEBs	0
	Notching Flakes	23
Late Prehistoric	Complete Flakes	168
(AU 1A & 1B)	Billet: r-flakes	2
	Billet: DEBs	0
	Notching Flakes	15

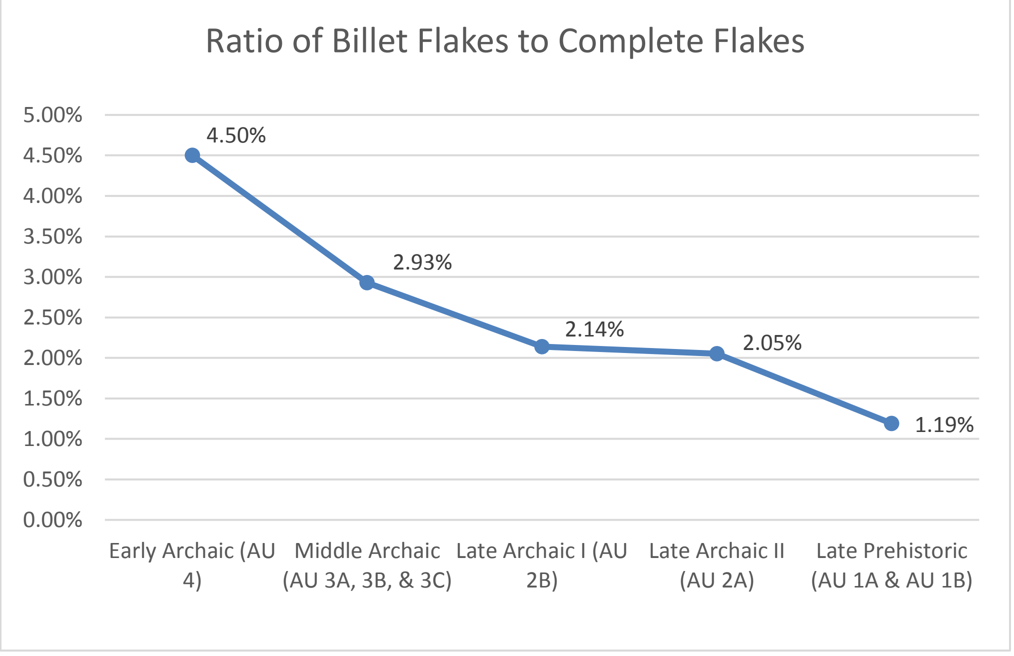

Figure 6-65. Ratio of Billet Flakes to Complete Flakes through time.

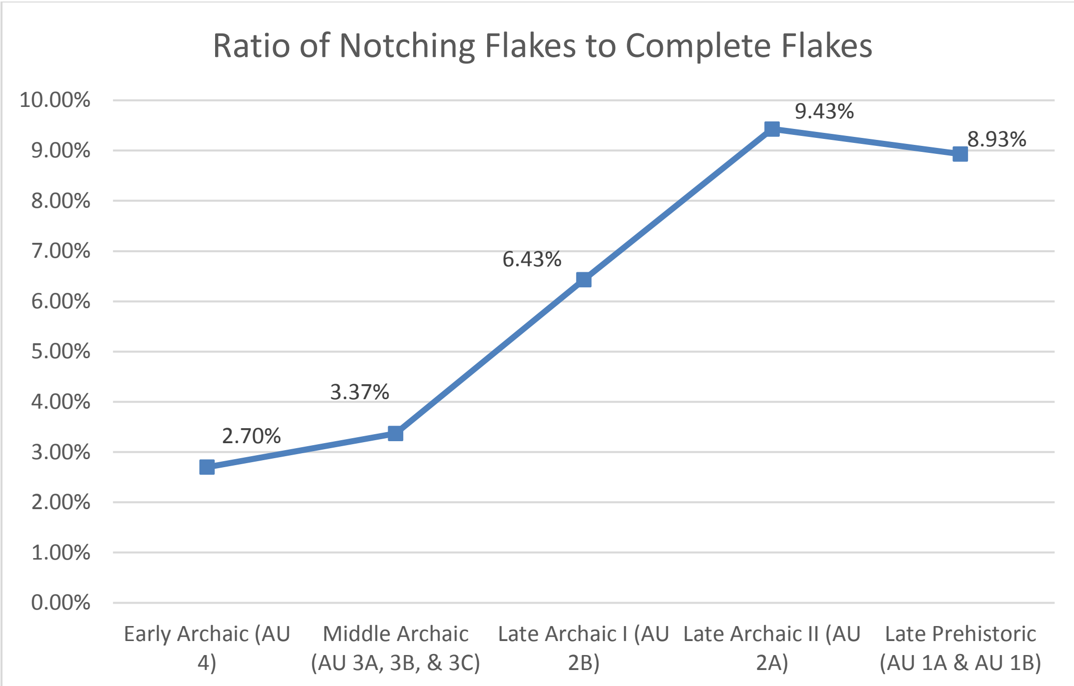

Figure 6-66. Ratio of Notching Flakes to Complete Flakes through time.

Summary of Results

Several trends can be established from the analysis of debitage at 41HY160. Biface thinning via billet technology was the least common during the Late Prehistoric. The Middle Archaic time period contained the highest frequency of biface thinning flakes, though the ratio of thinning flakes to complete flakes was highest in the Early Archaic. This suggests that later stages of tool production evidenced by billet flaking technology was most common during the Early Archaic and that bifacial technology in general decreased through time. Notching flakes were most numerous during the Middle Archaic. However, the ratio of notching flakes to complete flakes was highest during the Late Archaic II.

Discussion

After reviewing the available data and analysis notes, it was determined that the assemblage was not initially sorted into non-thinning and thinning flakes before the billet flakes were sorted. Therefore, the total number of general thinning flakes is unknown (as they are still mixed in with the complete flakes); it was not possible to compare ratios of thinning flakes and non-thinning flakes to the total number of complete flakes.

Not only does this impede comparisons between non-thinning flakes and thinning flakes, it makes it difficult to reach meaningful conclusions about specialized billet technology as it compares to other thinning techniques at 41HY160. Also, it is was not possible to look at trends in on site core reduction as would be evidenced by the non-thinning flakes. The debitage analysis also appears to have been focused on the Middle Archaic lots; the counts and totals of different flake types within other AUs should be considered with caution. A comprehensive re-analysis of the debitage located within all identifiable analytical units is recommended. Future studies should examine the debitage recovered from investigations at 41HY160 during the 2001, 2002, 2003 and 2006 field school seasons in conjunction with the more recent dataset generated from the Spring Lake Data Recovery project, which involved the controlled excavation of 25 adjacent units (Reid *et al*. 2018).

There is also potential for future studies to look at morphological variation among the notching flakes at 41HY160 and associated diagnostic projectile points. In *The Calf Creek Horizon: Middle Holocene Hunter Gatherers on the Southern Plains and Their Margins*, Sergio Ayala defined “diagnostic notching flakes that are the result of specialized methods, techniques and manners of production” (Ayala 2017). Ayala’s study, “Calf Creek Diagnostics: The Technology Behind Andice, Bell and Calf Creek Spear Points”, technologically and experimentally examines unique notching behaviors on the Early-Middle Archaic projectile point types of the Calf Creek Horizon. Future analyses of the lithic debitage from the 41HY160 field school assemblage should consider the variability of notching flakes present from a range of notching techniques and differences in hafting technologies. In particular, future studies should look for notching flakes diagnostic to the Calf Creek Horizon projectile points as defined in Ayala’s analyses (Ayala 2017).

Hammerstones (N= 4)

Hammerstones are non-chipped stone tools used to remove flakes from an objective piece such as a core or biface. Four hammerstones were identified within the 41HY160 field school collection. Three of the four hammerstones were found within the Middle Archaic AU: Specimens 129-59, 87-1, (Figure 6- 67), and 100-37 (not photographed). Specimen 81-39 was not recovered from a dateable context (Figure 6- 67).

Figure 6-67. Hammerstone tools.

Groundstone Artifacts (N=1)

One specimen, 151-2, appears to be a fragment of a metate or grinding slab (Figure 6-68). One surface is smooth, and 3 edges are angular in shape. There are some striations and/or incising visible on the smooth surface. Specimen 116-3 is categorized as a Mano, a ground stone tool that was used with metates or grinding slabs to process plant materials. Although it exhibits some battering on two ends typical of a hammerstone, the shape and smoothness of the artifact suggests it was used as a Mano. It is made of quartzite and has a natural indentation on one surface (Figure 6-69).

Figure 6-68. Metate or grinding slab fragment.

Figure 6-69. Mano Artifact made of quartzite.

Tabular Incised Stone Candidates (N=3)

Three tabular stones were recovered and categorized as Incised Stone Candidates (Figure 6-70). Although microscopic analysis was not included in the present research design, future studies should perform careful microscopic inspection as well as Polynomial Texture Mapping (PTM) to detect cultural modification patterns that are neither macroscopically nor microscopically apparent. In particular, studies should follow the analysis protocol developed by Lemke, Wernecke and Collins (2015) in their study of Clovis and Paleoindian incised artifacts from the Gault Site 41BL323.

Figure 6-70. Tabular, incised stone candidates.

Conclusions

The lithic assemblage from 41HY160 consists of reliable, maintainable tools such as projectile points and bifaces as well as expedient flake tools and minimally retouched unifaces. These findings are comparable to other assemblages from the multicomponent Spring Lake Complex. From one time period to the next, the lithic assemblages are shaped by population changes as well as changes in subsistence that required technological shifts (Bousman 2003, 2010, Leezer 2012, 2013, Oksanen 2011, Lohse 2013).

A total of (96) projectile points and point fragments were recovered from 41HY160. Of these, 65 are typeable dart points while 7 are typeable arrow points. Seventeen different point types were recovered, including: Lerma, Early Stemmed, Early Split Stemmed Variety, Martindale, and Merrell for the Early Archaic (n=10); Andice, Nolan, Early Triangular, and Travis for the Middle Archaic (n=34); Bulverde, Pedernales, Marcos, Montell, Ensor, and Ellis for the Late Archaic (n=21); Scallorn for the Austin phase (n=2); and Perdiz for the Toyah phase (n=5). Additionally, 10 unidentifiable dart points, 7 unidentifiable projectile point base fragments, 6 unidentifiable dart point barbs, and 1 unidentifiable arrow point were recovered. Four projectile points, morphologically similar to the Pedernales point style, were recovered from an Early Archaic context; are referred to as an Early Split Stemmed Variety. A complete descriptive analysis was conducted which also examined tool use, task specialization, skill and style. Also, metric data was quantified for in order to identify trends and determine differences in the degree of variation fount within and/among Pedernales, Nolan, Travis, Early Triangular, and Bulverde point types. It was determined that Nolan points, were the most homogenous type followed by the Travis dart point. Bulverde and Pedernales point types were the most variable overall.

Looking at the raw frequencies of all point types by time period, we see a peak in the Clear Fork Series of the Middle Archaic (Figure 6-51). Looking at just the AU projectile points, the highest frequency of projectile points from the established analytical units also occurs during the Middle Archaic. The raw frequencies of projectile points were also examined within transitional periods, cultural strata containing projectile point types diagnostic of two or more different but consecutive time periods. Table 6-9 illustrates the spatial and temporal relationships of the excavation units and the assigned analytical units, including transitional AUs assigned to unit-levels containing time diagnostic projectile points from multiple but contiguous major time periods. This table also demonstrates the significance of the Middle Archaic occupation in terms of overall depth, richness of diagnostic artifacts and contextual integrity.

When standardized for differences in durations of time and volumes of excavated samples, the frequency of discarded projectile points suggests that the Middle Archaic was indeed the most heavily occupied period with 1.889 points discarded per century. A sharp incline occurs from the Early Archaic to the Middle Archaic, and then visitation declines during the Late Archaic and Austin phase of the Late Prehistoric period. Site occupation increases again during Toyah times.

The 2001-2006 excavations are the first to identify an intact Calf Creek component at the Spring Lake Site. The Calf Creek component was evidenced by the recovery of three Calf Creek artifacts within well stratified and datable contexts. The authors would like to remind the reader that the present analysis was conducted according to the belief that the Calf Creek horizon occurred during the Middle Archaic. The Calf Creek horizon is now thought to represent the terminal Early Archaic period evidenced by the sharply defined period of bison exploitation and a marked disjunction of Bell/Andice material with later Middle Archaic deposits. It should be repeated that the Early Archaic is likely underrepresented in the field school excavations considering the excavation units were arbitrarily terminated at 170 cmbd. Recent investigations at Spring Lake have provided evidence for Early Archaic deposits extending below the field school termination depth to at least 295 cmbd (Lohse et al 2013). Therefore, the Early Archaic data presented here cannot be considered alone as a reliable sample for interpreting Early Archaic period occupation at Spring Lake. Future studies should compile and compare all available datasets for 41HY160 and should focus on developing radiocarbon assays from discrete "sealed" deposits containing both diagnostic artifacts and nearby datable organic material.

Non-hafted bifaces were found to be most numerous during the Middle archaic, and late-stage bifaces were more common than other reduction stages at this location during all time periods.

The analysis of flake tools showed that flake tool use intensified during the Late Archaic I. The limited number of MRUs and formal unifaces from dated contexts prevents detailed temporal analysis. Cores were most frequently associated with Middle Archaic contexts, and the debitage analysis revealed that the Middle Archaic time period contained the highest frequency of biface thinning flakes, though the ratio of thinning flakes to complete flakes was highest in the Early Archaic. This suggests that later stages of tool production evidenced by billet flaking technology was most common during the Early Archaic and that this technology generally decreased through time. As a percentage of all complete flakes, the notching flake ratio is highest during the Late Archaic II (Figure 6-66).

These observations point towards a more maintainable and curated tool kit during the Early and Middle Archaic which suggests that people visiting 41HY160 during the Early and Middle Archaic may have practiced collector strategies. A transition to subsistence strategies more reliant on foraging may have occurred during the Late Archaic, as evidenced by increased use of the more expedient flake tools. However, this hypothesis should be tested by looking more at tool use than just tool types. For example, future studies should look at the degrees of curation within both categories of tools by looking at the Total Edge Modification (TEM) and the Potential Edge Modification (PEM). This method would help to document how intensively flake tools and MRUs were used and facilitate an assessment of changes in expediency in different parts of the tool kits at 41HY160 over time (Leezer 2013, LeDoux 2011, Prilliman and Bousman 1998).

The lithic analysis concluded with descriptions of the hammerstones and groundstone artifacts in addition to suggestions for future research involving microscopic inspection and PTM of the incised stone candidates.

CHAPTER 7: CERAMIC ANALYSIS OF SAMPLES FROM 41HY160 AND 41HY188, HAYS COUNTY, TEXAS

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In June 2011, the Center for Archaeological Research obtained ceramic sherd samples from the Center for Archaeological Studies for petrographic analysis. The samples derived from three archaeological sites near the Texas State University Campus. The samples consisted of 37 sherds from 41HY160, 24 sherds from 41HY165 and sixteen sherds from 41HY188. Following the receipt of the samples several discussions ensued regarding the nature of the analyses that were to take place regarding these samples. The tasks and analyses that were to be performed included the following:

1. Macroscopic ceramic analysis of each sherd prior to sub-sampling
2. Sub-sampling of sherds for Petrographic and neutron activation analysis
3. Creation of Petrographic thin-sections
4. Petrographic analysis and reporting
5. Instrumental Neutron Activation Analysis (INAA) and reporting through the University of Missouri Research Center (MURR)
6. Report preparation summarizing the results of the distinct analyses and integrating them into the existing ceramic traditions of the broader region

Because the analysis was to focus on sherd fragments that were sufficiently large to divide into subsamples for petrographic analysis as well as INAA, the very first tasks was to inspect the large original sample, determine how many vessels the sherd fragments represent and within each sherd cluster that represents a single vessel, select a sufficiently large sherd that could be subdivided into two fragments, one to be used in the production of a petrographic slide and the other to be used in the neutron activation analysis. Once the samples were identified, and prior to their subdivision, the fragments were to undergo macroscopic ceramic analysis involving the general description of their characteristics.

The goal of the macroscopic analysis was to define the surface treatment attributes of the vessels represented in the samples and also define the technological attributes associated with their manufacture. Specifically, we wanted to characterize the steps taken by the prehistoric/historic potters in manufacturing the vessel from the clays used, the a-plastic (tempers) additives to the raw clays, and the firing conditions employed. These findings were to be compared with findings derived from the

Petrographic analysis which typically is able to quantify more precisely the technological aspects of paste preparation and clay sources employed in fabrication. The original sample of sherds provided to the CAR was tagged and some tags indicated that the sherds were preliminarily categorized into prehistoric, Spanish Colonial wares, and at least one modern piece. In addition, some of the prehistoric wares were classified as either Leon Plain, Doss Redwares, or unknown prehistoric. Some historic sherds were in turn identified as majolica specimens.

The preliminary inspection of the original sherd samples indicated that quite a number of the sherds may be part of the same vessel and that several other sherds were simply too small to be subdivided. Table 7-1 provides the original list of sherd samples by site and the specimens that could be subdivided for the paired petrographic and INAA research. Thin-sections for petrographic analysis were created from a total of 50 sherds. Of these, 24 have sherd fragments that will be submitted for future neutron activation analysis. Not all 50 petrographic samples have paired INAA subsamples because the decision regarding the petrographic analysis of only sherds that were large enough to also undergo neutron activation analysis was made after the initial sample of sherds was submitted for thin-section production.

The broader goal of the research beyond the macroscopic and Petrographic analyses was to compare the samples to other ceramic assemblages from the Bexar County area as well as any other regions familiar to the CAR staff including both sherds from Late Prehistoric Toyah components as well as Spanish Colonial wares.

Following the completion of the preliminary analyses, CAR was asked to provide a separate report on the sherd samples from 41HY165 to allow for the completion of the respective site report. Thereafter, it was agreed that the subsequent report will only contain the results of the analyses of the sherd samples from 41HY160 and 41HY188. Therefore, this report summarizes the analysis results of these two collections.

Macroscopic Analysis Results

Twenty-nine ceramic sherds were examined. Of these, 15 are from 41HY160 and 14 are from 41HY188. Nearly all of these sherds are unglazed, native made wares. This "macro" analysis focused on attributes that could be seen under low magnification (10-20X) or without the aid of magnification. The analytical methods used were derived from previous analyses as well as guidelines provided by the Council of Texas Archaeologists (CTA). The findings from this analysis were compared to those derived from the analyses of several sites found within the broader region, including prehistoric and Spanish Colonial components.

Methodology

For each of the 29 sherds, the following attributes were examined and recorded: sherd paste color (interior, exterior), visible inclusions, inclusion size, paste texture (fine and course), surface treatments (interior and exterior), decoration (interior and exterior), size measurements (length, width, and thickness), sherd-segment (i.e. base, body, rim), orifice diameter, vessel form, rim profile, rim form, lip profile, lip form, lip decoration, and firing atmosphere. The attributes were noted with the naked eye and recorded in an Excel database. Of the sample, only three were rim sherds. No fresh breaks were made on these sherds as they were often small. However, fresh faces were observed on specimens that were split for INAA sub-samples.

Paste color was observed on the exterior and interior surfaces of the sherds when these surfaces. The recording of color was precipitated by one of the author's experiments with clay sources from various locations and the color different formations fire. It appears that distinct clays fire different colors thereby providing clues to the origins/formations of clays employed in pottery manufacture. The inclusions noted within the fabric were closely examined to determine what was being used to temper the clay prior to firing. Typically bone was found within the sherd paste, but evidence of grog and quartzite were noted in a couple sherds. The size of the inclusions was noted as small, moderate, moderate to large, and large. In addition to the inclusion characteristics, the paste texture was recorded. The texture was determined my observation and feel. The specimens either had coarse or fine paste textures.

Surface treatments of the vessels were categorized as smooth, burnished, or brushed. Both surfaces of the sherds (interior and exterior) were examined and the characteristic recorded. A smooth surface was smooth to the touch, but did not show a mirror-like sheen that is noted on well burnished and polished surfaces. Smoothing is the result of the drawing of the coils upon each other to overlap them and create a structurally sound vessel wall. During the process, the thickness of the vessel wall also can be adjusted. Burnishing occurs while the vessel is in a leather-hard state with the fabric retaining sufficient moisture to allow deformation of the vessel wall as the burnishing instrument is rubbed across the surface. Burnishing tends to leave narrow flat facets behind as the tool passes across the surface of the vessel. These surfaces may be horizontal or vertical depending on the orientation of the burnishing strokes. A brushed surface exhibits striations that are likely the result of using a brush-like tool to smooth the surface. This process is done when the clay is still wet. While striated surfaces were noted on one sherd, it is likely that the striations were not the result of brushing but rather attempts to smooth the walls of a vessel made of coarse textured clay.

The sherds were examined to determine if any decoration was present. Typically, decoration consists of the application of a substance, such as asphaltum, to produce designs on the surface of the vessel. One incised sherd was identified in the collection. Incising is done while the vessel fabric is sufficiently soft to allow designs to be incised with a sharp instrument such as a thorn, sharp stick or bone splinter.

The measurements of the sherds were recorded using a pair of digital calipers. All measurements were taken in millimeters. The sherds were measured in length, width, and thickness. In most analyses, the ceramic assemblage is subjected to minimum measurement criteria for a sherd to be part of the sample. Due to the small nature of the assemblage in this study, all sherds were included.

The sherd segment was recorded as being base, body or rim during this analysis. In this case, the majority of the sherds were body. One of the 29 sherds was a rim sherd. Rim sherds typically provide much more information than body sherd, but due to its small size, the single rim sherd was not highly informative.

When analyzing rim sherds, the orifice diameter is obtained by placing the rim of the sherd on a concentric circle chart. The arc that it lines up with will give the diameter of the opening of the vessel. This is useful in determining the vessel form. In addition to the orifice diameter, rim sherds are examined for rim form, rim profile, lip form, and lip decorations. The rim form and rim profile are also helpful tools when determining the vessel form. The orientation of the rim profile aids in determining between bowls and jars. Very little information was gathered during the analysis of this assemblage concerning rim and lip attributes as there were only three rim sherds within the collection.

The firing atmosphere of the sherds was recorded according to the color that the sherds exhibited. A reduced atmosphere would produce colors from black to light grey. The dark color derives from the presence of organic carbon that is retained within the fabric because the firing temperature is not sufficiently high to burn off the organic matter. An oxidizing atmosphere produces sherds that have buff to red colors. It is indicative of firing temperatures that were sufficiently high to burn-off the organic carbon present in the clay fabric. It is important to note, however, that organic in the typical open-air bonfire type ceramic firing that is assumed to have been conducted by prehistoric potters, fires rarely reach high enough temperatures to fully oxidize the vessel walls and that even within the same vessel, there may be portions of the vessel that have fully oxidized while other thicker portions that were located in away from the flames may retain a reduced core. The firing atmosphere was recorded for the interior, exterior, and core.

These sherds had been provisionally classified into ceramic types prior to arriving at CAR. The types included Doss Red, Leon Plain, Goliad, Spanish Colonial, modern, and unknown. Eleven sherds were identified as Leon Plain, five were identified as Doss Red ware, one was identified as Spanish Colonial, one was identified as modern, one was identified as possible Caddo, and another was identified as Goliad. The remainder were identified as unknown, in terms of ceramic manufacture tradition.

The Doss Red Ware classification originated in the 1940s. The type was described as a native bone-tempered ware that appeared to have a red slip. The name quickly fell out of use, and the bone tempered wares recovered from Central Texas prehistoric sites were called Leon Plain wares. Goliad wares were first identified in the late 1960s during excavations conducted in Goliad, Texas. These ceramic sherds also were bone tempered and resembled the Leon Plain wares. The type has been considered a continuation of the Toyah Phase ceramic technology. The two types are distinguished primarily on the basis of their archaeological context, when found in Spanish Colonial missions, the wares are identified as Goliad, while in apparent prehistoric contexts, and often in association with Toyah Phase cultural materials, they are identified as Leon Plain wares.

Macroscopic findings were to be compared with findings derived from the petrographic analysis which typically is able to quantify more precisely the technological aspects of paste preparation and clay sources employed in fabrication. Thin-sections for petrographic analysis were created from 26 of the 29 sherds originally chosen for macroscopic analysis. The macroscopic analysis showed that the other five specimens were likely part of vessels already represented in analysis sample and therefore they were not thin-sectioned. Table 7-1 provides the original list of sherd samples.

Table 7-1. Ceramic Sample from 41HY160 and 41HY188.

Site	Lot #	Original Description	Inclusions	Inclusion Size	Paste Texture	Surface Treatment		Decoration		Measurements			Sherd Form	Firing		
						Interior	Exterior	Interior	Exterior	Length	Width	Thickness		interior	exterior	core
41HY188	501	Doss Red	bone	moderate	fine	polished	polished	none	none	12.82	12.12	5.46	body	oxidized	oxidized	reduced
41HY188	274	Doss Red	bone	moderate	fine	polished	floated	none	none	22.46	17.1	5.73	rim (12)	reduced	oxidized	reduced
41HY188	274	Unknown	bone	moderate	fine	polished	polished	none	none	21.97	18.27	5.88	rim (19)	oxidized	oxidized	oxidized
41HY188	274	Leon Plain	bone	moderate to large	coarse	smooth	smooth	none	none	22.26	18.8	7.25	body	reduced	reduced	reduced
41HY188	274	Leon Plain	bone	moderate to large	coarse	rough	polished	none	none	29.71	16.51	7.17	body	reduced	reduced	reduced
41HY188	314	Unknown	bone	moderate	fine	polished	polished	none	none	31.73	19.27	7.52	body	oxidized	oxidized	oxidized
41HY188	501	Unknown	bone	moderate	fine	smooth	smooth	none	none	24.74	15.19	5.21	body	oxidized	oxidized	oxidized
41HY188	373	Leon Plain	bone	moderate to large	coarse	floated	smooth	none	none	22.67	18.84	6.96	body	oxidized	oxidized	oxidized
41HY188	501	Unknown	bone	moderate	fine	polished	polished	none	none	29.74	20.82	7.15	body	reduced	reduced	reduced
41HY188	501	Doss Red	bone	moderate	fine	polished	polished	none	none	16.11	11.71	7.64	body	oxidized	reduced	reduced
41HY188	501	Doss Red	bone	moderate	fine	floated	brushed	none	none	12.65	12.23	6.27	body	oxidized	oxidized	reduced
41HY188	501	Doss Red	bone	moderate	coarse	floated	floated	none	none	9.19	7.7	4.4	body	oxidized	oxidized	oxidized
41HY188	501	Leon Plain	bone	moderate to large	coarse	smooth	smooth	none	none	17.43	12.73	5.2	body	reduced	reduced	reduced
41HY188	501	Leon Plain	bone	moderate to large	coarse	smooth	smooth	none	none	16.17	15.36	5.42	body	oxidized	oxidized	reduced
41HY160	110	Leon Plain	bone	moderate to large	coarse	polished	polished	none	none	22.38	14.94	7.02	body	reduced	reduced	reduced
41HY160	164	Unknown	bone	moderate	fine	smooth	smooth	none	none	16.42	13.21	4.53	body	oxidized	oxidized	reduced
41HY160	136	Unknown	bone	moderate	fine	polished	floated	none	none	11.31	9.61	5.23	body	reduced	oxidized	Reduced
41HY160	139	Leon Plain	bone	moderate to large	coarse	rough	rough	none	none	19.42	17.29	7.32	body	reduced	reduced	Reduced
41HY160	92	Modern	quartzite and shell	small	coarse	smooth	worn	none	none	13.15	11.45	7.28	body	oxidized	oxidized	Oxidized
41HY160	3	Unknown	grog	large	coarse	floated	floated	none	incised	11.16	9.39	3.92	body	reduced	reduced	Reduced
41HY160	137	Leon Plain	bone, grog, quartzite	large	coarse	slipped	slipped	none	none	15.86	11.06	3.42	body	reduced	reduced	Reduced
41HY160	121	Unknown	bone	moderate to large	fine	smooth	smooth	none	none	16.65	9.91	5.08	body	reduced	reduced	Reduced
41HY160	168	Goliad	bone	moderate to large	coarse	floated	floated	none	none	16.95	13.43	5.42	body	oxidized	oxidized	Oxidized
41HY160	42	Unknown	bone	moderate	fine	polished	polished	none	none	17.09	14.68	5.99	body	oxidized	oxidized	oxidized
41HY160	136	Spanish Colonial	unknown	small	fine	glazed	burnished	none	none	29.7	14.5	6.31	body	oxidized	oxidized	oxidized
41HY160	4	Unknown Caddo	bone	moderate	fine	burnished	burnished	none	none	28.9	15.4	5.97	body	reduced	oxidized	reduced
41HY160	66	Leon Plain	sand	small	fine	burnished	burnished	none	none	32.1	16.2	7.85	body	oxidized	oxidized	reduced
41HY160	41	Leon Plain	bone, sand	large	coarse	burnished	burnished	none	none	28.9	16.4	6.17	body	oxidized	oxidized	oxidized
41HY160	66	Leon Plain	bone, sand	moderate	coarse	burnished	smooth	none	none	26.7	20.8	5.21	body	oxidized	oxidized	oxidized

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Results

Twenty-nine sherds were examined as part of the macro-analysis. Of these, 15 were from 41HY160 and 14 were from 41HY188. A summary of the findings is provided below.

Inclusions and Inclusion Size: Based on the macroscopic examination of the sherds, sand was part of the paste of all but four specimens (Table 7-2). Given the medium to small size of the quartz grains, it would appear that the sand is likely to be a natural constituent of the clays employed in vessel construction rather than a selectively added tempering agent. Hematite is often present in Navarro formation clays and therefore, it is not surprising to find four sherds where relatively large grains of hematite were present among the fine grained quartz grains. Twelve (41%) sandy paste sherds with no other additives are part of the collection of sherds. In contrast, 13 (45%) sandy paste sherds also contain finely ground bone as tempering agents. Finally, four (14%) other sherds appear to have only bone tempering although silt-sized quartz particles may be present within the constituents of the clays. No sherds contained grog and/or shell as tempering agents, at least upon inspection with the unaided eye. One sherd each from the previously examined 41HY165 site, contained grog, bone, sand and grog, and sand and shell. These tempering agents are typical of the Caddoan ceramic tradition.

Table 7-2. Breakdown of inclusion types and sizes within sherds from 41HY160 and 41HY188.

Inclusion Type	**Inclusion Size**			**Grand Total**
	Large	**Moderate**	**Small**	
Bone	1	1	2	4
Bone, Sand	2	10	1	13
Sand		3	5	8
Sand, Hematite	1		3	4
Grand Total	**4**	**14**	**11**	**29**

The bone-tempered paste tended to contain moderate-sized bone particles and only 3 of 17 bone tempered sherds contained large bone tempering particles suggesting that some attention went into preparing the bone temper prior to mixing the fabric for vessel construction.

Paste texture: The paste textures were split nearly evenly between the fine (55%) and coarse (45%) categories (Table 7-3). The majority of the sherds with moderate to large inclusions fell in the coarse paste texture group while all of the sherds with small inclusions were classified as having fine paste texture.

Table 7-3. Breakdown of paste texture groups within sherds from 41HY160 and 41HY188.

Inclusion Size	**Paste Texture**		
	Coarse	**Fine**	**Grand Total**
Large	3	1	4
Moderate	10	4	14

Table 7-3. Breakdown of paste texture groups within sherds from 41HY160 and 41HY188.

Inclusion Size	**Paste Texture**		
	Coarse	**Fine**	**Grand Total**
Small		11	11
Grand Total	**13**	**16**	**29**

Surface treatments: Both interior and the exterior surfaces of each sherd were examined to determine the type of treatment they had received. Smoothed exterior surfaces outnumbered (55%) burnished 41%) surfaces and one sherd appeared to have a brushed exterior surface although the brushed appearance could have simply derived from smoothing the coarse fabric that contained moderate sized sandy inclusions (Table 7-4). The majority (59%) of the interior surfaces are smoothed while slightly more than one third of the sample (34%) has burnished interiors. The burnished interior may signify that these sherds represent bowl fragments since wares such as bottles, jars and ollas would often have restricted openings that would inhibit significant surface treatment of the interior. One sherd appears to have a glazed interior surface.

Table 7-4. Breakdown of interior surface treatment within sherds from 41HY160 and 41HY188.

Exterior	**Interior**			**Grand Total**
	Burnished	**Glazed**	**Smooth**	
Brushed	1			1
Burnished	8	1	3	12
Smooth	1		15	16
Grand Total	**10**	**1**	**17**	**29**

Decoration: Only one sherd exhibited evidence of decoration in the form of incising. This sherd was recovered in Level 3 of Quad 6. The decoration was noted on the exterior surface of the sherd. The sherd is a sandy paste specimen with pieces of hematite.

Size Measurements: The average length of the sherds examined was 35 mm. The length of the sherds ranged from 19.1 mm to 69.5 mm. Eighteen of the sherds are smaller than 30.0 mm in maximum length with the remaining 11 exceeding this dimension. The average width of the assemblage was 25.7 mm. The minimum measurement was 14.5 mm, and the maximum was 55.6 mm. The average thickness of the sherds was 6.46 mm. The minimum thickness recorded was 4.32 mm, and the maximum recorded was 9.76 mm. Fourteen of the specimens are between 4-6 mm in maximum thickness and only five exceed 8 mm in maximum thickness.

Firing Atmosphere: The firing atmosphere exhibited by the ceramic assemblage is dominated by sherds with oxidized interior and exterior surfaces (79%) (Table 7-5). This suggests that the firing occurred while the wares were sitting upright within the bonfire and that oxygen was freely available during the fire and subsequently the vessels cooled in an open setting. Typically, vessels fired upside down, or with their mouth sitting on the coals will have a reduced inner surface due to the lack of oxygen and sufficiently high temperatures to burn off the organics drawn toward the outer surface of the sherd. Only five vessels exhibit reduced exterior surfaces and reduced interior surfaces are noted on only three vessels. The three sherd fragments with reduced interior surfaces may have been intentionally fired upside down to create the blackened interior.

Table 7-5. Breakdown of exterior firing atmosphere within sherds from 41HY160 and 41HY188.

Interior	Exterior		Grand Total
	Oxidized	**Reduced**	
Oxidized	23	3	26
Reduced	1	2	3
(Blank)			
Grand Total	**24**	**5**	**29**

Not surprisingly, given the bonfire-type firing conditions for most of the sherds in this sample, twenty (69%) of the specimens have a reduced core (Table 7-6). Experiments by the senior author indicate that, depending on the thickness of the wares and the amount of temper present in the fabric, temperatures in excess of 900 degrees Celsius may be needed for extended times to create a oxidized core on ceramics measuring 6-7 mm in wall thickness. The mean thickness of the eight sherds with oxidized cores is 6.6 mm, while the mean thickness of the sherds with reduced cores is 6.7 mm. The lack of difference in mean thickness between the oxidized and reduced core sherds suggests that vessel wall thickness may not have been responsible for the oxidation of the eight sherds. Rather, these sherds may have either been exposed to higher temperatures during firing or may have been exposed to similar temperatures but for longer than the reduced core vessels.

Table 7-6. Breakdown of core firing atmosphere within sherds from 41HY160 and 41HY188.

	Core			Grand Total
	Oxidized	**Reduced**	**Zoned**	
Count	8	20	1	29

Paste color also was recorded on sherds because the color of the fired clay is in part conditioned by the constituent elements present within the clay and this in turn may vary by clay formation. In addition, past color also is conditioned by firing temperature and the availability of oxygen during firing. When vessels are fired in an oxygen free environment, past colors tend to be light while vessels fired in a reduced atmosphere tend to acquire a dark gray to black color. In an attempt to gauge the number of possible clay sources that may have been used to fabricate the vessels present in the sample, the color of the ceramic fabric as exhibited on both interior, exterior surfaces and the core was recorded. Fabric color was not useful on sherds with reduced surfaces given their typically uniformly black or dark gray surfaces.

Three general color groupings were noted in the sherd samples analyzed. The majority of the sherds had a reddish brown to red color. The senior author has replicated the reddish color of vessels using Navarro formation clays from the upper San Antonio River Basin. Navarro Formation clays tempered with bone regularly produced a reddish outer and inner surface under oxidized firing conditions. When well burnished, the reddish surface can appear as through they have a red floated surface or a red wash. The cores of these red colored sherds typically remained reduced except in rare conditions when firing temperatures were maintained above 900 degrees Celsius for extended time. A second group of colors noted in the archaeological specimens were specimens with a light gray color. The author has recently been able to reproduce this fabric color in experimental firings when firing temperatures were kept around 600-700 degrees Celsius. However, upon use, these vessels were discovered not to have been vitrified and melted back into clay when used in water boiling experiments. Finally, the third color group (n=3 sherds), exhibited by a smaller number of sherds had a tan color. This color was reminiscent of vessel colors attained by firing Houston Black clay mixed with the Navarro Formation clay. Houston Black Clay has a very high shrinkage rate that makes it very difficult to construct and dry vessels without cracking. However, the mixing of the black clay with Navarro Formation clays reduces the shrinkage rate and results in a fired clay color that is similar to the tan colored sherds noted in the ceramic sample.

As noted above, burnishing of vessel walls is relatively common in the archaeological samples examined. Based on experimental vessel manufacture and burnishing, it is clear that the burnishing of the vessels occurred while the vessels were "leather hard" rather than entirely dried. Micro-ridges and intervening lower lying smooth tracts along the vessel wall confirmed this observation. The burnishing is a product of the smoothing of the coils but it does not result in a high gloss on the vessel surface. Experimentation suggests that a high gloss polish of the vessel surface will create a film of fine particle on the outer surface of the vessel that slows the drying of the vessel wall and can result in "blow-outs" during firing as excess moisture that is vaporized during the firing has a more difficult time to escape from the interior of the fabric. It is for this reason that I suspect many of the prehistoric vessels have moderate to heavy quantities of temper. The temper increases the porosity of the fabric allowing it to both absorb moisture during manufacture and cooking but more importantly allowing the moisture to escape both during the initial firing of the vessel as well as during typical cooking with the vessel.

Floating is the result of fine particles rising to the surface of the vessel as a result of burnishing. A very thin film has been observed on most bone tempered sherds suggesting that the burnishing has resulted in floating some fine clay particles to the surfaces of these vessels. However, the film is so thin that the underlying temper is clearly visible within the fabric. This also signals the fact that in most instances the vessel walls have not been covered by a wash.

Petrographic Analysis

The analysis of sherd collections using only unaided eye exams is of limited value since only a small portion of the constituent elements of the clay fabric can be discerned without some degree of magnification. While 29 sherds were included in the macro analysis, during the inspection of the specimens it became evident that some of the sherds may be fragments of the same vessel. Therefore, petrographic thin sections were created of only those sherds that appeared to represent distinct vessels in part because it was originally planned that sub-samples of distinct vessels groups would be submitted for INAA analysis. As a result, petrographic analysis was performed on only 26 thin sections representing 26 visually distinct sherds and possibly vessels.

Methodology

The sherds were sent to National Petrographic Services in Houston, Texas, for the creation of thin sections. The thin sections were created following industry standard procedures. A small piece of the sample was removed and placed in blue-dyed epoxy and vacuum impregnated. In most cases, the initial cut was transverse to the plane of the sherd so that a slip could be identified, if present. A slice of the cured specimen was then removed and mounted on a 1" x 2" microscope slide and ground down to 0.03 mm in thickness. A permanent cover slip was not used on the thin sections. A blue-dyed epoxy was chosen over clear epoxy to allow for easier identification of voids and bone.

The thin sections were examined with a Leica Petrographic microscope with a mechanical stage attached. A two-step process was used to examine the thin sections. Given that a permanent cover slip was not used on the thin sections, a drop of distilled water and a temporary glass cover slip was placed on the thin section to aid in viewing. The first step involved recording the general characteristics and taking photomicrographs of the thin section. The general characteristics recorded included paste matrix description, paste color, b-fabric (Stoops 2003:95), estimated size of quartz inclusions (based on Wentworth scale), slip and description of edges. A Petrographic Analysis Coding Sheet was used; included descriptions and codes used for the general characteristics. For the photomicrographs, at least one set (plane light and cross-polar light) were taken of each thin section at 4x magnification. At least one additional set of photomicrographs were taken of the edges, inclusions, or paste at 4x, 10x, or 40x magnification for each thin section.

The second step involved point counting, using the Glagolev-Chayes method. The Glagolev-Chayes method involves using the mechanical stage, which allows one to move the thin section at a given interval beneath the crosshairs in the ocular, and identifying and recording each point encountered in the crosshairs (Galehouse 1971:389-390). For the point counting sampling, the microscope was set at 10x magnification and the stage was set so that the vertical and horizontal increments were both 0.4 mm. For each point encountered in the crosshairs, the point was identified as paste matrix, void, or nonplastic inclusion. Paste matrix, voids, and all nonplastic inclusions except bone were recorded by tally. For all bone inclusions the estimated size, based on ocular scale, was recorded. The Petrographic Analysis Coding Sheet provides a description and codes used for the point counting. Nonplastic inclusions were only counted once, even if they were encountered more than once in the crosshairs. In addition to the point counting, mineral/temper present but not encountered in the crosshairs was noted.

To assign temper categories to the thin sections and for comparison with other thin sections, the recorded paste/inclusions were combined into the following simplified categories:

Recorded Paste/Inclusion	**Simplified Inclusion Category**
Paste	Paste
Bone	Bone
Grog	Grog
Shell	Shell

Recorded Paste/Inclusion	Simplified Inclusion Category
Quartz	Sand
Polycrystalline quartz	Sand
Alkali feldspar	Sand
Muscovite	Mica
Calcium carbonate	Carbonates
Clay pellet	Other
Hematite	Other
Opaque	Other
Voids	Not included in simplified categories
Biotite	Mica
Calcite	Carbonates
Fossil	Carbonates
Plagioclase	Sand
Secondary calcite	Not included in simplified categories
Unknown	Other
Rock Conglomerate	Sand
Microcline	Sand
Mafic mineral	Sand
Hornblende	Sand
Perthite	Sand

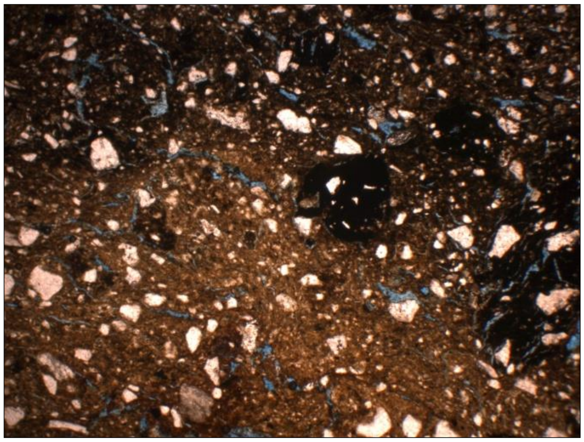
Thin Section Descriptions for 41HY188 and 41HY160

Site: 41HY188 Thin Section #: 501-4A

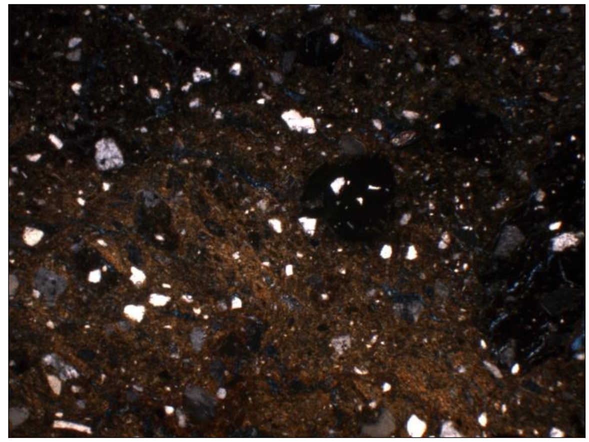
Paste Matrix: mottled
Paste Color: yellowish brown (10YR5/6) to dark brown (10YR3/3)
Paste Description: Silty
B-fabric: Striated/active
Slip/Edges: No –one edge is little darker than the other; dark paste is less active
Comments: Rock conglomerate is possibly weathered andesite; grog tempered with sand
Paste Group: Sandy paste-grog temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	241	75.08%	Paste	241	77.74%
Voids	11	3.43%	Sand	61	19.68%
Quartz	53	16.51%	Grog	6	1.94%
Rock Conglomerate	1	0.31%	Other	2	0.65%
Grog	6	1.87%	Total	310	
Polycrystalline quartz	3	0.93%			
Alkali feldspar	4	1.25%			
Opaque	2	0.62%			
Total	**321**				

Present but not sampled: muscovite, hornblende, augite, microcline



Paste in plane light 4x (501-4A)



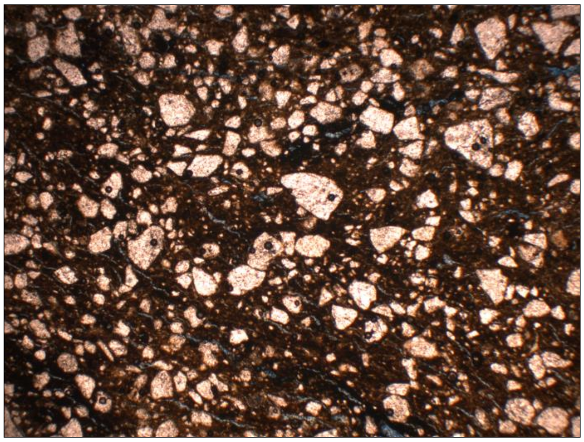
Paste in cross-polar light 4x

Site: 41HY188 *Thin Section #: 501-3A*

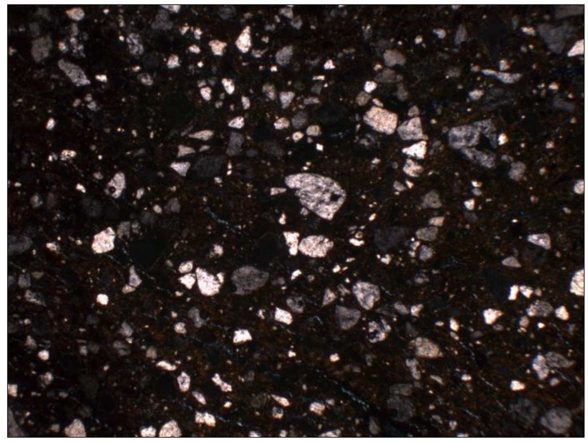
Paste Matrix: mottled
Paste Color: yellowish brown (10YR 5/8) with spots of dark yellowish-brown (10 YR 4/3)
Paste Description: fine sand
B-fabric: speckled/active
Slip/Edges: No –same as rest of paste
Paste Group: Sandy paste-sand temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	200	62.11%	Paste	200	64.31%
Voids	11	3.42%	Sand	110	35.37%
Quartz	96	29.81%	Other	1	0.32%
Polycrystalline quartz	8	2.48%	**Total**	**311**	
Alkali feldspar	6	1.86%			
Opaque	1	0.31%			
Total	**322**				

Present but not sampled: microcline, perthite



Paste in plane light 4x (501-3A)



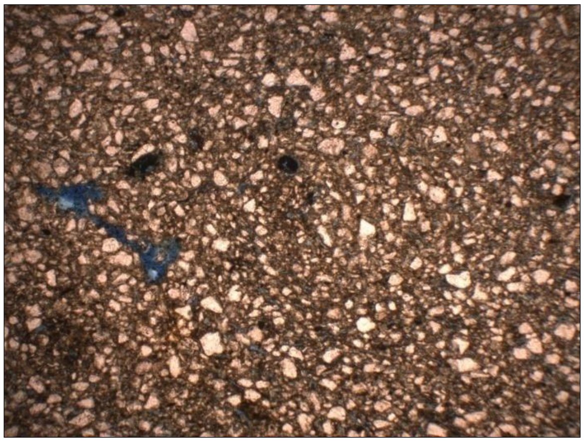
Paste in cross-polar light 4x

Site: 41HY188 *Thin Section #: 501-5A*

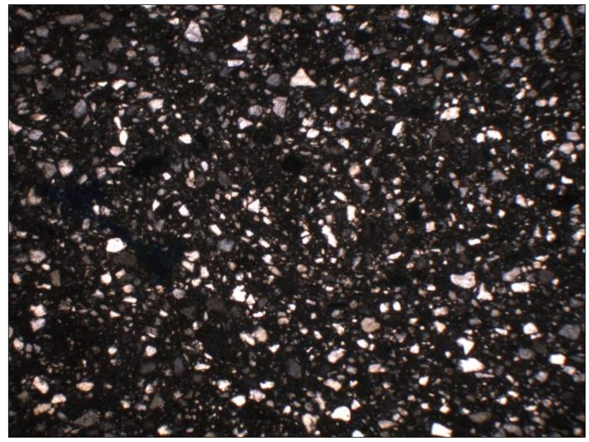
Paste Matrix: continuous
Paste Color: olive yellow (2.5Y 6/8)
Paste Description: silty to fine sand
B-fabric: speckled/slightly active
Slip/Edges: Yes –thin layer (.04mm) of yellow (2.5Y 7/8) lens on one side; highly active
Comments: Very sandy paste, quartz in abundance
Paste Group: Sandy paste-sand temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	160	50.96%	Paste	160	53.16%
Voids	13	4.14%	Sand	137	45.51%
Quartz	130	41.40%	Other	4	1.33%
Polycrystalline quartz	4	1.27%	**Total**	**301**	
Opaque	4	1.27%			
Alkali feldspar	3	0.96%			
Total	**314**				

Present but not sampled: muscovite, augite, hornblende, biotite, plagioclase, microcline



Paste in plane light 4x (501-5A)



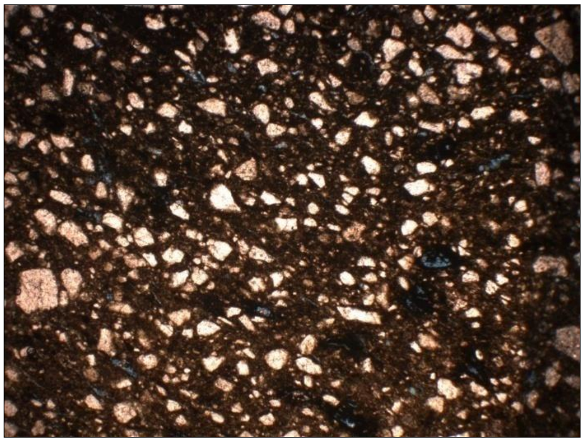
Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 501-6A

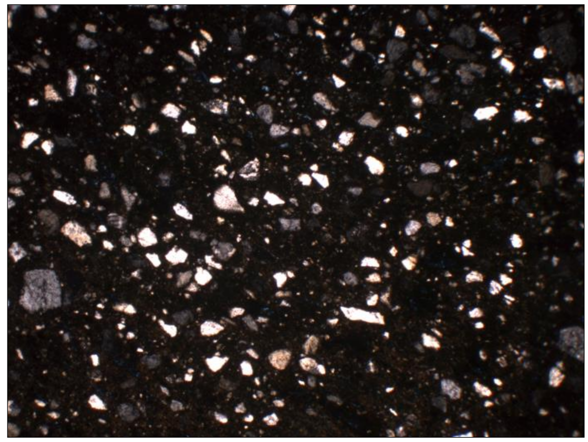
Paste Matrix: continuous
Paste Color: light olive brown (2.5 Y5/6)
Paste Description: silty to fine sand
B-fabric: speckled; slightly active
Slip/Edges: No –one edge darker than the other, dark grayish brown (2.5Y 4/2) and undifferentiated
Comments: Very porous; most quartz is very small
Paste group: Sandy paste-sand temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	221	69.94%	Paste	221	71.06%
Voids	5	1.58%	Sand	90	28.94%
Quartz	74	23.42%	**Total**	**311**	
Microcline	1	0.32%			
Polycrystalline quartz	10	3.16%			
Perthite	1	0.32%			
Alkali feldspar	4	1.27%			
Total	**316**				

Present but not sampled: opaques



Paste in plane light 4x (501 6A)



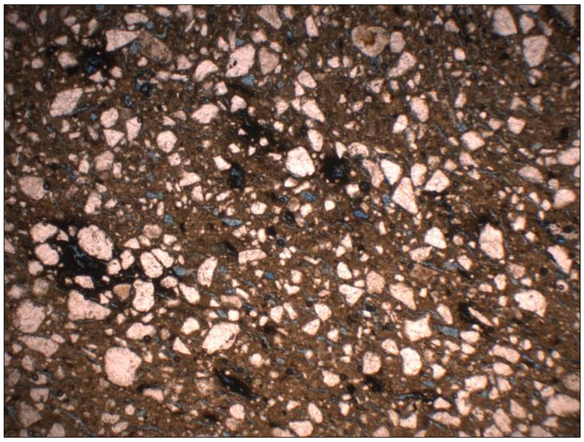
Paste in cross-polar light 4x

Site: 41HY188   *Thin Section #: 501-7A*

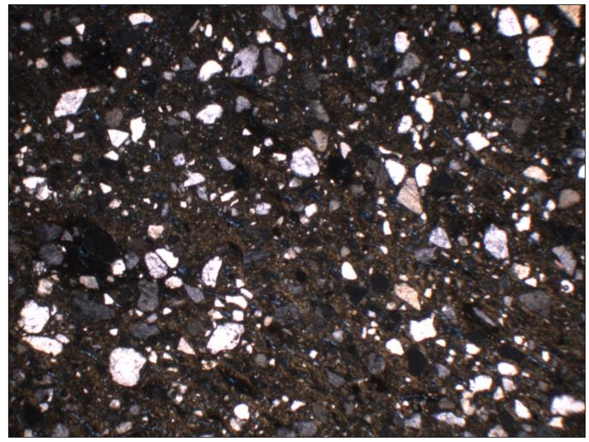
Paste Matrix: continuous
Paste Color: olive yellow (2.5Y 6/6)
Paste Description: silty to fine sand
B-fabric: striated/slightly active
Slip/Edges: No –same as rest of the paste
Comments: Very porous
Paste Group: Sandy paste-sand temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	200	61.61%	Paste	200	63.90%
Voids	17	5.15%	Sand	112	35.78%
Quartz	101	30.61%	Other	1	0.32%
Alkali feldspar	3	0.91%	**Total**	**313**	
Polycrystalline quartz	8	2.42%			
Opaque	1	0.30%			
Total	**330**				

Present but not sampled: muscovite, hornblende, augite, microcline, plagioclase



Paste in plane light 4x (501 7A)



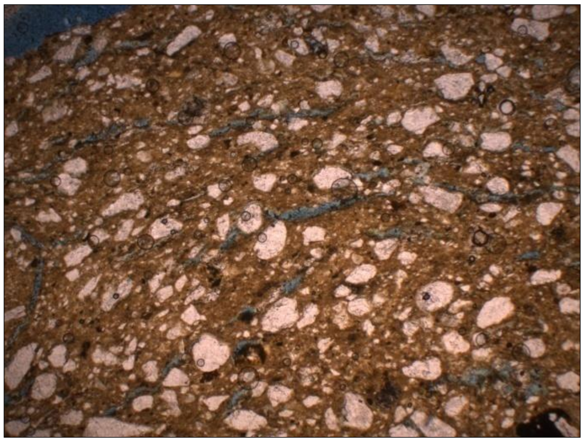
Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 501-8A

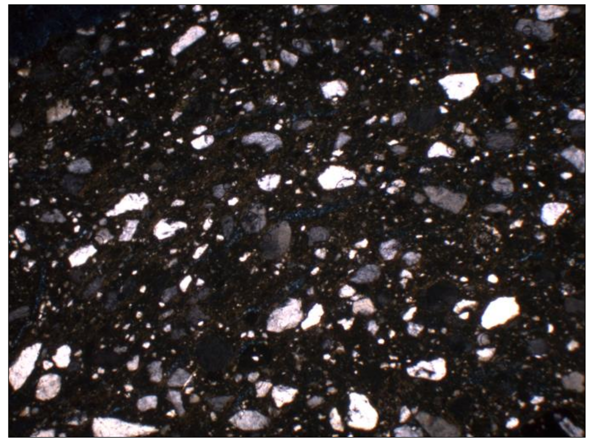
Paste Matrix: continuous
Paste Color: yellow (2.5Y 7/8)
Paste Description: silty to fine sand
B-fabric: striated/slightly active
Slip/Edges: No –same as rest of the paste
Comments: Very porous
Paste Group: Sandy paste-sand temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	214	66.25%	Paste	214	68.81%
Voids	12	3.72%	Sand	95	30.55%
Quartz	90	27.86%	Other	2	0.64%
Polycrystalline quartz	3	0.93%	**Total**	**311**	
Opaque	2	0.62%			
Alkali feldspar	2	0.62%			
Total	**323**				

Present but not sampled: small mafic minerals, perthite, plagioclase, hornblends, muscovite



Paste in plane light 4x (501-8A)



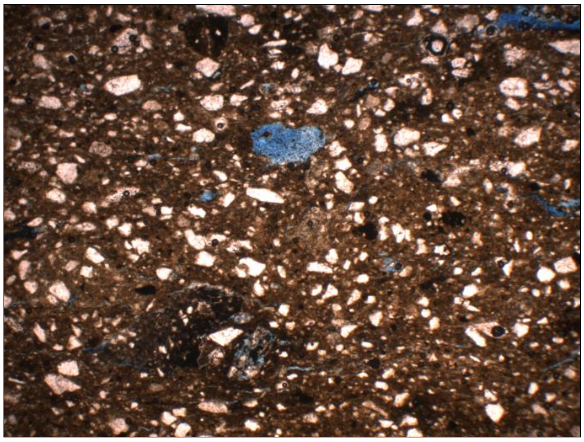
Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 501-9A

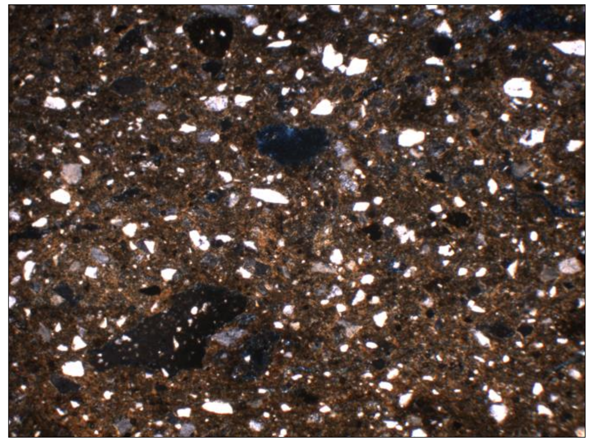
Paste Matrix: continuous
Paste Color: brownish yellowish (10 YR 6/6)
Paste Description: silty to fine sand
B-fabric: striated/active
Slip/Edges: No –one edge darker than rest of the paste (dark yellowish brown; 10YR 4/6)
Comments: Grog tempered with sand
Paste Group: Sandy paste-grog temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	211	70.33%	Paste	211	71.77%
Voids	6	2.00%	Sand	72	24.49%
Quartz	65	21.67%	Grog	8	2.72%
Grog	8	2.67%	Other	3	1.02%
Mafic Mineral	1	0.33%	**Total**	**294**	
Alkali feldspar	1	0.33%			
Polycrystalline quartz	5	1.67%			
Opaque	3	1.00%			
Total	**300**				

Present but not sampled: n/a



Paste in plane light 4x (501-9A)



Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 501-1A

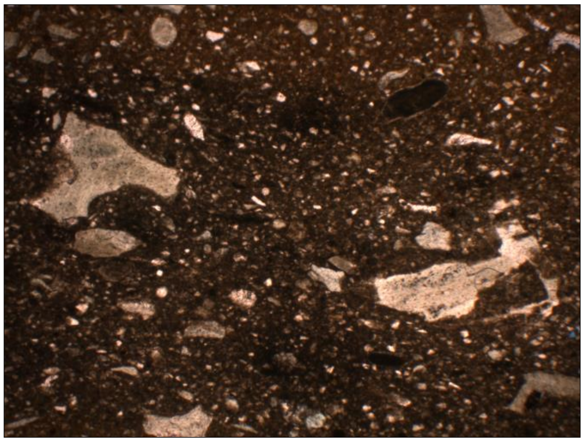
Paste Matrix: continuous
Paste Color: strong brown (7.5YR 5/8) surface; light olive brown (2.5YR 5/6) core
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: No –same as rest of the paste
Comments: secondary calcite present around most bone edges
Paste Group: Unsandy/calcareous paste-bone temper

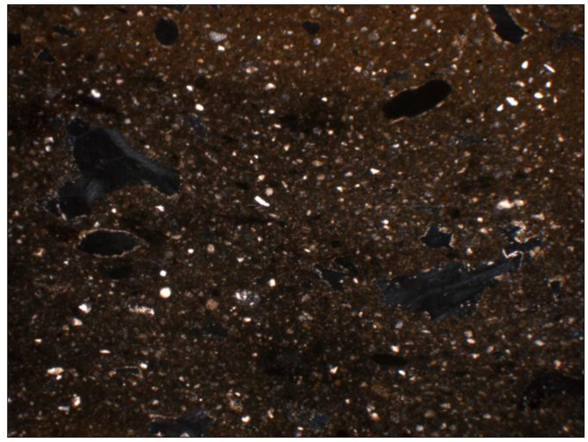
Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	240	76.68%	Paste	240	78.18%
Voids	3	0.96%	Sand	16	5.21%
Quartz	16	5.11%	Bone	39	12.70%
Bone	39	12.46%	Carbonates	9	2.93%
Secondary calcite	3	0.96%	Other	3	0.98%
Calcium carbonate	7	2.24%	**Total**	**307**	
Opaque	3	0.96%			
Calcite	2	0.64%			
Total	**313**				

Present but not sampled: amphibole, fossil

Bone Size Statistics

Range: .06 to 1.04 mm
Mean: .44 mm
Median: .44 mm
Interquartile range: .44 mm


Paste in plane light 4x (501-1A)


Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 274-3A

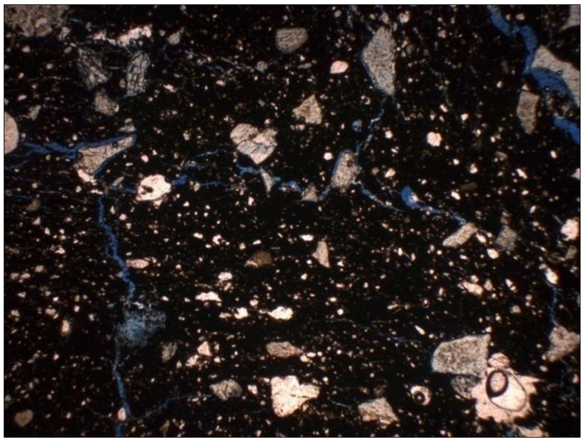
Paste Matrix: continuous
Paste Color: very dark grayish brown (10YR 3/2)
Paste Description: silty
B-fabric: undifferentiated
Slip/Edges: indeterminate–both faces have thin slip of light paste (10YR5/8); yellowish brown slightly active
Comments: rock conglomerates contain chalcedony; no secondary calcite on bone
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	242	77.81%	Paste	242	81.48%
Voids	14	4.50%	Sand	24	8.08%
Bone	31	9.97%	Bone	31	10.44%
Quartz	23	7.40%	**Total**	**297**	
Rock conglomerate	1	0.32%			
Total	**311**				

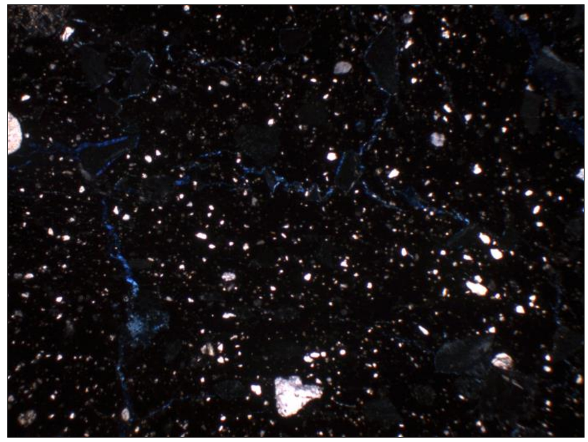
Present but not sampled: small mafic minerals, polycrystalline quartz, calcium carbonate

Bone Size Statistics

Range: .04 to .60 mm
Mean: .28 mm
Median: .28 mm
Interquartile Range: .20 mm



Paste in plane light 4x (274-3a)



Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 274-4A

Paste Matrix: continuous
Paste Color: very dark grayish brown (10YR 3/2)
Paste Description: silty
B-fabric: undifferentiated
Slip/Edges: indeterminate–one faces has thin slip of light paste (10YR5/6); yellowish brown slightly active
Comments: porous fabric; no secondary calcite on bone
Paste Group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	225	71.20%	Paste	225	74.26%
Voids	13	4.11%	Sand	33	10.89%
Bone	43	13.61%	Bone	43	14.19%
Quartz	31	9.81%	Carbonates	2	0.66%
Calcium carbonate	2	0.63%	**Total**	**303**	
Polycrystalline quartz	2	0.63%			
Total	**316**				

Present but not sampled: n/a

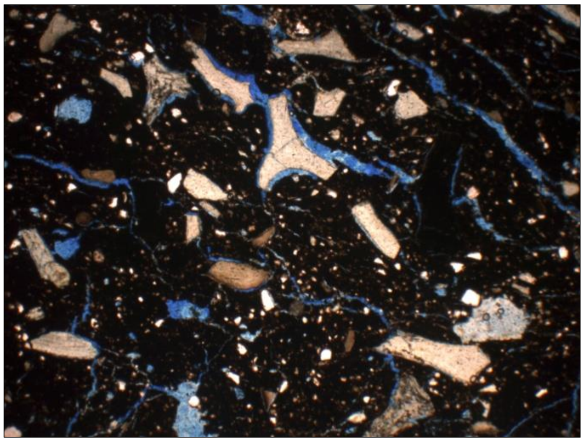
Bone Size Statistics

Range: .06 to 1.18 mm

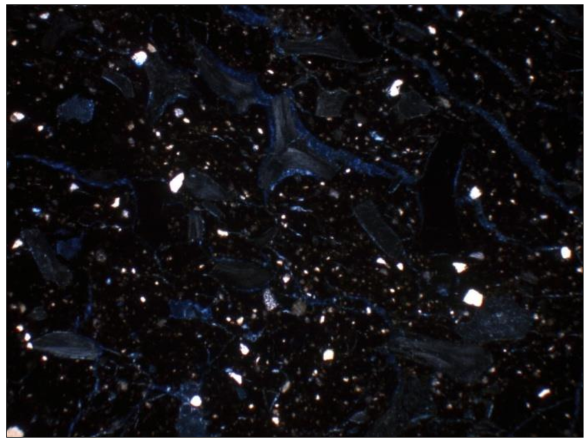
Median: .40 mm

Mean: .46 mm

Interquartile Range: .48 mm



Paste in plane light 4x (274-4a)



Paste in cross-polar light 4x

Site: 41HY188 Thin Section #: 373-1A

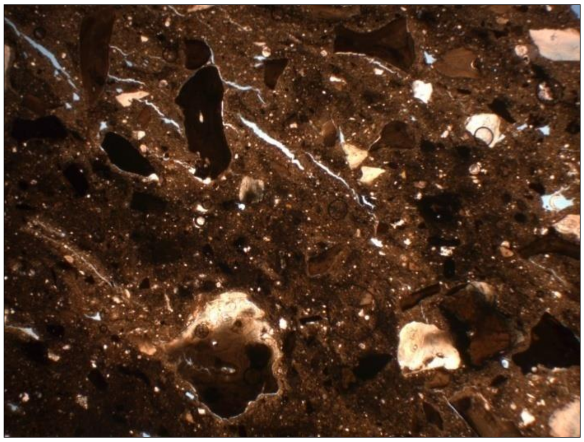
Paste Matrix: continuous
Paste Color: strong brown (7.5YR5/6) core is dark brown (7.5YR 3/3)
Paste Description: silty
B-fabric: striated; core slightly active
Slip/Edges: No–same as rest of paste
Comments: porous fabric; little to no secondary calcite on bone
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	220	69.40%	Paste	220	74.32%
Voids	21	6.62%	Sand	30	10.14%
Bone	43	13.56%	Bone	43	14.53%
Quartz	26	8.20%	Carbonates	3	1.01%
Calcium carbonate	3	0.95%	**Total**	**296**	
Perthite	1	0.32%			
Polycrystalline quartz	2	0.63%			
Alkali feldspar	1	0.32%			
Total	**317**				

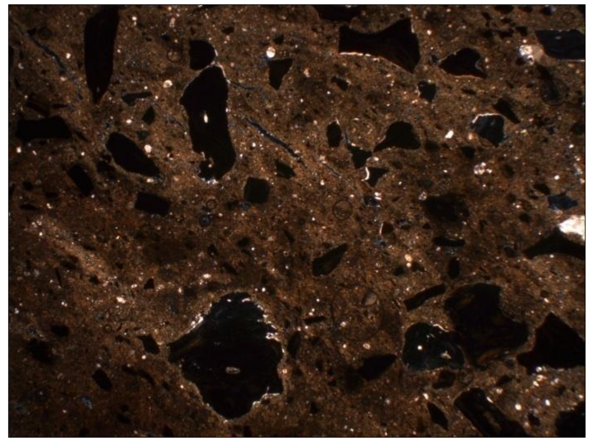
Present but not sampled: opaques

Bone Size Statistics

Range: .06 to 1.2 mm
Median: .48 mm
Mean: .49 mm
Interquartile Range: .46 mm



Paste in plane light 4x (492-24)



Paste in cross-polar light 4x

Site: 41HY160   Thin Section #: 66-1

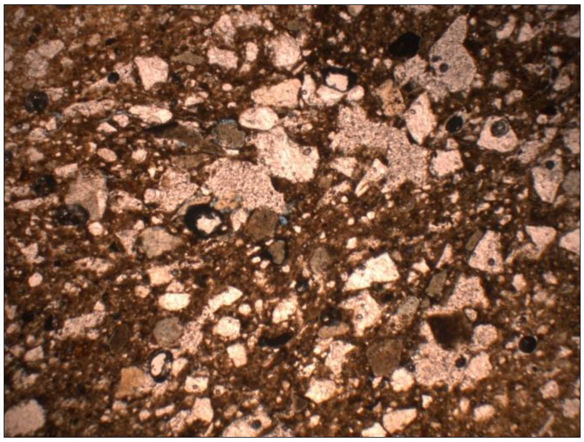
Paste Matrix: continuous
Paste Color: brownish yellow (10YR6/8); core – dark yellowish brown (10YR 4/6)
Paste Description: fine to medium sand
B-fabric: striated/active
Slip/Edges: edges more active in XPL
Comments: some voids are inclusions that have popped out
Paste group: Sandy paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	200	63.49%	Paste	200	68.49%
Voids	23	7.30%	Sand	70	23.97%
Bone	19	6.03%	Bone	19	6.51%
Quartz	59	18.73%	Other	3	1.03%
Polycrystalline quartz	10	3.17%	**Total**	**292**	
Hematite	3	0.95%			
Alkali feldspar	1	0.32%			
Total	**315**				

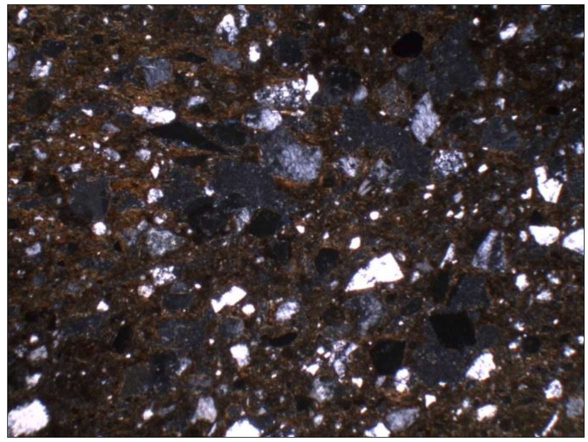
Present but not sampled: chalcedony

Bone Size Statistics

Range: .16 to 1.14 mm
Mean: .38 mm
Median: .22 mm
Interquartile Range: .34 mm



Paste in plane light 4x (66-1)



Paste in cross-polar light 4x

Site: 41HY160 *Thin Section #: 66-2A*

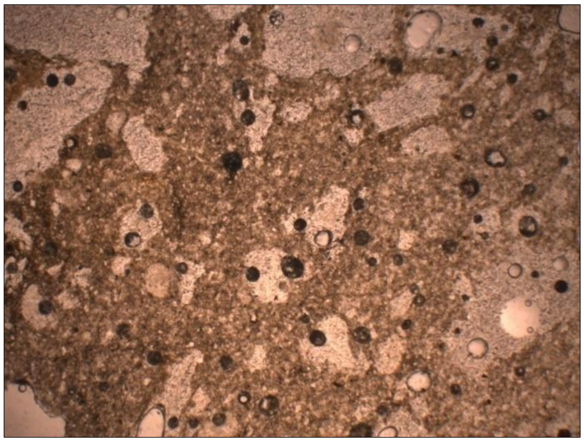
Paste Matrix: continuous
Paste Color: light yellowish brown (2.5Y 6/4)
Paste Description: silty
B-fabric: undifferentiated
Slip/Edges: No-paste is mottled along one edge with olive brown spots (2.5Y4/4)
Comments: quartz is silt size; very poor quality thin section – most inclusions have popped out
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	237	74.76%	Paste	237	90.46%
Voids	55	17.35%	Sand	6	2.29%
Bone	17	5.36%	Bone	17	6.49%
Quartz	4	1.26%	Carbonates	2	0.76%
Polycrystalline quartz	2	0.63%	**Total**	**262**	
Calcite	2	0.63%			
Total	**317**				

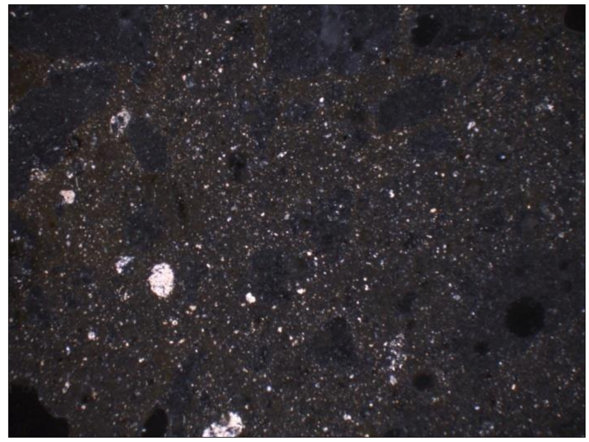
Present but not sampled: muscovite, microcline, calcium carbonate

Bone Size Statistics

Range: .08 to .78 mm
Mean: .32 mm
Median: .28
Interquartile Range: .33 mm



Paste in plane light 4x (66-2A)



Paste in cross-polar light 4x

Site: 41HY160   Thin Section #: 41-1A

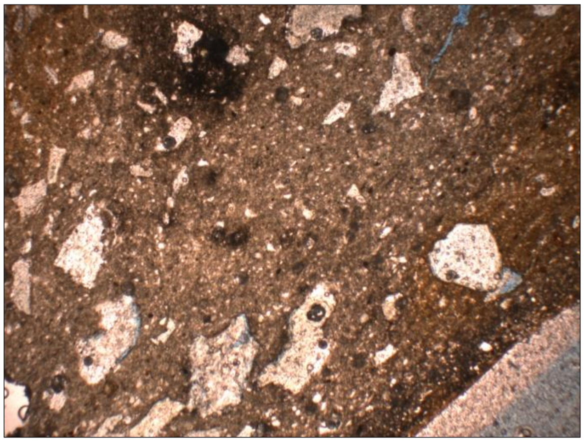
Paste Matrix: continuous
Paste Color: core - light yellowish brown (2.5Y 6/4)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: both edges are lighter than core – 10YR 5/6 yellowish brown
Comments: quartz is silt size; some voids are inclusions that have popped out; paste is calcareous
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	250	81.97%	Paste	250	85.62%
Voids	13	4.26%	Sand	6	2.05%
Bone	32	10.49%	Bone	32	10.96%
Quartz	6	1.97%	Carbonates	4	1.37%
Calcium carbonate	4	1.31%	**Total**	**292**	
Total	**305**				

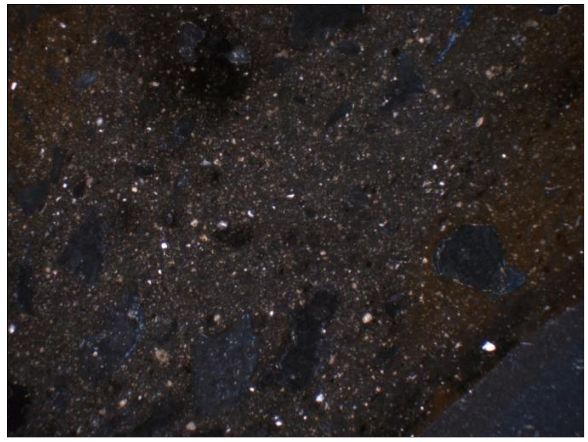
Present but not sampled: hematite

Bone Size Statistics

Range: .02 to 1.2 mm
Mean: .42 mm
Median: .40 mm
Interquartile Range: .34 mm



Paste in plane light 4x (41-1A)



Paste in cross-polar light 4x

Site: 41HY160　　*Thin Section #: 3-6A*

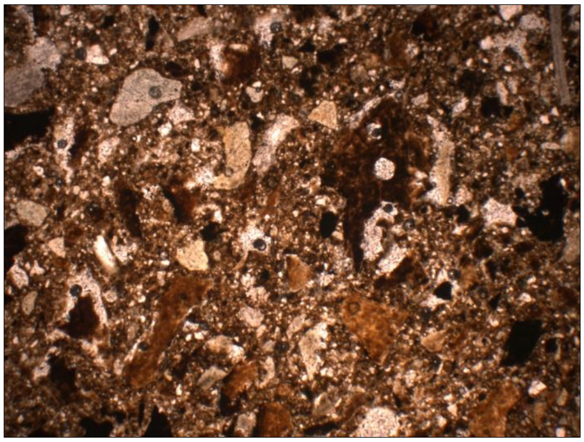
Paste Matrix: continuous
Paste Color: yellowish brown (10YR 5/6)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: No – same as the rest of the paste
Comments: a calcareous paste; most quartz is silt size
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	162	52.60%	Paste	162	55.48%
Voids	16	5.19%	Sand	25	8.56%
Bone	97	31.49%	Bone	97	33.22%
Quartz	23	7.47%	Carbonates	6	2.05%
Calcium carbonate	4	1.30%	Other	2	0.68%
Alkali feldspar	1	0.32%	**Total**	**292**	
Polycrystalline quartz	1	0.32%			
Calcite	2	0.65%			
Hematite	2	0.65%			
Total	**308**				

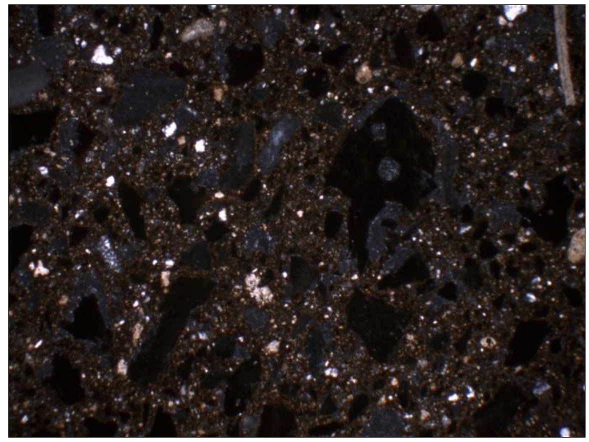
Present but not sampled: shell

Bone Size Statistics

Range: .04 to 1.2 mm
Mean: .28 mm
Median: .24 mm
Interquartile Range: .27 mm



Paste in plane light 4x (3-6A)



Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 4-1A

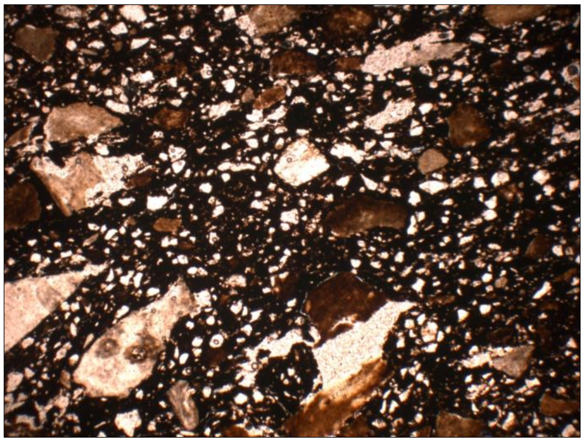
Paste Matrix: continuous
Paste Color: dark yellowish brown (10YR 3/6)
Paste Description: Fine to Medium sand
B-fabric: undifferentiated
Slip/Edges: one edge is lighter – strong brown (7.5YR 5/8) and striated/active in XPL; likely a wash
Comments: some voids may be popped out inclusions
Paste group: Sandy paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	200	61.54%	Paste	200	66.45%
Voids	24	7.38%	Sand	57	18.94%
Bone	43	13.23%	Bone	43	14.29%
Quartz	53	16.31%	Other	1	0.33%
Alkali feldspar	2	0.62%	**Total**	**301**	
Polycrystalline quartz	2	0.62%			
Hematite	1	0.31%			
Total	**325**				

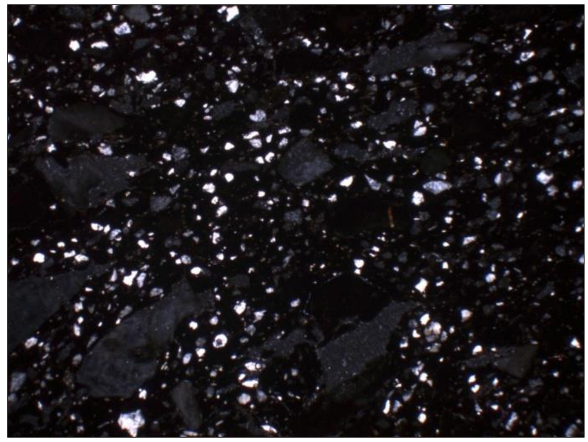
Present but not sampled: muscovite, hornblende

Bone Size Statistics

Range: .06 to 2.28 mm
Mean: .38 mm
Median: .30 mm
Interquartile Range: .34 mm



Paste in plane light 4x (4-1A)



Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 42-1A

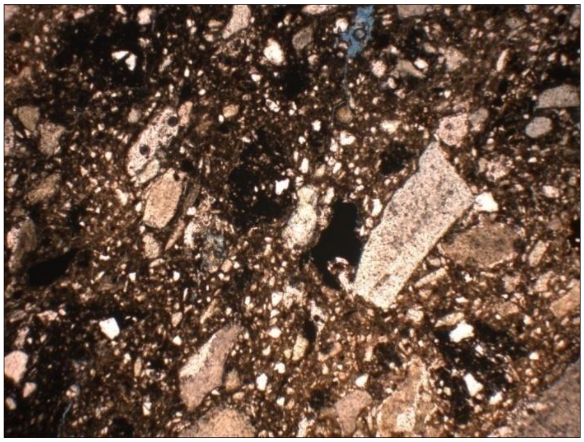
Paste Matrix: continuous
Paste Color: olive brown (2.5Y 4/4)
Paste Description: silty to very fine sand
B-fabric: undifferentiated
Slip/Edges: One side is lighter – yellowish brown (10YR 5/6)
Comments: grog is tempered with sand or bone and sand; some voids may be inclusions that have been popped out
Paste group: Sandy Paste-bone and grog temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	188	58.75%	Paste	188	63.51%
Voids	24	7.50%	Sand	34	11.49%
Bone	53	16.56%	Bone	53	17.91%
Quartz	32	10.00%	Grog	16	5.41%
Grog	16	5.00%	Mica	1	0.34%
Hematite	3	0.94%	Other	4	1.35%
Polycrystalline quartz	1	0.31%	**Total**	**296**	
Muscovite	1	0.31%			
Opaque	1	0.31%			
Alkali feldspar	1	0.31%			
Total	**320**				

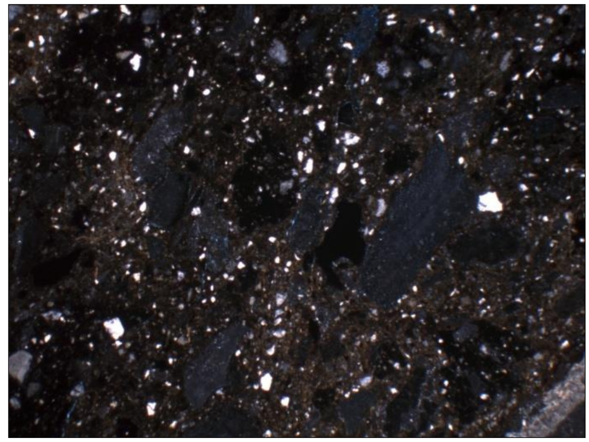
Present but not sampled: plagioclase

Bone Size Statistics

Range: .04 to 1.98 mm
Mean: .37 mm
Median: .32 mm
Interquartile Range: .36 mm



Paste in plane light 4x (42-1)



Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 110-6A

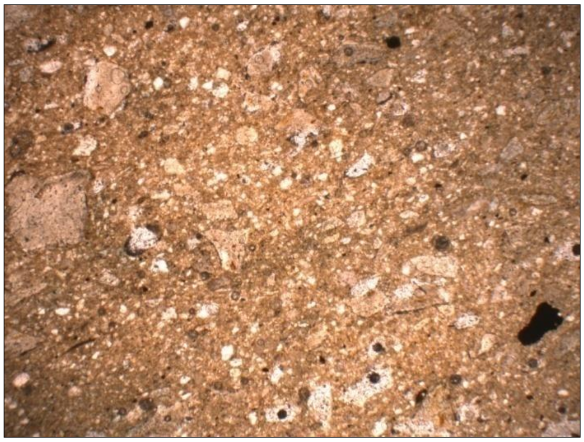
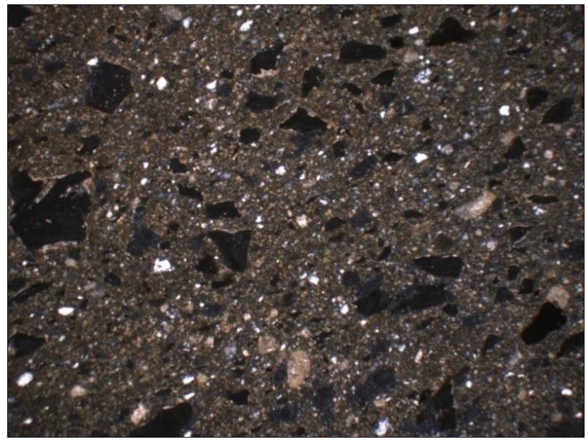
Paste Matrix: continuous
Paste Color: yellowish brown (2.5Y 7/6)
Paste Description: silty
B-fabric: slightly active
Slip/Edges: No-same as rest of paste
Comments: silt-sized quartz grains; bone is fairly reduced, some secondary calcite present around bone
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	206	66.67%	Paste	206	69.59%
Voids	13	4.21%	Sand	15	5.07%
Bone	65	21.04%	Bone	65	21.96%
Quartz	15	4.85%	Carbonates	10	3.38%
Calcium carbonate	10	3.24%	**Total**	**296**	
Total	**309**				

Present but not sampled: alkali feldspar, shell, polycrystalline quartz, calcite

Bone Size Statistics

Range: .04 to 1.12 mm
Median: .22 mm
Mean: .29 mm
Interquartile Range: .27 mm

Paste in plane light 4x (110-6A) Paste in cross-polar light 4x

Site: 41HY160 *Thin Section #: 121-2A*

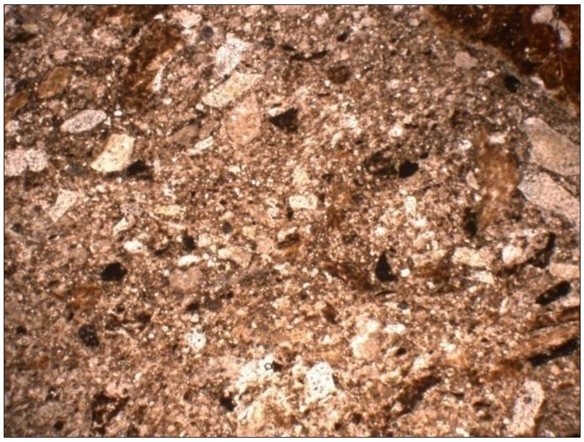
Paste Matrix: continuous
Paste Color: yellowish brown (10YR 5/6)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: one side lighter (10YR 6/6 brownish yellow)
Comments: poor quality thin section too thin with some inclusions popped out – very calcareous paste
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	199	58.02%	Paste	199	64.61%
Voids	35	10.20%	Sand	12	3.90%
Bone	80	23.32%	Bone	80	25.97%
Quartz	11	3.21%	Carbonates	17	5.52%
Calcite	6	1.75%	**Total**	**308**	
Calcium carbonate	11	3.21%			
Hornblende	1	0.29%			
Total	**343**				

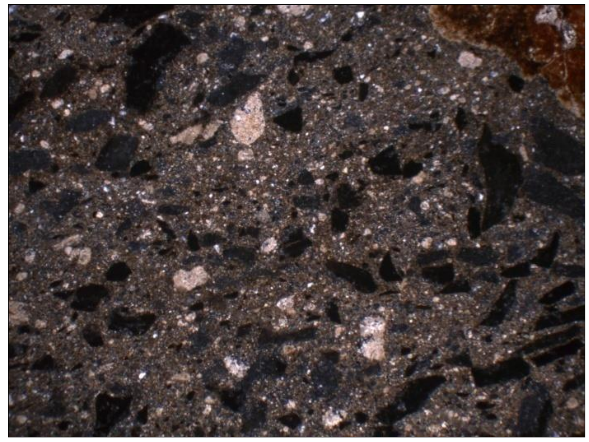
Present but not sampled: shell

Bone Size Statistics

Range: .02 to .90 mm
Mean: .29 mm
Median: .23 mm
Interquartile Range: .26 mm



Paste in plane light 4x (121-2A)



Paste in cross-polar light 4x

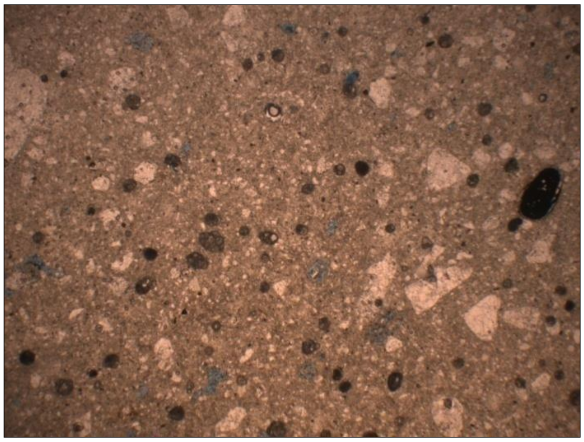
Site: 41HY160 Thin Section #: 136-1A

Paste Matrix: continuous
Paste Color: pale brown (2.5Y 7/3)
Paste Description: silty to fine sand
B-fabric: undifferentiated
Slip/Edges: Indeterminate – spots of calcium carbonate along all edges of the thin section – along one edge there are spots of a almost transparent strong brown (7.5YR 5/8) color (very thin layer)
Comments: Thin section is a little thin
Paste group: Sandy paste-sand temper

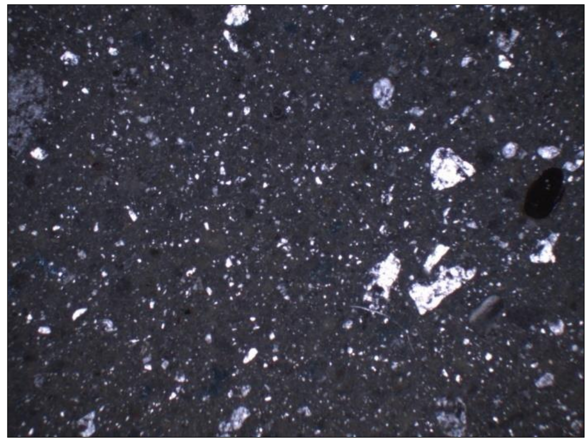
Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	215	69.13%	Paste	215	74.14%
Voids	21	6.75%	Sand	74	25.52%
Quartz	63	20.26%	Other	1	0.34%
Polycrystalline quartz	9	2.89%	**Total**	**290**	
Alkali feldspar	2	0.64%			
Hematite	1	0.32%			
Total	**311**				

Present but not sampled: muscovite, biotite, small mafic minerals, calcium carbonate

Bone: no bone



Paste in plane light 4x (136-1A)



Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 136-3A

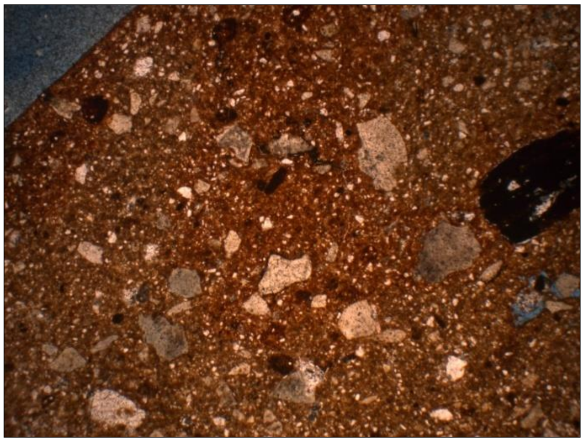
Paste Matrix: continuous
Paste Color: strong brown (7.5YR 5/8)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: No – same as the rest of paste
Comments: most quartz is silt size
Paste group: Unsandy paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	230	74.43%	Paste	230	78.50%
Voids	16	5.18%	Sand	23	7.85%
Bone	35	11.33%	Bone	35	11.95%
Quartz	23	7.44%	Other	5	1.71%
Hematite	5	1.62%	**Total**	**293**	
Total	**309**				

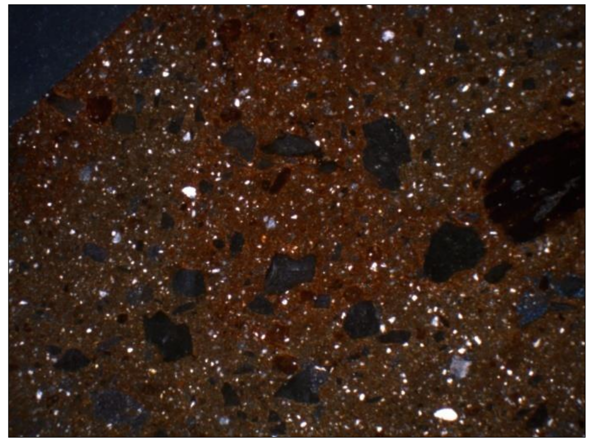
Present but not sampled: polycrystalline quartz, muscovite

Bone Size Statistics

Range: .02 to .86 mm
Mean: .27 mm
Median: .22 mm
Interquartile Range: .18 mm



Paste in plane light 4x (136-3A)



Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 137-4A

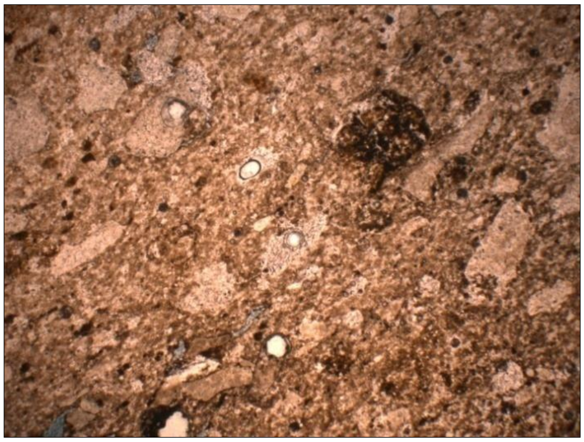
Paste Matrix: continuous
Paste Color: core = light olive brown (2.5Y 5/6)
Paste Description: silty
B-fabric: striated/active
Slip/Edges: Edges are lighter - brownish yellow (10YR 6/8) and more active in XPL
Comments: Thin section is very poor quality (too thin) – some voids are missing inclusions
Paste group: Unsandy/calcareous paste-bone temper

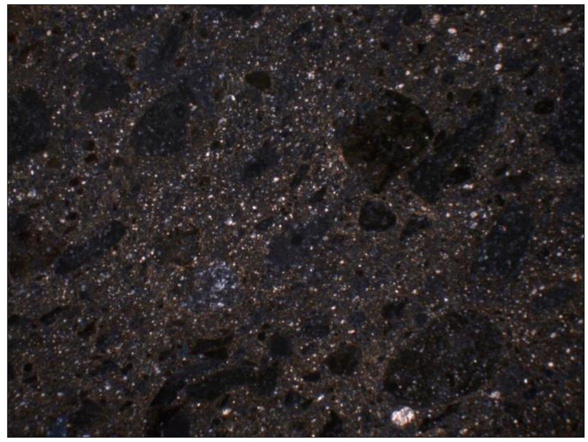
Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	235	74.84%	Paste	235	82.17%
Voids	28	8.92%	Sand	6	2.10%
Bone	34	10.83%	Bone	34	11.89%
Quartz	6	1.91%	Carbonates	8	2.80%
Hematite	3	0.96%	Other	3	1.05%
Calcite	7	2.23%	**Total**	**286**	
Calcium carbonate	1	0.32%			
Total	**314**				

Present but not sampled: N/A

Bone Size Statistics

Range: .06 to .96 mm
Mean: .48 mm
Median: .55 mm
Interquartile Range: .48 mm





Paste in plane light 4x (137-4A) Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 139-2A

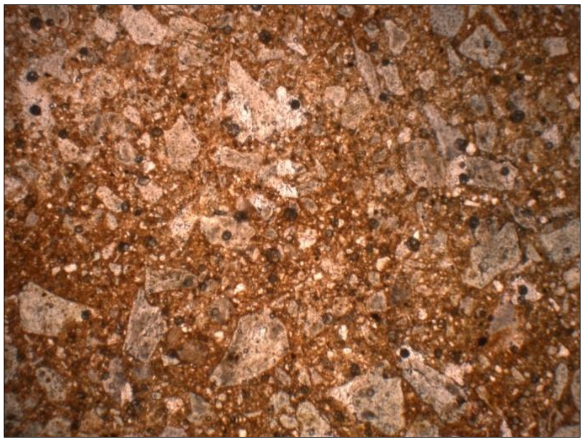
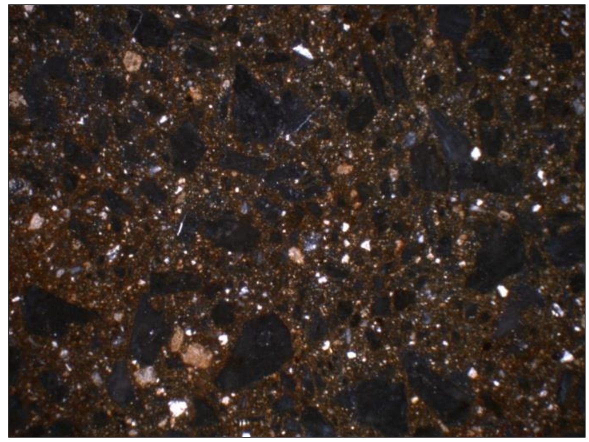
Paste Matrix: continuous
Paste Color: strong brown (7.5YR 5/8)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: No-same as rest of paste
Comments: some voids may be popped out inclusions
Paste group: Unsandy/calcareous paste-bone temper

Paste/Inclusion	Count	Percentage	Simplified Inclusion Category	Count	Percentage
Paste	185	55.22%	Paste	185	58.54%
Voids	19	5.67%	Sand	21	6.65%
Bone	99	29.55%	Bone	99	31.33%
Quartz	21	6.27%	Carbonates	11	3.48%
Calcite	3	0.90%	**Total**	**316**	
Calcium carbonate	8	2.39%			
Total	**335**				

Present but not sampled: polycrystalline quartz, hematite

Bone Size Statistics

Range: .04 to .62 mm
Median: .24 mm
Mean: .28 mm
Interquartile Range: .26 mm

Paste in plane light 4x (139-2A) Paste in cross-polar light 4x

Site: 41HY160 Thin Section #: 164-10A

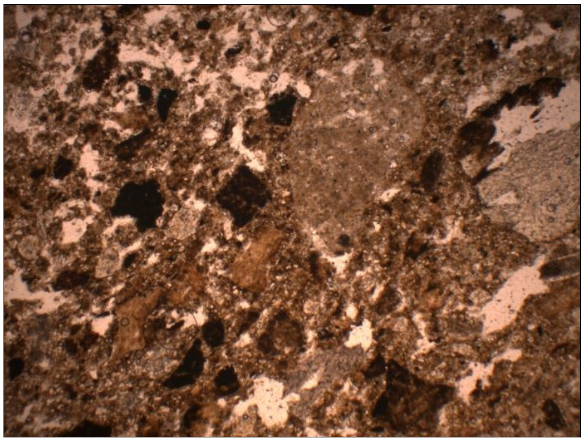
Paste Matrix: continuous
Paste Color: yellowish brown (10YR 5/8)
Paste Description: silty
B-fabric: speckled/slightly active
Slip/Edges: No – same as the rest of the paste
Comments: some voids may be popped out inclusions; opaques may be burnt bone; quality of thin section very poor – several spots too thin
Paste group: Unsandy/calcareous paste-bone temper

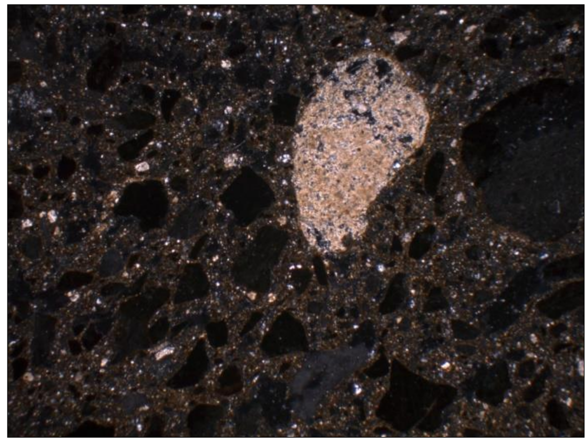
Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	163	50.62%	Paste	163	56.01%
Voids	31	9.63%	Sand	17	5.84%
Bone	96	29.81%	Bone	96	32.99%
Quartz	17	5.28%	Carbonates	12	4.12%
Calcium carbonate	10	3.11%	Other	3	1.03%
Opaque	3	0.93%	**Total**	**291**	
Calcite	2	0.62%			
Total	**322**				

Present but not sampled: fossils

Bone

Range: .06 to .86 mm
Median: .24 mm
Mean: .28 mm
Interquartile Range: .28 mm


Paste in plane light 4x (164-10A)


Paste in cross-polar light 4x

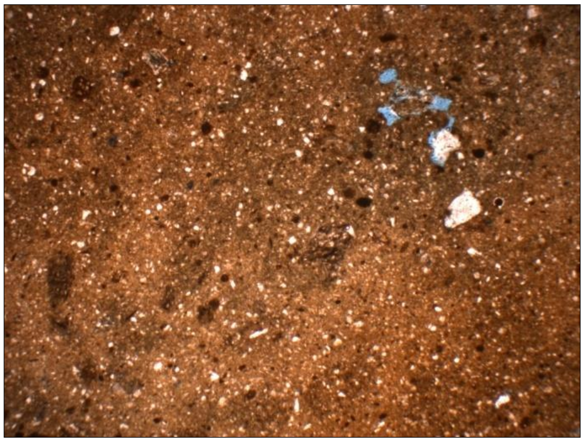
Site: 41HY160   *Thin Section #: 168-1A*

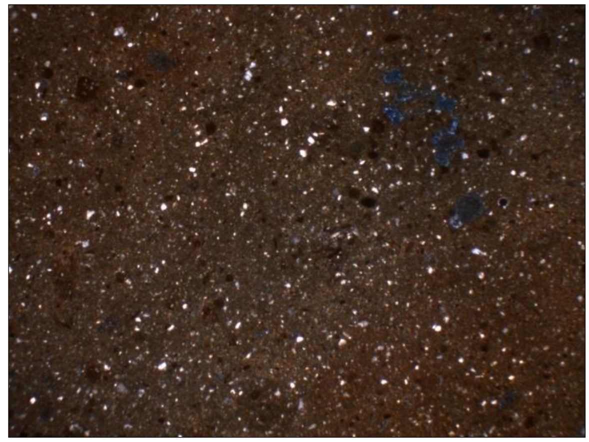
Paste Matrix: continuous
Paste Color: yellowish brown (10YR 5/8)
Paste Description: silty
B-fabric: Speckled/slightly active
Edge Description: thin spots of brownish yellow (10YR 6/8) along both edges (very spotty)
Comments: no bone present in paste, several inclusions are popped out
Paste group: Unsandy paste-untempered

Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	292	90.97%	Paste	292	91.54%
Voids	2	0.62%	Sand	20	6.27%
Quartz	20	6.23%	Other	7	2.19%
Hematite	7	2.18%	**Total**	**319**	
Total	**321**				

Present but not sampled: Muscovite, polycrystalline quartz, clay pellet, alkali feldspar

Bone: no bone





Paste in plane light 4x (168-1A) Paste in cross-polar light 4x

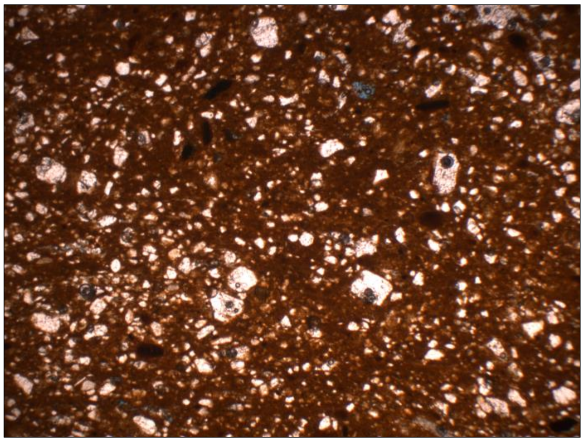
Site: 41HY160 Thin Section #: 92-2A

Paste Matrix: continuous
Paste Color: yellowish red (5YR 5/8)
Paste Description: silty to fine sand
B-fabric: Speckled/slightly active
Edge Description: Same as the rest of the paste
Comments: No orientation of the inclusions – not wheel thrown; unknown is possibly bone or calcium carbonate; thin section too thick in spots
Paste group: Sandy paste-sand temper

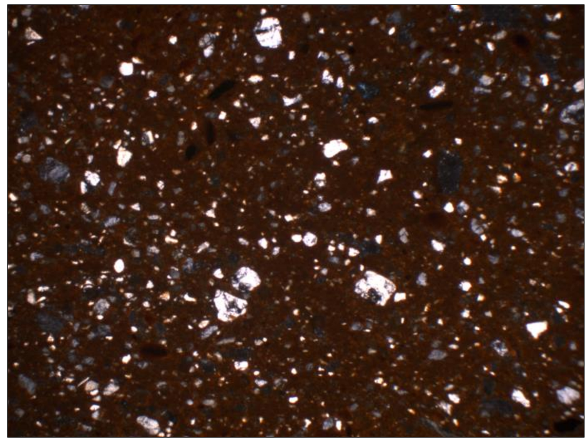
Paste/Inclusion	**Count**	**Percentage**	**Simplified Inclusion Category**	**Count**	**Percentage**
Paste	225	72.35%	Paste	225	75.00%
Voids	11	3.54%	Sand	69	23.00%
Quartz	65	20.90%	Other	6	2.00%
Hematite	4	1.29%	**Total**	**300**	
Clay pellet	1	0.32%			
Polycrystalline quartz	2	0.64%			
Unknown	1	0.32%			
Rock conglomerate	1	0.32%			
Alkali feldspar	1	0.32%			
Total	**311**				

Present but not sampled: plagioclase, muscovite

Bone: no bone



Paste in plain light (92-2A)



Paste in cross polar light (92-2A)

Paste Groups

The petrographic analysis of the 26 sherds identified seven paste groups based on the proportions of constituent elements present in the paste fabric based on the simplified inclusion categories. Paste type was defined on the percentage of sand. Unsandy paste is defined as less than 10% sand inclusions. A sandy paste is defined as having greater than 10% sand inclusions based on point counting.

Paste Group 1: Sandy Paste-Grog Tempered – Caddoan (n=2)

Two sherds (8%) of the samples were classified into this paste group. The primary distinguishing characteristic of the paste group is the presence of grog temper (1.94% and 2.72%). No bone temper is present in either of the two sherds. The percentage of sand ranged from 19.68% to 24.49%. The grog was tempered with sand in both thin sections.

41HY188	501-4A
41HY188	501-9A

Paste Group 2: Sandy Paste-Bone Tempered – (n=2)

Two specimens (8%) are part of this paste group. The ceramic fabric contains both bone and greater than 10% sand. The percentage of bone ranged from 6.51% to 14.29%. The size of the bone ranged from 0.06 mm to 2.28 mm with the mean bone size .38 mm. The percentage of sand ranged from 18.94% to 23.97%. Quartz was variable in size, ranging from silt to fine sand. Calcium carbonate, calcite, and fossils were absent in this paste group.

41HY160	66-1A
41HY160	4-1A

Paste Group 3: Unsandy Paste-Bone Tempered (n=1)

One sherd was placed in this paste group (4%). The ceramic fabric in this group contained bone and less than 10% sand. The percentage of bone was 11.95%. The size of the bone ranged from .02 mm to .86 mm with a mean of .27 mm. The percentage of sand was 7.85%. The sand was uniformly silt sized. Carbonates were absent in this paste group.

41HY160	136-3A

Paste Group 4: Unsandy/Calcareous Paste-Bone Tempered – (n=12)

Twelve sherds are grouped into this paste group (46%). The ceramic fabric in this group contained, bone, carbonates and generally less than 10% sand. Two sherds (274-4A and 373-1A) placed in this group had just over 10% sand; however, given that their ceramic fabric and inclusions were consistent with the other sherds in this category, they were included in this group. The percentage of sand ranged from 2.05% to 10.89%. The sand was silt size. Calcium carbonate, calcite, and fossils were common inclusions in this paste group. The percentage of bone ranged from 6.49% to 33.22%. The size of the bone ranged from 0.02 mm to 1.2 mm with a mean bone size of .33 mm.

41HY188	501-1A
41HY188	373-1A
41HY188	274-3A
41HY188	274-4A
41HY160	3-6A
41HY160	110-6A
41HY160	121-2A
41HY160	66-2A
41HY160	41-1A
41HY160	137-4A
41HY160	164-10A
41HY160	139-2A

Paste Group 5: Sandy Paste-Sand Tempered – (n=7)

Seven sherds (27%) were included in this paste group. This group was characterized by the absence of bone temper. The percentage of sand ranged from 23.00% to 45.51%. The quartz size was variable, ranging from silt to fine sand size. Feldspars, mica, and hornblende were common inclusions in this paste group.

41HY188	501-3A
41HY188	501-5A
41HY188	501-6A
41HY188	501-7A

41HY188	501-8A
41HY160	136-1A
41HY160	92-2A

Paste Group 6: Sandy Paste-Bone and Grog Tempered – Caddoan – (n=1)

One sherd (4%) was included in this paste group. This paste group was characterized by the presence of bone and grog temper in a sandy paste. The percentage of quartz was 11.49%. The quartz size ranged from silt to fine sand size. The percentage of bone was 17.91%. The bone size ranged from .04 mm to 1.98 mm, with a mean bone size of .37 mm. The percentage of grog was 5.41%. The grog was tempered with sand or bone and sand.

41HY160	42-1A

Paste Group 7: Unsandy paste-untempered – (n=1)

One sherd (4%) was included in this paste group. This paste group was characterized by less than 10% sand and no bone or grog. The percentage of quartz was 6.27%. The sand was silt size.

41HY160	168-1A

Paste Group Summary

Based on the simplified inclusion categories, seven paste groups were identified for the thin sections from 41HY188 and 41HY160. Five paste groups were represented at 41HY160 with the unsandy/calcareous paste-bone temper group the most common (Table 7-6). At 41HY188 only three of the paste groups were represented with the sandy paste-sand temper group the most common (Table 7-7). Only the unsandy/calcareous paste-bone temper and sandy paste-sand temper paste groups were found at both sites. Table x provides a distribution of paste groups by ware type identified. For Leon Plain, the most common paste group was unsandy/calcareous paste-bone temper. The one sherd identified as Goliad, is likely not Goliad, given that it is not a bone-tempered ware. It is possible that the two Leon Plain sherds with sandy paste-grog temper and the one unknown sherd with sandy paste-bone and grog temper are a Caddo ware or wares made in the Caddo tradition.

Table 7-6. Distribution of paste group by site.

Paste Group	**41HY160**		**41HY188**	
	Count	**Frequency**	**Count**	**Frequency**
Unsandy/Calcareous paste-bone temper	8	60.00%	4	36.36%
Unsandy paste-bone temper	1	66.67%	0	0%
Sandy paste-bone and grog temper	1	6.67%	0	0%
Sandy paste-bone temper	2	13.33%	0	0%
Sandy paste-sand temper	2	13.33%	5	45.45%
Sandy paste-grog temper	0	0%	2	18.18%

Table 7-6. Distribution of paste group by site.

Paste Group	41HY160		41HY188	
	Count	**Frequency**	**Count**	**Frequency**
Unsandy paste-untempered	1	6.67%	0	0%
Total	**15**		**11**	

Table 7-7. Distribution of paste groups by ceramic ware and site.

Ceramic Ware	**Site**	**Unsandy/Calcareous paste bone temper**	**Unsandy paste-bone temper**	**Sandy paste bone and grog temper**	**Sandy paste-bone temper**	**Sandy paste-sand temper**	**Sandy paste-grog temper**	**Unsandy paste-untemper**	**Total**
Goliad	HY160							100%	1
Total Goliad								**100%**	**1**
Leon Plain	HY160	100%							3
Leon Plain	HY188	36.36%				45.45%	18.18%		11
Total Leon Plain		**50.00%**				**35.71%**	**14.29%**		**14**
Unknown	HY160	45.45%	9.09%	9.09%	18.18%	18.18%			11
Total Unknown		**45.45%**	**9.09%**	**9.09%**	**18.18%**	**18.18%**			**11**

Although the unsandy/calcareous paste-bone temper group was represented at both sites, there are differences in this group by site. In general the sherds from 41HY188 had more sand and less bone and carbonates than 41HY160 (Figure 7-1). The difference in sand and carbonate inclusions mean percentages between the two sites are likely due to the use of different clay sources. To test the null hypothesis that the bone measurements were the same at the two sites, the Mann-Whitney test was used. The difference in bone inclusion size between 41HY160 and 41HY188 unsandy/calcareous paste-bone temper groups is significant ($U = 29489.5$, $p > .0001$). A box plot of the bone measurements from the two sites is shown in Figure 7-2. The difference in bone inclusion size is likely related to different manufacturing processes at the two sites.

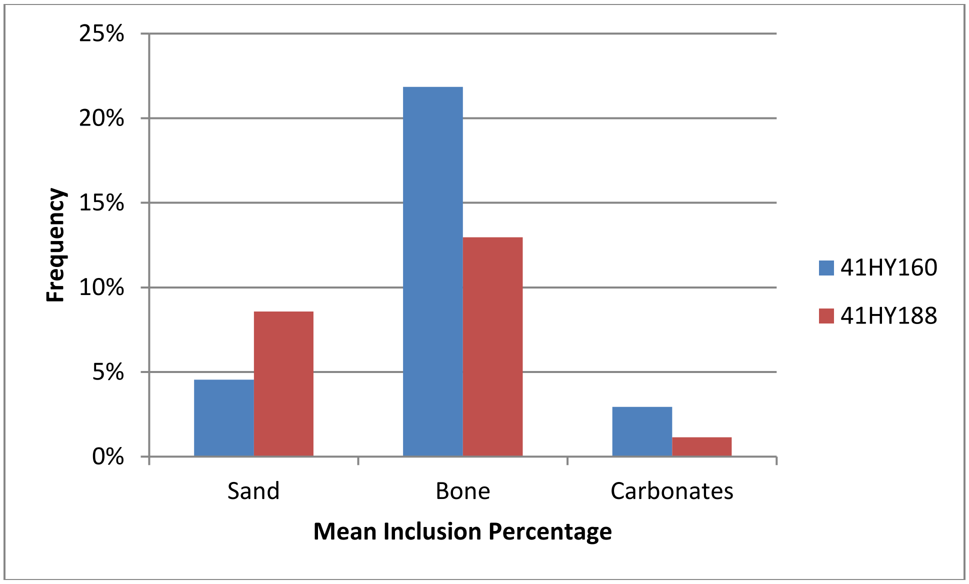


Figure 7-1. Comparison of the mean inclusion percentage of sand, bone and carbonates between the unsandy/calcareous paste-bone temper groups at 41HY160 and 41HY188.

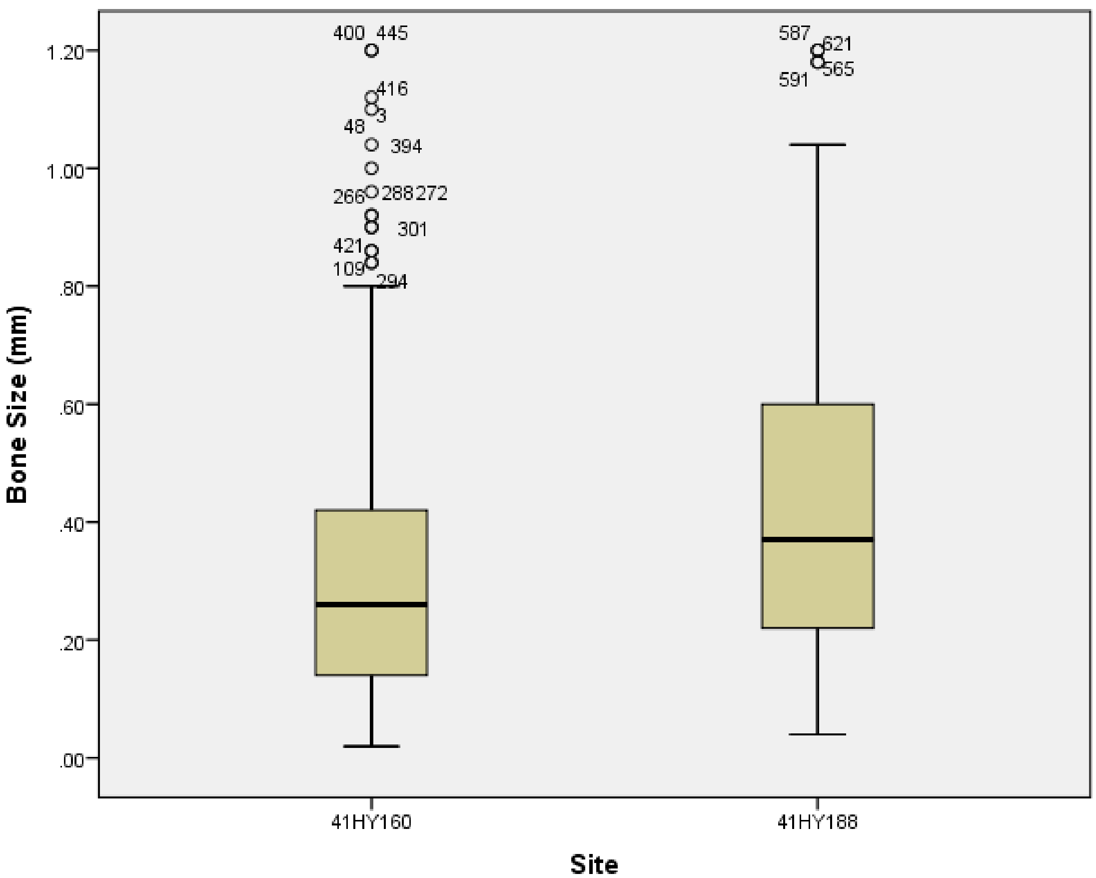


Figure 7-2. Box plot comparison of bone size within the unsandy/calcareous paste-bone temper group at 41HY1560 and 41HY188.

Like the unsandy/calcareous paste-bone temper group, there were also differences in the sandy paste-sand temper group between the two sites. At 41HY160, both of the sherds in this paste group were identified as unknown Colonial wares, whereas at 41HY188, all the sherds in this group were identified as prehistoric Leon Plain. At 41HY160, both the sherds were classified as having a heavy (21% to 30.00%) amount of sand; however, 136-1A also had carbonates present, but in 92-2A carbonates were absent. At 41HY188, three of five sherds had very heavy (31+%) amount of sand and two of the sherds had a heavy amount of sand. Carbonates were absent and feldspars were very common in all the sandy paste-sand tempered sherds at 41HY188.

Comparative Analyses

The sample of ceramics from the Hays County sites was compared to a large number of other ceramics from other prehistoric and Spanish colonial sites. The goal of these comparisons was on the one hand to determine whether the Hays samples were similar to any other ceramics from the southern part of the Central Texas Archaeological Region and also seek similarities and/or differences to assemblages from Spanish Colonial sites since it was suspected that a small number of the bone tempered wares may have been Goliad specimens.

Thickness

The thickness of the paste groups was compared to Caddoan ceramics from several sites in East Texas. Four sherds in 41TG2 are possible Caddoan specimens. However, three of these four have a mean thickness of varying from 4.98 mm (3.9, 5.4 and 5.5) while the fourth has a mean thickness of 7.1 mm. The three thinnest specimens most closely resemble the sherds from 41MX5 where a large number of the sherds were slightly thinner than the bulk of the Caddoan sherds in other collections examined. The thickest sherd fits the range of Caddoan sherds.

Toyah sherds in general, are thinner than Caddoan sherds and also thinner than the plain wares found at the missions. For collections of 40 or more sherds examined, the mean thickness of the sherds ranges from 5.1 to 7.3 mm. The 41WN88 assemblage is at the thicker end of this range, while sherd samples from 41KM16, 41LK201, 41KM69 and 41KM16 are at the lower end of the distribution. Mission-associated plain wares, tend to be thicker than the Leon Plain ceramics.

Aplastic Inclusions

Table 7-8 provides the breakdown of four inclusion categories created from point counting from samples representing Goliad, Caddo, and Leon Plain wares by site. The four inclusion categories represent the most common inclusions found in native wares from Texas. The shell inclusions included in this table reflect natural inclusions in a calcareous clay and not shell added as temper. In general, Goliad wares tend to have more bone and less sand than either Leon Plain or Caddo wares. Caddo wares have the highest percentage of sand and generally include grog temper in addition to or instead of bone temper. Carbonates are found in low percentages in both Goliad and Leon Plain wares, but are absent in the Caddo wares sampled.

Table 7-8. Breakdown of inclusion categories within Goliad, Caddo, and Leon Plain wares by site.

Ceramic Ware	**Site**	**Bone %**	**Sand %**	**Carbonates %**	**Grog%**	**Shell%**	**Sample Size**
Goliad	41BX5	19.48	5.27	1	0	0	50
Goliad	41BX12	16.28	3.58	1.60	0	0	33
Goliad	41BX3	16.39	9.93	1.39	0	0	19
Goliad	41BX4	14.33	7.45	.82	0	0	19
Goliad	41WN30	24.02	12.98	.53	0	0	15
Goliad	41HY165	12.37	2.01	8.36	0	.33	1
Mean Goliad		**18.01**	**6.63**	**1.18**	**0**	**0**	**137**
Caddo	41AN1	0	16.39	0	3.83		6
Caddo	41AN19	.36	15.32	0	7.42		6
Caddo	41AN8	2.27	23.10	0	3.01		6
Caddo	41CE19	3.30	14.74	0	5.85		6
Caddo	41MX5	2.46	15.42	0	3.78		6
Caddo	41NA27	.11	17.73	0	2.96		6
Caddo	41WD13	.60	15.33	0	4.96		6
Mean Caddo		**1.30**	**16.86**	**0**	**4.54**		**42**
Leon Plain	41BX288	18.23	18.31	.68	0		7
Leon Plain	41BX5	7.47	5.95	.51	0		5
Leon Plain	41ED28	15.20	5.14	2.22	0		11
Leon Plain	41JW8	16.76	20.46	2.51	0		6
Leon Plain	41KM69	12.25	8.95	.29	0		6
Leon Plain	41LK201	19.24	12.65	.49	0		15
Leon Plain	41LK67	16.73	13.52	1.21	0		7
Leon Plain	41RE1	0	25.71	5.28	0		3
Leon Plain	41HY165	13.70	13.51%	1.21%	0	.06	13
Mean Leon Plain		**14.93**	**12.71**	**1.31**	**0**	**0**	**73**

Paste Groups

Table 7-9 provides a breakdown of the paste groups, based on petrographic analysis, assigned to Goliad, Leon Plain, Caddo, and indeterminate Colonial wares by site. Caddo wares have the most variation in paste groups. Within a sample 42, eight paste groups were identified. However, the majority of the Caddo sherds sampled fall within the sandy paste-grog temper group. Goliad had the least variation in paste groups with an overwhelming majority of the sherds falling in the unsandy paste-bone temper group. The Leon Plain sherds sampled generally fell within the unsandy paste-bone temper or sandy paste-bone temper categories. Among the indeterminate Colonial wares, the unsandy paste-shell and bone tempered group is possibly Caddo ware or made in the Caddo tradition. Three of the indeterminate Colonial ware sherds were classified in the sandy paste-sand temper category. Five percent of the Leon Plain and 12% of the Caddo wares samples fell within the sandy paste-sand temper category. Future petrographic analysis work needs to include Rockport wares to see if the sandy paste-sand temper Leon Plain and indeterminate Colonial ware sherds are more similar to sand tempered Rockport or Caddo wares.

Bone Amount in Leon Plain and Goliad

As mentioned above, Goliad tends to have more bone temper than Leon Plain (Figure 7-3). To examine the difference in bone temper amount between Leon Plain and Goliad wares, the bone temper percentage recorded during point counting was converted to the following categories: Light (1% to 10%), Moderate (10.01% to 20%), or Heavy (greater than 20%). For this comparison, only sherds classified as Leon Plain or Goliad and that have bone temper were used. The difference in bone temper amount between Leon Plain and Goliad wares is significant ($\chi^2 = 6.653$, $p = .0359$). When the wares are separated by paste type (sandy or unsandy) (Figure 4), the difference in bone amount between sandy paste Leon Plain and Goliad wares is significant ($\chi^2 = 8.961$, p = .0113); however, the bone amount was not significant with the unsandy paste wares ($\chi^2 = 5.708$, p = .0576). In sandy paste Goliad wares, the bone amount tends to be light. In general, there is little variation in bone amount about between sandy and unsandy pastes in Leon Plain wares; however, with the Goliad wares there is considerable variation in bone amount with the different types of paste.

Table 7-9. Distribution of paste groups for Caddo, Goliad and Leon Plain wares by site.

Site	Ceramic Ware	Unsandy paste-untempered	Unsandy paste-shell and bone	Unsandy paste-limestone	Unsandy paste-grog	Unsandy paste-bone	Unsandy paste-bone & grog	Sandy paste-sand	Sandy paste-grog	Sandy paste-bone	Sandy paste-bone & grog	Sample Size
41AN1	Caddo				16.67%			16.67%	66.67%			6
41AN19	Caddo								83.33%		16.67%	6
41AN8	Caddo							16.67%	66.67%	16.67%		6
41CE19	Caddo	16.67%				16.67%		16.67%	50.00%			6
41MX5	Caddo				33.33%		16.67%		33.33%		16.67%	6
41NA27	Caddo				16.67%			33.33%	50.00%			6
41WD13	Caddo				16.67%		33.33%		50.00%			6
Total Caddo		**2.38%**			**11.90%**	**2.38%**	**7.14%**	**11.90%**	**57.14%**	**2.38%**	**4.76%**	**42**
41BX288	Leon Plain					28.57%				71.43%		7
41BX5	Leon Plain					80.00%				20.00%		5
41ED28	Leon Plain					90.91%		9.09%				11
41JW8	Leon Plain					16.67%				83.33%		6
41KM69	Leon Plain					100%						6
41LK201	Leon Plain					46.67%				53.33%		15
41LK67	Leon Plain					14.29%				85.71%		7
41RE1	Leon Plain			33.33%				66.67%				3
41HY165	Leon Plain					46.15%				53.85%		13
Total Leon Plain				**1.37%**		**50.68%**		**4.11%**		**43.84%**		**73**

Table 7-9. Distribution of paste groups for Caddo, Goliad and Leon Plain wares by site.

Site	Ceramic Ware	Unsandy paste-untempered	Unsandy paste-shell and bone	Unsandy paste-limestone	Unsandy paste-grog	Unsandy paste-bone	Unsandy paste-bone & grog	Sandy paste-sand	Sandy paste-grog	Sandy paste-bone	Sandy paste-bone & grog	Sample Size
41BX12	Goliad					96.97%				3.03%		33
41BX3	Goliad					73.68%				26.32%		19
41BX4	Goliad					68.42%				31.58%		19
41BX5	Goliad					88.00%				12.00%		50
41WN30	Goliad					46.67%				53.33%		15
41HY165	Goliad					100%						1
Total Goliad						**81.02%**				**18.98%**		**137**
41BX12	Indeterminate (Colonial)		50%					50%				2
41BX3	Indeterminate (Colonial)	100%										1
41BX4	Indeterminate (Colonial)							100%				1
41BX5	Indeterminate (Colonial)							100%				3
41HY165	Indeterminate					80.00%		10.00%	10.00%			10
Total Indeterminate		**5.58%**	**5.58%**			**47.06%**		**35.29%**	**5.88%**			**17**

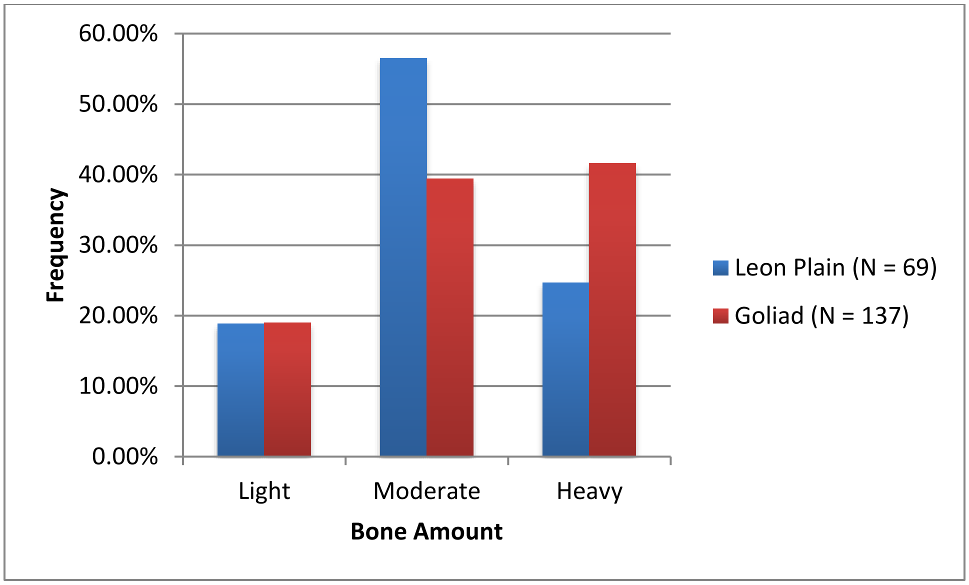


Figure 7-3. Comparison of bone amount found in Leon Plain and Goliad wares.

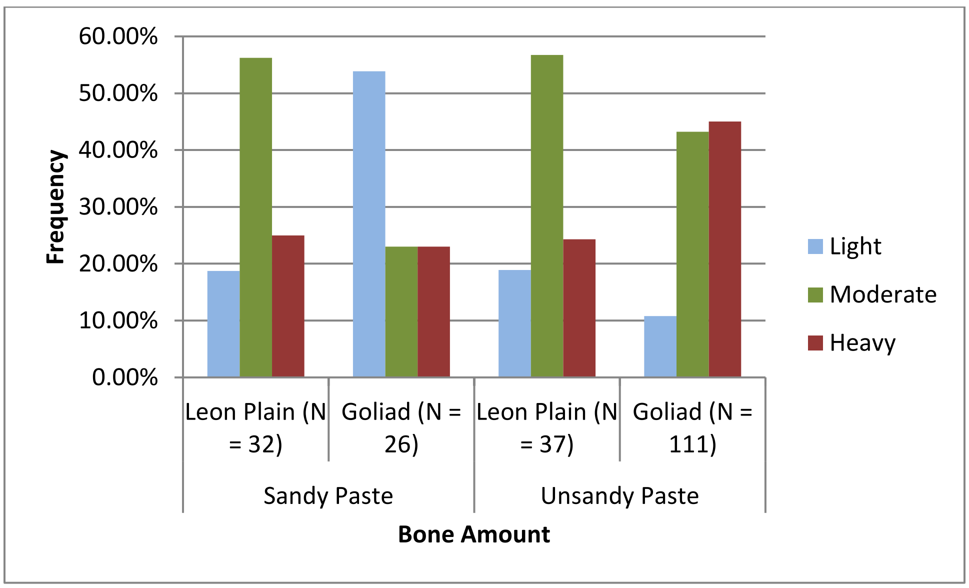


Figure 7-4. Bone amount found in sandy paste and unsandy paste Leon Plain and Goliad wares.

41HY160 and 41HY188 Comparison to Database

Given this comparative database, I suggest that grog temper and bone and grog temper sherds (501-9A and 501-4A from 41HY188 and 42-1A from 41HY160) are likely Caddo wares given the presence of grog temper. The sherd identified as Goliad (168-1A) from 41HY160 is likely not Goliad given the lack of bone temper. In the comparative database, two other sherds (CE19-001-37 from 41CE19 and 89091-a-89 from 41BX3) are categorized in the unsandy-untempered paste group. Although one of these sherds is from a Caddo site (41CE19), it is unknown whether the untempered sherds are Caddo wares, given that this temper type is not generally listed as a temper type for Caddoan ceramics (Perttula et al. 1995:177). The five sandy paste-sand tempered sherds (501-3A, 501-5A, 501-6A, 501-7a and

501-8A) from 41HY188 are likely not Leon Plain wares given the lack of bone temper. Similar prehistoric sherds with sand temper have been identified at 41ED28, 41RE1 and at Caddo sites (41AN1, 41AN8, 41CE19, and 41NA27). A definitive type cannot be determined for these sherds at this time. Also the ceramic type for the sandy paste-sand tempered Colonial period sherds cannot be determined. Similar indeterminate Colonial period, sand tempered sherds have been found at 41BX12, 41BX4 and 41BX5. The majority (57.69%) of the sherds from 41HY160 and 41HY188 have bone temper and would be classified as either Leon Plain or Goliad wares. It is likely that sherds 66-1A, 139-2A, 164-10A, and 3-6A from 41HY160 are Goliad wares. Sherd 66-1A has a sandy paste with less than 10% bone temper. Based on the comparative database, sandy paste Goliad wares tend to have less bone than sandy paste Leon Plain wares. The other three sherds have an unsandy/calcareous paste with greater than 30% bone. In the comparative database, none of the bone-tempered Leon Plain wares have greater than 30% bone; therefore it is likely that these three sherds are Goliad wares. It is hopeful that more petrographic analysis done in the future on Leon Plain and Goliad ceramics will enable the ability to further distinguish between these two ceramic wares.

CHAPTER 8: PLANT REMAINS FROM 41HY160, A PREHISTORIC SITE IN HAYS COUNTY, TEXAS

By Kandace D. Hollenbach

Introduction

The analysis of plant remains is one avenue of research into a group's foodways – the procurement, production, preparation, consumption, display, storage, and discard of food. These practices vary by economic, social, and political situation, and thus give us an entry to study the cultural traditions of a group (Johannessen 1993).

This report details the analysis of carbonized plant remains from site 41HY160, an Early Archaic through Late Prehistoric site in Hays County, Texas. The site is located below the Balcones Escarpment, placing it in a prime ecotonal position between the Edwards Plateau to the west and the Blackland Prairies to the east. The former is characterized by oak (*Quercus* spp.) and juniper (*Juniperus* sp.) savannah with an understory of grasses. The Blackland Prairie is dominated by tall grass species, with oaks and mesquite (*Prosopis* sp.) on uplands and slopes, and denser forests of oak, pecan (*Carya illinoinensis*), walnut (*Juglans* sp.), hackberry (*Celtis* sp.), sumac (*Rhus* sp.), bald cypress (*Taxodium distichum*), and cottonwood (*Populus* sp.) in rich stream valleys (Ricklis and Collins 1994:33).

Perhaps more importantly, 41HY160 is situated between along Spring Lake, and very close to the intermittent drainage Sink Creek. While Sink Creek may have been a seasonal source of water in the past, the numerous springs underlying present-day Spring Lake would have supplied water from the Edwards Aquifer year-round (Eckhardt 2010). The springs surely contribute to the long sequence of occupation at the site.

Previous investigations here indicate a long sequence of serial occupations associated with the springs beginning at least in Clovis times and extending to Spanish contact. Much of this record for Spring Lake is available from 41HY160, including evidence for an important early Middle Archaic Calf Creek horizon, followed by extensive and time-ordered Middle Archaic deposits that was recorded by the 2001-2006 field school. This field school exposed and documented a number of features from these lower levels; most features consist of clusters of burned and fire-cracked rock. Sediment sample recovery from feature contexts was carried out in 2006, resulting in the current sample from lower-most features, dating to Middle and late Early Archaic time periods.

Plant remains were analyzed from 11 floatation samples collected from 11 features, and 126 bulk samples collected from 74 unit/level contexts at the site (Appendix D, Table D-1).

All 11 features are described as "burned rock clusters", with top depths below 110 cm below datum, likely placing them in the late Early to Middle Archaic occupation of the site. The flotation samples were collected during the 2006 excavations. The majority of the bulk samples were also collected in 2006, although five derive from the 1998 field school excavations at the site. The bulk samples primarily represent samples taken from concentrations of carbonized materials recognized during field excavation. These often serve as samples for radiocarbon dating.

Uncarbonized plant materials are unlikely to be preserved outside of dry rock shelters and caves in the relatively moist, acidic soils of east-central Texas, even from relatively recent historic contexts (Reitz and Scarry 1985:10; Yarnell 1982). As such, only carbonized plant remains are considered here to be part of the archaeological record and uncarbonized plant materials are generally assumed to be modern contaminants that reflect the present-day local habitat. One exception is hackberry, the stones of which can be preserved without carbonization due to their high calcium carbonate content (Wang et al. 1997).

Methods

The 11 feature samples were processed by the Center for Archaeological Studies at Texas State University in San Marcos. The "heavy" fraction was captured in nested 0.25-inch and 0.125-inch screens, and the "light" fraction in fine mesh. Personnel from CAS sorted carbonized plant remains and other materials from these sample fractions; these sorted materials were sent to the Archaeological Research Laboratory (ARL) at the University of Tennessee-Knoxville for analysis, along with the 126 bulk samples.

The samples were analyzed using standard paleoethnobotanical procedures (Pearsall 2000). Once weighed, the samples were size-graded using nested geologic sieves. Shell, lithics, burnt clay, and plant remains were sorted down to the 2.00 mm sieve (Appendix D, Table D-2). Plant remains were further identified to the lowest possible taxonomic level using a stereoscopic microscope with 10 to 40 power magnification. Materials less than 2.00 mm in size were scanned for seeds and plant remains not represented in the larger size fraction. If present, acorn remains were pulled from the 1.40 mm sieve to mitigate biases against their preservation. All materials were then counted and weighed, although shell was only weighed. Plant identifications were made with reference to Martin and Barkley's (1961) *Seed Identification Manual* and the PLANTS Database (U.S. Department of Agriculture – Natural Resources Conservation Service [USDA-NRCS] 2010), as well as modern comparative specimens housed at the ARL.

Results

The 11 feature samples yielded 2.90 g of carbonized plant remains, the majority of which (2.22 g; 77 percent) is represented by wood (Table 8-1). The non-wood plant materials include nuts, fruits, and miscellaneous taxa (Table 8-2; see Appendix D-2 for a listing of plant taxa recovered from each sample).

Table 8-1. Feature Samples Analyzed from 41HY160. All weights are in grams.

Lot Number	Feature	Sample context	Sample Weight	Contaminant Weight	Residue Weight	Bone Count	Bone Weight	Lithic Count	Lithic Weight	Plant Weight	Carbonized Plant Weight	Wood Weight
185	21	among rocks	2.13	0.34	0.26	9	0.23			1.30	0.24	0.11
		under rocks	2.21	1.46	0.51	3	0.16			0.08	0.08	0.03
186	22	among rocks	4.47	2.66	0.57	36	0.57	1	0.01	0.53	0.53	0.42
		under rocks	3.18	0.31	2.69	4	0.05			0.11	0.11	0.09
187	23	under rocks	2.38	0.92	1.16	2	0.02			0.28	0.12	0.04
188	24	under rocks	1.19	0.81	0.28					0.09	0.09	0.07
189	25	under rocks	1.08	0.12	0.71	2	0.07			0.17	0.17	0.14
190	26	among rocks	0.32	0.11	0.17					0.03	0.01	0.01
		under rocks	2.59	1.15	1.12	8	0.12			0.21	0.09	0.05
191	27	among rocks	0.43	0.06	0.19	1	0.00			0.18	0.18	0.18
192	28	among rocks	0.28	0.08	0.13	3	0.02	1	0.00	0.05	0.05	0.04
		under rocks	2.17	0.89	1.12	4	0.05			0.08	0.08	0.08
193	29	among rocks	2.57	0.93	1.42	9	0.09			0.12	0.12	0.10
		under rocks	4.59	3.28	0.71	13	0.15	1	0.01	0.45	0.45	0.44
194	30	among rocks	3.24	2.40	0.68	9	0.06			0.09	0.09	0.05
		under rocks	0.12	0.04	0.06					0.02	0.02	0.02
195	31	among rocks	2.02	0.43	1.22	9	0.10	1	0.01	0.28	0.28	0.20
		under rocks	2.65	1.01	1.26	2	0.13			0.23	0.19	0.15

Nuts

Nut taxa recovered from the samples include acorn and hickory, which may also include pecan (*Carya illinoinensis*). Thirteen definitive fragments of hickory nutshell and four fragments of acorn shell were identified in the samples (Table 8-2). Although few fragments were recovered, acorn shell is relatively fragile, especially when compared with hickory nutshell. This condition often results in the underrepresentation of acorn at archaeological sites (Yarnell and Black 1985:97-98). Acorn shell was recovered from four of the features, and hickory nutshell from five, further suggesting that acorn use was more comparable to hickory nut use than indicated by the raw counts.

Table 8-2. Plant Taxa Recovered from 41HY160 Feature Samples.

Category: **Common Name**	**Taxonomic Name**	**Seasonality**	**Count**	**Weight (g)**
Nuts:				
Acorn	*Quercus* sp.	fall	4	0.00
Acorn cf.	*Quercus* sp. cf.	fall	4	0.01
Hickory	*Carya* sp.	fall	13	0.12
Hickory cf.	*Carya* sp. cf.	fall	1	0.00
Nutmeat cf.		fall	1	0.01
Walnut	*Juglans* sp.	Fall	1	0.01
Walnut family	Juglandaceae	fall	12	0.07
Walnut family cf.	Juglandaceae cf.	fall	1	0.01
Fruits:				
Fruit pit cf.			3	0.01
Grape cf.	*Vitis* sp. cf.	summer	3	0.00
Hackberry	*Celtis* sp.	fall	4	0.00
Hackberry, uncarbonized	*Celtis* sp.	fall	14	0.18
Persimmon cf.	*Diospyros virginiana* cf.	fall	5	0.03
Prickly pear cf.	*Opuntia* sp. cf.	summer	7	0.00
Miscellaneous:				
Bark			1	0.01
Bark/pine cone			1	0.00
Bedstraw	*Galium* sp.		2	0.00
Bedstraw cf.	*Galium* sp.		2	0.00
Cheno/am	*Chenopodium/Amaranthus*	late summer/fall	1	0.00
Grass family	Poaceae		1	0.00
Pine cone	*Pinus* sp.		1	0.00
Pitch			12	0.05

Table 8-2. Plant Taxa Recovered from 41HY160 Feature Samples.

Category: **Common Name**	**Taxonomic Name**	**Seasonality**	**Count**	**Weight (g)**
Stem			1	0.00
Unidentifiable			31	0.06
Unidentifiable seed			86	0.04
Unidentified			3	0.00
Unidentified - bulb?			12	0.05
Unidentified seed a			22	0.03
Unidentified seeds			4	0.00
Wood				2.22

Hickory nuts and acorns are frequently recovered from sites in the Eastern Woodlands, as both were important staples in the diets of prehistoric peoples (Gardner 1997; Scarry 2003; Yarnell and Black 1985). Acorns were used widely throughout North America by prehistoric and historic native groups, as various oak species enjoy a wide distribution throughout the continent. Although central Texas is generally the western limit of the geographical distribution of most hickories (Hammett 1997:203; USDA-NCRS 2010), pecans have a significant presence in the region (Hall 2000:Figure 2). Both pecans and hickory nuts, highly nutritious and produced in significant quantities every two to three years, were significant storable foodstuffs for foragers in this region and the greater Eastern Woodlands (Hall 2000:Figure 2; Hammett 1997:203-205). Acorns, pecans, and hickory nuts would have been collected in autumn and could be stored and eaten through winter, until fresh plant foods became available again in spring.

Despite their similarities, acorns, pecans, and hickory nuts play very different dietary roles and require significantly different processing techniques. Hickory nuts are high in fat and protein (U.S. Department of Agriculture, Agricultural Research Service, Nutrient Data Laboratory [USDA NDL] 2004), and were often crushed and boiled down to make an oil or milk. The resulting liquid could be drunk as a beverage or used in stews or porridges (Carr 1895:171, 182-3; Kuhnlein and Turner 1991:209; Swanton 1946:265). Pecans have a similar nutrient content, but are not likely to have been crushed and boiled. They have much thinner and less convoluted shells, making it much easier to pick the nutmeats directly from the shell than other species of hickory. In addition, pecans have a thin, woody septum between the two halves of the nutmeat that floats in water; fragments of this bitter, woody septum would effectively spoil the liquid (Scarry 2003:61). In contrast to hickory nuts and pecans, acorns are high in carbohydrates (USDA NDL 2004). After being leached of tannins, the nutmeats were commonly ground into a meal and subsequently made into a mash or bread (Carr 1895:172; Densmore 1974:320; Kuhnlein and Turner 1991:200-1; Palmer 1871:409-410).

The collection of nuts requires few implements other than baskets or bags to carry loads back to camp, but may demand a significant labor investment, particularly for groups whose diets include considerable quantities of nuts. This is certainly true for native groups in California, for whom acorns were a staple food. “[A]ll competent family members, male and female, and adult and child” (Jackson

1991:303-304) participated in collecting acorns, primarily to harvest as many as possible before birds and animals did.

Gatherers more likely brought collected nuts back to camp instead of processing them in the field. While field-processing would allow gatherers to bring larger quantities of nutmeats and lesser quantities of low-utility nutshell back to camp, the time required to process nuts in the field prohibits this (Metcalfe and Barlow 1992). Bettinger and colleagues (1997) estimate that gatherers would have to travel one-way distances of roughly 50 km to make field-processing of acorns worthwhile. Since oak trees are common in the plant communities in the vicinity of 41HY160, the occupants almost certainly would have processed acorns at the site.

While all family members were enlisted to collect nuts, ethnographic accounts indicate that processing fell primarily to women (Jackson 1991). As such, features and implements used to process nuts, such as roasting/parching features, nutting stones, and mortars, were likely the domain of women. To the extent that processing stations were fixed loci on the landscape, clusters of food-processing features and artifacts, as well as stands of highly productive trees, likely figured prominently in gatherer's mental maps of the landscape (Jackson 1991).

In addition to acorn and hickory nutshell, one walnut shell fragment and several fragments that may represent either hickory or walnut (Walnut family; Juglandaceae) were recovered (see Table 8-2 above). In general, walnut shell is recovered in smaller quantities than hickory nutshell from archaeological samples, even though the potential for preservation of the two is similar. This pattern suggests that prehistoric peoples did not use walnuts to the same extent as hickory nuts or acorns. Walnuts grow as solitary trees, rather than in stands like hickories and oaks, making collection of large numbers of walnuts more difficult. Because the bitter hull remains attached to the nutshell, walnuts cannot be boiled and processed in bulk like hickory nuts. Instead, the meats must be picked by hand from the shells. These higher processing costs may have also discouraged greater use of these flavorful nuts (Gardner 1997; Talalay et al. 1984).

Fruits

Fruit remains recovered from the samples include hackberry seed fragments, as well as several tentatively identified taxa (see Table 8-2 above). Several fragments that may represent persimmon seed were identified in Features 23 and 24; three possible grape seed fragments were recovered from Feature 29; and possible prickly pear seed fragments were recovered from Features 22, 23, 26, and 31.

The hackberry seeds present an interesting interpretative dilemma. Although uncarbonized hackberry seeds may be preserved in archaeological sites, due to their high calcium carbonate content (Wang et al. 1997), the trees produce significant numbers of fruits that, at the end of the season, leave significant quantities of seeds on the ground. As such, it may be prudent to consider uncarbonized hackberry seeds to be modern inclusions. The carbonized hackberry seeds are another question. The four fragments, recovered from Features 21 and 28, may have been carbonized by anthropogenic efforts, rather than natural fires. Hackberry seeds have also been recovered from other prehistoric sites in Texas, such as the Vargas site in Edwards County and the Lower Pecos rock shelters in southwest Texas (Dering 2006a), and the nearby Zatopec site, 41HY163 (Hollenbach 201).

Although small, hackberries are good sources of nutrients such as sugar and calcium (Dering 2006a). These small berries can be eaten fresh (Niethammer 1974:72; Peterson 1977:194) or pounded into a meal. This meal can then be shaped into cakes and dried for use in the winter (Niethammer 1974:72), used to flavor meat (Kindscher 1987:242; Kurz 1997:74; Yanovsky 1936:19), or mixed with parched corn and fat (Dering 2006a; Yanovsky 1936:19).

Grapes and persimmons also may be eaten fresh or dried (Havard 1896; Kuhnlein and Turner 1991; Moerman 2004; Swanton 1946; Yanovsky 1936), and persimmons apparently were consumed in "large quantities" (Palmer 1871:471) by some historic native groups. Some native groups prepared persimmons for winter use by fashioning the pulp into cakes and drying them (Swanton 1946), or making them into preserves (Palmer 1871:471). Preserves were also made from grapes (Yanovsky 1936:42-43).

Both the fruits and pads of prickly pear were eaten by various historic native groups (Dering 2006b; Kindscher 1987:154-157; Moerman 2004). Once the fruits are twisted or knocked off the pads, the hairs that cover them must be removed, by rolling them on the ground, rubbing them off with a rock, or parching them over coals. The sweet, juicy fruits can be eaten fresh or pounded, formed into pulpy cakes, and dried for future use. The preserved fruits were often added to other dishes for flavoring, like corn meal mush or soups. Immature pads were eaten fresh, while mature pads were roasted first. The seeds themselves, available in fall, were also ground into a meal and eaten. Beyond their use as food, prickly pear pads and fruits served a variety of medicinal purposes, the pads were used as containers, and the spines were used as needles (Dering 2006b; Kindscher 1987:154-157; Moerman 2004).

Both hackberries and persimmons ripen in fall; the latter are not palatable until after the first frost of autumn (Radford et al. 1964; Schopmeyer 1974). The two trees are also similar in habitat, growing in a variety of settings but preferring disturbed grounds and alluvial soils (Radford et al. 1964). Grapes ripen in summer and are found in various settings but prefer wooded areas (Radford et al. 1964). While prickly pear fruits ripen in midsummer, the pads are available year-round. Prickly pears grow in large stands, locales that would have been the focus of foraging groups when the fruits were ripe (Dering 2006b; Kindscher 1987:155).

Miscellaneous Taxa

The miscellaneous plant remains recovered from the site provide a general indication of the local habitat. For example, the recovery of pine cone scales suggests the presence of pine trees in the local vicinity.

The weedy taxa recovered, including bedstraw, chenopod/amaranth, and grasses, generally indicate the presence of disturbed grounds, such as domestic settings, in which these weedy species thrive (Radford et al. 1964). These miscellaneous taxa have additional uses, though. Chenopod and amaranth seeds are edible, as are the spring and summer leaves of chenopod, amaranth, and grasses (Hunt 1992; Kavasch 1977:22; Kuhnlein and Turner 1991; Moerman 2004; Niethammer 1974; Palmer 1871; Peterson 1977:152; Yanovsky 1936). Native groups also used the leaves, roots, and stems of these taxa for a variety of medicinal and ceremonial uses (Moerman 2004). It should be noted, however, that the seeds were recovered from the archaeological deposits. These do not provide direct evidence that the spring and summer shoots and leaves, not to mention the roots, of these plants were used by the occupants of the site. However, they do indicate that these plants were growing in the immediate vicinity of the site and therefore were available for use. In fact, it is quite plausible that the occupants of the site actively encouraged these useful plants to grow nearby.

Several unidentified specimens require additional mention. Twelve relatively small fragments displayed a highly layered and vitrified texture, suggesting an item with a relatively high sugar content. These may represent some kind of fruit, but the layered texture is also suggestive of a bulb of sorts. Wild onion (*Allium* sp.) and other bulbs are commonly recovered from Late Archaic and Late Prehistoric sites throughout Texas (Dering 2006c), serving as an important source of carbohydrates from late fall through spring, when other plant foods are unavailable. In addition to a foodstuff, wild onions were used by native peoples for a wide variety of medicinal applications (Moerman 2004).

More notable are 22 fragments of small, rounded seeds, measuring roughly 1.5-2.0 mm in diameter. These often have tiny, pinprick dimples on the outer surface, especially in instances where the outermost layer of the seed coat has been worn away. The specimens often appear to represent two halves of a larger whole. A more complete specimen has a groove down the center, with an indentation at the base where the embryo may have once been. The specimens resemble seeds of the fogfruit family (*Phyla* Lour.) or lippia (*Lippia* L.). The latter includes Mexican oregano (*L. graveolens*), the leaves of which have medicinal uses (Dering 2006d), as do the leaves of several fogfruit species (Moerman 2004). However, the natural range of Mexican oregano barely extends into southern Texas (USDA-NRCS 2010). Indeed, Dering (2006d) reports that no Mexican oregano seeds have been recovered from archaeological sites in Texas, as the seeds have no apparent economic value. It is likely, though, that the seeds found in the 41HY160 assemblage represent a wild subshrub or herb with useful leaves.

Bulk Samples

The 126 bulk samples were overwhelmingly comprised of wood, representing 99 percent (19.36 g) of the 19.51 g of carbonized plant remains in the samples (Appendix D-1). The remainder includes hickory, possible acorn, bark, an unidentifiable seed fragment, and most notably, four possible bulb fragments (Table 8-3).

Table 8-3. Plant Remains Recovered from Bulk Samples at 41HY160.

Common Name	Count	Weight (g)
Nuts:		
Acorn cf.	1	0.00
Hickory	1	0.03
Hickory cf.	1	0.01
Hickory cf., uncarbonized	1	0.02
Hickory husk, uncarbonized	4	0.17
Hickory husk cf., uncarbonized	1	0.03
Fruits:		
Hackberry, uncarbonized	1	0.00
Hackberry	2	0.00

Table 8-3. Plant Remains Recovered from Bulk Samples at 41HY160.

Common Name	Count	Weight (g)
Miscellaneous:		
Bark	1	0.04
Bark, uncarbonized	1	0.05
Bark cf., part carbonized	2	0.01
Bark/bulb, uncarbonized	3	0.02
Bark/husk	1	0.01
Bark/husk, uncarbonized	4	0.14
Bulb?	4	0.04
Unidentifiable	5	0.01
Unidentifiable seed	1	0.00

Also of note are a number of samples comprised of uncarbonized plant materials. While the majority are likely to be modern inclusions, introduced to the samples by bioturbation or other non-cultural means, several specimens included uncarbonized leaves, rootlets, hickory nut hulls, etc., that were matted in clay. These samples are associated with relatively deep deposits: Feature 26 (Level 14); Unit 8, Level 13 (Lot 28); Unit 10, Level 12 (Lot 58); and Unit 15, Level 8 (Lot 126). Collected in situ, these may not be modern contaminants. It is possible that, due to its proximity to the San Marcos springs, the site experiences a relatively high and consistent water table, creating an anaerobic environment with excellent conditions for preservation of organic materials. However, this speculation should be further evaluated by a geoarchaeologist familiar with the depositional setting at the site. Interestingly, excavators of Feature 26 remarked on the "bright orange clay" associated with this context (CAS feature/field notes, 2010), which suggests an oxidized, rather than an anaerobic, setting.

Comparison by Context

The eleven features are all described as burned rock clusters of various sizes, ranging from about 5 cm to 20 cm deep and less than 50 cm to over a meter in diameter. Perhaps the most notable difference among them is that Feature 30 lacks associated artifacts (Jon Lohse, personal communication 2010).

Because the recovered plant assemblage is relatively small and does not represent a controlled volume sampling strategy, few comparisons can be made among the features. Samples from Features 22, 29, and 31 yielded the greatest quantities of carbonized plant materials. It is not entirely surprising, then, that their assemblages are relatively diverse. Features 22 and 31 are two of the three samples that included both possible prickly pear and the unidentified round, dimpled seed; the third is Feature 23. Feature 29 includes acorn, hickory, possible grape, and a number of unidentified and unidentifiable seed fragments.

Discussion

The plant remains recovered from 41HY160 indicate that, among other activities, the site's occupants gathered and processed plant foods, likely using hot rock cooking. These plant foods included nuts, such as acorns, hickory nuts and/or pecans, and walnuts, and likely wild fruits like prickly pear fruits, persimmons, and hackberries. They may have also collected edible seeds, such as chenopod, amaranth, and some grasses, and perhaps greens from some of these plants as well. No direct evidence for use of greens is available, as greens are very unlikely to be preserved, but seeds of plants with edible and/or medicinally useful leaves, shoots, and stems were recovered.

Edible greens would primarily have been gathered in spring and early summer, when leaves and shoots are most tender. The occupants may have collected and processed prickly pear fruits and grapes in summer. The remaining plant taxa suggest a fall occupation, with nuts collected in earnest with competition from wildlife, and edible seeds such as chenopod and ripened hackberries and perhaps persimmons likely collected before and/or after peak availability of nuts. Edible seeds and hackberries often persist through early winter, and wild bulbs may be collected from fall through spring. However, this does not suggest continuous use of the site, but rather that the occupants moved from resource to resource as they became available throughout the year at different spots on the landscape.

The assemblage from 41HY160 displays some similarities to other Archaic and Late Prehistoric sites on the Edwards Plateau and central Texas. At the Britton site (41ML37), McMillan site (41ML162), and Higginbotham site (41ML195), bulbs were commonly identified from Late Archaic deposits (3220-1200 BP), including camas (*Camassia* sp.) bulbs. In addition, acorns, knotweed (*Polygonum* sp.), pokeweed (*Phytolacca americana*), hawthorn (*Crataegus* sp.), prickly pear, stretchberry (*Forestiera* sp.), Grape family (Vitacaea), Spurge family (Euphorbiacaea), Grass family, and Mallow family (Malvaceae) seeds indicate use of nuts, weedy plants with edible greens and seeds, and wild fruits (Bush 2008). Late Archaic deposits at the Mustang Branch (Bluff) site (41HY209-M) included hickory nutshell, a cheno-am seed, and a grape/peppervine (*Vitis/Ampelopsis)* seed (Cummings 1994:393). Early and Late Archaic contexts at the Wilson-Leonard site (41WM235) yielded wild bulbs, including wild hyacinth (*Camassia scilloides*), as well as walnut shell fragments, grass seeds, and one carbonized hackberry seed (Dering 1998).

Dering (2008) has compiled subsistence data from several sites on the plateau dating to the Austin (1250-750 BP) and Toyah (750-300 BP) phases of the Late Prehistoric period, and notes that those in the northern and eastern portions of the plateau seem to focus on the baking of bulbs, roots, and tubers (Dering 2008:68). Large numbers of wild onion bulbs were recovered at the Kyle site (41HI1, n=65), and onion/camas bulbs at the Camp Bowie sites (41BR250, n=91; and 41BR253, n=110) (Dering 2008:Table 3; Karbula et al. 2001:27-28). In contrast, assemblages from sites in the western portion of the plateau regularly include agave leaves and fibers (*Agave* spp.) (Dering 2008:68, Table 3). Leaf stalks identified as sotol/yucca (*Dasylirion/Yucca*), prickly pear pads and seeds, and hedgehog cactus (*Echinocereus* sp.) are additional resources prepared in earth ovens that have been recovered from sites in the region (Dering 2008:62, Table 3; Karbula et al. 2001:27-28, 31-32). Gourd roots were also apparently recovered from the Kyle site (Karbula et al. 2001:27-28).

Acorns are also commonly recovered from Late Prehistoric sites, including the Kyle site (n=49) and Honey Creek site (41MS32, n=58) (Dering 2008:Table 3; Karbula et al. 2001:27-28, 31-32). Additional nut taxa include walnuts, hickory nuts, and pecans (Dering 2008:Table 3; Karbula et al. 2001:27-28, 31-32). At the Biesenbach site (41WN88), 254 hickory nutshell fragments were recovered (Dering 2008:Table 3).

Fruit taxa are notably scarce. Wild plum/cherry (*Prunus* sp.) was recovered from the Kyle and Biesenbach sites; grape from Mustang Branch (41HY206); hackberry from the Kyle and Rush sites (41TG346); hawthorn from the Honey Creek site; and mesquite seeds and pods from the Rush site and Varga site (41ED28), both of which are located in the western portion of the plateau, (Dering 2008:Table 3; Karbula et al. 2001:27-28, 31-32).

Seeds of weedy taxa with edible greens and seeds, as well as medicinal properties, are also recovered in low numbers at sites in the region. These include sunflower (*Heliathnus* sp.), grass (mostly Poaceae, and *Muhlenbergia* sp. at the Kyle site), cheno-am, dock (*Rumex* sp.), purslane, plantain (*Plantago lanceolata*), and dropseed (*Sporobolus* sp.) (Dering 2008:Table 3; Karbula et al. 2001:27-28, 31-32, B12-17). Also notable is evidence for limited use of maize (*Zea mays*) at the Kyle site, suggesting some level of agricultural investment (Dering 2008:Table 3; Karbula et al. 2001:27-28).

The plant food remains recovered from 41HY160 are thus similar to contemporaneous sites in the region. The possible bulb fragments hint at the use of bulbs, roots, and other carbohydrate-rich resources that require preparation in earth ovens. The acorn and hickory nutshell indicate that the occupants collected nuts, which can be readily stored. Although fruit taxa are recovered in low numbers, these more likely reflects differences in preservation potential rather than lack of use by peoples in the region. Several weedy seed taxa are present at most sites, including 41HY160, suggesting that the occupants used these plants, likely for various nutritional, medicinal, utilitarian, and perhaps ritual purposes.

Conclusions

The plant assemblage recovered from 41HY160, although not particularly extensive, provides valuable information regarding the foodways of the site's occupants. These groups gathered various wild food resources, including acorns, hickory nuts and/or pecans, hackberries, edible seeds like chenopod, amaranth, and some grass seeds, and likely prickly pear, grape, persimmon, and bulbs. Although "wild", it is probable that groups managed these resources to some degree, through planting, pruning, weeding, and the like (Hammett 1997; Munson 1986; Scarry 2003). In this vein, the late Early Archaic and Middle Archaic occupants of the site, periods that are best represented by botanical data, might have encouraged, if not actively tended, useful plants like prickly pear and chenopod. Such tending would likely require repeated visits to the site during the course of the year. Similarly, the seasonality of the various plant foods recovered suggests that the occupants returned to the site during peak seasons of availability, considering that edible greens would have been collected in spring and early summer; prickly pear fruits and grape in summer; nuts, edible seeds, persimmons, and hackberries in fall; and wild bulbs from fall through spring.

To the extent that these plant resources served as predictable, reliable foodstuffs, it is likely that the occupants of 41HY160 organized their use of the landscape around the exploitation of these plant foods. Gatherers, namely women, children, and the elderly, would have worked in seasonal rhythms to obtain particular plant foods from various habitats, and processed and stored some of them. Sites with prepared features and cached tools, such as earth ovens, manos, and metates, as well as resource-rich locales, would have held prominent places in gatherers' mental maps of local landscapes. As such, it is important to view the gathering activities of the peoples living at 41HY160 and other sites along the Balcones Escarpment as the result of meaningful decisions made by individuals, rather than simply as opportunistic.

CHAPTER 9: FEATURES

By David Yelacic

Through the excavation of approximately 24 cubic meters of 41HY160 site matrix over four discontinuous summer session field schools, 31 feature designations were assigned to collections of burned and fire-cracked rocks and other cultural material. Descriptors used for these features included various sizes of clusters and scatters. Two features were encountered during the 2001 field school, six during 2002, 12 during 2003, and 11 during 2006. Quality of records for each of the features is highly variable and ranges from virtually absent to well-documented. In any event, the descriptions that follow are based on feature forms completed in the field and the artifact inventory or catalog, which has been created for the current analysis.

Feature 1

Type	Fire-cracked rock
Analytical Unit	None
Provenience	Units 9, 10, and 11, level 6
Top Elevation	~50 cmbd
Bottom Elevation	~70 cmbd
Size	> 1 m2
Associated Lots	36, 37, and 165
Samples	Radiocarbon (x3)
Faunal Remains	Deer, rabbit, fish, snake, UID mammal
Diagnostic Projectile Points	None
Description	Feature 1 consists of scattered fire-cracked rock with clusters of bone, lithic debitage, stone tools, and snail shells found in level 6 (approximately 80-92 cmbd) of excavation units 9 and 11. Feature 1 was situated beneath the A Horizon and directly above Feature 7, which was described as a basin-shaped hearth. Given the cultural material associated with this feature and the spatial association with Feature 7, Feature 1 was tentatively interpreted as a scatter of a camp site associated with the adjacent hearth.

Figure 9-1. Feature 1 in Unit 9, Level 6.

Feature 2

Type	Fire-cracked rock
Analytical Unit	None
Provenience	Units 7 and 9, level 8
Top Elevation	80 cmbd
Bottom Elevation	100 cmbd
Size	> 1 m diameter
Associated Lots	8 and 166
Samples	Charcoal (x2)
Faunal Remains	Fish, snake, rodent, rabbit, and UID small mammal
Diagnostic Projectile Points	Bulverde, Ellis, Nolan (x2)
Description	Feature 2 is described as a scatter of burned and fire-cracked rocks, lithic tools and debitage, and faunal remains. It spanned two excavation units (7 and 9) and potentially 10-15 cm in depth. Though first identified as a

discrete cluster of burned rocks and other artifacts in the southeast corner of Unit 7, further excavation revealed an increasingly amorphous distribution of the cultural remains.

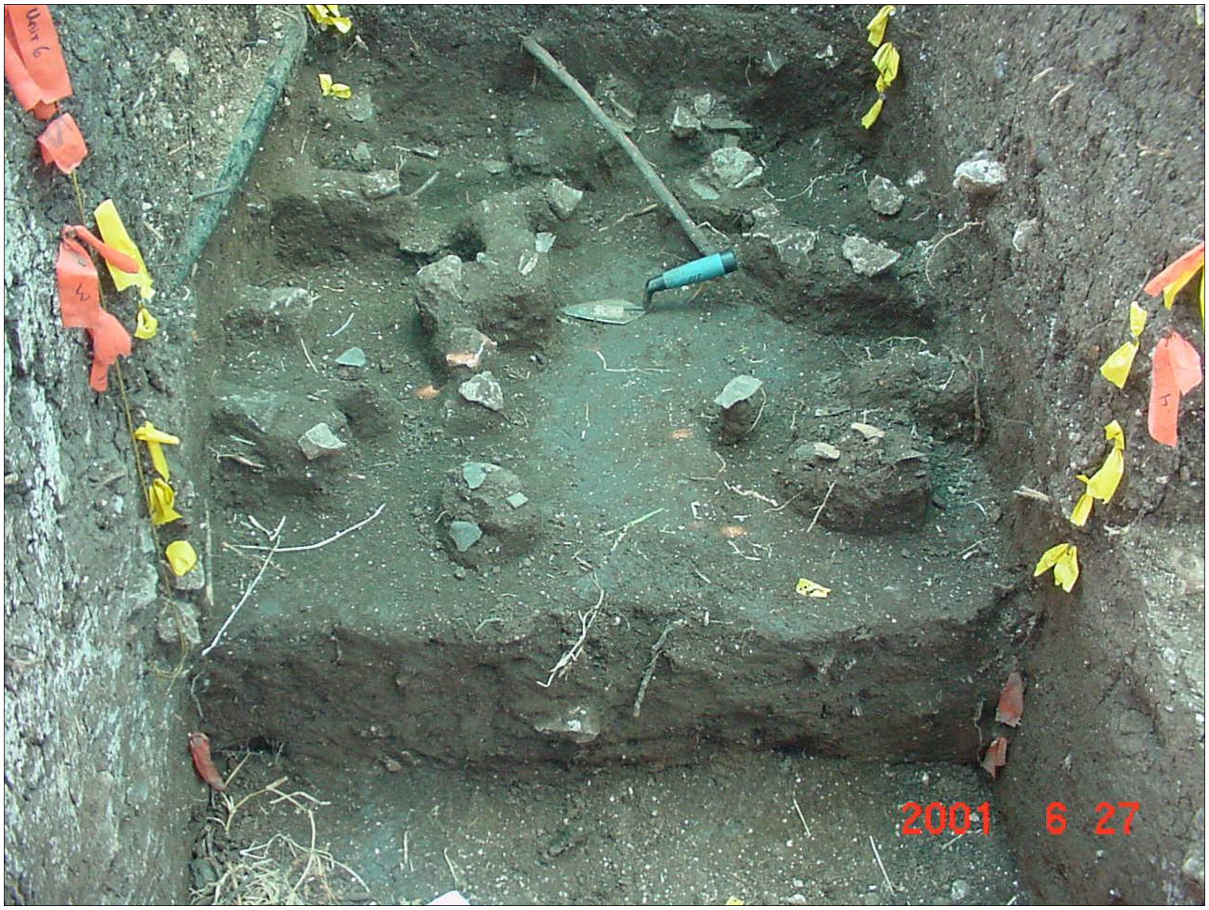


Figure 9-2. Feature 2 photographed in excavation unit 7, level 8.

Feature 3

Type	Scattered fire-cracked rock
Analytical Unit	Middle Archaic-Late Archaic mixed
Provenience	Unit 8, level 8
Top Elevation	91 cmbd
Bottom Elevation	Unknown
Size	< 75 cm diameter
Associated Lots	167
Samples	None
Faunal Remains	Unknown
Diagnostic Projectile Points	Unknown

Description	In the southern half of Unit 8, beginning at approximately 91 cm below datum, a small cluster of burned and fire-cracked rock, as well as lithic debitage and faunal remains, were encountered and assigned to Feature 3. The feature appears to be a discrete cluster, but all artifacts from the unit/level were unfortunately screened together. Artifacts that could or could not be associated with the feature, obscured for the reason stated previously, include a Bulverde point and other remnants of stone tool technology; remains of bird, deer, snake, turtle and other unidentified mammals; burned clay; and potentially intrusive organic remains. This feature was interpreted as a small hearth.

Feature 9-3. Photograph of Feature 3 in excavation unit 8, level 8.

Feature 4

Type	Scattered fire-cracked rock
Analytical Unit	None
Provenience	Unit 9, level 12
Top Elevation	110 cmbd
Bottom Elevation	114 cmbd
Size	< 20 cm diameter
Associated Lots	42 and 168

Samples	None
Faunal Remains	Unknown
Diagnostic Projectile Points	Unknown
Description	Feature 4 was recorded as a distinct, small cluster of burned and fire-cracked rocks. Faunal remains, vestiges of stone tool technology, and burned clay were recovered from the unit/level in which this feature was encountered, but there is not a recorded association of the features with the other cultural materials. Little other information is available about this feature.

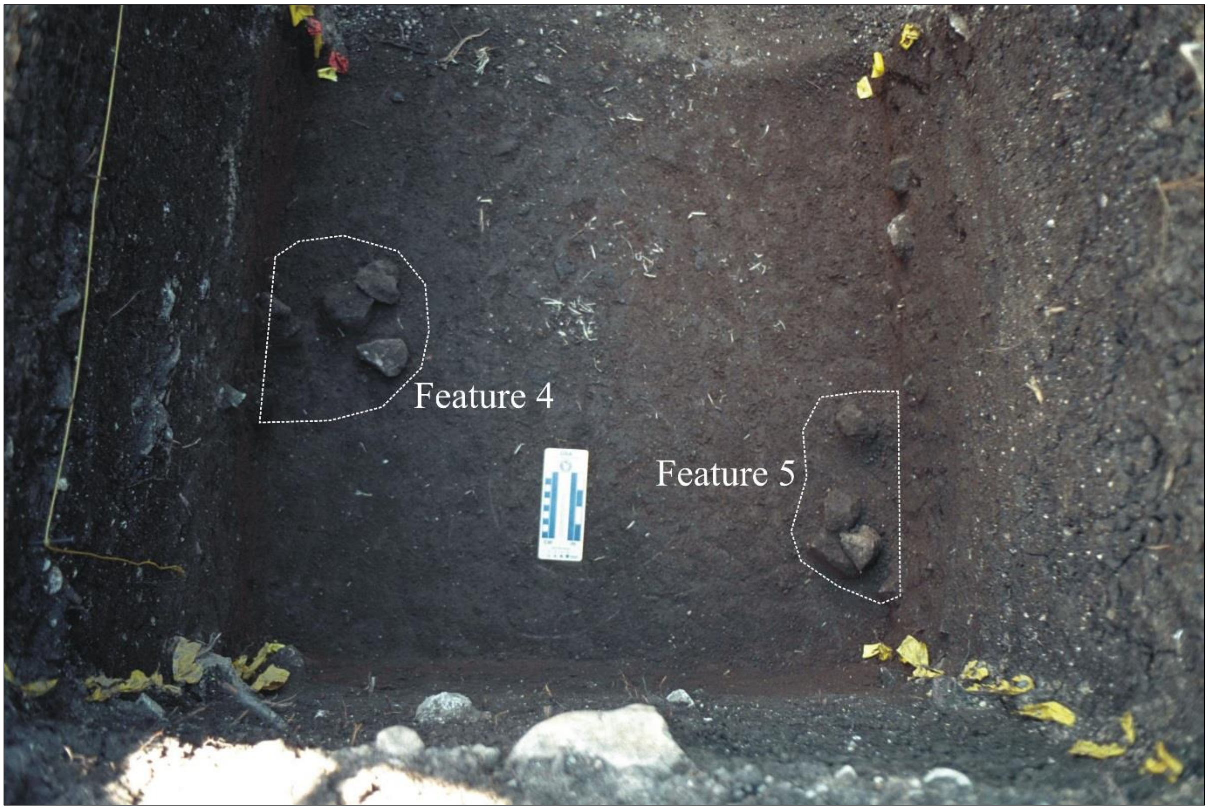


Figure 9-4. Feature 4 in the northern portion of excavation unit 9, level 12.

Feature 5

Type	Scattered fire-cracked rock
Analytical Unit	None
Provenience	Unit 9, level 12
Top Elevation	110 cmbd
Bottom Elevation	114 cmbd
Size	12-by-8 cm

Associated Lots	42 and 169
Samples	None
Faunal Remains	Unknown
Diagnostic Projectile Points	Unknown
Description	Feature 5, which is photographed with Feature 4 in Figure 9-4, was recorded as a distinct, small cluster of burned and fire-cracked rocks. Though not clearly associated with Feature 5, faunal remains, vestiges of stone tool technology, and burned clay were recovered from the unit/level in which this feature was encountered. Little other information is available about this feature.

Feature 6

Type	Scattered fire-cracked rock
Analytical Unit	None
Provenience	Unit 7, level 11
Top Elevation	~115 cmbd
Bottom Elevation	~123 cmbd
Size	< 1 m diameter
Associated Lots	170
Samples	None
Faunal Remains	None
Diagnostic Projectile Points	None
Description	Feature 6 is composed of more than a score of burned and fire-cracked rocks concentrated in the southwest corner of the unit but spreading throughout. Many artifacts were recovered from this unit/level, including a dart point stem, lithic debitage, faunal remains, a ceramic fragment, burned clay, and charcoal, but no artifacts were recorded in association with the feature, unfortunately. Since it is not a discrete feature and also because it spanned nearly the entire level, maybe it is not presumptuous to include the artifacts from this unit/level with the feature.

Figure 9-5. Feature 6 photographed in level 11 of excavation unit 7.

Feature 7

Type	Circular cluster of fire-cracked rock
Analytical Unit	Late Archaic
Provenience	Unit 11, level 7
Top Elevation	61-63 cmbd
Bottom Elevation	66 cmbd
Size	34-by-40 cm
Associated Lots	171
Samples	None
Faunal Remains	None
Diagnostic Projectile Points	None
Description	Notes for Feature 7 indicate that this feature is located directly beneath Feature 1, and together they potentially form a basin-shaped hearth. Feature 7 is also described as a circular cluster of four large (>5 cm diameter) burned rocks. Again, stone tools and remnants of the stone tool manufacturing process, as well as faunal remains, charcoal, and burned clay, were recovered from this unit/level, but none were recorded as associated with the feature, however.

Figure 9-6. Cross section of Feature 7 in excavation unit 11, level 7.

Feature 8

Type	Cluster of fire-cracked rock
Analytical Unit	Late Archaic
Provenience	Unit 11, level 8
Top Elevation	72.5 cmbd
Bottom Elevation	84.5 cmbd
Size	32-by-26 cm
Associated Lots	172
Samples	Charcoal and rock core (i.e., archaeomagnetic)
Faunal Remains	None
Diagnostic Projectile Points	None
Description	Feature 8 was composed of clustered fire-cracked rocks, with additional rocks, fire-cracked and not, scattered around the unit. In the field, the feature was interpreted as two possible hearths, both consisting of semi-circular, fire-cracked rock accumulations. Lithic debitage and charcoal were noted to be associated with the feature, but the unit/level also yielded faunal remains, which included bison and mussel shell along with

other mammals. Four archaeomagnetic samples were collected (see Figure 9-7).

Figure 9-7. Archaeomagnetic sampling of Feature 8 in excavation unit 11, level 8.

Feature 9

Type	Cluster of fire-cracked rock
Analytical Unit	None
Provenience	Unit 15, level 5
Top Elevation	47 cmbd
Bottom Elevation	49.5 cmbd
Size	26-by-20 cm
Associated Lots	173
Samples	None
Faunal Remains	None
Diagnostic Projectile Points	None
Description	Feature 9 is composed of a relatively small amount of burned limestone rocks (N = 5) ranging in size but no larger than 4.5 cm diameter. No artifacts were recorded to be associated with the feature, but the unit/level produced relicts of stone tool production, faunal remains, and charcoal. This feature was interpreted/described as a cluster of burned rocks.

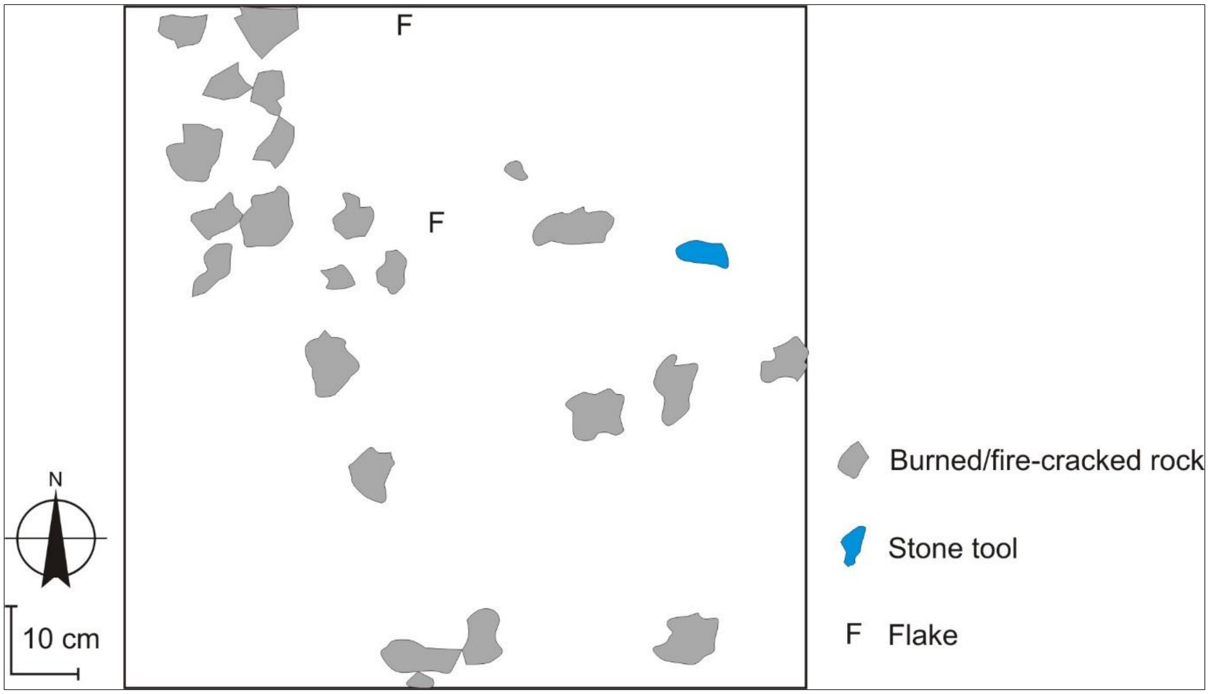


Figure 9-8. Burned rocks composing Feature 9 in excavation unit 15, level 5, and other lithic artifacts.

Feature 10

Type	Scattered cluster of fire-cracked rock
Analytical Unit	Middle Archaic-Late Archaic mixed
Provenience	Unit 12, level 8
Top Elevation	81 cmbd
Bottom Elevation	86 cmbd
Size	< 1 m diameter
Associated Lots	83 and 174
Samples	Rock core (i.e., archaeomagnetic)
Faunal Remains	Turtle, bird, deer, mussel, UID small and medium mammal
Diagnostic Projectile Points	Pedernales and Nolan
Description	Feature 10 is a scatter of burned and fire-cracked rocks ranging in size from approximately two to 10 cm in diameter. The scatter of thermally altered rocks spreads across the unit, and records indicate there were associated artifacts, which include remnants of the stone tool production process and faunal remains. Cores from two of the burned rocks were collected for archaeomagnetic analysis. Faunal remains include specimens of turtle, bird, deer, small and medium unidentifiable mammals, and mussel and snail shells. Lithic material includes two diagnostic projectile points identified as one Pedernales and one Nolan.

These identifiable projectile points place the unit level in the analytical unit representing the Middle to Late Archaic transition.

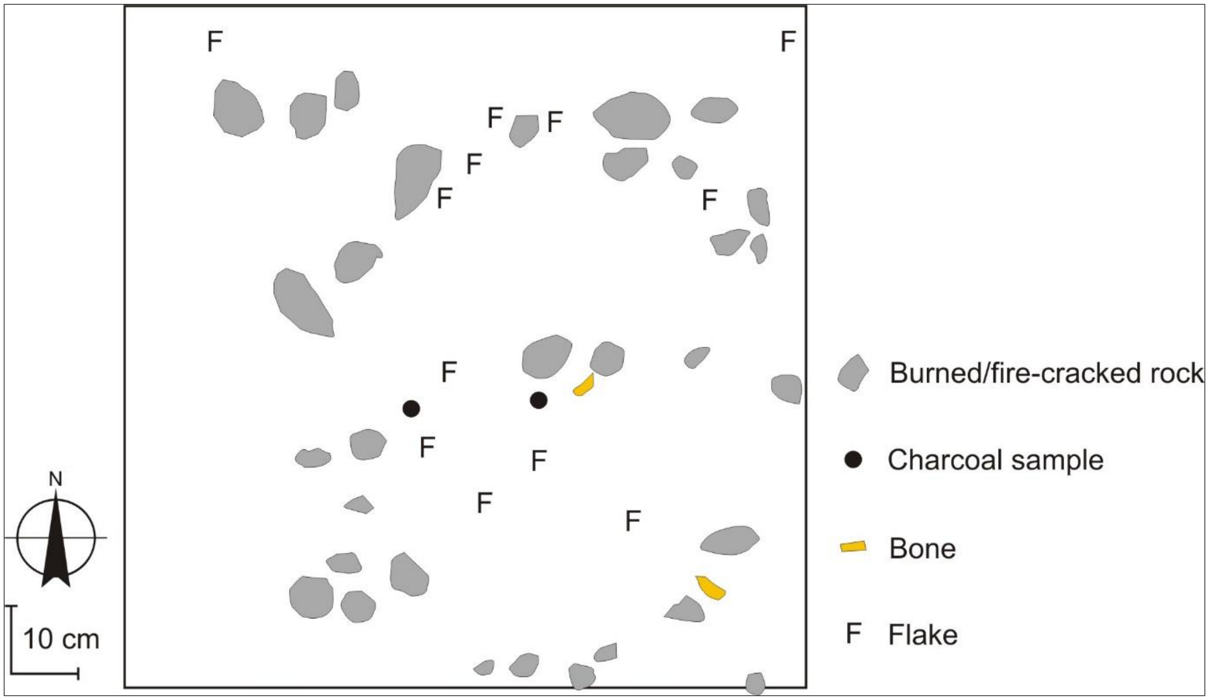


Figure 9-9. Illustration of the artifacts associated with Feature 10 in excavation unit 12, level 8.

Feature 11

Type	Small cluster of fire-cracked rock
Analytical Unit	Late Archaic
Provenience	Unit 15, level 6
Top Elevation	60.5 cmbd
Bottom Elevation	64 cmbd
Size	70-by-53 cm
Associated Lots	124 and 175
Samples	Rock core (i.e., archaeomagnetic)
Faunal Remains	None
Diagnostic Projectile Points	None
Description	Feature 11 was composed of burned rocks that appeared to be clustered in the northern portion of the unit and fan out to the south. Six of these burned rocks were chosen for archaeomagnetic sampling. Though no artifacts were recorded in association with the feature on the feature-specific form, it appears that there was charcoal and lithic debris present within the cluster of burned rocks. Additionally, excavation unit 15, level

6 also yielded two non-diagnostic projectile point fragments and faunal remains.

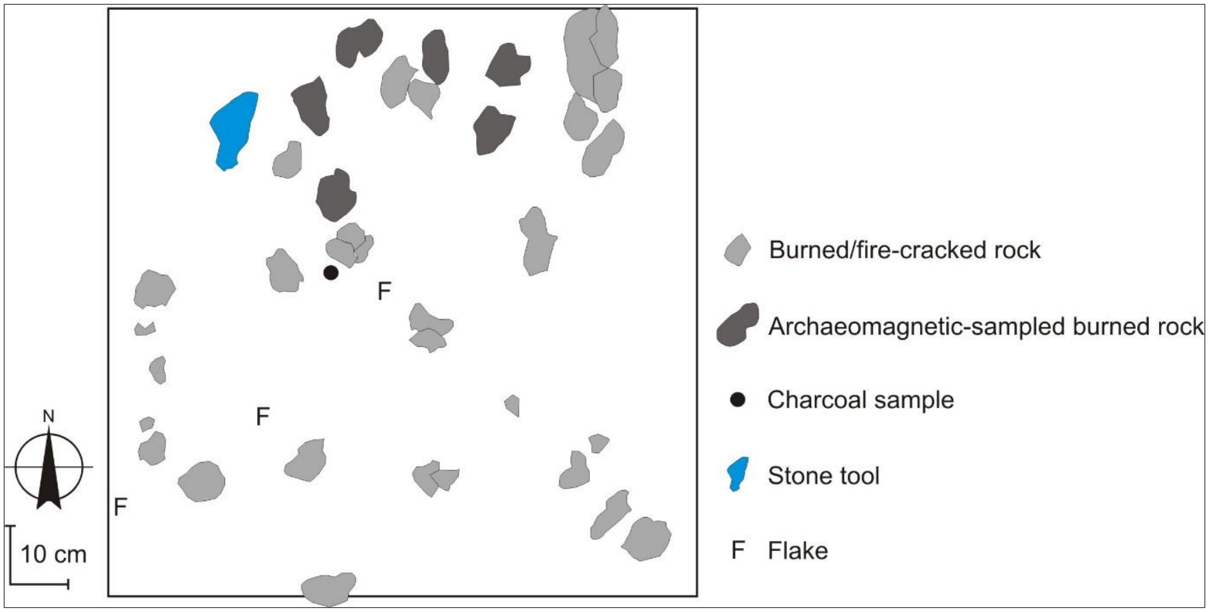


Figure 9-10. Illustration of Feature 11 in excavation unit 15, level 6.

Feature 12

Type	Small cluster of fire-cracked rock
Analytical Unit	Middle Archaic
Provenience	Unit 12, level 10
Top Elevation	95 cmbd
Bottom Elevation	99 cmbd
Size	< 1 m diameter
Associated Lots	85 and 176
Samples	Charcoal and rock core (i.e., archaeomagnetic)
Faunal Remains	Fish, frog, turtle, snake, rabbit, rodent, deer, rat, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 12 is described as a cluster of burned and fire-cracked rocks scattered in a crescent shape in the southeast corner of the unit. Three of these rocks were chosen for archaeomagnetic sampling. Other artifacts associated with the feature include vestiges of stone tool manufacturing processes, faunal remains, and charcoal. Charcoal was collected but not submitted for radiocarbon analysis.

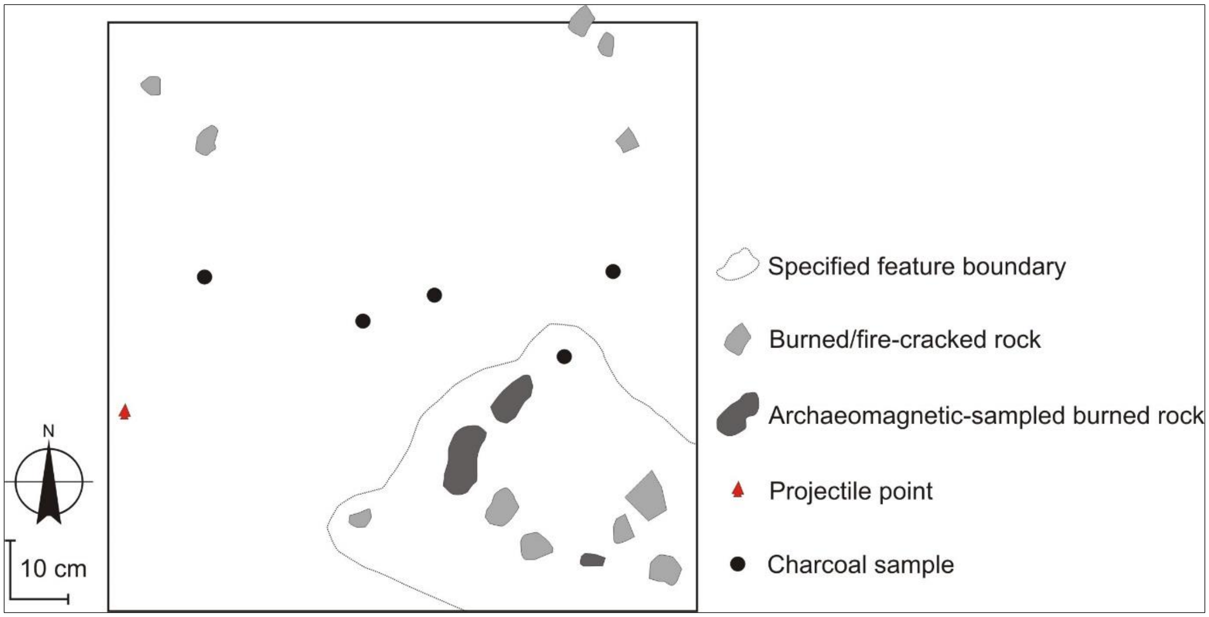


Figure 9-11. Illustration of Feature 12 in the southeast corner of excavation unit 12, level 10.

Feature 13

Type	Small cluster of fire-cracked rock
Analytical Unit	Middle Archaic
Provenience	Unit 12, level 11
Top Elevation	101 cmbd
Bottom Elevation	111 cmbd
Size	~75-by-25 cm
Associated Lots	86 and 177
Samples	Charcoal and rock core (i.e., archaeomagnetic
Faunal Remains	UID vertebrate
Diagnostic Projectile Points	None
Description	Feature 13 is described as a small, semi-circular cluster of burned and fire-cracked rocks in the southeast corner of excavation unit 12, level 11. Three of these rocks were chosen for archaeomagnetic sampling. In addition to the burned rocks, other artifacts found in this unit/level, yet not specifically recorded in association with the feature, include relicts of stone tool manufacturing, faunal remains, burned clay, and charcoal. Charcoal was collected for identification and radiocarbon analysis. Results of this analysis revealed that the charcoal was remnants of burned Live Oak dating to approximately 4730 ±30 cal. years before present. This date puts at least the charcoal into the early Middle Archaic period.

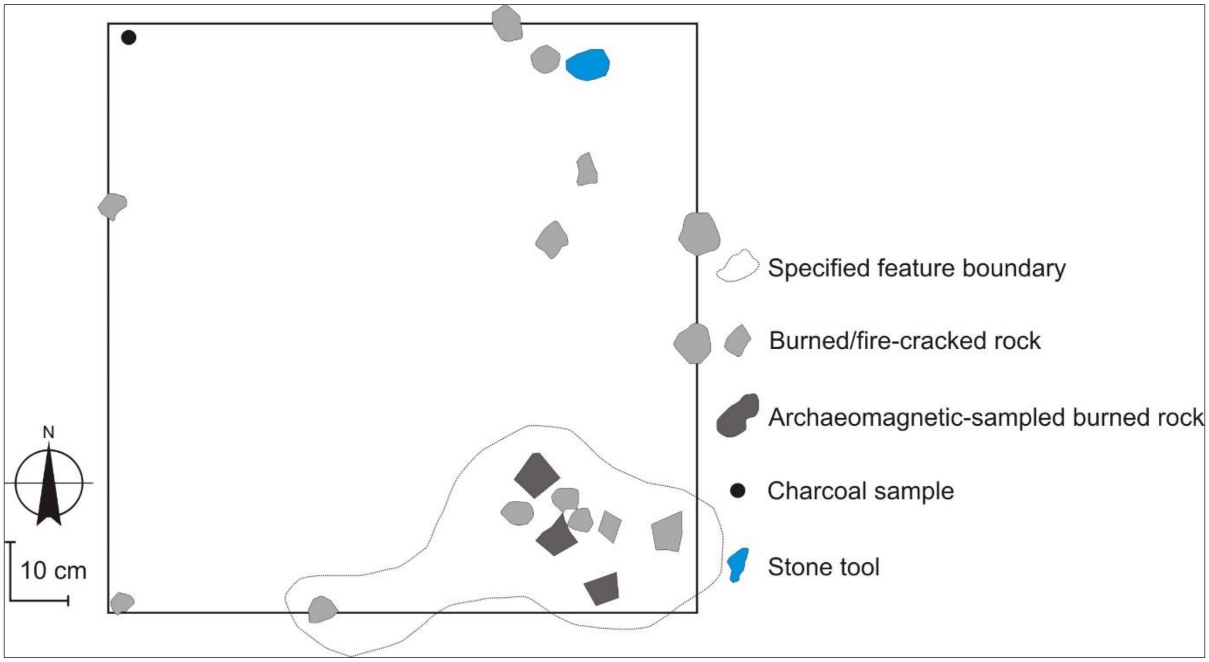


Figure 9-12. Illustration of Feature 13 in the southeast corner of excavation unit 12, level 11.

Feature 14

Type	Small cluster of fire-cracked rock
Analytical Unit	Late Archaic-Late Prehistoric mixed
Provenience	Unit 14, level 6
Top Elevation	55 cmbd
Bottom Elevation	62 cmbd
Size	18-by-15 cm
Associated Lots	110 and 178
Samples	Rock core (i.e., archaeomagnetic)
Faunal Remains	Fish, bird, snake, turtle, rabbit, deer, antelope, mussel, and UID small and medium mammals
Diagnostic Projectile Points	Ellis and Marcos
Description	Feature 14 was a small cluster of burned and fire-cracked rock near the center of excavation unit 14, level 6. These rocks were situated very close to each other, and two of the rocks were chosen for archaeomagnetic sampling. No artifacts were recorded as being directly associated with the feature, but the unit/level yielded two diagnostic projectile points, an abundance of lithic debitage, a relatively great amount of faunal remains, and a ceramic sherd. One projectile point is an Ellis type and the other a Marcos, and the ceramic sherd was misplaced in the time between excavation and analysis. Nonetheless, the temporally diagnostic artifacts

place this unit/level, and likely the feature, too, into the analytical unit representing the Late Archaic and Late Prehistoric.

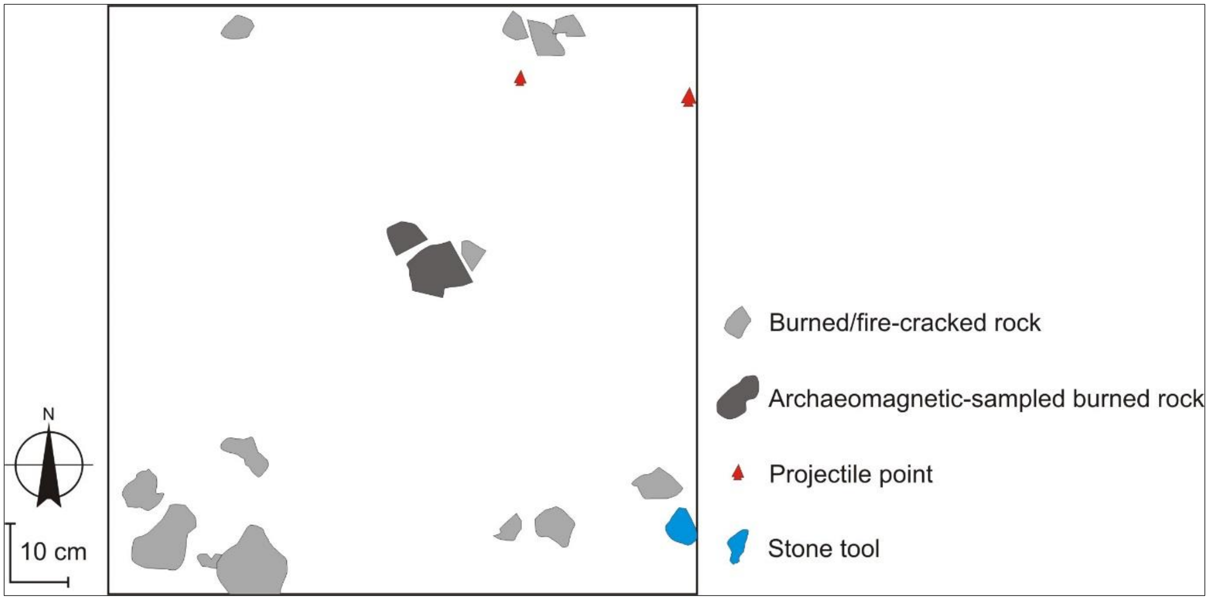


Figure 9-13. Illustration of Feature 14, which is limited by records to the two archaeomagnetic-sampled rocks and one burned rock in the center of excavation unit 14, level 6.

Feature 15

Type	Small cluster of fire-cracked rock
Analytical Unit	None
Provenience	Unit 15, level 7
Top Elevation	63 cmbd
Bottom Elevation	78 cmbd
Size	~50-by-50 cm
Associated Lots	125 and 179
Samples	Charcoal
Faunal Remains	Armadillo, fish, frog, snake, turtle, rabbit, deer, rat, mussel, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 15 is described as a small cluster of burned and fire-cracked rock in the southeast corner of excavation unit 15, level 7. This feature shared the unit/level with Feature 16, which was also a cluster of burned and fire-cracked rock. In addition to the other feature, Feature 15 was noted to have lithic debitage, charcoal, faunal remains, and red ochre associated with it. No diagnostic materials were recovered from the feature, but levels above and below this are designated as Late Archaic in the analytical unit scheme for this analysis.

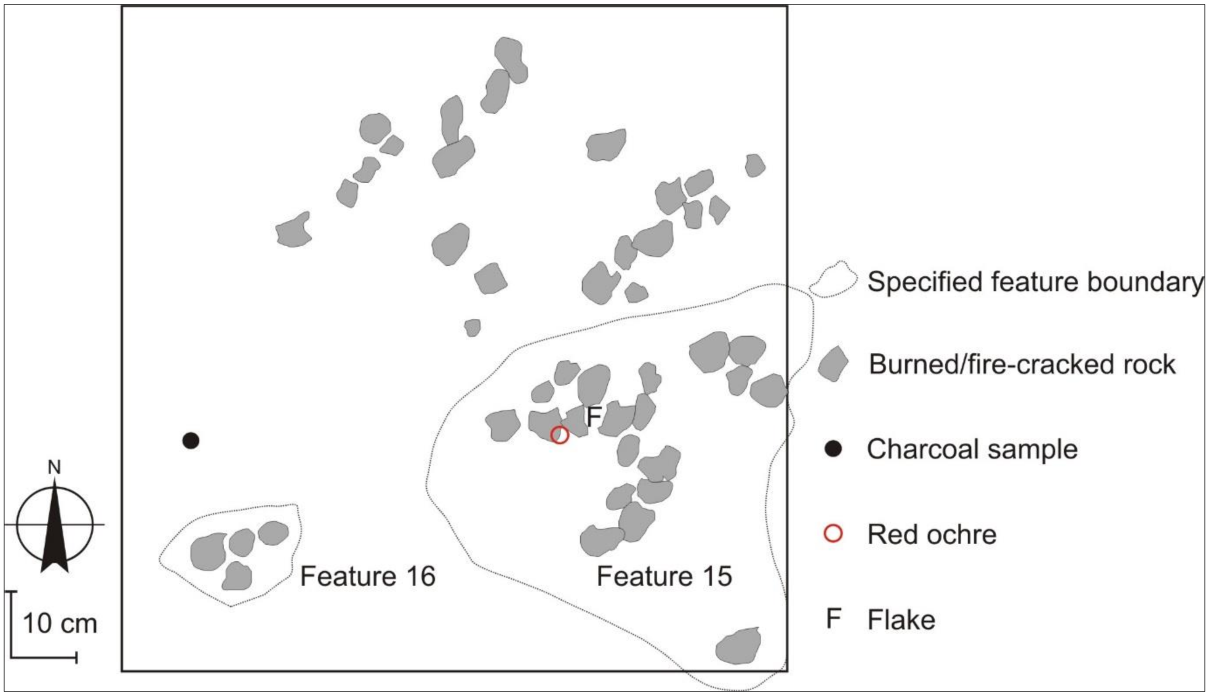


Figure 9-14. Illustration of Feature 15 and 16 in the southern half of excavation unit 15.

Feature 16

Type	Small cluster of fire-cracked rock
Analytical Unit	None
Provenience	Unit 15, level 7
Top Elevation	67 cmbd
Bottom Elevation	78 cmbd
Size	~20-by-20 cm
Associated Lots	125 and 179
Samples	None
Faunal Remains	Armadillo, fish, frog, snake, turtle, rabbit, dder, rat, mussel, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 16, illustrated with Feature 15 in Figure 9-14, is a small cluster of burned and fire-cracked rock located in the southwest corner of excavation unit 15, level 7. It is clear that the feature shares the unit/level with Feature 15, but depth measurements reveal that Feature 16 begins at a slightly lower depth. Artifacts noted as being associated with this feature are faunal remains, but the unit/level and adjacent feature both contain lithic debitage, charcoal, and other organic detritus.

Feature 17

Type	Small cluster of fire-cracked rock
Analytical Unit	Late Archaic
Provenience	Unit 14, level 7
Top Elevation	67 cmbd
Bottom Elevation	Unknown
Size	34-by-29 cm
Associated Lots	111 and 181
Samples	Rock core (i.e., archaeomagnetic)
Faunal Remains	Fish, snake, turtle, bird, rabbit, rat, deer, and UID small and medium mammals
Diagnostic Projectile Points	Bulverde
Description	Feature 17 is a semi-circular cluster of burned and fire-cracked rocks in the southern portion of excavation unit 14, level 7. Two of these rocks, unspecified in the feature summary form and plan map, were sampled for archaeomagnetic analysis. Found in this unit/level, yet not recorded to be associated with the feature, are a Bulverde point and other remnants of stone tool making and an abundance of faunal remains. Little other information is available about this feature.

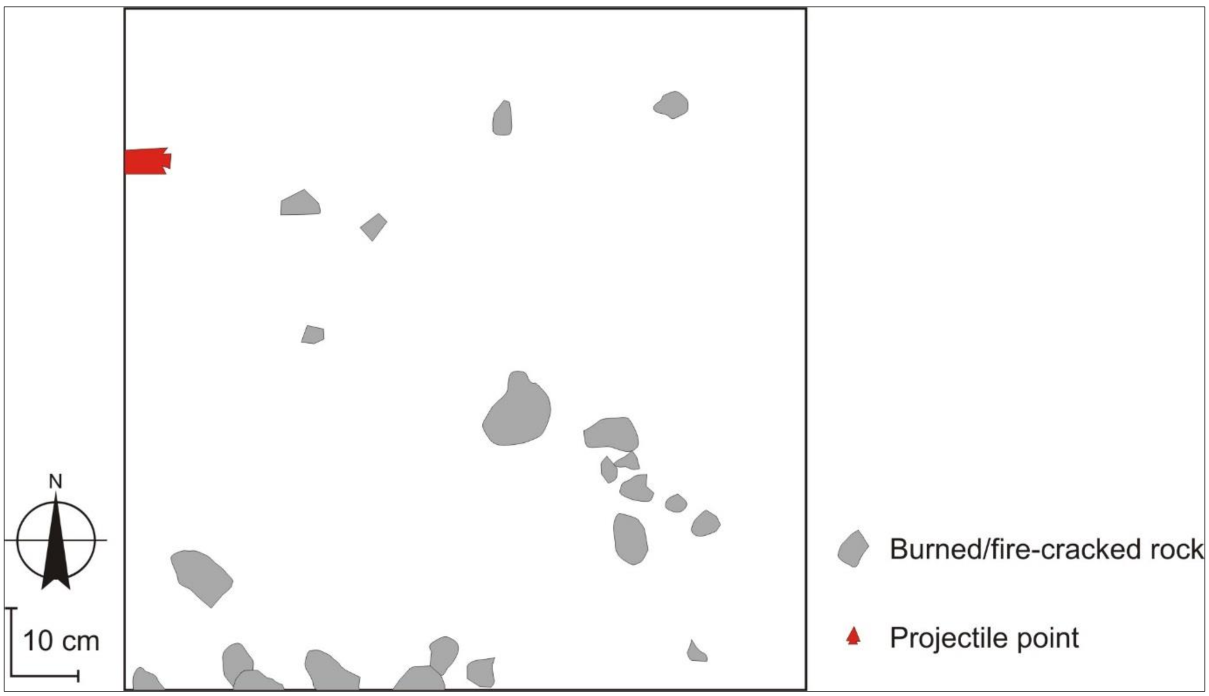


Figure 9-15. Feature 17, in excavation unit 14, illustrated from field map.

Feature 18

Type	Scattered cluster of fire-cracked rock
Analytical Unit	Middle Archaic
Provenience	Unit 15, level 9
Top Elevation	Unknown
Bottom Elevation	Unknown
Size	Unknown
Associated Lots	127 and 182
Samples	Unkown
Faunal Remains	Unkown
Diagnostic Projectile Points	Unkown
Description	No feature form exists for Feature 18, and the only record of the feature is cataloged burned and fire-cracked rock. A charcoal sample collected from the encompassing unit/level was identified as Condalia and dated to 4335±85 calibrated years before present, which places the unit/level with in the Middle Archaic analytical unit.

Feature 19

Type	Cluster of fire-cracked rock
Analytical Unit	Middle Archaic
Provenience	Unit 13, level 11
Top Elevation	110 cmbd
Bottom Elevation	122 cmbd
Size	< 50 cm diameter
Associated Lots	100 and 183
Samples	Rock core (i.e., archaeomagnetic)
Faunal Remains	Fish, snake, turtle, rabbit, deer, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 19 has very few notes or records of its excavation, but it is clear that it was a cluster of burned and fire-cracked rocks in the southern portion of unit 13, level 11. Ten of these rocks were sampled for archaeomagnetic analysis, but it is not clear which rocks these were. Additionally, relicts of stone tool making and faunal remains were found in association with the feature. Little else is recorded for this feature.

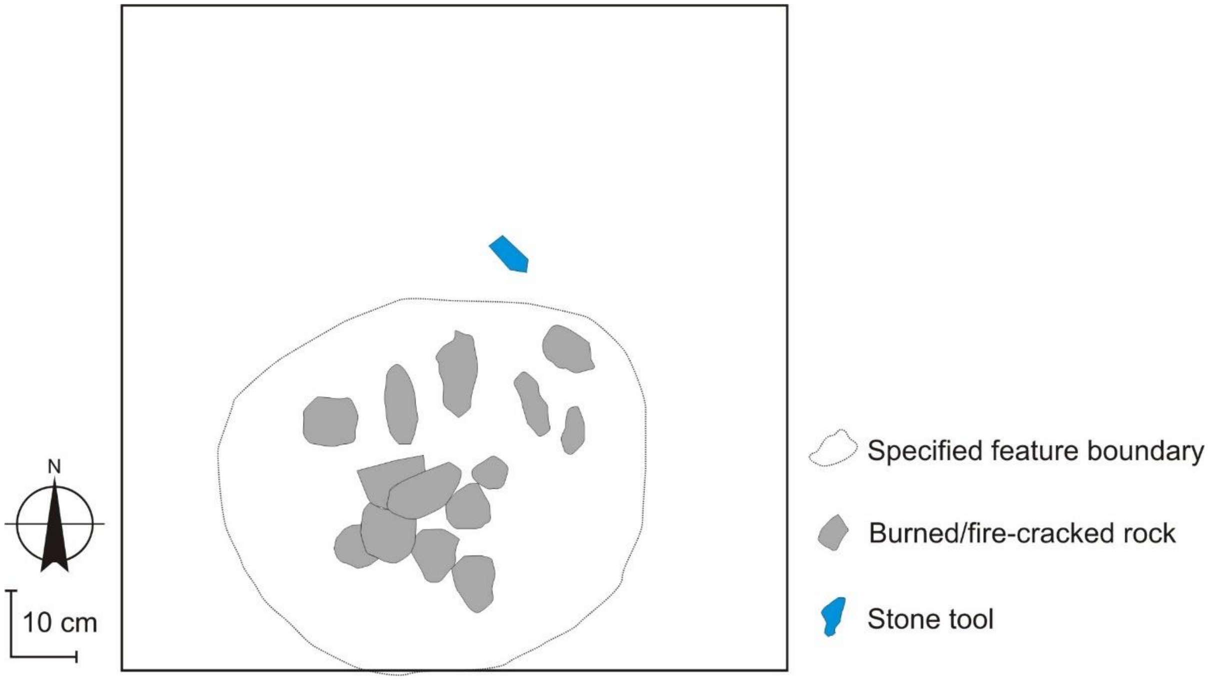


Figure 9-16. Illustration of Feature 19 in excavation unit 13, level 11.

Feature 20

Type	Fire-cracked rock and flake concentration
Analytical Unit	Middle Archaic
Provenience	Unit 14, level 10
Top Elevation	88 cmbd
Bottom Elevation	98 cmbd
Size	< 50 cm diameter
Associated Lots	114 and 184
Samples	Charcoal
Faunal Remains	Fish, snake, turtle, bird, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 20 consisted of a cluster of burned and fire-cracked rock, large flakes, fossilized shell, and faunal remains in the southeast quadrant of excavation unit 14, level 10. Aside from a burned rock on the opposite side of the unit, the remainder of excavation unit 14, level 10 was relatively bare. The flakes are noted to appear similar in raw material quality and were hypothesized to be of the same core. Larger flakes were encountered lying flat, whereas smaller flakes were found with vertical orientations. In addition to the stone and bone artifacts, there was an abundance of charcoal present and collected for analysis. These charcoal samples were not submitted for analysis.

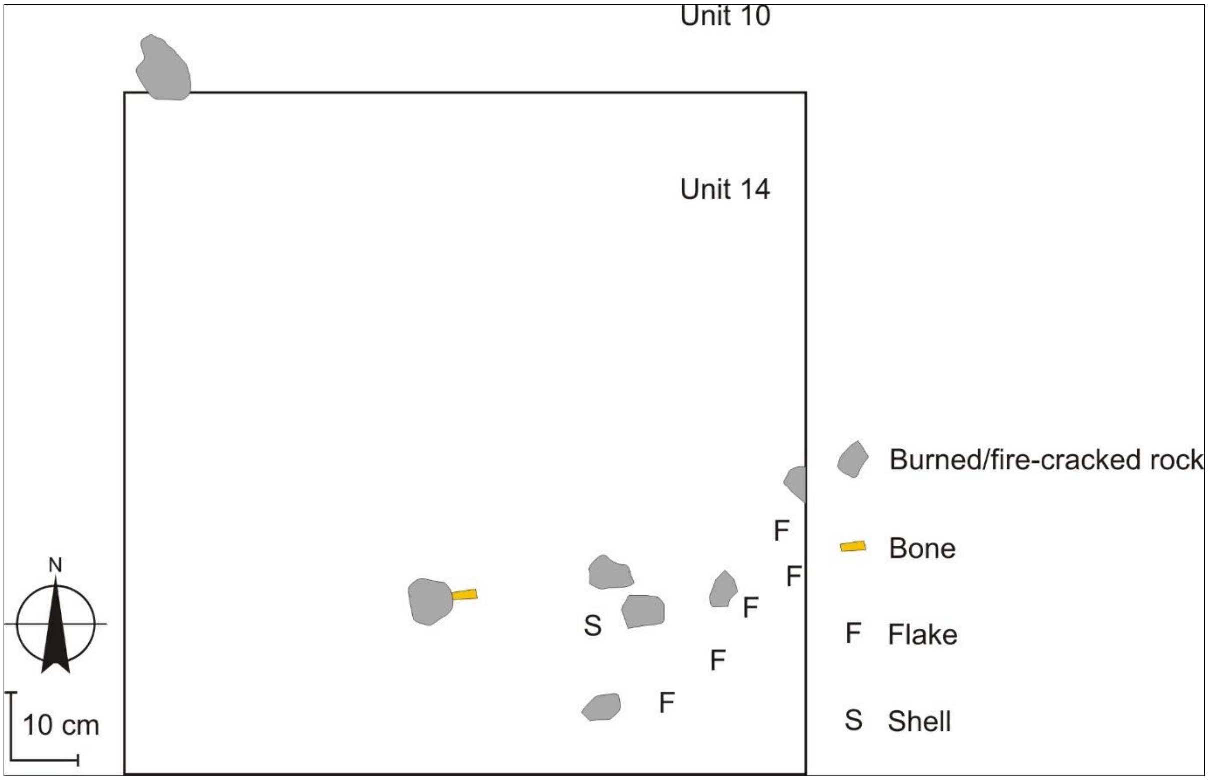


Figure 9-17. Feature 20 illustrated extending from excavation unit 14 to unit 10, level 10.

Feature 21

Type	Small scattered cluster of burned rocks
Analytical Unit	Middle Archaic
Provenience	Units 12 and 16, level 12; units 8 and 15, level 13
Top Elevation	121 cmbd
Bottom Elevation	126 cmbd
Size	~1 m diameter
Associated Lots	131 and 185
Samples	Charcoal and bulk sediment
Faunal Remains	Fish, snake, and UID small and medium mammals
Diagnostic Projectile Points	None
Description	Feature 21 is described as scattered burned and fire-cracked rocks, flakes, and faunal remains spanning the intersection of excavation units 8, 15, 16, and 12. No temporally diagnostic artifacts were found directly in association with the feature, but given upper and lower adjacent unit/levels, Feature 21 appears to belong in the analytical unit representing the Middle Archaic period. In addition to the abundance of lithic and faunal material that was recovered, bulk sediment samples were

collected from among and beneath the rocks composing the feature. These samples were sent for macro- and microbotanical analyses, which resulted in the discovery of Hackberry, Hickory, and Walnut family remains associated with Feature 21. Chapter 8 (Botanical Analysis) of this text describes possible reasons for inclusion of these types of botanical remains in the feature's sediment.

Figure 9-18. Feature 21 spanning excavation units (clockwise beginning with upper right corner) 8, 15, 16, and 12.

Feature 22

Type	Large cluster of burned rock
Analytical Unit	Middle Archaic
Provenience	Unit 17, level 12; units 8, 13, and 15, level 13
Top Elevation	116 cmbd
Bottom Elevation	129 cmbd
Size	89-by-112 cm
Associated Lots	102 and 186
Samples	Charcoal and bulk sediment
Faunal Remains	Fish and UID mammal

Diagnostic Projectile Points	None
Description	Feature 22 was decribed as a scatter of burned and fire-cracked rocks with no apparent clustering or shape and no apparent alteration of the adjacent sediment (i.e., darkening, oxidation, etc.). Among the burned rocks, remnants of stone tool manufacture, faunal remains, and charcoal were observed and recovered, and additional bulk sediment samples were collected from among and beneath the burned rocks composing the feature. Macro- and microbotanical remains identified are limited to Hackberry. Chapter 8 (paleobotany analysis) describes and discusses the possible reasons of why these remains were found and for what they may have been used.

Figure 9-19. Feature 22 photographed spanning excavation units (clockwise from upper right) 13, 17, 15, and 8.

Feature 23

Type	Small cluster of fire-cracked rock
Analytical Unit	None
Provenience	Unit 7, level 13
Top Elevation	110 cmbd
Bottom Elevation	129 cmbd
Size	Unkown extent (> 1 m diameter)

Associated Lots	12, 13, and 187
Samples	Charcoal
Faunal Remains	UID mammal
Diagnostic Projectile Points	None
Description	Feature 23 is described as a scatter of burned and fire-cracked rock concentrated around the north and east walls. No apparent shape is recorded of the collection of burned rocks, and it is noted to extend beyond the boundaries of excavation unit 7. In addition to burned rock, faunal remains, lithic debitage, charcoal, and burned clay were observed and recovered. Charcoal was collected for radiometric analysis, but it was not submitted. Bulk sediment was collected from among and beneath the burned rocks composing this feature, and results of this analysis indicate the presence of Hickory, Acorn, Prickly pear, and other woody debris. Much of excavation unit 7, in fact, was considered compromised due to the presence of subterranean utility lines traversing the northeast quadrant of the unit. Feature 23 is beneath the utility lines, but it is not clear to what extent the installation of these lines disturbed site matrix in this excavation unit.

Figure 9-20. Photograph of Feature 23 in excavation unit 7, level 13.

Feature 24

Type	Small cluster of fire-cracked rock and faunal remains
Analytical Unit	Middle Archaic
Provenience	Unit 16, level 12
Top Elevation	120 cmbd
Bottom Elevation	127 cmbd
Size	< 40 cmbd
Associated Lots	117, 145, and 188
Samples	Charcoal and bulk sediment
Faunal Remains	UID mammal
Diagnostic Projectile Points	None
Description	Feature 24 is described as burned and fire-cracked rocks and possibly burned bones, which appear to be clustered in the southwest corner of excavation unit 16, level 12. Lithic debitage, a single biface, faunal remains, and charcoal were all observed and recovered from contexts associated with this feature. Additionally, bulk sediment samples were collected from among and beneath the burned rocks composing Feature 24. Identifiable macro- and microbotanical remains associated with this feature include, Walnut family wood and Persimmon. No temporally diagnostic artifacts were recovered with this feature, but adjacent unit/levels place Feature 24 in the Middle Archaic analytical unit.

Figure 9-21. Feature 24 photographed in excavation unit 14, level 12.

Feature 25

Type	Small cluster of fire-cracked rock
Analytical Unit	Middle Archaic
Provenience	Unit 17, level 12; unit 15, level 13
Top Elevation	115 cmbd
Bottom Elevation	130 cmbd
Size	Unknown extent
Associated Lots	159 and 189
Samples	Charcoal and bulk sediment
Faunal Remains	Fish and UID small and medium to large mammal
Diagnostic Projectile Points	None
Description	Feature 25 is described as a cluster of burned and fire-cracked rocks emerging from the south walls of excavation units 15 and 17 near their intersection. Lithic debitage and faunal remains were observed and recovered in association with the feature, and a bulk sediment sample was collected from around and beneath the burned rocks composing Feature 25. Charcoal, as well as Walnut family wood and an unidentifiable seed, was identified in the paleobotanical analysis. No temporally diagnostic

artifacts were observed or recovered from the feature, but Feature 25's proximity to adjacent unit/levels designated as Middle Archaic analytical units marks it as the same era and analytical unit.

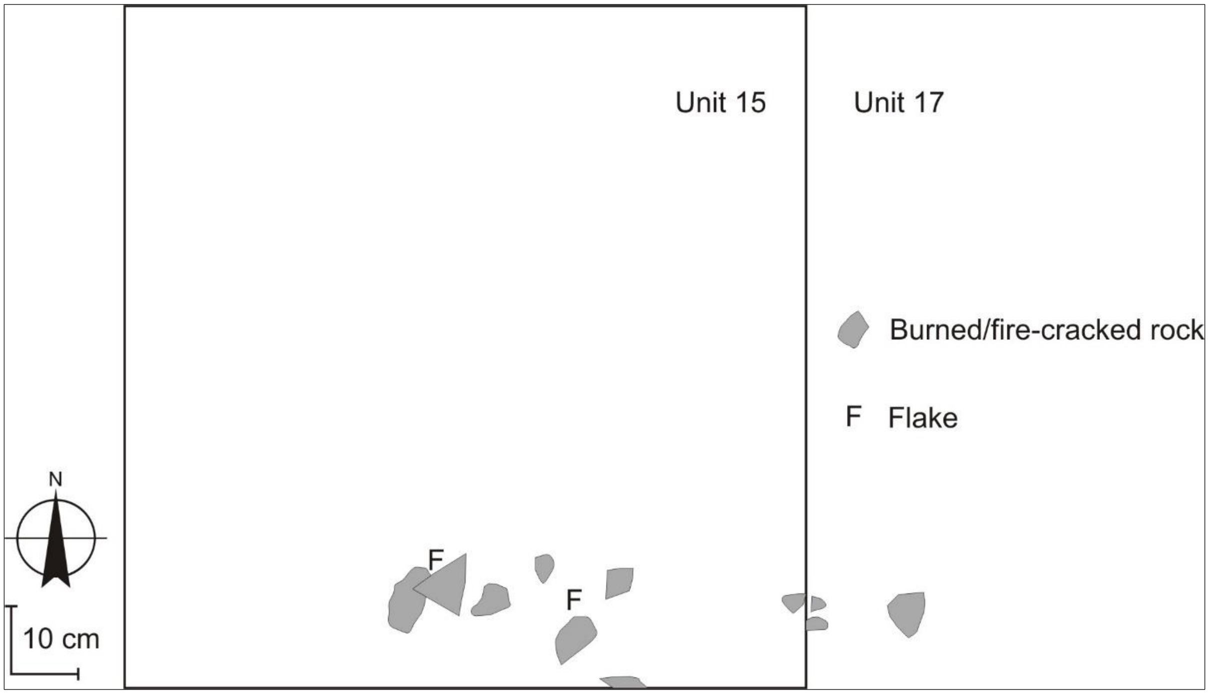


Figure 9-22. Illustration of burned rocks and lithic debitage composing Feature 25 in the southern portions of excavation units 15 and 17.

Feature 26

Type	Cluster of fire-cracked rock and oxidized sediment
Analytical Unit	None
Provenience	Units 10 and 14, level 14
Top Elevation	128 cmbd
Bottom Elevation	148 cmbd
Size	Unknown extent
Associated Lots	60, 118, and 190
Samples	Bulk sediment
Faunal Remains	Fish, turtle, bobcat, and UID mammal
Diagnostic Projectile Points	None
Description	Feature 26 is described as burned and fire-cracked rocks, burned clay, and lithic and faunal artifacts apparently clustered along the western portion of the boundary between excavation units 10 and 14. Bulk sediment was collected from among and beneath the burned rocks, and analysis revealed the presence of charcoal, Prickly pear, Walnut family, and unidentified seeds. No temporally diagnostic artifacts were observed

with this feature, and the upper unit/level—Feature 26 was encountered in the basal level of each of these units—was not designated as an analytical unit; therefore, Feature 26's orientation in time is not clear.

Figure 9-23. Feature 26 shown spanning excavation unit 14 (left) and 10 (right), level 14.

Feature 27

Type	Small cluster of fire-cracked rock
Analytical Unit	None
Provenience	Unit 8, levels 14 and 15
Top Elevation	132 cmbd
Bottom Elevation	149 cmbd
Size	50-by-25 cm
Associated Lots	191
Samples	Bulk sediment
Faunal Remains	UID vertebrate
Diagnostic Projectile Points	None
Description	Feature 27 is a cluster of burned and not burned rocks in levels 14 and 15 of excavation unit 8. In addition to rocks, this feature included lithic

debitage and faunal remains. A bulk sediment sample was collected from among and beneath the rocks composing the feature, and paleobotanical analysis revealed charcoal, faunal remains, and unidentifiable wood. The lack of temporally diagnostic artifacts and adjacent levels designated as analytical units, Feature 27 is not controlled for in time.

Figure 9-24. Feature 27 photographed near the terminus of excavation unit 8.

Feature 28

Type	Small cluster of fire-cracked rock
Analytical Unit	Early Archaic-Middle Archaic mixed
Provenience	Units 10, 14, and 16, level 14
Top Elevation	~135 cmbd
Bottom Elevation	150 cmbd
Size	< 75 cm diameter
Associated Lots	116, 147, and 192
Samples	Bulk sediment
Faunal Remains	Fish, mussel, and UID vertebrate
Diagnostic Projectile Points	Taylor and Lerma (possible)

Description	Feature 28 was encountered at the intersection of excavation units 10, 14, and 16, in the southwest corner of the excavation block, and is composed of a cluster of burned and fire-cracked rocks. In addition to the burned rocks, the feature contained a Baird projectile point, a possible Lerma projectile point, other stone tools, lithic debitage, faunal remains, and a round nail. Presence of a round nail, which typically represents the 20th century, compromises the integrity of the feature. In addition to recovered artifacts, a bulk sediment sample was collected for paleobotanical analysis. Results of paleobotanical analysis revealed the presence of Walnut family wood, unidentified seeds, Acorn, and Hackberry remains.

Figure 9-25. Feature 28 at the intersection of excavation units 10 (upper left), 14 (lower left), and 16 (lower right), near the terminus of the excavation block.

Feature 29

Type	Scattered clusters of fire-cracked rock
Analytical Unit	None
Provenience	Units 12 and 16, level 14
Top Elevation	142 cmbd
Bottom Elevation	151 cmbd
Size	< 1 m diameter

Associated Lots	89 and 193
Samples	Bulk sediment
Faunal Remains	Fish, rat, and UID vertebrate
Diagnostic Projectile Points	None
Description	Feature 29, unfortunately, has very little descriptive data recorded. It appears to be scattered burned and fire-cracked rock near the intersection of units 12 and 16 in their basal levels. Lithic debitage and faunal remains were encountered in association with the feature, and three non-diagnostic projectile point fragments were recovered with the feature. One of the projectile points has retouching that suggests it was later shaped into an adze. A bulk sediment sample was collected from among and beneath the burned rocks composing the feature, and paleobotanical analysis revealed that unidentified wood, Acorn, Hickory, and grape remains were present. This feature and encompassing unit/levels do not contain data necessary to designate an analytical unit.

Figure 9-26. Feature 29 exposed near the terminus of excavation units 12 (upper) and 16 (lower).

Feature 30

Type	Small cluster of fire-cracked rock
Analytical Unit	Early Archaic
Provenience	Units 10, 11, and 12, level 14; unit 9, level 15
Top Elevation	136 cmbd
Bottom Elevation	150 cmbd
Size	60-by-40 cm
Associated Lots	194
Samples	Bulk sediment
Faunal Remains	UID vertebrate
Diagnostic Projectile Points	None
Description	Feature 30 has no record describing the nature of the feature, but it appears to be a cluster of burned and fire-cracked rock near the intersection of excavation units 9, 10, 11, and 12 at their terminal depth (i.e., basal level). In addition to burned rocks, the feature also contained faunal remains and lithic debitage, and a bulk sediment sample was collected for paleobotanical analysis. Paleobotanical analysis revealed that the feature also contained charcoal, Hickory, and unidentified wood. Excavation units 9 and 11 containing this feature are designated as Early Archaic analytical units, but excavation units 10 and 12 have no such designation.

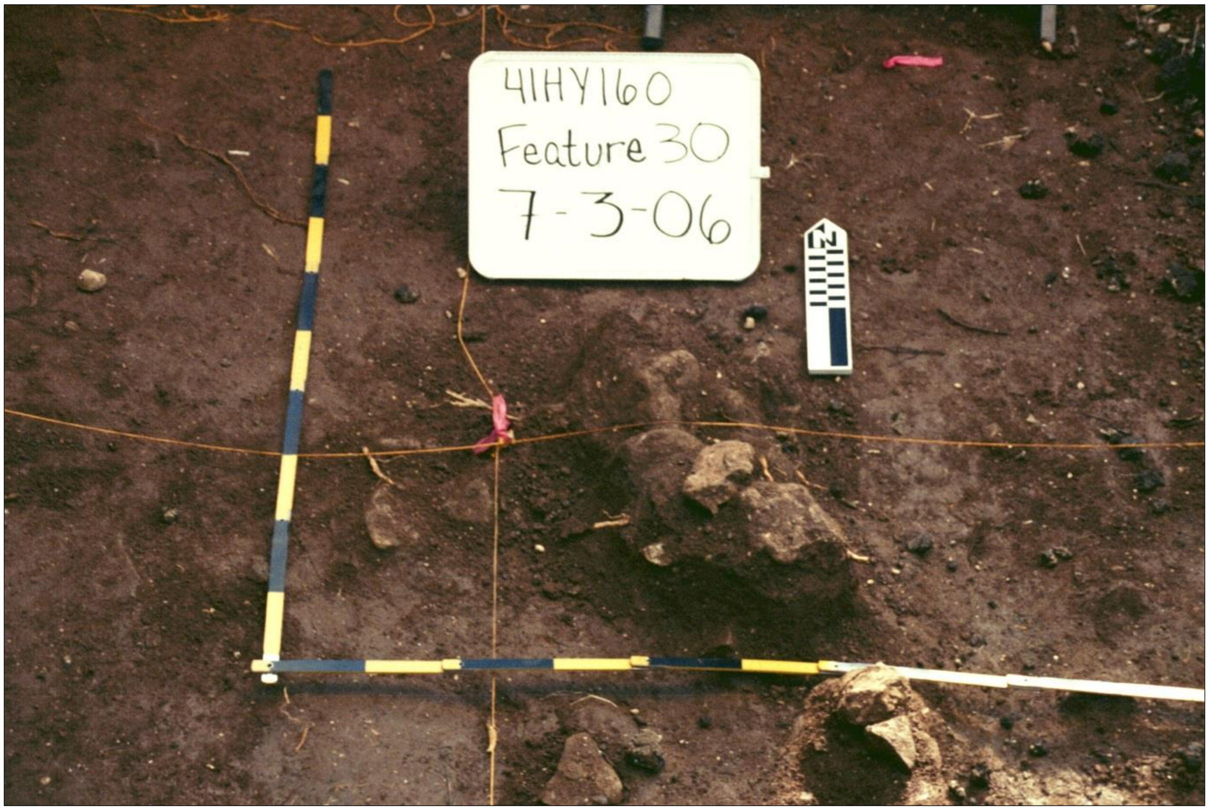


Figure 9-27. Feature 30 near the terminus of excavation (160-170 cmbd) in units (clockwise beginning in upper right) 9, 12, 10, and 11.

Feature 31

Type	Scattered fire-cracked rock
Analytical Unit	Early Archaic-Middle Archaic mixed
Provenience	Unit 7, level 15
Top Elevation	139 cmbd
Bottom Elevation	150 cmbd
Size	~1 m2
Associated Lots	15 and 195
Samples	Bulk sediment
Faunal Remains	UID vertebrate
Diagnostic Projectile Points	None
Description	Feature 31 was scattered burned and fire-cracked rocks at the base of excavation unit 7 (i.e., basal level). Remnants of stone tool manufacturing, faunal remains, and charcoal were encountered with the feature, and a bulk sediment sample was collected from among and beneath the rocks composing Feature 31. Paleobotanical analysis revealed the presence of Acorn, Walnut family, Black walnut, Hickory, Prickly

pear, Juniper, and unidentified wood, bulb and seed remains associated with the feature. Two bison bone fragments from this unit/level submitted for radiocarbon analysis yielded ages of 5903±20 calibrated years before present, which places at least the bison bone within the late Early Archaic period.

Figure 9-28. Feature 31 photographed near the termination of excavation unit 7, level 15.

Feature Descriptions Synthesis

Features encountered over the course of field school excavations during 2001-2003 and 2006 at 41HY160 reveal trends in cultural and natural depositional processes, as well as potential issues with field methods. Trends identified with cultural and natural depositional processes are primarily apparent in comparison of artifact and feature frequencies by depth, and those processes identified in this field school block appear to be supported by results from excavations elsewhere at the site.

It should be noted that some potentially problematic limitations have been identified in the field methods and the feature data collected from the field school block. Specifically, there are inconsistencies among the horizontal exposures and records. This is merely an example of how spatial parameters can affect data, and at larger scales this issue may be more prevalent within the field of cultural resource management. It may be useful to begin to conceptualize this issue in its historical context. As it happened, the three-by-four meter field school excavation block was excavated in a checkerboard pattern during the first field season. In the subsequent two seasons, the remaining seven units (i.e., that fill out the three-by-four meter block) were excavated to varying depths, and all eleven units were nearly level by the end of 2003. Excavations during the 2006 field season worked to bring down the entirety of the block to the basal depth, ranging from approximately 130 to 150 centimeters below the ground surface. In other words, unit/levels of excavation during the early years of field schools were commonly adjacent to units at a different level of excavation, if excavated at all, and it was not until the final year of excavation that units were kept relatively close to each other in terms of depth as they proceeded downwards. Excavating units at different rates had at least two effects, which were compounded by year-to-year changes in personnel. First, features were divided into fragments that typically did not extend beyond the one-by-one meter boundary of any particular unit (i.e., because the extent of those features into the adjacent units could not be determined). Spatial extents of these trans-unit features were commonly described as greater than one meter or unknown extent. In the first three years of excavations at the site, it did not appear that any of these trans-unit features were revisited or revised in subsequent years' excavations. Of interest, however, is that during the last year of excavations, when the entire block was excavated down to depth relatively simultaneously, seven of the 11 recorded features were found in more than one unit.

In addition to the fragmentation of the archaeological data, interpretations of features also seemed to be affected by a version of the modifiable aerial unit problem (MAUP). This concept is fundamental in spatial sciences/geocomputation, and it relates to the effect of scale on interpretation of patterns or distribution. The concept essentially questions whether samples accurately represent their populations, and it helps to define an adequate, minimum scale of analysis. In spatial sciences, MAUP is typically restricted to two dimensional distributions, but practical application in the field of archaeology broadens the concept to three dimensions, as archaeological features have volumetric morphology. In the 41HY160 field school excavation block and field records, MAUP is related to the fragmentation of features or the creation of features. For example, Nickels and Bousman (2010) note that three features in excavation unit 6 of the 41HY160 testing phase—the unit that exposed the portion of the site that was targeted by subsequent field school excavations—were aggregated, because laboratory analysis of the burned rock feature contents revealed that the three features were actually not distinct from each other in the three dimensional matrix. That is, instead of being three scatters of burned rocks, it was determined to be a relatively thick zone of "loosely integrated" burned rocks and other cultural remains. A similar aggregation of features recorded during the field school excavations at the site might be appropriate in some but certainly not all cases.

Additionally, it is apparent from comparison among some of the foregoing figures that arrangements of cultural materials, burned rock and otherwise, were not consistently recorded. For this reason, assessing feature frequency by depth is not sound, conservatively speaking. Nevertheless, there were a number of features recorded, however, that in post hoc analysis appear to be fairly individually designated as such. Features 6, 7, 15, and 28 may all be approximately intact heating elements of burned rock ovens.

CHAPTER 10: GEOARCHAEOLOGY OF THE SPRING LAKE ARCHAEOLOGICAL SITE (41HY160)

by Jacob Hooge and Amy E. Reid

Introduction

The Spring Lake vicinity has been the focus of prehistoric and historic human occupations for the past approximately 13,000 years. Several archaeological sites have been identified and examined, and a number of investigations have included geoarchaeological components, or studies of soils and sediments that span the valley and that may also contain cultural material (Arnn and Kibler 1999; Goelz 1999; Ringstaff 2000; Bousman 2010 and Hooge 2013, 2018). Previous geoarchaeological investigations have contributed considerably to the understanding of Sink Creek/Aquarena Springs Valley formation, and also to the potential for particular strata to contain archaeological material.

This chapter addresses questions of site formation and artifact context within the field school excavation pit through a synthesis of literature resulting from previous geoarchaeological investigations at various sites in the vicinity of Spring Lake. In addition, a limited analysis of profile illustrations and a description of stratigraphic observations from the field school excavations as well as the more recent 2014 Spring Lake Data Recovery project (SLDR) are presented here (Reid *et al*. 2018).

Geology and Soils

Geology in the vicinity of the site is generally complex due to the location along the Balcones Escarpment and fault zone. Bedrock is mapped by the Bureau of Economic Geology (1974) as Quaternary Alluvium (Qal), Eagle Ford Group and Buda Limestone Undivided (Keb), Del Rio Clay and Georgetown Formation Undivided (Kdg), and Edwards Limestone (Ked). Quaternary alluvium represents Holocene floodplain deposits and other fluviatile morphology (i.e., channel features), and it is composed of silt to gravel size sediments. Eagle Ford Group is composed of shale and limestone, with an upper stratum of shale approximately 10 ft. (3.0 m) thick, a 4-5-ft. (1.2-1.5 m) thick sand and flaggy limestone middle stratum, and a lower stratum composed of calcareous shale approaching 7 ft. (2.1 m) in thickness. Buda Limestone is a massive, fine grained, poorly bedded to nodular deposit. Del Rio Clay has a thickness of 40-60 ft. (12.2-18.3 m) and is composed of calcareous and gypsiferous clays interrupted by thin lenses or beds of siltstone and limestone, whereas Georgetown Formation is a 10-45-ft. (3.0-13.7 m) thick deposit of mostly fine-grained to nodular limestone with some soft calcareous shale. Edwards Limestone covers a great area of Texas, however, in the project area it approaches 400 ft (<121.9 m) in thickness and ranges from massive to thinly bedded nearly-pure calcareous to dolomitic deposits with chert nodules and thin cherty strata (Bureau of Economic Geology

1974; Sellards et al. 1932). As 41HY160 is located just above the confluence of the San Marcos River headwaters and Sink Creek, much of the sediment is likely Qal. However, the proximal Balcones Escarpment surely contributes colluvially or alluvially reworked Keb, Kdg, and Ked bedrock to the valley's stratigraphy.

Soils in the project area at the base of the Balcones Escarpment, as described by Batte (1984), include Oakalla soils, frequently flooded (Ok) and Tinn clay, frequently flooded (Tn) (Figure 10-1). Oakalla soils are characterized as deep, calcareous, and well-drained located on near-level to gently undulating flood plains, and consisting of overbank fines (i.e., varying proportions of silts and clays). The upper stratum of Oakalla soils is generally dark grayish brown clay loam extending to a depth of 40 inches (101.6 cm). Light yellowish brown clay loam subsoil extends to a depth of 49 inches (124.5 cm), and overlies very pale brown clay loam, which extends to a depth of 80 inches (203.2 cm). Tinn clays are also very deep, calcareous, and located on near-level flood plains; however, the soil's clayey texture impedes permeability of water and is, therefore, poorly drained. The upper stratum of Tinn clays is generally 25 inches (63.5 cm) thick and is composed of dark gray clay. The upper stratum overlies a grayish brown clay that extends to a depth of approximately 80 inches (203.2 cm). In addition to inhibiting drainage, the clayey nature of the Tinn clays introduces shrink-swell potential.

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Figure 10-1. Soils within the project area.

Synthesis of Previous Investigations

Investigations of sediments and soils composing the matrix of the cluster of sites adjacent to Spring Lake have been performed by Arnn and Kibler (1999), Goeltz (1999), Ringstaff (2000), Lee Nordt (Nordt 2010), Leezer (2011), Lohse et al (2013) and Jacob Hooge (2013, 2018). These investigations utilized a number of investigation methods including, observation of profiles exposed in archaeological test units, coring, and backhoe trenching. Though these previous investigations' results were procured by a variety of different methods and presented in different formats, direct dating of sediments and indirectly dating deposits with diagnostic artifacts contained therein provide sufficient information to correlate sediments encountered throughout the multiple investigations.

Arnn and Kibler (1999) excavated backhoe trenches across the Sink Creek floodplain and along the northern valley escarpment. No datable or time-diagnostic materials were discovered in the floodplain down to depths of 3 meters. However, along the valley escarpment radiocarbon ages from buried features indicated the presence of at least 2 meters of Late Holocene colluvium. Goeltz (1999), in association with the Trinity Engineering Testing Corporation (TETCO), excavated cores in the immediate vicinity of the springs at Spring Lake. Two bulk humate radiocarbon ages were obtained. The oldest dated to Clovis time (11,470 ±100 P.P., Beta 132062), which came from the base of the alluvial valley fill at a depth of 8.6 m. A bulk humate date of 3660±50 B.P. (Beta 132061) was obtained from a depth of 2.4 meters. Although these ages are only estimates, they demonstrate the importance of the Sink Creek valley as a reservoir for preserving a long-term prehistoric archaeological record of Central Texas.

As a result of the 1996-1998 field schools at nearby site 41HY165, Ringstaff (2000) identified three locally defined soil horizons (Figure 10-2) from two excavation units at the site, which he designated Units III - I. Unit III is the uppermost A horizon and occurs between 15 and 50 centimeters below the ground surface. This unit is described as a very dark brown silty clay loam with granular structure. Ringstaff (2000:50) identified an Ap horizon (Unit IIIa) in the upper 15 centimeters of this horizon as a thin, gravelly, humic zone. Unit II is an ABb horizon between 50 and 90 centimeters below the ground surface and Ringstaff (2000:50) described the boundary between Unit III and Unit II as clear and smooth. This horizon consists of dark yellowish brown silty clay with moderate sub angular blocky structure due to its higher clay content. Ringstaff (2000:51) noted little evidence of bioturbation in this horizon. The final horizon consists of two soil units occurring from 95 to 110 centimeters to a depth of 280 centimeters where excavation was deepest. The upper portion of this horizon (Unit Ia) ranges from a Bw2b to Bwk2b dark reddish brown silty loam with weak sub angular blocky structure. Ringstaff (2000:52) noted some krotovina in this horizon filled with artifacts and sediments from Unit II. Underlying Unit Ia is a C2b horizon (Unit 1b) consisting of reddish brown silty clay with moderate sub angular block structure. Ringstaff (2000:53) also noted that the soil is friable with little evidence of bioturbation and may extend to a depth of six to nine meters below ground surface (meters below surface).

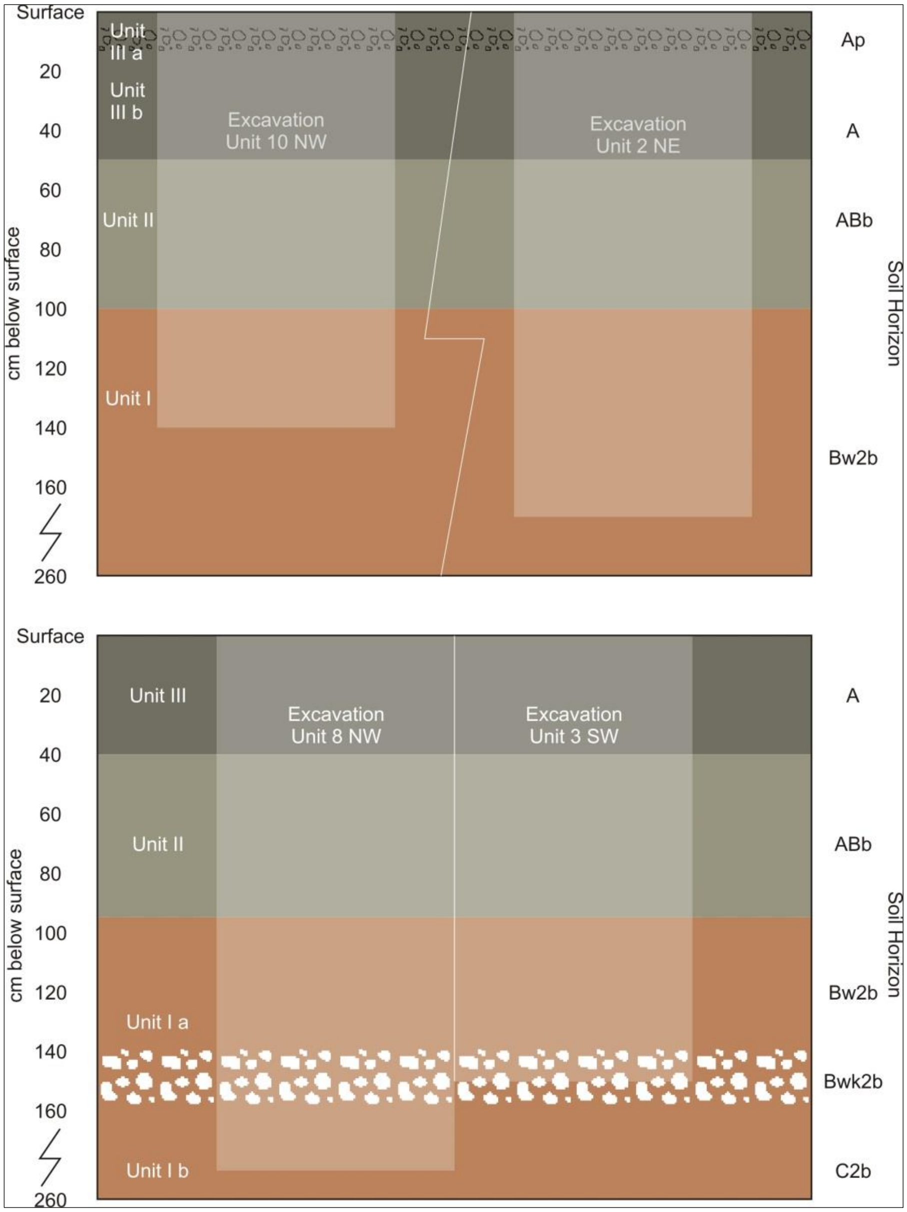

Figure 10-2. Soil horizons at 41HY165 identified by Ringstaff (2000).

In 2001, Lee Nordt collected and analyzed 22 sediment cores as part of an archaeological survey of the upper Spring Lake Peninsula in preparation for the development of the Texas Rivers Center, now the Meadows Center for Water and the Environment (Nickels and Bousman 2010). The cores were taken by a truck-mounted drill rig provided by the Bureau of Economic Geology at the University of Texas and were collected in 5 ft sections. Figure 10-3 shows the locations of cores taken by Nordt (2010).

Nordt identified five unconformably bound depositional units, labeling them A-E from oldest to youngest (Figure 10-4). Unit A rests unconformably on limestone bedrock and is described as being 2 to 2.5 m thick, consisting of intermingling channel gravels, yellowish brown to brownish yellow overbank deposits, and dark gray to black marsh deposits. Nordt assigned two radiocarbon ages to Unit

A marsh deposits, one at 9585±40 B. P.(CAMS 85777) obtained from plant fragments and a bulk humate date of 11,470±100 B.P. taken by Goelz (1999) (Beta 132062). Unit B is confined to the area surrounding the spring head and was deposited following a termination of floodplain stability and a down cutting of Unit A which extended to bedrock in some places. Unit B also consists of intermingled marsh and overbank deposits and was deposited sometime following 9585±40 B.P. (CAMS 85777) and continued until at least 7365±40 B.P (CAMS 85776). Following a brief period of erosion, Unit C deposits filled down cuts into Unit A nearer to the modern Sink Creek channel. Nordt noted that Unit C also contains interbedded marsh and flood deposits but is unique in that its channel gravels are encased in reddish brown to strong brown mud matrix. Unit C was deposited beginning sometime after 7365±40 B.P (CAMS 85776) and continued no later than 5975±40 B.P (CAMS 85778). Unit D occurred in all cores and unconformably buried all previous units. Unit D consists of dark brown clays grading to strong or reddish brown Bk horizons and is absent of gravelly channel deposits. The deposition of Unit D began sometime after 5975±40 B.P (CAMS 85778), lasting through at least 3300±40 B.P (CAMS 85780). Nordt argued that following the deposition of Unit D, a period of floodplain stability ensued with little to no significant sedimentation. Unit E only occurs near the springhead and Sink Creek and likely represents a fine veneer of Late Archaic and Late Prehistoric deposits. Unit F buries most previous deposits except for near the springhead and consists of mostly post-Historic period fill. Figure 10-5 shows Nordt's interpretation of the stratigraphy across Spring Lake Peninsula from northwest to southeast, and Figure 10-6 shows the same down the length of the peninsula from northeast to southwest (Nordt 2010).

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Figure 10-3. Location map showing distribution of sediment cores taken by Lee Nordt (from Nordt 2010: Figure 6-3).

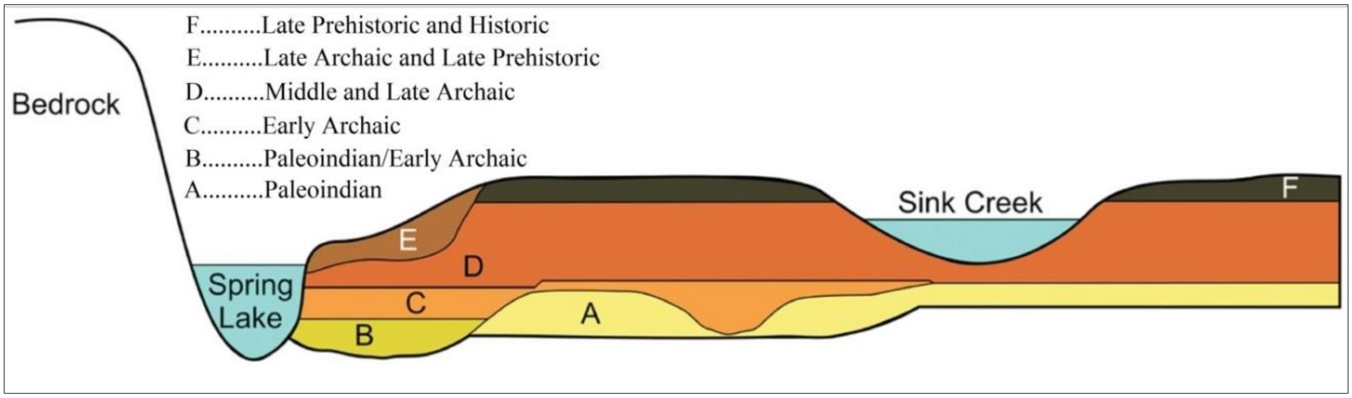

Figure 10-4. Idealized geologic cross-section of the Sink Creek Valley, looking upstream, illustrating alluvial units and their expected prehistoric preservation (redrawn from Nordt 2010: Figure 6-8).

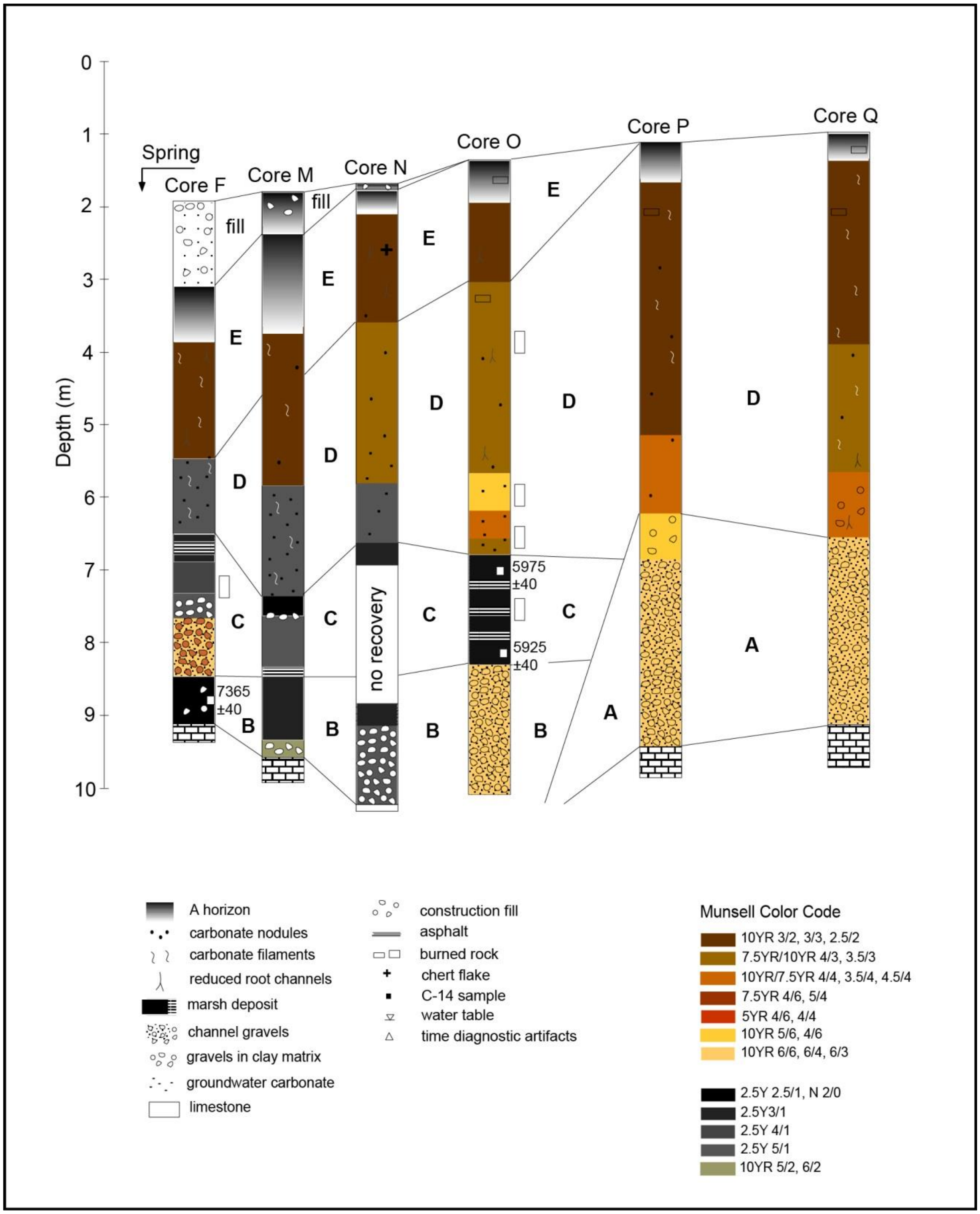

Figure 10-5. Stratigraphic cross-plot of Cores F, M, N, O, P, and Q taken by Lee Nordt. Lined up from northwest to southeast (from Nordt 2010: Figure 6-5).

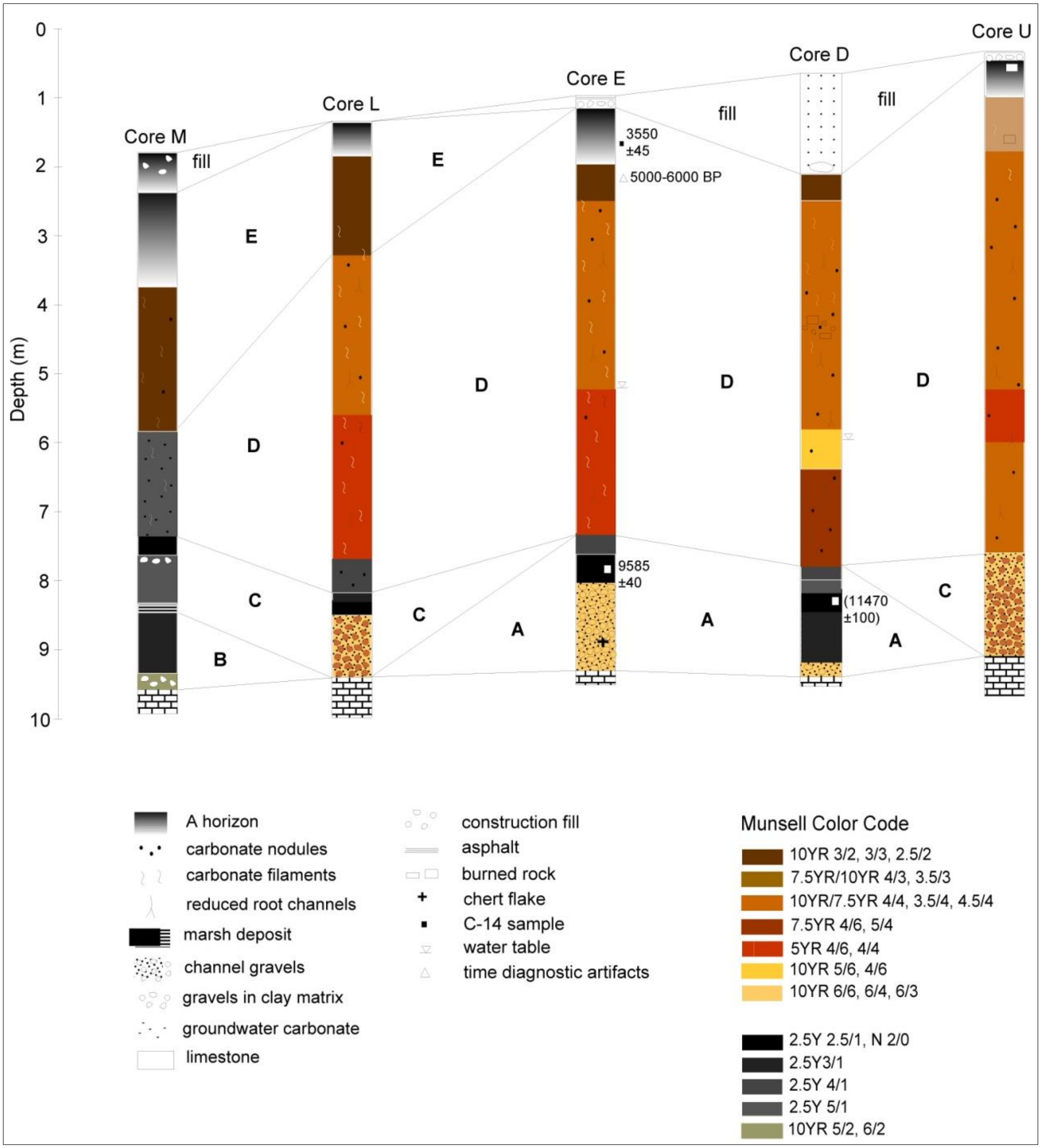

Figure 10-6. Stratigraphic cross-plot of Cores M, L, E, D, and U taken by Lee Nordt. Lined up from northeast to southwest (from Nordt 2010: Figure 6-7).

In 2010, Center for Archaeology Studies (CAS) conducted an archaeological survey of the area surrounding the submarine theater in order to determine what impacts its removal would have on buried cultural resources (Leezer et al. 2011). CAS collected 8 sediment cores and excavated one 50 x 50 cm test unit in areas immediately adjacent to the submarine theater. Cores were collected by hammering 2¼-inch PVC pipe into the lake bottom and then extracting through either physical force or by chain-hoist. The test unit was excavated using an air-lift; however, sediments were not screened (Leezer et al. 2011). CAS identified a complex stratigraphy around the sub. In front of the sub (spring side) CAS dated a wood fragment contained in a marsh deposit in Test Pit 1 (Figure 10-7) at 11,390±50 B.P. (Beta 282624). The marsh deposit was capped by a channel deposit absent at similar depths in cores taken nearby (see Figure 10-7). Behind the sub (peninsula side) at its northeast corner a bulk sediment sample collected in Core 7 at a depth 3 m above the previously mentioned marsh was dated at 15,980±60 B.P. (Beta 282623) (see Figure 10-6) (Leezer et al. 2011).

In 2011, CAS excavated four 1 x 1-m units in preparation for the installation of a lift station for a Ticket Kiosk and bathrooms near the north end of Spring Lake (Figure 10-8) (Lohse et al. 2013). The eastern block of units (see Figure 10-8) were excavated to a depth of 300 cm. CAS interpreted the stratigraphy as containing 3 depositional units (Figure 10-9). The lowermost unit, Unit 3 consists of greyish brown clays with gradational carbonate development and is capped by what may represent a truncated A horizon (see Figure 10-9). Artiodactyl bone fragments at the top of Unit 3 were dated at 6015±20 B.P. (UCIAMS 111180) and 5290±20 B.P. (UCIAMS 111179). Unit 2 consists of dark brown to yellowish brown clay and is bracketed between bison bone fragment dates of 5145±20 B.P. (UCIAMS 106469) and 515±15 B.P. (UCIAMS 106464) (Lohse et al. 2013).

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Figure 10-7. Stratigraphic reconstruction of area surrounding submarine theater. Dates are uncalibrated radiocarbon ages B.P. with errors. (modified from Leezer et al. 2011: Figure 5-22).

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Figure 10-8. Excavation sites for ticket kiosk mitigation. Areas colored in red were shallowly excavated by backhoe. Yellow squares mark excavation unit sites. From Lohse et al. (2013).

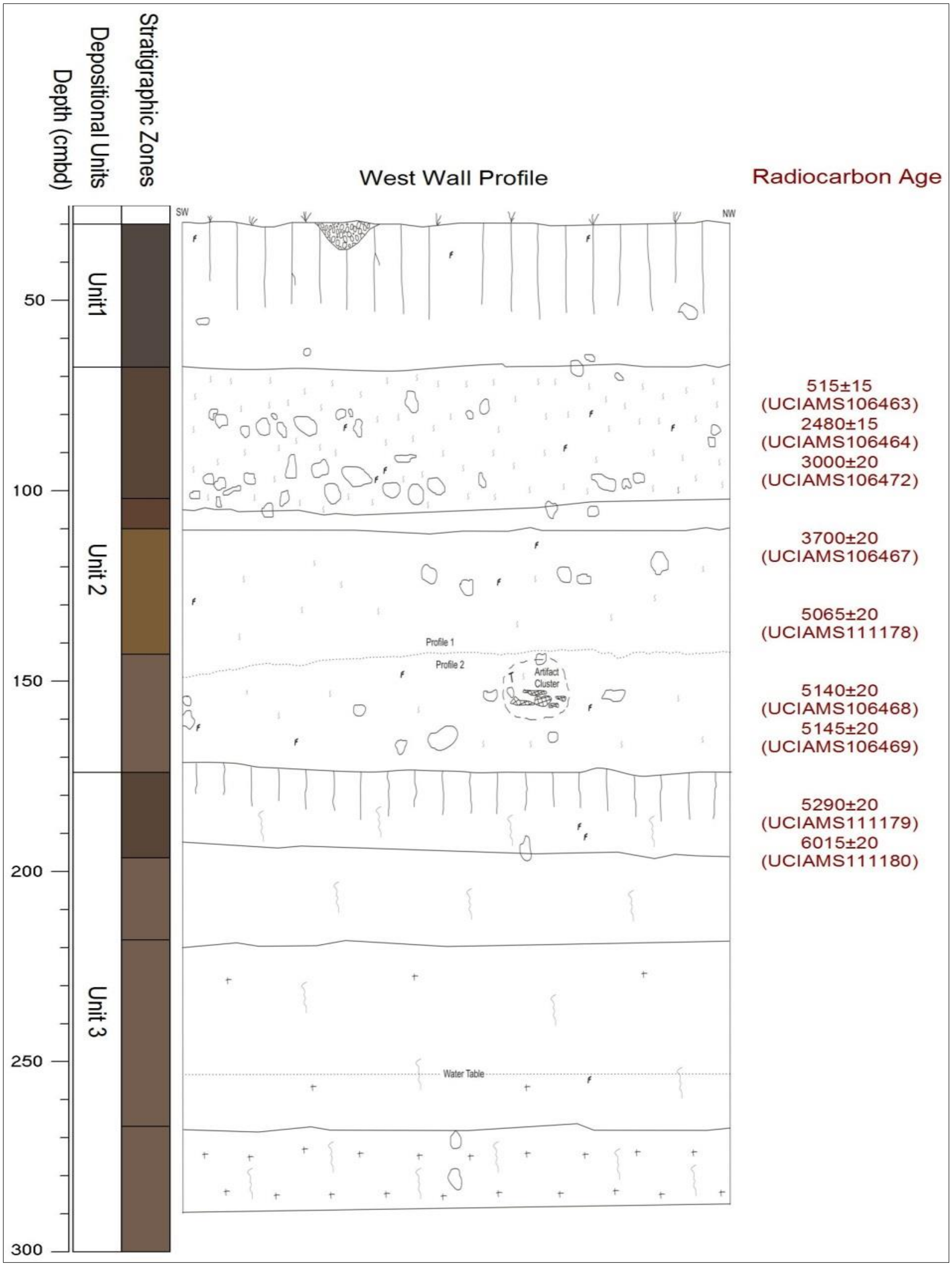

Figure 10-9. Stratigraphic profile from CAS's Ticket Kiosk Excavation. Shows the west wall of Units 3 and 4 (modified from Lohse et al. 2013). Dates are shown as uncalibrated radiocarbon ages B.P. with errors.

From 2011 to 2013 Jacob Hooge conducted geoarchaeological investigations of Late Pleistocene and Holocene sediments in order to increase the resolution of our understanding of the geoarchaeological record of Spring Lake and to achieve a more thorough understanding of the stratigraphic contexts of alluvial deposits now flooded by the man-made Spring Lake, in a chronologically controlled framework (Hooge 2013). His work consisted of using new underwater and geoarchaeological field and laboratory methods to analyze an array of core samples taken from within the lake. In addition to examining the core samples, a naturally cut profile exposure was observed and described. Four distinctive sedimentary units were identified, examined, and dated (Figures 10-10 and 10-11). In a synthesis of previous geoarchaeological analyses (Nordt 2010; Leezer et al. 2011; Lohse et al. 2013), Hooge (2013) developed a new depositional model for the Spring Lake Peninsula.

Hooge (2013) determined the oldest and most substantial deposition in Spring Lake (Sedimentary Unit IV) dates to at least 11390±50 B.P (Beta 282624) and is composed of interbedded poorly developed marsh deposits and rapidly deposited alluvium derived from freshly eroded mature soils originating in the nearby uplands of the Balcones Canyonlands. Hooge established that a rapid and massive sedimentation with a range of coarse, clay matrix-supported channel gravels to fine overbank deposits continued in the area around the San Marcos Springs until at least 5469±30 B.P (DAMS 001781). Given the findings of Cooke et al. (2003; 2007) at Hall's Cave, Hooge argued that the deposition of Unit IV is most likely a direct result of the removal of the Pleistocene soil cover from the Edwards Plateau. It was posited that if the end of Unit IV deposition is linked to the exhaustion of a sediment source rather than a change of moisture availability affecting spring-side vegetation, little truncation can be expected close to the springheads. Nordt (2010) showed that truncation did occur in the middle of Spring Lake Peninsula in sediments recovered from Cores O and N (see Figures 10-12 and 10-13). Hooge suggested that because the incision of a stream channel into bedrock to an elevation below the deepest areas of the spring channel, a proto-Sink Creek must have flowed through this paleochannel and migrated laterally, away from the springs. According to Hooge's findings, deposition in Spring Lake following Unit IV was sporadic and most likely tied to drier regional conditions beginning perhaps as early as 2380±15 B.P. (Table 10-1, UCIAMS 95430) and peaking between 1645±25 and 1414±25 B.P. (Table 10-1, DAMS 001783 and DAMS 001775). Hooge's deposition model also states that following 1400 B.P., very little sediment was deposited around the San Marcos Springs until sometime after the onset of the Historic period. Figure 10-14 presents Hooge's (2013) proposed deposition model for the Spring Lake Peninsula which accommodates the presence of Paleoindian and Early Archaic age soils and materials recorded by Leezer (et al. 2011) and Lohse (et al. 2013).

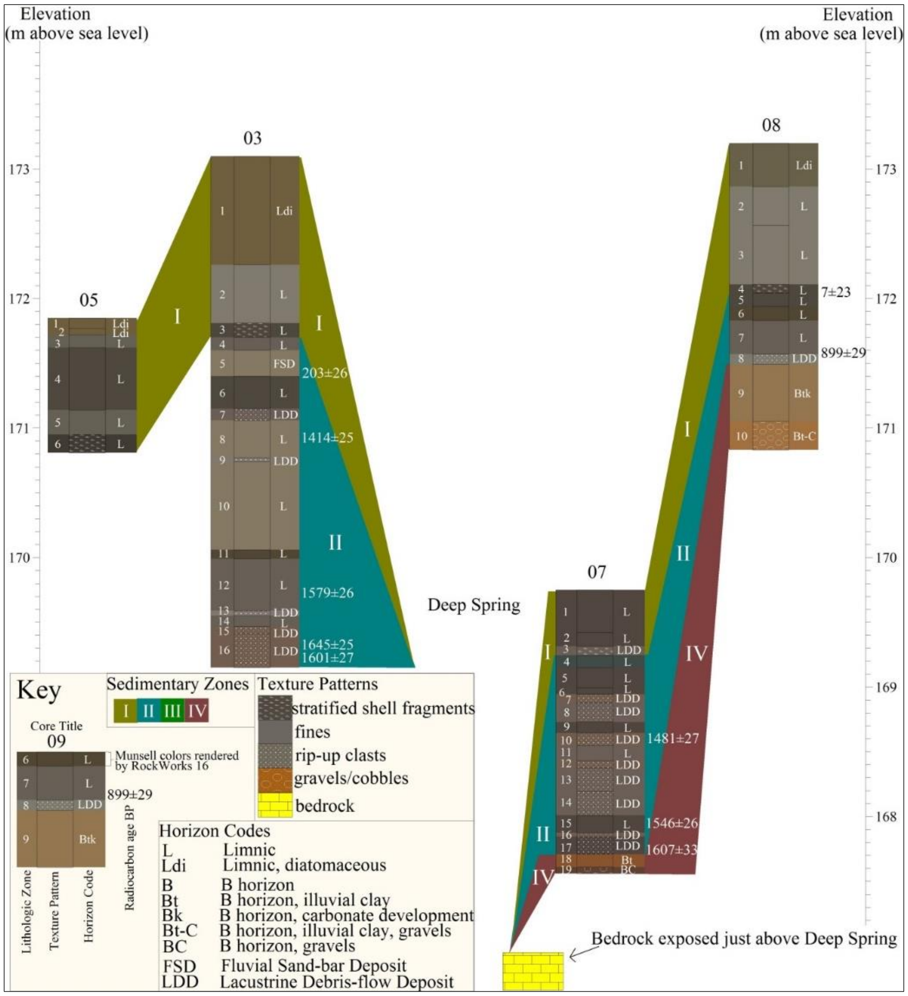

Figure 10-10. Stratigraphic cross-section plot of Cores 05, 03, 07, and 08 from Hooge (2013). Lined up northwest to southeast in Spring Lake. Uncalibrated radiocarbon dates and errors are plotted adjacent to sample locations.

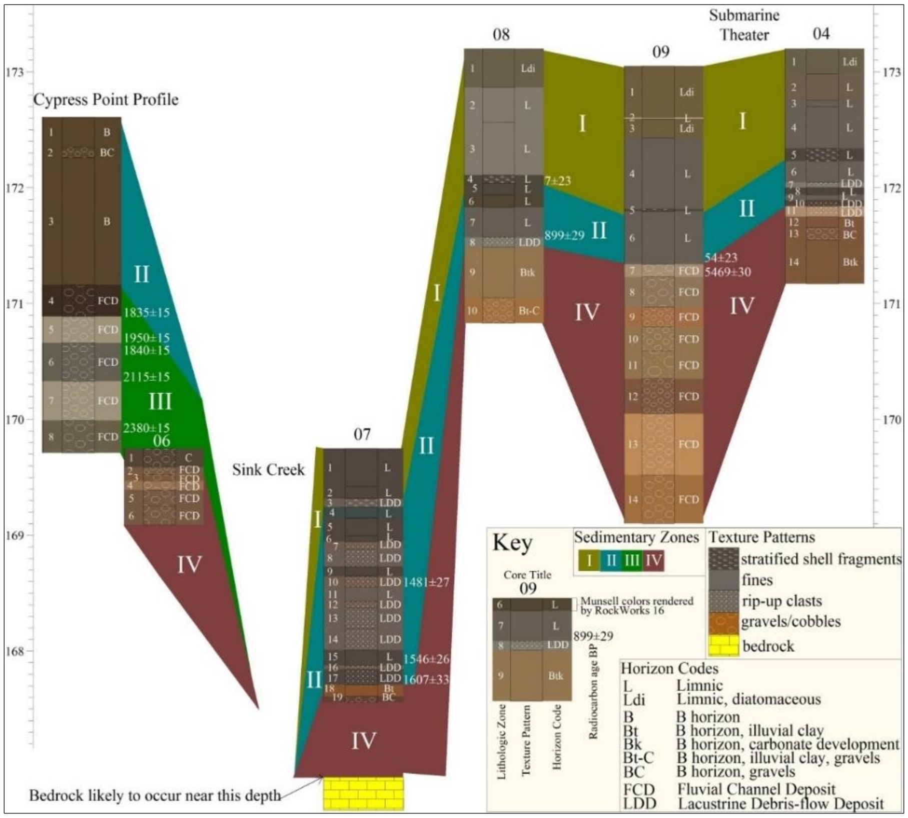

Figure 10-11. Stratigraphic cross-section plot of profile log and Cores 06, 07, 08, 09, and 04 from Hooge (2013). Lined up southwest to northeast in Spring Lake. Uncalibrated radiocarbon dates and errors are plotted adjacent to sample locations.

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Figure 10-12. Composite topographic/bathymetric contour surface of Spring Lake. Shows an oblique view of the distribution of cross-section paths and Cores 09 and 04, Test Unit 1 (Leezer et al. 2011), and Nordt's (2010) Cores D, E, F, M, N, O, P, and Q, vertically exaggerated by a factor of 3.

Figure 10-13. Stratigraphic cross-section plot showing Core 09, Test Unit 1 (Leezer et al. 2011), Core 04, and Nordt's (2010) Cores F, M, N, O, P, and Q. Lined up from west to east in Spring Lake and across the Spring Lake Peninsula.

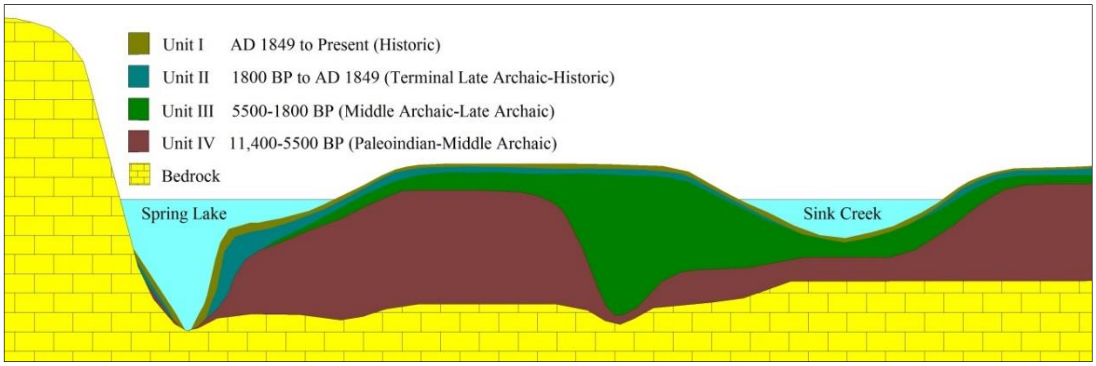

Figure 10-14. Idealized stratigraphic cross-section of the San Marcos Springs (northwest to southeast across the Spring Lake Peninsula) showing modifications to Nordt's (2010) model.

Table 10-1. ^{14}C ages from cores and exposed profile in Spring Lake. DAMS: Direct-AMS, Seattle, UCIAMS: University of California at Irvine Keck Carbon Cycle AMS Program, Irvine. For reader convenience, calendar ages showing a 2σ range have been calibrated using OxCal-IntCal 2013.

Sample Number	Location	Depth (cm)	^{14}C Age B.P.	$\delta^{13}C$ ‰	Calendar Age B.P.	Material
DAMS 001773	**Core 03**	163	**203±26**	-25.6	301-0	wood
DAMS 001775	**Core 03**	213	**1414±25**	-26.4	1353-1290	wood
DAMS 001774	**Core 03**	333	**1579±26**	-36.6	1534-1407	wood
DAMS 001783	**Core 03**	373	**1645±25**	-28.8	1613-1420	wood
DAMS 001772	**Core 03**	383	**1601±27**	-25.6	1549-1413	charcoal
DAMS 001782	**Core 07**	110	**1481±27**	-33.7	1409-1310	wood
DAMS 001777	**Core 07**	176	**1546±26**	-28.2	1525-1378	plant fragment
DAMS 001776	**Core 07**	196	**1607±33**	-33.0	1560-1410	wood
DAMS 001779	**Core 08**	111	**7±23**	-23.7	244-36	plant fragment
DAMS 001778	**Core 08**	160	**899±29**	-20.3	911-740	wood
DAMS 001780	**Core 09**	171	**54±23**	-25.5	254-32	wood
DAMS 001781	**Core 09**	180	**5469±30**	-34.0	6310-6208	charcoal
UCIAMS 95427	**Cypress Point Profile**	169	**1835±15**	-	1820-1719	wood
UCIAMS 95426	**Cypress Point Profile**	190	**1950±15**	-	1944-1866	wood
UCIAMS 95425	**Cypress Point Profile**	198	**1840±15**	-	1821-1722	wood
UCIAMS 95428	**Cypress Point Profile**	220	**2115±15**	-	2146-2010	wood
UCIAMS 95430	**Cypress Point Profile**	265	**2380±15**	-	2456-2347	wood

Table 10-1. ^{14}C ages from cores and exposed profile in Spring Lake. DAMS: Direct-AMS, Seattle, UCIAMS: University of California at Irvine Keck Carbon Cycle AMS Program, Irvine. For reader convenience, calendar ages showing a 2σ range have been calibrated using OxCal-IntCal 2013.						
Sample Number	**Location**	**Depth (cm)**	**^{14}C Age B.P.**	**$\delta^{13}C$ ‰**	**Calendar Age B.P.**	**Material**
Beta 282624	**Test Unit 1 (Leezer et al. 2011)**	40-45	**11390±50**	-27.2	13332-13106	wood

Field School Block and 2014 Data Recovery Investigations: Stratigraphic Observations

Field School Excavations

Four seasons of excavation at 41HY160 resulted in the excavation of approximately 24 cubic meters of sediment, which yielded thousands of artifacts. Cultural materials that were recovered included a number of artifacts with diagnostic characteristics, i.e., projectile points and ceramics. Projectile points have long been used in Texas to identify periods of time and geographic origin (cf., Prewitt 1981, 1985; Suhm and Jelks 1962), and indigenous ceramics, though not appearing until much later in time, also offer temporal and geographic insights. With greater accuracy than projectile points and ceramics, results of radiocarbon analysis on faunal remains, specifically bison for this project, and charred floral remnants provide yet another line of temporal evidence. Diagnostic artifacts and their proveniences were compiled and used to begin assessing the depositional history of 41HY160 within the excavation. Analytical units, explained in Chapter 5, were elucidated from these temporal data.

Although no geoarchaeological analyses were conducted specific to the 2001, 2002, 2003 and 2006 field school investigations, CAS conducted limited analysis of profile illustrations for the present report and in preparation for the Spring Lake Data Recovery (SLDR) project in 2014. Figure 10-15 illustrates the stratigraphy encountered in the south wall profile of the field school block. Four stratigraphic zones were recorded to a depth of 93 centimeters below surface (cmbs). Upon completion in 2006, all units were excavated to a final depth of 170 centimeters below datum (cmbd). However, no profile illustrations were located within the field school project records that documented the stratigraphy encountered to the final depth.

Zone 1	0-12 cmbs. Compacted fill mixed with disturbed clayey loam over the compacted fill. 10YR 4/1
Zone 2	12-42 cmbs. Very dark gray (10YR 3/1) clay loam, angular blocky vertical cracking runs through entire horizon. Artifacts (bone, chert, FCR) observed in profile. Snail (7%) throughout with common rootlets.
Zone 3	42-79 cmbs. Mottled 10YR 3/1 with dark reddish brown (10YR 3/4), dense snail (10%), FCR more abundant in profile, sub-angular blocky, semi-moist.
Zone 4	79-93 cmbs. Reddish brown (7.5 YR 3/3) clayey loam, much more sticky than previous horizons. No vertical cracking observed. Snail dropping off this horizon (3-4%), granular semi-blocky softer texture.

Figure 10-15. South wall profile of field school block with descriptions.

2014 Spring Lake Data Recovery Project Excavations

Fieldwork for the 2014 SLDR project included the excavation of approximately 40 cubic meters of soil spread between two blocks of 1 x 1-meter excavation units (Figure 10-16). The main excavation block was 4 x 4 meters (main block) and placed immediately to the south of the 3 x 4 meter block excavated during the 2001, 2002, 2003 and 2006 field schools (Figures 10-16 and 10-17). The secondary 3 x 3-meter excavation block (secondary block) was placed 8 meters east and 1 meter south of the southwest corner of the main block to determine if trends observed in the main block extended further away from the springs (Figures 10-16 and 10-17).

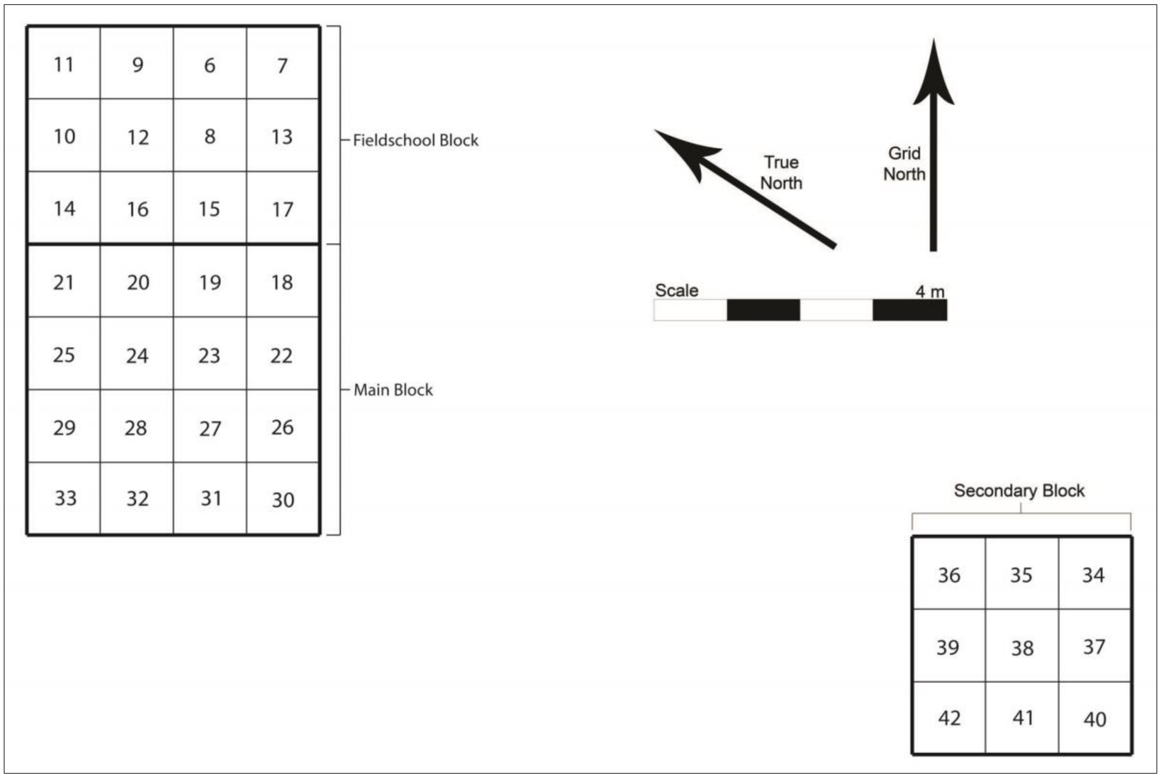

Figure 10-16. Plan view diagram of the field school block and 2014 Spring Lake Data Recovery Project excavation units.

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Figure 10-17. Excavation unit layout map showing locations of the Field School and 2014 Spring Lake Data Recovery excavation blocks.

Figures 10-18, 10-19 and 10-20 show the north wall of the secondary excavation block; this profile contains both the typical native soil profile as well as the most significant unconformities encountered during the Spring Lake Data Recovery. The upper right portion of the profile exhibits a backfilled hole which was excavated sometime after the gravel parking lot was laid down. Just below, on the right side of the profile, Feature 6 is visible in the form of the distinctive burned clay masses. Although no clear alteration of the soil zonation is apparent, Feature 6 contains mixed diagnostic cultural material which implies the feature represents a backfilled void created during the Late Archaic or later, suggesting an unconformity is present although invisible relative to diagenetic soil color changes. Given that Feature 6 is at least 2,000 years old, other unconformities and backfilled pits may exist which are not readily identifiable by changes in soil characteristics.

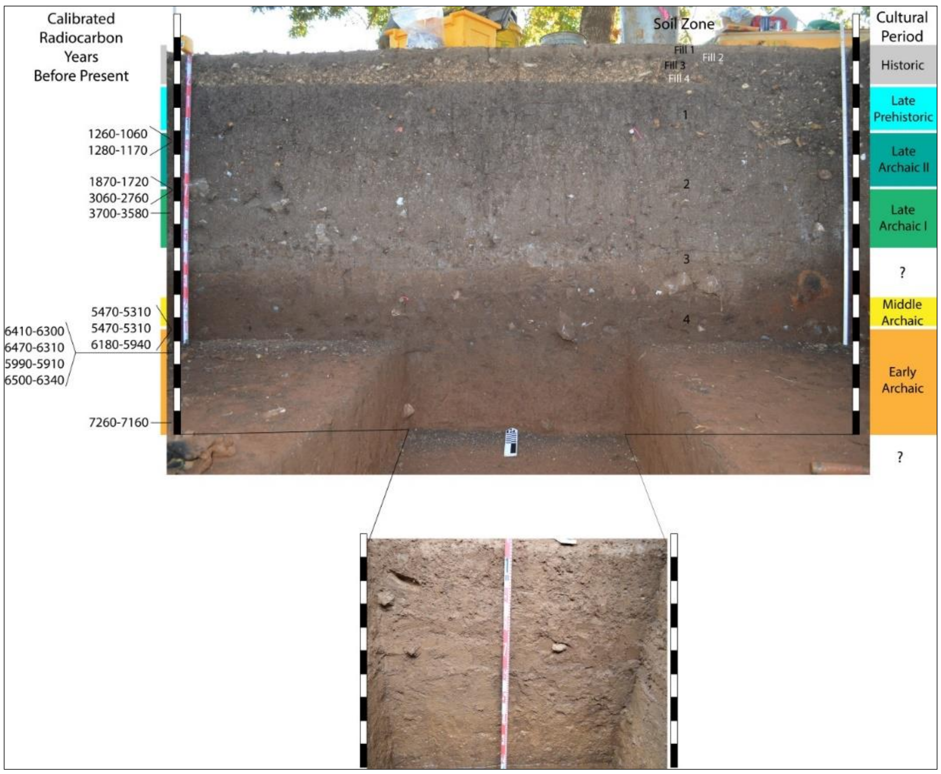

Figure 10- 18. North wall profile of secondary excavation block with radiocarbon dates and associated cultural periods.

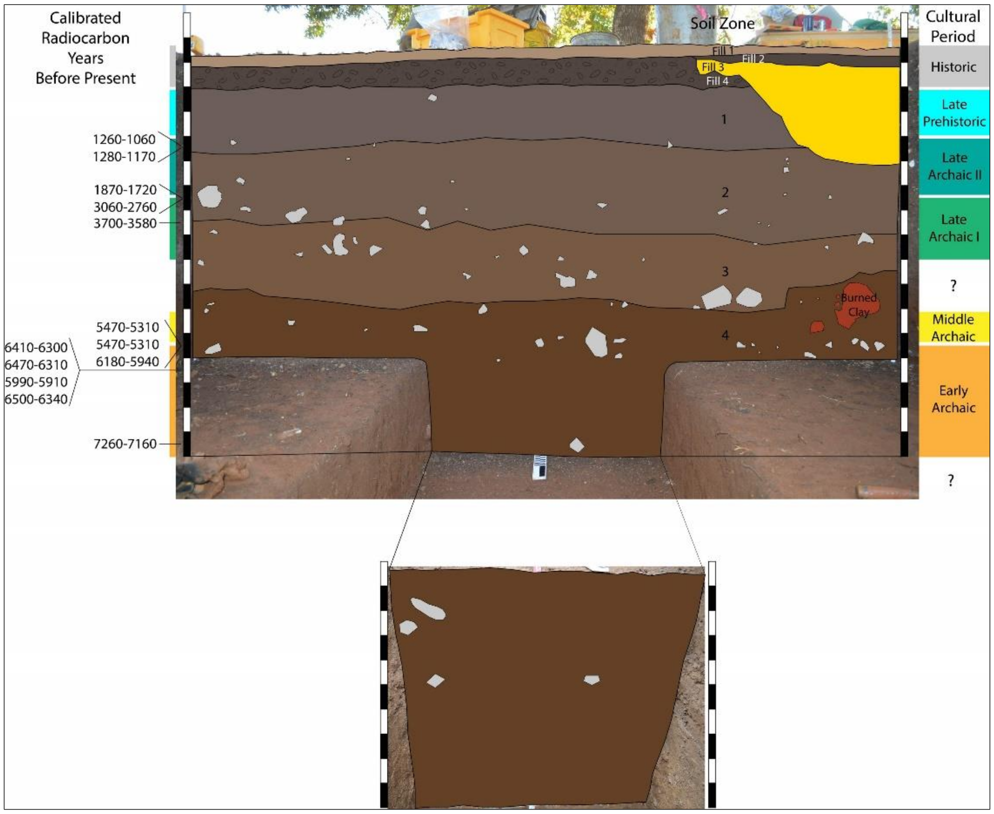

Figure 10-19. North wall profile of secondary excavation block with soil zones enhanced.

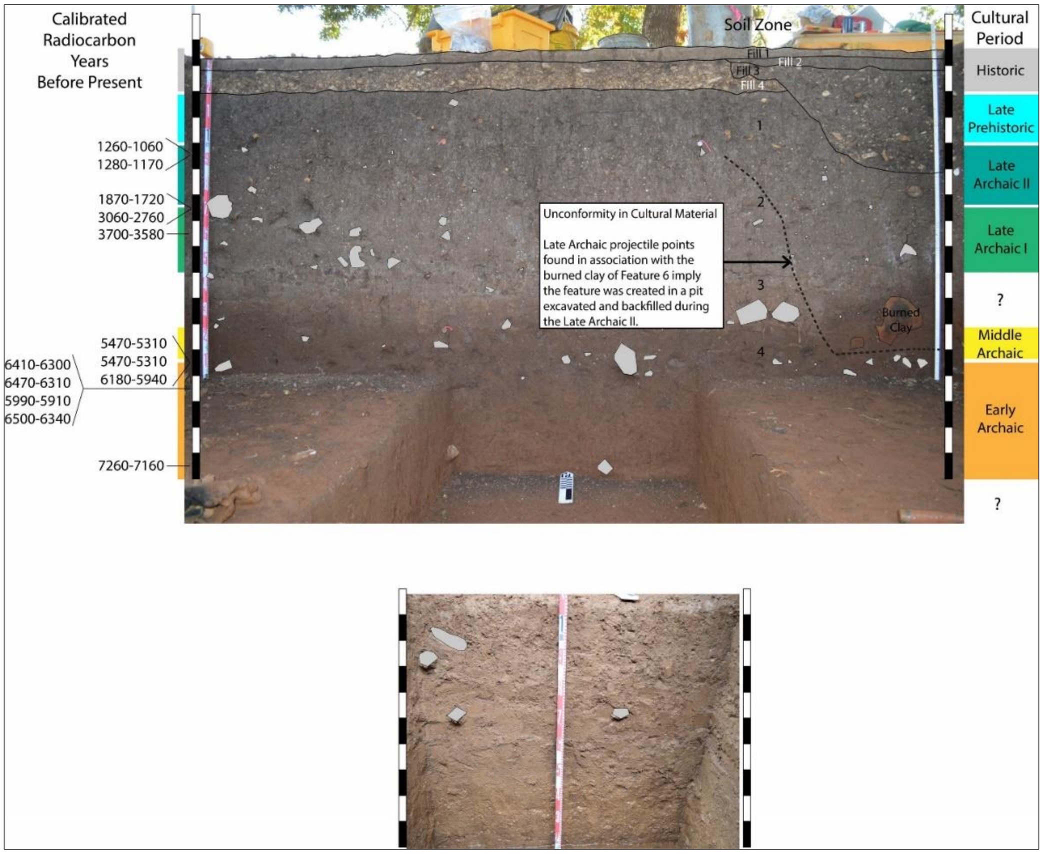

Figure 10-20. North wall of secondary excavation block showing unconformities.

The majority of the excavation units within the main block were excavated to 150 centimeters below datum (cmbd). Then, the main block was stepped in to a 2 x 3 meter block which was taken to level 20 (200 cmbd) at which point the water table was encountered. Then by using a water pump to draw out water seeping in from the walls, a single 1 x 1 m unit in the middle was taken to level 30 (300 cmbd). The north ends of the east and west profiles of the main block correspond with the south end of the field school block excavation units. Therefore, those profiles are the best representations of the stratigraphy encountered during the 2001, 2002, 2003 and 2006 field school excavations (Figures 10-21 and 10-22).

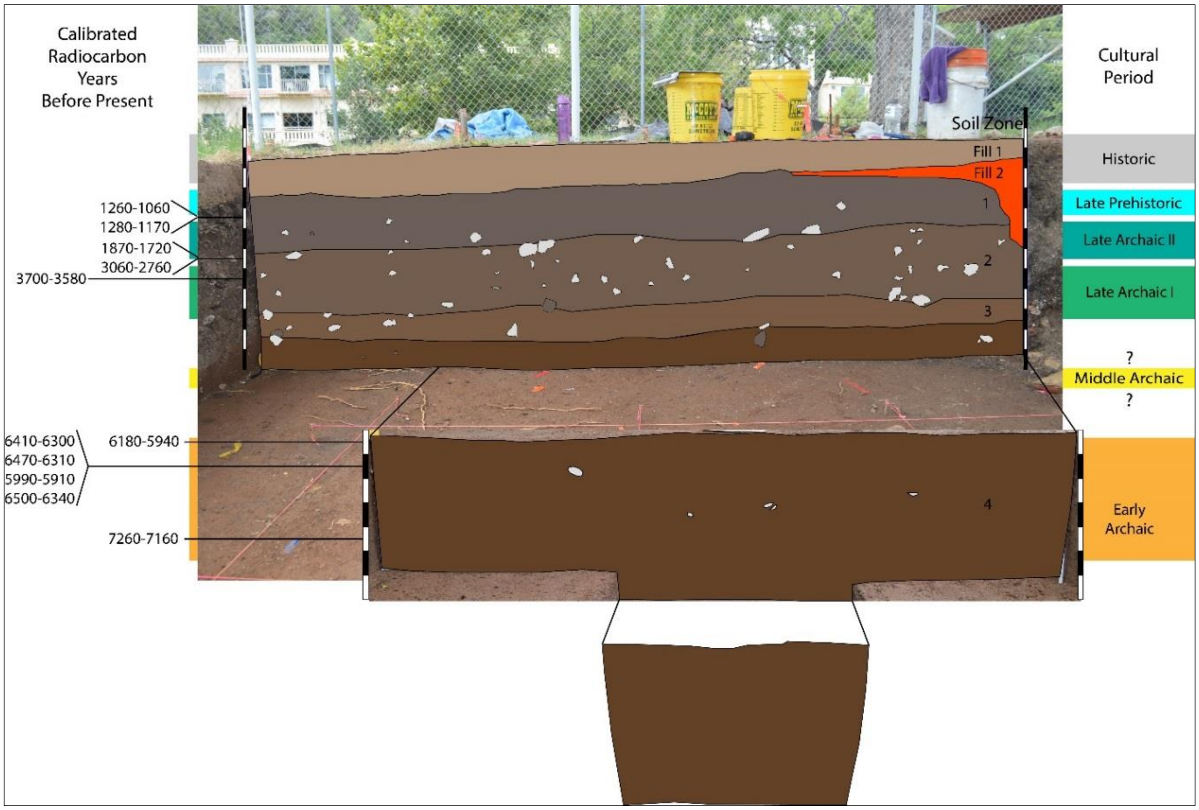

Figure 10-21. West profile of main excavation block from 2014 Spring Lake Data Recovery Project with radiocarbon dates and associated cultural periods.

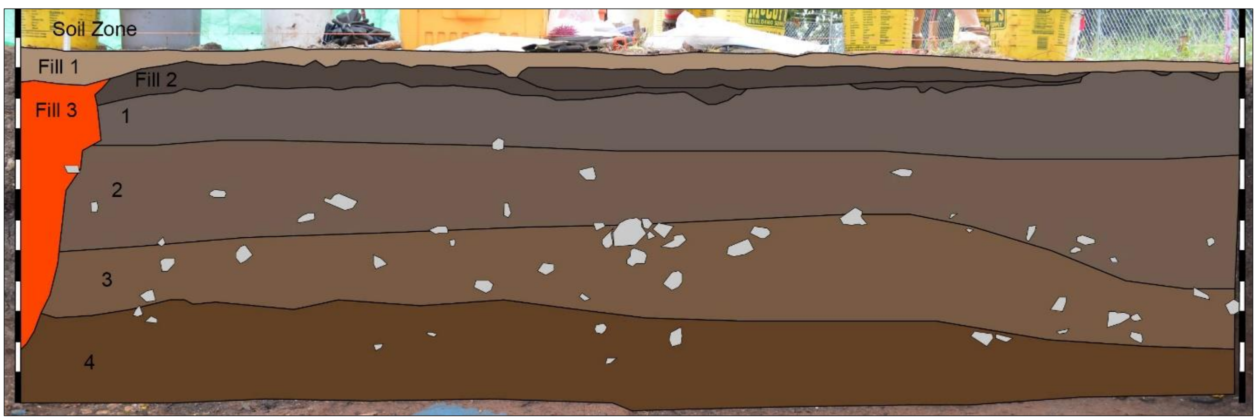

Figure 10-22. East profile of main excavation block from 2014 Spring Lake Data Recovery Project with soil zones enhanced.

Soil Zone Descriptions

These descriptions apply to both excavation blocks of the SLDR as the only differences between the two lie in the varied width of zones. The descriptions of each zone do not vary any more significantly between the two blocks than they do between any two units within the same block. In total, 4 zones were identified during excavations. These zones were named from shallowest to deepest

Zones 1 through 4. Zone 2 was subdivided into Zone 2a and 2b. Zone 3 was subdivided into Zones 3a, 3b, and 3c.

Zone 1

Zone 1 is a recently deposited topsoil laid down by the United States Army Corps of Engineers (USACE) following the completion of the Spring Lake Aquatic Ecosystem Restoration Project (SLAERP). Prior to laying down Zone 1, USACE scraped an amount of top soil off of the area that was supposed to be 6 to 8 inches. The purpose of this sediment removal was to remove exotic grasses. It is difficult to determine if the depth of the sediment removal was inconsistent or if the former ground surface was less even than it appears in field school photographs; however, the lower boundary of Zone 1 in the main block slopes slightly to the west, and the thickness of the imported topsoil triples in the same direction. The thickness of Zone 1 in the main block varies from 3 cm on the east side to 20 cm on the west. The thickness of Zone 1 in the small block is more uniform and similar to that of the eastern side of the main block. Zone 1 is a 7.5YR 6/3 loam; structureless with few inclusions other than plastic trash; Very abrupt, smooth lower boundary.

Zone 2a

Zone 2a is a 7.5YR 3/1 clay loam which appears to be a top soil formed or perhaps deposited on top of a former gravel parking lot. Zone 2a is up to 5 cm in thickness, but is irregularly present and difficult to immediately differentiate from Zone 1. Much of Zone 2a may have been scraped away by USACE. Artifacts in Zone 2a range from late historic to modern trash including most notably numerous fruit/produce stickers—area was formerly known as the Pecan Grove and was the location of school-group picnics for at least the past 15 years. Lower boundary is abrupt, smooth. In the southwest corner of the main block, Zone 2a is overlain by a thin layer of bright orange sand (baseball diamond sand) which appears to have been imported to fill the sandbags which were placed in the fieldschool block.

Zone 2b

Zone 2b is a likely historic deposit of poorly sorted, well rounded limestone gravels to cobbles which is anecdotally a parking lot surface. The matrix material is a 7.5YR 3/1 clay loam virtually identical to that of Zone 2a. Few artifacts other than late historic to modern trash, mostly pop tops and plastic scrap. Zone 2b is up to 7 cm in thickness, but pinches out to the south and west in the main block, but exists in more or less uniform thickness (5 to 7 cm) across the small block.

Zone 3a

Zone 3a is what appears to be the topmost *in situ* soil, likely an A to AB horizon. It is a 7.5YR 4/1 clay to clay loam; very hard consistence; angular blocky structure; common roots very fine to very coarse; ~2% snail shell; ~2% coarse fragments including both burned rock and rounded gravels (likely fallen through surface cracks from Zone 2a; many peds in the southwest corner of the main block have orange coats almost certainly from the orange sandbag sand); gradual smooth lower boundary.

Zone 3b

Zone 3b is more clearly a B horizon. It is a 7.5YR 4/2 clay loam; hard consistence; sub-angular blocky structure; common roots fine to very coarse; ~5% snail shell—mostly fragmentary; ~5% burned rock; ~2% other coarse fragments; gradual smooth lower boundary.

Zone 3c

Zone 3c is a B to Bk horizon with no $CaCO_3$ development other than some strangely permineralized roots. Zone 3c is a 7.5YR 4/3 clay loam; moderately hard consistence; sub-angular blocky structure; common roots fine to very coarse; up to 10% snail shell—mostly whole; 10-15% burned rock (increasing to west in large block; relatively uniform in small block); ~2% other coarse fragments.

Zone 4

Zone 4 is a Bk horizon, increasing to a Bkk horizon at 2.5 to 3 m in depth. It is a 7.5YR 3/4 clay to clay loam; slightly hard consistence (furthest from water table at about 200 cmbd); sub-angular blocky to granular structure; few roots fine to coarse; 10% snail shell in first 10 cm, drops to 3% after that—mostly whole; 3% burned rock; 2 % coarse fragments.

Overall, stratigraphy observed during the 2014 SLDR excavations was found to be largely intact in both excavation blocks, although some small vertical movement of cultural material is likely to have occurred due to bioturbation and the shrink/swell properties of the clayey vertisol. The exposed soil profiles consist of 4 zones of native soil capped by 2 zones of widespread imported fill. The uppermost stratum labeled "Fill 1" is a loamy soil imported by the Unites States Army Corps of Engineers (USACE) in 2012 as part of the Spring Lake Aquatic Ecological Restoration project (Leezer et al 2011). Prior to the importation of the USACE loam, the entire peninsula was bladed to a depth of 10 to 20 centimeters in order to remove non-native grasses brought in during the days of the Aquarena Springs amusement park. Although great care was taken to avoid removing native soil (and cultural material with it), the uneven nature of the ground led to a small amount (probably less than 10 cm) of native soil being removed from the west side of the main excavation block. The uneven cut of the uppermost soil is visible from the south wall profile of the main excavation block (Figure 10-23). The native soil in the majority of the main and secondary blocks was capped by a previously imported gravel (note gravel labeled "Fill 3" in Figure 10-23), which was part of a parking lot for the Aquarena Springs amusement park. It is unclear how much, if any, native soil was removed for leveling prior to the importation of the parking lot gravel. The 4 zones identified represent native alluvial soil and follow a typical A, AB, B, Bk progression with no clear markers for widespread unconformities. In the west profile wall (see Figure 10-21), Fill 2 is the backfill of the excavation block of a 2006 Texas State archaeological field school. The field school excavation block was left open for several years resulting in the collapse of the upper parts of the walls and the sloping nature of Fill 2. Fill 2 is contained between two unconformities.

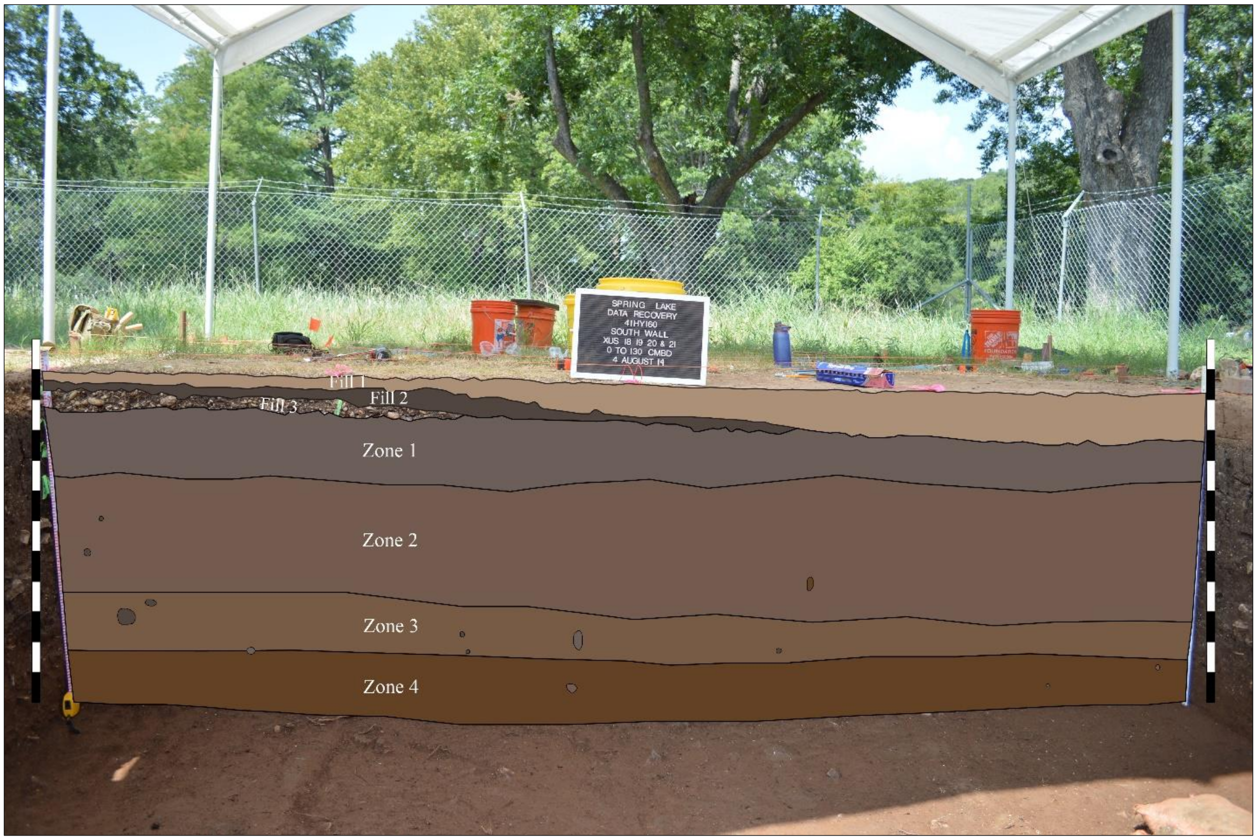

Figure 10-23. Illustration of the south wall profile from the 2014 Spring Lake Data Recovery project.

Summary

Altogether, the investigations described above demonstrate clearly that the sediments in Spring Lake have potential to hold *in situ* prehistoric cultural materials, including organics, ranging from Paleoindian to Late Prehistoric. However, several problems are apparent. According to Nordt's (2010) analysis, very little deposition of Paleoindian age remains, having been truncated sometime before 5900 B.P. By Nordt's model the vast majority of intact sediments making up the Spring Lake Peninsula (6 to 8 meters) have been deposited since 5900 B.P. The results of the recent Ticket Kiosk Excavation (Lohse et al. 2013) appear to contradict Nordt's hypothesis, demonstrating that undisturbed deposits as old as 6000 B.P. rest at only 2 meters below the surface. CAS's testing of the sediments around the submarine theater complicates the picture further, showing that organic components of sediments very near the surface date to 16,000 B.P, while more deeply buried wood dates to only 11,400 B.P. Hooge's (2013) study, which employed new underwater geoarchaeological field and lab methods and his synthesis of more recent data (Leezer et al. 2011 and Lohse et al. 2013), resulted in major modifications to Nordt's deposition model (Figure 10-14), arguing the majority of sediments in the Spring Lake Peninsula were deposited during the Paleoindian and Early archaic periods. A summary of the authors' current understanding of the Geoarchaeology at the Spring Lake site (including sites 41HY160, 41HY165 and 41HY147) is presented below.

Sediments have been accumulating in the Sink Creek valley and the San Marcos Springs since at least 11,400 B.P., very near the beginning of the Paleoindian period (Figure 26). Given current dates of charcoal, wood and plant fragments, Unit IV and the Units A, B, C, and most of D identified by Nordt (2010), were deposited from as early as 11,390±50 B.P. (Beta 282624) through at least 5469±30 B.P. (DAMS 001781) at an average rate of at least 1.25 mm/year (Hooge 2013). The northwestern half of Spring Lake Peninsula has the potential to preserve Paleoindian through Early Archaic cultural features including organic material culture; the inundated banks, especially those behind the submarine theater, may exhibit these features on or near to the surface. This is consistent with the excavations performed in Spring Lake by Shiner (1981, 1984, 1983) who demonstrated the presence of Paleoindian and Early Archaic artifacts buried under only 1 to 2 m. Although 41HY147 was most likely the result of secondary deposition, cultural activity was clearly present around the San Marcos Springs. Areas on the upper terraces above the early anastomosing stream would have been more attractive locations for Paleoindian occupations; however, the remains of any activity areas associated with these occupations that were located on the early Spring Lake Peninsula may have been preserved in vertically discrete cultural zones given the high rate of sedimentation. Given a more established peninsula towards the end of this period, late Paleoindian and Early Archaic populations would have been more likely to camp nearer the springs.

Following the Late Pleistocene/Early Holocene erosion of mature soils from the uplands of the Balcones Escarpment, alluvial deposition on the Spring Lake Peninsula slowed considerably due to reduced unconsolidated sediment availability. Given a stabilized landscape, Middle and Late Archaic occupations on the peninsula are likely to have occurred with greater frequency, although preserved in deposits with less vertical separation and a higher frequency of disturbance to the sediment column due to pedogenesis and associated turbation processes. A perceived increase in the intensity of hot rock cooking by the presence of increased concentrations of burned rock is likely real but also exaggerated due to the greatly reduced rate of sedimentation during the same period.

At some time before 2400 B.P. deposition of channel gravels at the mouth of Sink Creek began to extend into the main spring channel. By 1600 B.P. the Cypress Point Peninsula had formed a large enough levee so as to raise the water level, establishing a small lake. Between 1645 B.P. and 1414 B.P., large amounts of organic material collected in the newly formed basin. Although the main spring channel was able to eventually cut through the levee, many of the lake deposits including the organic materials were preserved, yielding a good possibility for the preservation of terminal Late Archaic organic culture (Hooge 2013).

During the Late Prehistoric the rate of alluvial deposition around the San Marcos Springs was relatively low leaving at most only 10 to 20 cm of sediment. The large majority of deposits forming the topmost 1.0 to 1.5 meters of the modern lake bottom accumulated throughout the lake after 203±26 B.P.; these deposits consist of low-density, diatomaceous sediments which were most likely deposited following the damming of the San Marcos Springs in A.D. 1849 (Hooge 2013).

Chapter 11: Faunal Analysis

By Cinda Timperley

Introduction

The Spring Lake area in San Marcos, Hays County, Texas, has produced significant quantities of archaeological material and some notable faunal assemblages. Several sites have been recorded through various survey efforts in and around the spring-fed lake, north along the Balcones Escarpment, and south along the San Marcos River (summarized in Nickels and Bousman 2010, and Chapter 3 of this volume). Sites situated at or near the base of the escarpment and along the waterway appear to represent similar regimes regarding faunal remains. Bison, deer and pronghorn are prevalent at 41HY160 T-Box 6 locality (Garber et al. 1983). In the 41HY160 Phase I testing (Nickels and Bousman 2010) and at 41HY165 (Timperley and Leezer 2013) deer and pronghorn are the prevalent game animals, with bison less well represented. All these faunal assemblages are fortified with remains of snake, turtle and small mammals.

Site 41HY160 encompasses several projects undertaken in the vicinity of Aquarena Springs/Spring Lake. Among these projects is a series of field schools conducted from 2001-2006. The material recovered from the 2001-2006 field schools will be referred to here as the 41HY160 Field School Block, or simply FS Block, to designate it from other, pre-2000 survey and field school efforts as well as from later field projects. 41HY160 is one of the largest defined sites located around in the vicinity of Spring Lake and the Field School Block samples a small percentage of this area. The block appears to be dominated by a hearth/earth oven area that was used and re-used over time. Six units in the southwest portion (XU 10, 12, 8, 14, 16, 15) are dominated from about 120 cm to 150 cm, the lower limits of excavation, by burned rock features.

The 41HY160 FS Block preserves a multicomponent record spanning the Early Archaic through Prehistoric time periods. Some aspects of stratigraphy suggest a compressed record, and other aspects indicate that this record has been disturbed. However, much of the stratigraphy in the block is intact and temporally diagnostic chipped stone artifacts bracket the deposits. Further, 14C dating of bone samples provides more finely-grained temporal resolution, possibly extending or limiting the temporal ranges of certain diagnostic tool/point types. This correlation has allowed researchers to assign seven time-specific Analytical Units (AU) to excavation levels, providing a temporal framework for discussion of the archaeology. The AU include the Early Archaic (EA), Early Archaic-Middle Archaic (EAMA), Middle Archaic (MA), Middle Archaic-Late Archaic (MALA), Late Archaic (LA), Late Archaic-Prehistoric (LAPH), and Prehistoric (PH).

This zooarchaeological analysis focuses on four units along the south tier of the block (from west to east): XU 14, 16, 15, and 17. (Analyzed material from other XU in the block is not addressed here.) The faunal assemblage comprises 4656 NISP (number of identified specimens) with a total mass of 1.74 kg (3.83 lb). All five vertebrate classes are represented. Preservation of osseous material itself is generally moderately good, but highly fragmented. 68% of the study material (3167 NISP) is identifiable to Class or lower. 24% of this taxonomically identifiable material is burned. 12.7% of the taxonomically unidentifiable material is burned. Much of the larger-bodied mammal material (deer, pronghorn, bison) is spirally broken suggesting cultural processing for bone marrow or bone grease, with a low occurrence of tabular or irregular breaks. Turtle material is mostly broken along sutures. Remains of smaller-bodied vertebrates (smaller than deer) exhibit spiral breaks as well, and often remains are complete or very nearly complete elements.

The Spring Lake deposits are compared to and contrasted with other well-stratified, well-documented Archaic sites in Central Texas to gain a better understanding of procurement patterns that focus on bison and what adaptations are made when bison is not abundantly available. These comparative sites include Middle Onion Creek (41HY202, 41HY209, 41HY210; Ricklis and Collins 1994), Choke Canyon (41LK201; Hall et al 1986, Highley 1986), and Wilson-Leonard (41WM235; Collins 1998).

This chapter sets out to answer several specific questions regarding the procurement and utilization of faunal resources at Spring Lake, Hays County, Texas. First, what faunal material has been recovered from the 41HY160 2001-2006 Field School Block, and how was it procured? Second, in what taphonomic condition is the faunal material? Third, are temporal and spatial distribution patterns evident in the assemblage? This study will explore the cultural associations and implications of the faunal assemblage, both locally and regionally. More specifically, the evidence for procurement and utilization of *Bison* will be explored in its immediate temporal contexts and as part of a temporal pattern of subsistence for the Spring Lake area.

Organization of Chapter

This chapter begins by determining a suitable sample of material for analysis. An Analytical Unit (AU) is assigned to an excavation level in an excavation unit (XU) if the level has produced a temporally diagnostic artifact, and evidence of chrono-cultural mixing is limited to one adjacent time period. XU with higher proportions sound archaeological context are given priority in this study. This analysis is followed by discussion of cultural implications regarding procurement patterns, changes in subsistence foci through time, and regional significance of site. A summary closes out the chapter.

Materials and Methods

Description of Block. The 41HY160 2001-2006 Field School Block faunal assemblage was derived from a 4x3 m excavation block divided into 12 1x1 m excavation units (XU) (Figure 5-1). This block was set up around XU 6, a test unit dug prior to the 2001 field school work (*cf.* Nickels and Bousman, 2010). Of several units dug in a previous testing of the Aquarena Springs grounds, XU 6 appeared to have the most intact sedimentary profile (Aery 2007). Material recovered from XU 6 is not considered in this study.

Eleven units were excavated during field schools dating from 2001, 2002, 2003, and 2006 to a maximum depth of 150 cm below datum, comprising 14 or 15 levels of varying thickness, but with 10-cm thickness as the ideal. 161 levels in total were excavated.

The northern tier excavation units (XU) are numbered, from west to east: 11, 9, 6 and 7. The middle tier units are numbered, west to east: 10, 12, 8, and 13. The southern tier units are numbered, west to east: 14, 16, 15, and 17. Figure 11-1 illustrates spatial and temporal relationships of the excavation units and analytical units discussed in this section.

It is believed that the degree of disturbance in this area decreases from north to south, due to increasing distance from sites of modern construction activity. Cultural material recovered from the northern tier appears to have been displaced vertically, and sediments appear disturbed in profiles. Sediments in the middle tier also exhibit some mixing. Cultural material from the southern tier appears to have largely sound vertical context, and sediments in profile do not appear disturbed.

Field Collection Dates and Methodology. Southwest Texas State College/Texas State University conducted four field school sessions between 2001 and 2006. Manual excavation was conducted with hand tools. Faunal material was recovered with other material from arbitrary excavation levels by water-screening using 1/4–inch hardware mesh, garden hose, and spigots tapping into the municipal water supply (Aery 2007). Large items (size parameter undefined) were point plotted. Various samples, including resistivity, charcoal, and archaeomagnetic, were collected. Matrix was collected from each feature and further treated in the laboratory. Faunal and botanical remains and other material were recovered from feature matrix via flotation.

Field School Laboratory Methodology. Lithic specimens were cleaned and sorted into analytical categories for projects at hand. Non-lithic samples, including sediment, susceptibility, and archaeomagnetic samples, were submitted to processing. Charcoal and bone were curated for future analyses. Matrix samples from the features were subjected to flotation treatment in the laboratory. Light fraction consists of material skimmed from the upper part of the water column with cheesecloth. Heavy fraction comprises of the material that did not float. This material was sieved through 1/8” mesh. The light and heavy fraction samples were curated for future analysis. A detailed explanation of the field and laboratory methods employed can be found in Aery (2007).

North Tier				
XU	11	9	6	7
LV				
1	62	31	*	1
2	63	32	*	2
3	64	33	*	3
4	65	34	*	4
5	66	35	*	5
6	67	36	*	6
7	68	37	*	7
8	69	38	*	8
9	70	39	*	9
10	71	40	*	10
11	72	41	*	11
12	73	42	*	12
13	74	43	*	13
14	75	44	*	14
15		45	*	15

Middle Tier				
XU	10	12	8	13
LV				
1	46	76	16	90
2	47	77	17	91
3	48	78	18	92
4	49	79	19	93
5	50	80	20	94
6	51	81	21	95
7	53	82	22	96
8	54	83	23	97
9	55	84	24	98
10	56	85	25	99
11	57	86	26	100
12	58	87	27	101
13	59	88	28	102
14	60	89	29	103
15	61		30	104

South Tier				
XU	14	16	15	17
LV				
1	105	134	119	148
2	106	135	120	149
3	107	136	121	150
4	108	137	122	151
5	109	138	123	152
6	110	139	124	153
7	111	140	125	154
8	112	141	126	155
9	113	142	127	156
10	114	143	128	157
11	115	144	129	158
12	116	145	130	159
13	117	146	131	160
14	118	147	132	161
15			133	162

- Prehistoric
- Late Archaic/Prehistoric
- Late Archaic
- Middle Archaic/Late Archaic
- Middle Archaic
- Early Archaic/Middle Archaic
- Early Archaic

Figure 11-1: Excavation Unit (XU) levels with AU assignments. Lot numbers are included in the appropriate XU cells. Units are listed (left to right) from west to east.

Criteria for Selection of Study Material

While as much care as possible is dedicated to accurately assigning taxonomic and elemental identifications and extracting high-quality data from a collection, some expeditiousness must be practiced when analyzing a large collection under limited resources. With this in mind, the sample was limited to the faunal material recovered from the 77 levels with good temporal context out of the 161 total excavated levels.

Qualifying Material. All skeletal material from Quaternary sediments initially qualified for analysis in this study. Based on degree of disturbance seen in the north and middle tiers, the study sample ultimately was narrowed to temporally-defined levels in the south tier of the block, XU 14-17. Excluded are any lithics, geologic specimens, Cretaceous invertebrate fossils, contemporaneous rhizoliths, and modern botanical material that were sorted from the bulk fauna. Bones and teeth and fragments thereof from levels assigned AU were used. Feature material was not included. Float material, except for fish remains, was not analyzed. While not all AU are represented in each XU, at least one level of each AU is represented in this tier of units.

Of the 161 levels excavated, 77 (47.8%) yielded time-diagnostic cultural material. This material allowed for assignment of temporally based AU to each of these levels (see Figure 11-1). Fifty-eight of these 77 levels (75%) originally were selected as the sample assemblage. This sample included material from all eleven units. The north tier contained 11 AU, 6 of which were to be included in the study. The middle tier contained 33 AU, 20 of which were to be included in this study. The south tier contained 33 AU, 32 of which were to be included in this study.

However, since it was determined that the south tier of units had the best stratigraphic integrity, the north and middle tier of units were subsequently excluded from the study sample. The final study sample comprises 32 lots from four XU representing all the AU defined in this excavation block. This allowed us to skip over the upper and possibly heavily disturbed levels and move right to levels with intact stratigraphy and good time control. Since we are also trying to answer questions regarding labor shifts and bison procurement, this also allowed us to move more immediately to levels that we believed would yield bison material. Levels that were targeted for 14C dating of *Bison* bone were so chosen due to association with Calf Creek components.

Zooarchaeological Analysis Procedures

Preliminary sorting. A preliminary sorting of the faunal material was conducted during the initial curation stages, when the material recovered from the various field schools was washed, sorted, tagged and bagged for storage. The faunal material from standard excavation was bagged as bulk samples per lot and tagged accordingly. Material derived from feature matrix float samples also was in bulk form, divided into light and heavy fraction. The float material was sorted into currently employed analytical categories in the laboratory by CAS staff in 2010. Fish material was pulled from all lots and from the feature material and sent out for identification and comment.

Analysis sorting. A secondary sort was conducted for the current study. In this secondary sort, the specimens were divided out, classified and recorded as per taxon, element, AU and taphonomic condition. Tags were made for each unit of division, and specimen numbers were assigned at this stage. The goal of this sorting was to categorize material for analysis and interpretation.

Identification. Lots were sorted one at a time to maintain provenience integrity. Material was first sorted by whether it was burned or unburned, then by element, and lastly by taxon. Taxonomic identifications were assigned to family or genus level, if identification confidence was high. More ambiguous material was compared to figured specimens and to comparative material held in-house and in the Recent Osteology Collection in the Vertebrate Paleontology Laboratory of the Texas Natural Science Center at The University of Texas at Austin. Thanks go to Drs. Timothy J. Rowe, Lyndon K Murray, and Ernest L. Lundelius, Jr., for granting access to and use of the collections there, other assistance, and discussions.

Vertebrate classification followed several sources. Susan L Jackson from University of Southern Mississippi conducted analysis on the fish material. Classification of fish material here followed Nelson (2006) and Roe et al. (2002). Herpetofauna classification (amphibians, snakes and turtles) followed Holman (2000) and Dixon (2000). Avian classification follows Gill (1995). Mammalian taxonomy generally followed Jones and Manning (1992) and Jones, Armstrong and Choate (1985), but also after Dewey and Ng (2001), and Wilson and Reeder (2005). Bovid postcranial skeletal identifications followed Todd (2001). Online material was double checked against peer-reviewed published material and comparative specimens.

Quantification. Archaeologists routinely want to know how much faunal material was being utilized in order to answer various subsistence-based questions and there are multitudinous philosophies regarding the tallying and accurate representation of the volume of biomass associated with the lithic assemblage from a site. This project does not deviate from that routine, so great effort was made to accurately represent in verbal form the amount of faunal material recovered from 41HY160 FS Block.

Specimens were weighed, measured, counted, and tagged. Elements diagnostic to genus or species such as teeth and jaws were tagged and packaged separately, and assigned specimen numbers. Specimen numbers were assigned to all specimens/groups of specimens.

Modified Bone. Most of the faunal material has been somehow altered, meaning it had been broken, consumed, otherwise modified, or a combination of these. Bone in the FS Block assemblage was not simply broken. Several fragments also exhibited gnawing by rodents; gnawing, puncturing and scalloping by carnivores; and carcass-processing and tool-making modifications made by humans.

If the specimen was broken, then attempts were made to determine the timing of the breakage. Regardless of break timing, attempts were consistently made to mend fragments in order to avoid a falsely inflated inventory with respect to processed bone. If the break is old, mends were attempted. If mended, the specimen was tallied as "n fragments, note mend on old breaks; n element(s)". The counts reflect as many elements as there are fragments, because the breaks are likely to have occurred preburial. If no mends were found, specimens were tallied as "n fragments, no mends". If the break was a fresh break, mends were attempted; tallying was similar to that for bone with old breaks, but with different taphonomic implications. Mended specimens were counted as "n fragments, mend one element on fresh breaks," and if not mended, counted as "n fragments with fresh breaks, no mends".

It is important to note the difference between an old break (i.e., one committed in prehistory), versus a fresh break (one committed during collection/processing) because of the clear effect on the NISP (Number of Identified Specimens) value. A fresh break speaks to taphonomic condition and its influence on robusticity/resilience with respect to recovery and collection procedures. Old breaks speak of treatment prior to burial. The characteristics of the break impart different information depending on the nature and timing of the break.

Archaeologically broken bone tends to have patination over its entire surface—the cortex, the trabecular portions, and the break surfaces. These "old breaks" can be attributed to archaeologically-emplaced activity. Bone broken diagenetically also tends to have patinated break surfaces, and may be difficult to distinguish from anthropogenic breakage. However, diagenetic breaks are usually not spiral in nature since the bone is no longer fresh after a period of post-burial time.

Bone broken in prehistory possesses a taphonomic signature that is part of the archaeological story of that specimen. Bone broken during collection or later has a taphonomic signature that is not part of its archaeological story but a part of the taphonomic history nonetheless, since data recovery is part of the story of the specimen. Essentially, one femur broken into 50 fragments is still only one femur. A consistent attempt to refit fragmentary specimens within the current study ensures the most accurate minimum number of elements.

Data-recovery broken bone has been broken during excavation, screening, cleaning, and/or curation. The surface of a fresh break will usually have a different color and texture compared with the patinated surfaces. In the case of 41HY160 bone, the patinated bone is often a tan to brown color, and white, blue-gray or black if burned, and can be matte or glossy in either case. The break surface on a freshly broken bone often appears much lighter in color, approaching a pale peach-yellow. The break is irregular, jagged and can also be grainy or otherwise uneven in texture. In burned bone sometimes the color difference is minimal, but the sheen of the break surface will differ from that of the patinated surface.

Curation and Record-keeping. Specimen tags were made in a fill-in-the-blank format, and the necessary information was hand-written in pencil. Tags were placed in plastic sleeves before inclusion in the specimen bag to prevent contamination of the bone or smudging of the tag. Final curation tags were laser-printed on archival paper.

Abbreviations and Definitions

The following abbreviation list and glossary define frequently used terms in this chapter. Where possible, discipline-wide standards used in vertebrate paleontology, zoology, and zooarchaeology, especially the mammalian focused subdisciplines, have been employed.

- *Institutions.* CAS: Center for Archaeological Studies.
- *Temporal*. AU: Analytical Unit; EA: Early Archaic; EAMA: Early Archaic-Middle Archaic, mixed; MA: Middle Archaic; MALA: Middle Archaic-Late Archaic, mixed; LA: Late Archaic; LAPH: Late Archaic-Prehistoric, mixed; PH: Prehistoric. NOAU: No Analytical Unit assigned. NR: No recovery.

- *Anatomical*. Dental material is described using upper case letters for the maxillary teeth and lower case letters for mandibular teeth: I/i – incisor, C/c – canine, P/p – premolar, M/m – molar, D/d -- deciduous; 1, 2, 3, and 4 indicate tooth position in series.

- *Animal Body Size Definitions*. Body masses were collected from various sources in mammalian literature. Based on such data, taxa were sorted into categories. Since some of these had a range that might overlap into the next smaller and/or larger size range, the methodology was adjusted to consider common-sense categorization as augmentation to the strict mass classification.

Categories are listed below roughly in decreasing order of size:

- Mammalia, large—probably bison, but not enough diagnostic characters to confidently assign to *Bison* sp.

- Artiodactyla, medium—deer- and pronghorn-size, but not enough diagnostic characters to confidently assign to one or the other taxon.

- Mammalia, medium—canids (*Canis* spp., coyote, dog, wolf); foxes (*Urocyon cinereoargenteus*; *Vulpes* spp.), raccoon (*Procyon lotor*).

- Mammalia, medium-small—cottontail rabbit (*Sylvilagus* spp.), opossum (*Didelphis virginiana*), beaver (*Castor canadensis*), porcupine (*Erethizon dorsatum*).

- Mammalia, small—squirrel (*Sciurus* spp.), wood rat (*Neotoma* spp.), cotton rat (*Sigmodon* sp.)

Taphonomy

Generally, excepting breakage, the Field School Block assemblage appears fairly well preserved. A few examples of relatively extreme **weathering** exist. Some lots comprise bone fragments exhibiting a range of weathering severity, suggesting that bone processing (and discard) was a continual activity at this locality. Along this same topic, bone fragments in some lots exhibit only smooth spiral breaks as well as jagged spiral breaks. Outram (2001) notes that bone that has been boiled will break somewhat differently than fresh bone, giving the break surface a jagged appearance.

Chemical etching, in the form of sinuous canals and circular pits, has been observed on a small number of specimens. The presence of rhizoliths in the matrix indicates that calcium carbonate has been mobilized and redeposited. Given this, it is safe to suggest that the observed etching is due to diagenetic processes rather than digestive chemicals.

Scavenging activity was recorded in the current study population in the form of rodent gnaw marks observed on several specimens, mostly on artiodactyl bone. Scalloped limb bone ends, and punctures ca. 0.5-1.0 cm in diameter indicate carnivore activity. The nature of observed **bone breakage** was recorded and noted as fresh (broken during archaeological recovery/processing), spiral—smooth, spiral—jagged, rectilinear or tabular, or impact. A significant amount of bone was burned. **Burned bone** was noted as charred, calcined, or calcined and crazed.

Cultural modification is largely represented by butchery cut marks, but some pieces have more industrial or aesthetic modifications as well. **Butchered bone** exhibits one or several short, shallow cuts that appear to have been made by a tool blade held perpendicular to the cortical surface. Also, on some specimens the cortical surface appears to have been scraped, as numerous longitudinal subparallel striae would indicate. Some pieces are fashioned in to tools (awls), ornaments (bone beads), or other objects (polished tabular bone). A few discard pieces from bone object production have also been recognized, and they exhibit hack marks and cut-and-snap furrows. Broken awl tips with polish comprise most of the bone tools recognized in the assemblage.

Fish bone generally is broken but well preserved - that is, the bone is not chalky or otherwise disintegrating. Vertebral spines are missing, leaving sharp breaks not truly classifiable as spiral or jagged. Scales are often complete or have a small portion broken, and some exhibit slight delamination. Skull bones are usually broken and often exhibit at least an irregular sharp break, but sometimes also appear to be eroded. This erosion may simply be diagenetic dissolution or could be due to partial digestion, but does not appear to be due to abrasion. Fresh breaks are visible on only a small number of fish bones. Very few fish bones are burned.

Few amphibian bones were recognized in the study assemblage. Amphibian bone largely derives from the MA deposits and consists of frog/toad ilia plus one scapula. A single Anura vertebra was recognized from the LA. All specimens have old, sharp breaks, and some ilia also exhibit sinuous etching and/or indeterminate etching. The vertebra also exhibits sinuous etching.

Numerous snake vertebrae were recovered, and represent all AU. Very few specimens are burned. Those that are tend to be charred, but there are a few that are calcined and one appears also to have undergone some mineralization. Unburned specimens generally exhibit a combination of breakage and surface degradation. The vertebrae are minimally weathered, less than 50% chemical etching, about 50% exhibited fresh breaks. The majority of breakage is prehistoric, with neural spines and hemal keels the most commonly broken portions. Some appear to have been partially crushed, as if by chewing. Some also exhibit some abrasion or digestion of protrusions.

Turtles are almost exclusively represented by shell fragments. Few cranial elements can be identified within AU context. Post-cranial elements are only identified in general/surface/backdirt recovery. Shell is fragmentary, but breaks are mostly along natural sutures. Some fragments are broken across a plate; this is often seen on burned specimens. A small number of fragments exhibit fresh breaks. Old breaks that do not appear related to subsistence but may represent incidental abrasion mar a small number of specimens. Very few exhibit cut marks or carnivore puncture marks. 23% of the fragments are burned. Surface etching is either shallow sinuous furrows, or blotchy sub-circular spots or shallow pits. The break edges on affected specimens do not appear rounded, as would be expected in digested material. Therefore, it is likely that these specimens simply exhibit the marks of plant root and soil acid etching.

A variety of taxa are represented only by limited samples within the 41HY160 collection. Avian remains represent less than 1% of identifiable taxa. Bone is spirally broken and three of the specimens are burned. Rabbits are represented by jaws, teeth and postcranial material, and comprise 2.3% of the identified assemblage. Rodent remains, including *Sigmodon*, *Neotoma*, and pocket gophers, comprise 2.7% of the identified assemblage with negligible burned material. Complete and broken postcranials are present, primarily humeri and femora. Maxillary material represents both *Neotoma* and *Sigmodon*. Canids, procyonids, hominids and other medium-size mammals are sparsely represented. Canid and other carnivore material comprises teeth and broken postcranial material. Human deciduous teeth are also present in the sample.

Artiodactyls are represented by broken postcranial material, largely comminuted long bone fragments. These specimens exhibit spiral breaks with lesser occurrence of more ragged or tabular breakage in combination with the spiral breaks. Fragmentary dental material also represents the three artiodactyl taxa: *Bison*, *Odocoileu*s, and *Antilocapra*.

NISP and MNI

Several workers have proposed methods to quantify animal and element abundance in archaeological assemblages (Grayson 1984, Lyman 1994, Reitz et al. 1987, Klein and Cruz-Uribe 1984, and Marshall and Pilgram 1993). Marshall and Pilgram (1993) propose that MNI may be less reliable an indicator of element frequency than NISP when applied to highly fragmented assemblages. Because of the fragmentary nature of the samples from 41HY160, it has been decided that MNI would not be a useful tool for analysis. NISP has been used instead.

Discussion

Changes in Faunal Composition Through Time

Changes in faunal composition through time are best illustrated through the examination of material recovered from the southernmost row of the excavated Field School Block. This row includes units (from west to east): XU 14, 16, 15, and 17. These units have been determined to have the most intact preserved stratigraphy in the Field School Block.

Since meaningful conclusions can only be drawn from time-controlled settings, each level has been assigned a temporal designation, or Analytical Unit (AU), based on time-diagnostic stone artifacts or on 14C dates derived from mammal bone. The AUs defined at this block are Early Archaic (EA) (8800-6000 BP), Early Archaic to Middle Archaic (EAMA), Middle Archaic (MA) (6000-4000 BP), Middle Archaic to Late Archaic (MALA), Late Archaic (LA) (4000-1200 BP), Late Archaic to Prehistoric (LAPH), and Prehistoric (PH) (1200-420 BP). Dates follow Collins (1995) cited in Nickels and Bousman (2010). All AU recognized at the Field School Block are represented within these four units. XU 14 contained material from Middle Archaic (MA), Middle Archaic to Late Archaic (MALA), Late Archaic (LA), Late Archaic to Prehistoric (LAPH), and Prehistoric (PH). XU 16 contained Early Archaic to Middle Archaic (EAMA), MA, and LAPH material. XU 15 contained material from Early Archaic (EA), MA, LA, and PH. XU 17 contained MA, LA, and PH material.

XU 14 and 16 have levels designated with mixed AU affiliation, where XU15 and 17 do not. XU 14 and 16 exhibit far greater feature activity than XU 15 and 17 (Figure 11-2). The features are described in the field notes as burned rock features. The features appear to be parts of an earth oven/hearth area that has been reworked over several generations. Notable amounts of associated burned chert flakes, fire cracked rock, burned bone, and other heat-damaged debris derived from in and around the field-defined features reinforce this diagnosis.

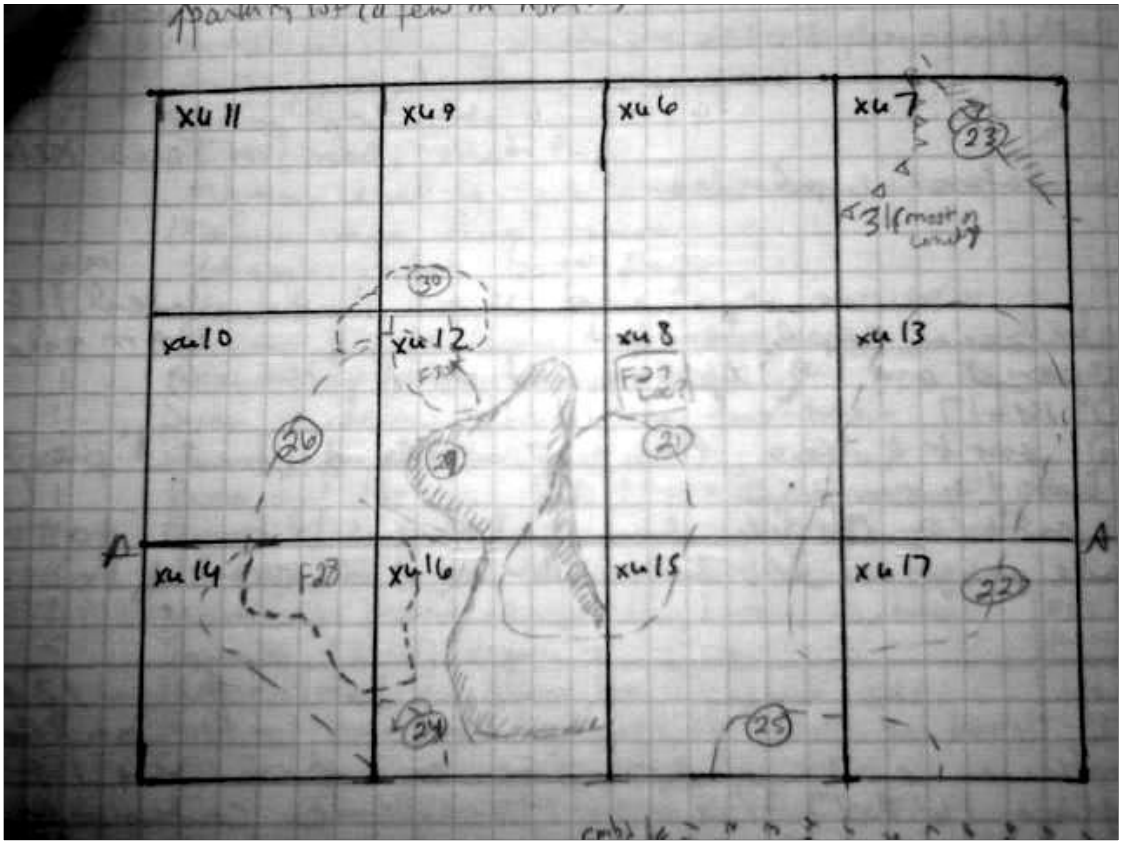

Figure 11-2. Compressed map view of Field School Block illustrating concentration of features recognized in southwest portion of block.

The assemblage comprises taxa from vertebrate classes that include fish, amphibians, reptiles, birds, and mammals. Unidentifiable specimens are assigned to Vertebrata. Mammals comprise the majority of specimens, followed in decreasing order by Reptilia, Osteichthyes, Amphibia, and Aves. Faunal assemblage composition shifts subtly through time, but remains largely consistent regarding major animal groups represented. These data illustrate shifts in faunal resource utilization through time from EA to PH.

Faunal Composition Through Time

With the exception of Amphibia and Aves, which have a sparse representation in this assemblage, major taxonomic groups are represented throughout the archaeological record at Spring Lake. Species richness (here taxon richness) changes somewhat through time. Recovery has been standardized using information on the EA, MA, LA, and PH as modeled in Yelacic and Lohse (2011) so that each AU samples equally. Standardization of occurrence per 100 years is accomplished via the following equation:

$$F_S = \frac{F_R/T}{V} * 100;$$

Where:

F_S = Standardized Frequency
F_R = Raw Frequency (raw number or mass of items)
T = Duration of AU in years
V = Excavated volume of matrix per AU in m^3.

Table 11-1. Standardized frequencies of taxa across AU

AU	T (yrs)	Vol (m^3)	R(NISP)	R(g)	F(NISP)	F(g)
PH	780	0.41	422	150.4	131.96	47.03
LA	2800	0.63	947	376.4	53.68	21.34
MA	2000	1.52	1919	648.1	63.12	21.32
EA	1800	0.1	270	91.4	150.0	50.78

Two sets of calculations have been run, for standardizing count (NISP) and mass (g) on the following groups fish, snake, turtle, bird, Leporinae (rabbits and hares), Rodentia (cotton rats, wood rats, pocket gophers), Carnivora (Canidae), medium-size artiodactyls, deer, pronghorn, bison, and fetal bone. These groups are variably lumped, e.g. all Leporinae, or split, e.g., Medium Artiodactyla, deer, pronghorn, as discussion requires.

Although taxa vary, fish remains have been identified from all AU at the site. Unidentified fish remains occur in all AU and are not included in these tallies. The MA exhibits the highest degree of diversity with 13 taxa identified in the southern tier. AU with low diversity (one taxon identified) include EA, EAMA, and MALA. Identification and analysis of fish remains has been performed by Susan Scott Jackson of the University of Mississippi. Her report is presented in Appendix E of this volume.

Table 11-2. Occurrence of fish remains from XU14-17 of 41HY160 Field School Block.

	EA	EAMA	MA	MALA	LA	LAPH	PH
Ameiurus			X	X			
Catostomidae			X		X		
Clupeidae							X
Ictalurus puctatus/furcatus			X		X		X
Ictalurus furcatus			X				
Ictalurus melas			X				X

Table 11-2. Occurrence of fish remains from XU14-17 of 41HY160 Field School Block.

	EA	EAMA	MA	MALA	LA	LAPH	PH
Ictalurus punctatus			X			X	
Ictaluridae			X		X	X	X
Lepisosteidae			X		X		
Lepomis					X		
Micropterus			X		X		
Minytrema melanops			X				
Morone			X				
Moxostoma			X				X
Perciformes	X		X				
Pylodictis olivaris					X		
UniD Fish	X	X	X	X	X	X	X

Some of the fish material provides information on seasonality. Vertebrae with preserved annuli from the LA indicate a late summer catch. Jackson's analysis indicates a change from smaller fish to smaller and larger fish. She suggests that this demonstrates an augmentation of technology, wherein fishing technique has broadened from seining in the EA to seining and trapping in the MA. Fish occurrence appears to dip from MA to LA before increasing again in PH (Figure 11-3).

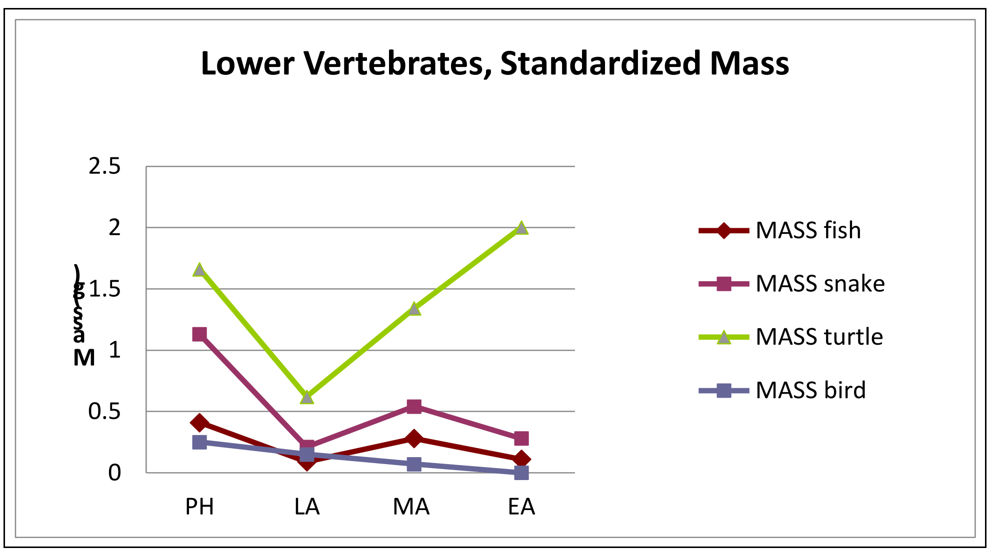

Figure 11-3. Temporal occurrence of lower vertebrates at 41HY160 Field School Block, standardized by mass.

Table 11-3. Temporal occurrence of amphibian, reptile, and avian material.

	EA	**EAMA**	***MA***	**MALA**	**LA**	**LAPH**	**PH**
Amphibia			X		X		
Anura			X				
Testudines	X	X	X	X	X	X	X
Serpentes	X	X	*X*	X	X	X	X
Aves	?	X	X		X	X	X
Gaviiformes (loons)						?	

Identified amphibian material is sparse. Only one anuran (frog/toad) has been identified in the sample. Reptiles are well represented in the assemblage, primarily by turtles, then snakes, and a possible lizard. Birds are sparse relative to other taxa but more abundant that amphibians. A possible loon bone in the LAPH suggests either a spring or fall hunt, as these are migratory birds. All lower vertebrates decrease from EA to LA, but fish and snake increase from EA to MA.

Mammal material vastly outnumbers material from the above-mentioned classes. Taphonomy appears to vary little from one AU to the next with regards to smaller-bodied taxa (ca. coyote and smaller). The postcranial remains of small-bodied animals tend to be complete or nearly so, with the exception of turtle material.

It is of interest to note that *Sigmodon* is nearly but not entirely ubiquitous throughout the archaeostratigraphy at 41HY160. It also occurs through most levels of 41LK201. Steele (1986) says there are two species of this genus observed in Texas: *Sigmodon hispidus*, and *Sigmodon ochrognathus*. Today, *Sigmodon ochrognathus* occurs in the Chisos Mountains, Big Bend area, and *S. hispidus* occurs widespread across the state. Steele gives a tentative identification of *S. hispidus* to samples from 41LK204, and therefore justifies the ecological interpretation of grassland habitat at the time of deposition. Species identification is not assigned to the *Sigmodon* sample from 41HY160 because some of the material is not entirely diagnostic to *S. hispidus*. However, *S. hispidus* occurs in the vicinity of the site, and probably occurred here in antiquity.

Specimen 156-23 (MA) is a cheek tooth fragment, broken/mend, that is heavily degraded to where the crown pattern is obliterated. It may be assignable to either *Castor* or *Erethizon*. A diagnosis of *Castor* would supplement evidence supporting running water in the vicinity. Porcupines occupy mixed hardwood-softwood habitat. They prefer areas with cover and travel along brushy water courses and draws (Woods 1973). A range map published by Woods (1973) indicates occurrence with an eastern boundary that runs roughly North to South, and trends well west of Central Texas. Davis and Schmidly (1994) include Hays County in their porcupine range. This author has observed no fewer than six porcupines in Hays County, Texas, as roadkill between Austin and San Marcos between August 2009 and October 2011. This strongly indicates that the range has moved to the southeast in the past 40 years. An archaeological presence is reflective of the ecotonal boundary situated nearby. There is no evidence at this site, but it is possible that porcupine was desirable for its quills in antiquity.

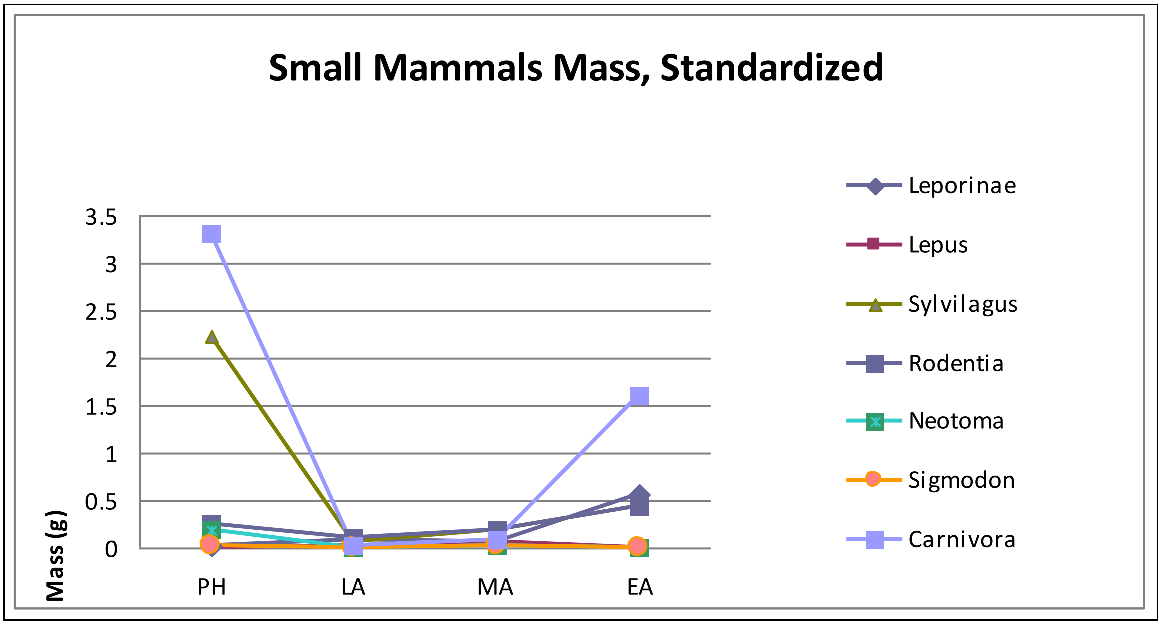

Figure 11-4. Occurrence of small mammals in the 41HY160 FS Block, standardized.

Table 11-4. Temporal distribution of identified mammals.

	EA	EAMA	MA	MALA	LA	LAPH	PH
Leporidae	X	X	X	X	X	X	X
Rodentia	X	X	X	X	X		X
Carnivora	X		X		X		X
Odocoileus	X	X	X	X	X	X	X
Antilocapra		X	X		X	X	X
Bison	X	**X**	X		X		X
UnID Mammal	X	X	X	X	X	X	X
Fetal	X	X	X		X	X	X

Small mammal occurrence drops from EA to MA, as deer and pronghorn increase (Figure 11-4 and Table 11-4). While it appears that deer drops precipitously between EA and MA, this is likely reflective of the bone condition and degree of identifiability of fragments. Concurrently Medium Artiodactyla increases and continues to increase through the PH. Pronghorn increases through time, probably reflecting an increase in prairie habitat. Most of the identified pronghorn specimens are teeth, so not likely to be heavily comminuted for bone greasing. Bison decrease through time may also reflect identifiability due to increased processing for bone grease. Fetal material, presumed to be Artiodactyla due to size of elements, occurs through the assemblage. This suggests springtime hunts in the area of Spring Lake.

In all, the graphs trend toward a decrease in small-bodied faunal remains between EA and MA, to increase again in the PH, but do not drop out completely. Large-bodied mammals increase in occurrence during the intervening periods.

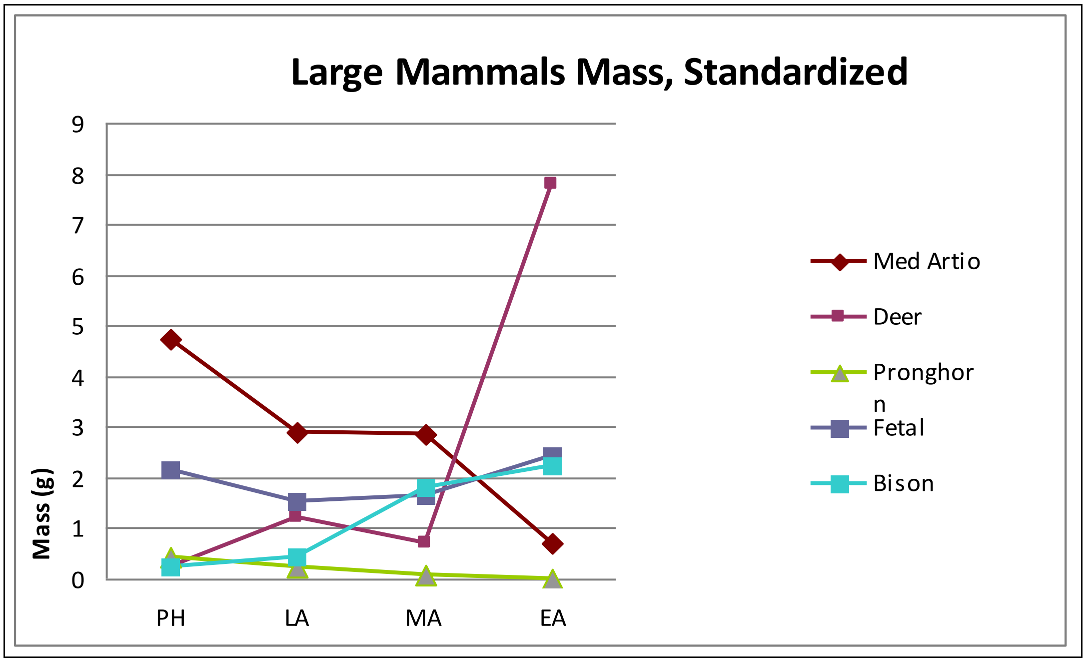

Figure 11-5. Occurrence of large mammals through time at 41HY160 Field School Block.

The small sample of EA material is moderately weathered and exhibits a variety of breaks. On larger specimens, breaks are helical with slight irregularity on the break surface. Most specimens are highly fragmentary, with breaks variable and difficult to classify.

EAMA material is spirally broken with some of the fracture surfaces almost perpendicular to the cortical surface, indicating some time passing between procurement and processing of the skeletal material (Outram 2001). Burned bone is present but does not dominate the assemblage.

There is some evidence of more intensive processing in the MA Artiodactyla bone. Not only was the bone broken for marrow (as evidenced by the presence of spiral breaks), it was also apparently boiled for further grease extraction (indicated by spiral/subspiral breaks, with break surfaces normal to the cortical surface). MA *Bison* specimens exhibit combinations of helical and jagged break surfaces illustrated in Outram (Outram 2001:406, figures 4 and 5). A small amount of cancellous bone (lot 143), rare in the 41HY160 assemblage, is preserved in this AU and also considered evidence of intensified bone-grease extraction (Outram 2001). Varying degrees of weathering observed on cortical bone fragments suggests that this excavation sampled an area routinely used for bone processing or disposal of bone-processing refuse. This preservation spectrum may also suggest that intense bone processing was also conducted as a matter of routine rather than seasonally.

Two examples of worked bone were identified in the MA assemblage (figure 7.7A, G). The first, 145-11 (figure 7.7, A), is a bone awl tip with point intact. The second, 157-25 (Figure 7.7, G), is a tabulate bone fragment with a polished end, possibly a burnishing tool.

Figure 11-6. Specimen 146-9 with breaks oblique spiral and perpendicular to cortical surface.

The LA sub-assemblage yielded several examples of worked bone as well (Figure 7.7: B-F). Specimen 125-22, a bone bead (Figure 7.7, D,), was recovered from the same lot as a bone shaft fragment with cut-and-snap scars (specimen 125-23, Figure 7.7F). Another possible bead fragment was also recovered, specimen 111-14 (Figure 7.7E). Specimens 153-14 and 154-36 are bone awl tips.

Figure 11-7. Bone tools, ornaments and production debris from 41HY160 Field School Block, south tier of units. A: Specimen 145-11, bone awl (Middle Archaic). B: Specimen 153-14, bone awl tip (Late Archaic). C: Specimen 154-36, bone awl tip (Late Archaic). D: Specimen 125-22, bone bead (Late Archaic). E: Specimen 111-14, possible bone bead fragment (Late Archaic). F: Specimen 125-23, ornament production debris—bone fragment with cut-and-snap scars (Late Archaic). G: Specimen 157-25, bone tool—possible burnisher (Middle Archaic).

Artiodactyla material and unidentified Mammalia material generally exhibit a mix of spiral breaks with smooth break surfaces oblique to cortical surface, and irregular break surfaces at or nearly perpendicular to the cortical surface. The cortex of the unidentified Mammalia fragments is variably weathered.

Preservation of bone similar to that seen in the MA sub-assemblage was also observed in PH samples. In summary, there does not appear to be much difference after the Middle Archaic in the intensity of bone processing. The nature of breakage as seen on the artiodactyl bone is similar from the Middle Archaic through the Prehistoric. This is apparent in the relative amount of bone that is identifiable to Medium Artiodactyla vs *Odocoileus* or *Antilocapra*.

Cultural Associations and Implications

Regional Significance

Spring Lake was probably continuously occupied prehistorically, although more intensive occupation and utilization during the Middle Archaic is suggested by the prodigious MA assemblages. As the regional climate was warming and drying, reliable water sources were in decline. Spring Lake's consistently flowing springs provided a constant source of fresh water. By extension, Spring Lake also provided a more reliable source of subsistence as species of edible plants grew nearby, and animals also utilized the water source. An increase in fish and turtle in the Middle Archaic assemblage indicates a broadening of the subsistence base as well.

Dillehay (1974) suggests there were large numbers of *Bison* coincident with moister periods and much smaller numbers during drier periods on the Southern Plains. At Spring Lake, *Bison* remains are recognized throughout all AU except the LAPH, suggesting that the springs mitigated climate shifts by providing a reliable water source, thus keeping larger mammals relatively nearby.

Bison Procurement and Utilization

Bison remains have been recognized in several lots in our sample (see Systematics section). But, overall, relatively few lots, only 0.8% of the identifiable assemblage (NISP = 3167), have produced bone confidently assignable to *Bison*. These samples have been sparse in quantity as well. Much bone, however, has been provisionally assigned to Medium or Large Mammal. And while Large Mammal could be synonymous with *Bison*, it is not assumed to be so. It appears that some of the Large Mammal may, upon further inspection, in fact be assignable to Artiodactyla, Medium. These bone fragments tend to have cortex of ca 4 mm thick, and a small relative diameter curvature to the outer cortex surface.

The hesitation to commit to a more precise identification derives from the potential for overlap in cortex thickness between the most robust individuals of deer and pronghorn and the most gracile individuals of bison. Robusticity in the medium artiodactyl taxa would suggest high quality available forage, and possibly that the specimens derived from bucks rather than does, as males tend to be somewhat more robust than females. *Antilocapra* mass varies seasonally, and males may be somewhat heavier than females (O'Gara 1978). *Odocoileus* subspecies in higher latitudes and altitudes tend have a larger body size than those closer to the equator and at lower altitudes. Males tend to weigh 20-40 % more than females (Smith 1991). However, if the specimens under discussion derived from *Bison*, it may indicate less desirable forage was available, or may indicate the specimens derived from cows rather than bulls, as *Bison* exhibit high sexual dimorphism in body size (Meagher 1986).

In the MA subset there are far more deer, antelope and medium Artiodactyla fragments than there are *Bison* fragments. There is nearly as much positively identified Odocoileus material as there is Medium Artiodactyla material. Foetal bone in this assemblage is extremely difficult to classify taxonomically, as it is highly fragmentary. Therefore, it is difficult to conclude that hunters were taking calving pronghorn as was demonstrated at Onion Creek (Ricklis and Collins 1994).

Changes in Subsistence Focus Through Time

Subsistence practices include the materials collected, processing methods, and whether materials are preserved for later use. Binford (1980) differentiates between foragers and collectors based upon the mode of gathering as well as whether resources are accumulated for later use. Foragers collect daily, often making seasonal residential moves between resource patches. Among foraging groups food is not typically stored. Group sizes are adjusted, and subgroups scatter or condense based on resource availability within extended foraging radii. Collectors, on the other hand, store food for at least a part of the year and organize task groups to obtain certain resources. Given these definitions, AU with more intensely processed artiodactyl bone could be interpreted as times when the collector mode was more prevalent.

Subsistence focus at the FS Block includes fish, frogs, snakes, turtles, birds, rabbits/hares, small and medium-sized rodents, canids, deer, pronghorn, and bison. Reliance upon these taxa vary with intensity through time. Co-occurrences of *Lepus* and *Antilocapra* in LA suggest hunting in open grassland setting and may have been opportunistic takes while on bison hunts. This co-occurrence may also suggest that hunters were moving farther from Spring Lake into the Blackland Prairie to find prey.

The non-mammal component of the assemblage includes fish, toads and frogs, turtles, snakes and birds. Through time, this component provides a consistent protein source. Small mammals (< 20 kg) vary somewhat through time, with a peak in the mixed MALA AU. If the counts for this AU were split evenly, the peak would occur at MA. That occurrence would be expected, given an increase in utilization intensity during this time period.

Gendered Tasks and Prey Preferences

This section would be incomplete without some discussion of gendered activity. Hide working and bone-greasing has been termed "women's work" ethnographically and archaeologically (Habicht-Mauche 2005; Scheiber 2005). Both activities are evident at the 41HY160 FS Block. The artifact assemblage includes bone awls (Figure 7.3) that are considered standard in the women's hide production tool kit. The faunal assemblage also contains numerous shattered bone fragments that exhibit breakage typical to bone broken for marrow and grease extraction (Figure 7.4) (Outram 2001).

Additionally, small-bodied vertebrates such as turtles, snakes, cotton rats and rabbits are also well-represented. These are animals that children could catch. Thus, the role that children played in protein contribution is not insignificant. Costa (1994) cited in Claassen (1997) discusses the increase in animal protein that women contributed in Southeast coastal settings by direct procurement of shellfish. Claassen reports that this procurement gave women in that context control and social power within their society. This example also serves to underscore that women were visibly contributing to the day-to-day protein ration.

At 41HY160, indeed in Plains archaeology generally, primary animal protein procurement has been largely credited to men in the role of big-game hunter. However, the faunal evidence here and at other sites in Central Texas (e.g., Lemke and Timperley 2007) is suggesting that women and children provided consistent protein sources while men were punctuating the subsistence base with large game animals like deer and bison. While men procured the large game, it was the women who processed said game to turn it into usable commodity.

Regional Comparisons

The faunal assemblage comprises 4656 individual specimens with a total mass of 1.99 kg (4.38 lb). Most specimens weigh less than 1.0 g, and the largest single specimen weighs 16.6 g. The highest relative amount of identifiable material derives from units assigned to AU MA-LA, where 58.4% can be identified beyond Vertebrata. A high percentage of identifiable small mammal remains bolster this number. The EA-MA ranks second, with 53.5% identifiable beyond Vertebrata. The LA-PH ranks lowest with 24.1% identifiable beyond Vertebrata.

In a line-graph comparison of small vertebrates from the 41HY160 assemblage, a dramatic decrease in the percentage of turtle represented coincides with an increase of snake (Figure 7-8). Rabbit spikes in the MALA but doesn't appear to coincide with a decrease of any other taxa.

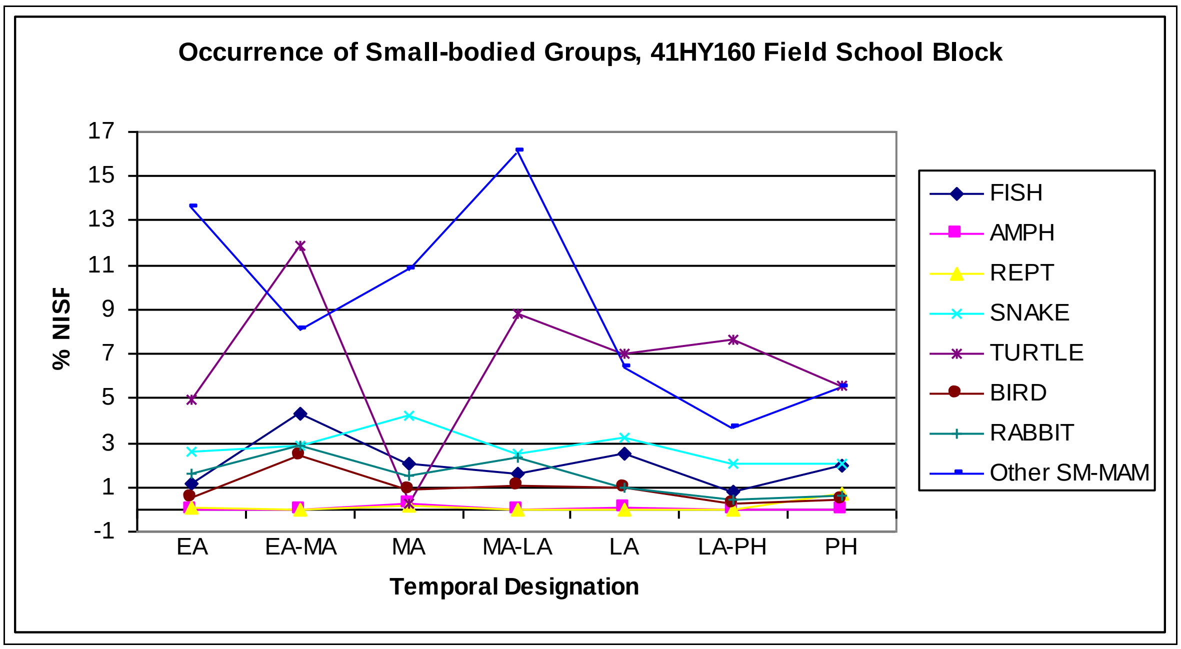

Figure 11-8. Occurrence of small-bodied taxa identified at 41HY160 Field School Block as a percentage of NISP per AU.

Subsistence trends through time at Spring Lake echo those seen regionally. When the highest ranked resource is not available, the next highest-ranked is procured. Here we see deer and/or pronghorn taken in the absence/scarcity of Bison. This trend is superimposed on the trends occurring in lower-ranked resources. Fish, turtle, snake, rabbit and rodents vary somewhat through time, but turtle and rabbits appear to be more consistently utilized.

Shifts from forager to collector (Binford, 1980) can be seen from the Early Archaic, through the Middle Archaic and into the late Middle Archaic. Breakage and surface degradation of artiodactyl bone indicates an intensification of bone processing during the Middle Archaic. Intensification in bone processing increases through the Prehistoric, as seen in the condition of bone fragments in this assemblage. A similar trend was noted at Choke Canyon (DeMarcay and Steele 1986; Steele and Hunter 1986) where an increased reliance on artiodactyl material was noted. Masson and Holderby (1994) also observed an intensification in fauna processing at Mustang Branch Terrace site.

The assemblage appears similar to those from nearby sites 41HY161 and 41HY165 (Oksanen 2008; Timperley and Leezer, 2013). Faunal material represents riverine/aquatic habitat as marked by fish and turtle remains. Cottontail and woodrat represent the diverse niches of the ecotonal boundary between the Blackland Prairie and the Balcones Escarpment canyonlands. Cotton rats, jack rabbits, deer, pronghorn and bison represent grassland and forest edge/scrubland as well. The FS Block assemblage is similar to 41HY165 in being highly fragmented, as is also seen in the Wilson-Leonard and Mustang Branch assemblages (Baker 1998, Masson and Holderby 1994).

Steele (1986:207-208) observed a pattern of occurrence through time similar to the pattern observed in the FS Block, when comparing number of identified elements per cubic m of matrix for rodents, rabbits and hares, and artiodactyls. Where rabbits decline artiodactyl counts increase, and vice versa.

The Field School Block multicomponent faunal assemblage exhibits patterns similar to other sites in Central Texas by providing evidence for an increase through time of bone processing efforts. These efforts manifest as more completely broken artiodactyl bone with breaks both oblique and perpendicular to cortical surfaces. Such breaks represent marrow extraction and boiling for grease. More bone is also so thoroughly comminuted that taxonomic identification is limited to class level. Ultimately, such evidence supports a local shift from a forager economy where people gathered food daily without putting aside to a collector economy where gathering occurred daily but food was also prepared for storage and use at a later time.

CHAPTER 12: SYNTHESIS AND CONCLUSIONS

By Amy E. Reid

The Spring Lake Site, 41HY160, is a multicomponent site located within the Sink Creek floodplain at Spring Lake on Texas State University property in San Marcos, Hays County. Evidence for prehistoric occupation in and around the San Marcos Springs extends from the Clovis period, approximately 13,500 years ago, up until the arrival of Spanish explorers in the early 1500s. This State Antiquities Landmark is characterized by intact deposits extending as much as or more than 20 ft below the modern ground surface representing all time periods that define the local and regional cultural chronology. In 1998, the University began developing plans with the Texas Parks and Wildlife Department (TPWD) to establish the Texas Rivers Center to be located at the headwaters of the San Marcos River in the building occupied by the former hotel at Aquarena Springs. The University was required to comply with provisions of the Antiquities Code of Texas; in preparation for the construction of the Texas Rivers Center, a Phase I archaeological testing project was conducted by the Center for Archaeological Studies (CAS) in January 2001. These investigations demonstrated the presence of intact and well stratified archaeological deposits dating from Paleoindian to Late Prehistoric times (Nickels and Bousman 2010). Therefore, data recovery excavations were considered necessary to mitigate the loss of information anticipated from impacts associated with the proposed construction of the Texas Rivers Center. These data recovery excavations at site 41HY160 began in 2001, shortly after the testing project, as a three by four-meter excavation block located adjacent to Test Unit 6. In all, the mitigation investigations occurred during four separate field schools in 2001, 2002, 2003, and 2006.

The University ultimately terminated its plans to construct the Texas River Center to instead establish the Rivers System Institute in 2002 (presently The Meadows Center for Water and the Environment housed in the restored Spring Lake Hotel). However, in 2010 CAS began conducting detailed analyses of the data recovered from the investigations during the 2001, 2002, 2003 and 2006 University field school seasons. These studies were initiated in order to finalize the requirements of the Texas Antiquities Permit that was obtained for the four field school data recovery years. This report represents the final reporting for the mitigation efforts associated with the proposed Texas Rivers Center construction. Discussions presented within this report are drawn from the artifact collection and associated records including (but not limited to) student field notes, daily journals, unit level forms, unit level plan maps, artifact inventory sheets, and collected artifacts. Analyses were designed to reconstruct the distribution of artifacts and features at the site. These reconstructions, supplemented with new radiometric dates, provide the content for the present report.

A primary goal of the present analyses and report was to address the research questions established for the current study as well as for previous investigations at 41HY160 and nearby sites. These research questions, outlined in chapter 4, examine how humans adapted to natural changes in the environment and the availability of fluctuating resources. While not all of these questions were resolved directly, a primary contribution of this report is an emphasis on understanding the chronological sequence of the immediate Spring Lake area and relating this chronology to broader patterns of cultural and ecological change through time so that future studies can situate their findings within a solid chronological framework. Specifically, research was focused on characterizing the Middle Archaic period. Although intact Middle Archaic deposits are difficult to find within the Central Texas region, they are relatively extensive at Spring Lake. The 41HY160 field school excavations revealed Middle Archaic deposits with excellent contextual integrity. Therefore, the analyses presented in this report concentrated on providing temporal resolution and discussing subsistence and technological trends identified during the robust Middle Archaic component.

Analysis of the field school excavations, recovered artifacts and associated data have been able to, through the research domains presented at the beginning of this report in conjunction with associated methodologies, present a detailed perspective on prehistoric cultural adaptations in the Central Texas region. This chapter discusses the most significant interpretations derived from these analytical investigations within the context of these research domains, particularly in terms of how they contribute to ongoing investigations into hunter-gatherer adaptations of prehistoric periods in Central Texas cultural chronology.

Summary of the Data Recovery

Investigations during the 2001, 2002, 2003 and 2006 University field school seasons resulted in a total of 12 excavation units (Figure 5-1). Upon completion in 2006, all units were excavated to a final depth of 170 cm below datum. Approximately 24 cubic meters of sediment was excavated over four discontinuous summer session field schools. 31 fire-cracked rock features were identified, and over 151,000 artifacts were recovered from all four field school investigations including ground stone, modified flakes, bifaces, cores, core tools, unifaces, projectile points, faunal remains, shell and ceramic sherds.

Chronology

The recovered artifact assemblage represents continuous, multiple episodes of occupation dating from the Early Archaic to the Late Prehistoric, with the Middle Archaic being the most well-represented cultural period in terms of artifact density and stratigraphic integrity. In preparing for the analysis of the assemblage, a series of analytical units (AU) were established based on temporally diagnostic projectile points as well as radiometric dates obtained from 20 charcoal samples and 11 bison bone samples. Seven AUs were identified: AU 1, Late Prehistoric (Toyah and Austin); AU 2A, Late Archaic II; AU 2B, Late Archaic I; AU 3, Middle Archaic; AU 4, Early Archaic. These AUs provided the basis for all detailed, context specific analysis conducted and facilitate our understanding of behavioral changes through time. Accordingly, the following site chronology was established (Table 12-1).

Table 12-1 41HY160 Chronology

Point Type	Bison ^{14}C Age	Charcoal ^{14}C Age	Period	Analytical Unit (AU)
		765 ±20	Late Prehistoric	1A, 1B
Marcos		1245±20	Late Archaic/Late Prehistoric	1C
Ellis				
Montell				
Bulverde	2255±20	1790 ±20	Late Archaic I	2B
Pedernales	2210±20	2485 ±20		
	2955±20	2690 ±20		
	2985±20	2880 ±20		
		3320 ±20		
Bulverde			Late Archaic/Middle Archaic	2C
Travis				
Nolan				
Pedernales				
Andice		3855 ±15	Middle Archaic-General	3
Early Triangular		3900 ±20		
Travis		4205 ±20		
		4295 ±20		
		4520 ±20		
		4615 ±20		
		5155 ±20		
Nolan		4880 ±15	MA Clear Fork	3A
Travis				
Early Trangular			MA Oakalla	3B
Andice			MA Jarrel	3C
Lerma	5115 ±20	4140 ±15	Middle Archaic/Early Archaic	3D
Early Triangular	5120 ±20			
	5120 ±20			
Martindale	5060 ±40		Early Archaic	4
Merrell				

BP Dates calibrated using IntCal09 (Reimer et al. 2009)

Results of Analyses

Lithic Analysis

Lithic materials from 41HY160 were organized into the following categories: projectile points, bifaces, unifaces, flake tools, cores, debitage, hammerstones and groundstone artifacts. A total of (96) projectile points and point fragments were recovered from 41HY160. Of these, 65 are typeable dart points while 7 are typeable arrow points. Seventeen different point types were recovered, including: Lerma, Early Stemmed, Early Split Stemmed Variety, Martindale, and Merrell for the Early Archaic (n=10); Andice, Nolan, Early Triangular, and Travis for the Middle Archaic (n=34); Bulverde, Pedernales, Marcos, Montell, Ensor, and Ellis for the Late Archaic (n=21); Scallorn for the Austin phase (n=2); and Perdiz for the Toyah phase (n=5). Additionally, 10 unidentifiable dart points, 7 unidentifiable projectile point base fragments, 6 unidentifiable dart point barbs, and 1 unidentifiable arrow point were recovered. Four projectile points, morphologically similar to the Pedernales point style, were recovered from an Early Archaic context; were typed as an Early Split Stemmed Variety.

A complete descriptive analysis was conducted which examined tool use, task specialization, skill and style. Also, metric data was quantified for in order to identify trends and determine differences in the degree of variation fount within and/among Pedernales, Nolan, Travis, Early Triangular, and Bulverde point types. It was determined that Nolan points, were the most homogenous type followed by the Travis dart point. Bulverde and Pedernales point types were the most variable overall.

When the raw frequencies of all point types were examined by time period, it was found that a peak occurs during the Clear Fork Series of the Middle Archaic (Figure 6-52). When only looking at the projectile points from the established analytical units, it was found that the highest frequency also occurs during the Middle Archaic. The raw frequencies of projectile points were also examined within transitional periods, cultural strata containing projectile point types diagnostic of two or more different but consecutive time periods. Table 6-9 illustrates the spatial and temporal relationships of the excavation units and the assigned analytical units, including transitional AUs assigned to unit-levels containing time diagnostic projectile points from multiple but contiguous major time periods. This table also demonstrates the significance of the Middle Archaic occupation in terms of overall depth, richness of diagnostic artifacts and contextual integrity.

When standardized for differences in durations of time and volumes of excavated samples, the frequency of discarded projectile points suggests that the Middle Archaic was indeed the most heavily occupied period with 1.889 points discarded per century. A sharp incline occurs from the Early Archaic to the Middle Archaic, and then visitation declines during the Late Archaic and Austin phase of the Late Prehistoric period. It was determined that site occupation increases again during Toyah times.

The 2001-2006 excavations are the first to identify an intact Calf Creek component at the Spring Lake Site. The Calf Creek component was evidenced by the recovery of three Calf Creek artifacts within well stratified and datable contexts. The authors would like to remind the reader that the present analysis was conducted according to the belief that the Calf Creek horizon occurred during the Middle Archaic. The Calf Creek horizon is now thought to represent the terminal Early Archaic period evidenced by the sharply defined period of bison exploitation and a marked disjunction of Bell/Andice material with later Middle Archaic deposits. It should be repeated that the Early Archaic is likely underrepresented in the field school excavations considering the excavation units were arbitrarily terminated at 170 cmbd. Recent investigations at Spring Lake have provided evidence for Early Archaic deposits extending below the field school termination depth to at least 295 cmbd (Lohse et al 2013). Therefore, the Early Archaic data presented here cannot be considered alone as a reliable sample for interpreting Early Archaic period occupation at Spring Lake. Future studies should compile and compare all available datasets for 41HY160 and should focus on developing radiocarbon assays from discrete "sealed" deposits containing both diagnostic artifacts and nearby datable organic material.

Non-hafted bifaces were found to be most numerous during the Middle archaic, and late-stage bifaces were more common than other reductions stages at this location during all time periods.

The analysis of flake tools showed that flake tool use intensified during the Late Archaic I. The limited number of MRUs and formal unifaces from dated contexts prevents detailed temporal analysis. Cores were most frequently associated with Middle Archaic contexts, and the debitage analysis revealed that the Middle Archaic time period contained the highest frequency of biface thinning flakes, though the ratio of thinning flakes to complete flakes was highest in the Early Archaic. This suggests that later stages of tool production evidenced by billet flaking technology was most common during the Early Archaic. As a percentage of all complete flakes, the notching flake ratio is highest during the Late Archaic II (Figure 6-66).

These observations point towards a more maintainable and curated tool kit during the Early and Middle Archaic which suggests that people visiting 41HY160 during the Early and Middle Archaic may have practiced collector strategies. A transition to subsistence strategies more reliant on foraging may have occurred during the Late Archaic, as evidenced by increased use of the more expedient flake tools. However, this hypothesis should be tested by looking more at tool use than just tool types. For example, future studies should look at the degrees of curation within both categories of tools by looking at the Total Edge Modification (TEM) and the Potential Edge Modification (PEM). This method would help to document how intensively flake tools and MRUs were used and facilitate an assessment of changes in expediency in different parts of the tool kits at 41HY160 over time (Leezer 2013, LeDoux 2011, Prilliman and Bousman 1998).

The lithic analysis also included descriptions of the hammerstones and groundstone artifacts as well as tabular stones that are recommended as good candidates for microscopic inspection and Polynomial Texture Mapping (PTM) in order to detect cultural modification patterns, like incising.

Ceramic Analysis

Ceramic sherds from the assemblage were submitted to the Center for Archaeological Research at the University of Texas at San Antonio along with a comparative sample of ceramics from nearby site 41HY188. Both samples were subject to macroscopic ceramic analysis as well as petrographic and INAA research. The sherds were preliminarily categorized into prehistoric, Spanish Colonial wares, and at least one modern sherd. In addition, some of the prehistoric wares were classified as either Leon Plain, Doss Redwares, or unknown prehistoric. Some historic sherds were in turn identified as majolica specimens. The petrographic analysis of 26 sherds identified seven paste groups based on the proportions of constituent elements present in the paste fabric based on the simplified inclusion categories. Paste type was defined on the percentage of sand; the unsandy/calcareous paste-bone temper group was found to be the most common with a total of 12 sherds. At 41HY160, five of the paste groups were represented while only three were identified at 41HY188. Only the unsandy/calcareous paste-bone temper and sandy paste-sand temper paste groups were found at both sites. For Leon Plain, the most common paste group was unsandy/calcareous paste-bone temper. The one sherd identified as Goliad, is likely not Goliad, given that it is not a bone-tempered ware. It is possible that the two Leon Plain sherds with sandy paste-grog temper and the one unknown sherd with sandy paste-bone and grog temper are a Caddo ware or wares made in the Caddo tradition. These findings were substantiated by a comparative analysis conducted to determine whether the 41HY160 and 41HY188 samples were similar to any other ceramics from the southern part of the Central Texas Archaeological Region. It was also found that the five sandy paste-sand tempered sherds (501-3A, 501-5A, 501-6A, 501-7a and 501-8A) from 41HY188 are likely not Leon Plain wares given the lack of bone temper; a definitive type cannot be determined for these sherds at this time. Also, the ceramic type for the sandy paste-sand tempered Colonial period sherds cannot be determined. The majority (57.69%) of the sherds from 41HY160 and 41HY188 have bone temper and would be classified as either Leon Plain or Goliad wares. It is likely that sherds 66-1A, 139-2A, 164-10A, and 3-6A from 41HY160 are Goliad wares. Sherd 66-1A has a sandy paste with less than 10% bone temper. Based on the comparative database, sandy paste Goliad wares tend to have less bone than sandy paste Leon Plain wares. The other three sherds have an unsandy/calcareous paste with greater than 30% bone. In the comparative database, none of the bone-tempered Leon Plain wares have greater than 30% bone. Therefore, it is likely that these three sherds are Goliad wares. It is hopeful that more petrographic analysis done in the future on Leon Plain and Goliad ceramics will enable the ability to further distinguish between these two ceramic wares.

Paleobotany

The plant assemblage recovered from the 41HY160 field school excavations was analyzed in order to glean information regarding the foodways of the site's occupants. These groups gathered various wild food resources, including acorns, hickory nuts and/or pecans, hackberries, edible seeds like chenopod, amaranth, and some grass seeds, and likely prickly pear, grape, persimmon, and bulbs. Although "wild", it is probable that groups managed these resources to some degree, through planting, pruning, weeding, and the like (Hammett 1997; Munson 1986; Scarry 2003). In this vein, the late Early Archaic and Middle Archaic occupants of the site, periods that are best represented by botanical data, might have encouraged, if not actively tended, useful plants like prickly pear and chenopod. Such tending would likely require repeated visits to the site during the course of the year. Similarly, the seasonality of the various plant foods recovered suggests that the occupants returned to the site during peak seasons of availability, considering that edible greens would have been collected in spring and early summer; prickly pear fruits and grape in summer; nuts, edible seeds, persimmons, and hackberries in fall; and wild bulbs from fall through spring.

To the extent that these plant resources served as predictable, reliable foodstuffs, it is likely that the occupants of 41HY160 organized their use of the landscape around the exploitation of these plant foods. Gatherers, namely women, children, and the elderly, would have worked in seasonal rhythms to obtain particular plant foods from various habitats, and processed and stored some of them. Sites with prepared features and cached tools, such as earth ovens, manos, and metates, as well as resource-rich locales like

Spring Lake would have been important places in gatherers' mental maps of local landscapes. Therefore, the gathering activities of the peoples living at 41HY160 and other sites along the Balcones Escarpment should be recognized as the result of meaningful decisions made by individuals, rather than simply as opportunistic.

Features

31 feature designations were assigned to collections of burned and fire-cracked rocks and other cultural material over the course of field school excavations during 2001-2003 and 2006 at 41HY160. Two features were encountered during the 2001 field school, six during 2002, 12 during 2003, and 11 during 2006. These features, described as various sizes of clusters and scatters, reveal trends in cultural and natural depositional processes, as well as potential issues with field methods.

Trends identified with cultural and natural depositional processes are primarily apparent in comparison of artifact and feature frequencies by depth, and those processes identified in this field school block appear to be supported by results from excavations elsewhere at the site. Some features recorded individually during the field school excavations might represent aggregation, or a thick zone of loosely integrated burned rocks and other cultural material. Though, verifying this was found to be unachievable due to inconsistent rates of horizontal exposures. Furthermore, it became apparent from comparison among the photos and drawings of the features that arrangements of cultural materials, burned rock and otherwise, were not consistently recorded. Therefore, assessing feature frequency by depth would not be informative for this study. However, during post hoc analysis some of the recorded features appeared to be individually distinct. It was noted that features 6, 7, 15, and 28 may all be approximately intact heating elements of burned rock ovens. Interestingly, it was observed that during the last year of excavations, when the entire block was excavated down to depth relatively simultaneously, seven of the 11 recorded features were found in more than one unit (trans-unit features).

Features 6, 7, 15 and 28 may all be approximately intact heating elements of burned rock ovens.

It is recommended that the feature data from the testing and field school data recovery excavations are analyzed in conjunction with the dataset generated from the more recent, 2014 Spring Lake Data Recovery excavations at 41HY160 (in-text citation for website?) in order to reconstruct a more complete three-dimensional understanding of the features. Future work in this area of site 41HY160 should also attempt to expose a larger horizontal area with units excavated at consistent rates in order to accurately record and sample trans-unit features that are likely present.

Geoarchaeology

Geoarchaeological analyses addressed questions of site formation and artifact context within the field school excavation block through a synthesis of literature resulting from previous geoarchaeological investigations at various sites in the vicinity of Spring Lake. In addition, a limited analysis of profile illustrations and stratigraphic observations from the field school excavations was conducted and presented in chapter 10. This information was supplemented with profile illustrations and stratigraphic data from an adjoining excavation block that was excavated during the 2014 Spring Lake Data Recovery project.

Faunal Analysis

A zooarchaeological analysis was conducted on the faunal assemblage from 41HY160. This analysis focused on the south tier of the excavation block and included excavation units 14, 15, 16 and 17. This sample comprises 4656 identified specimens and includes all five vertebrate classes.

It was found that subsistence focus at 41HY160 includes fish, frogs, snakes, turtles, birds, rabbits/hares, small and medium-sized rodents, canids, deer, pronghorn, and bison. Reliance upon these taxa vary with intensity through time, though the temporal trends observed are comparable to those seen regionally. The study found that when the highest ranked resource is not available, the next highest-ranked is procured. The data showed that at Spring Lake, deer and/or pronghorn are utilized in the absence/scarcity of Bison. This trend is superimposed on the trends occurring in lower-ranked resources. Fish, turtle, snake, rabbit and rodents vary somewhat through time, but turtle and rabbits appear to be more consistently utilized. The analysis also identified co-occurrences of *Lepus* and *Antilocapra* during the Late Archaic suggesting hunting in open grassland setting and may represent opportunistic takes while on bison hunts. This co-occurrence may also suggest that hunters were moving farther from Spring Lake into the Blackland Prairie to find prey.

More intensive occupation and utililization of the Spring Lake Site during the Middle Archaic is evidenced by the prodigious Middle Archaic assemblage. This could be explained by the site's consistently flowing springs that undoubtedly provided a reliable source of fresh water, edible plants and animals even while the regional climate was warming and drying during this time. The faunal analysis also demonstrated that Bison remains were present during all AUs except the LAPH, which supports the theory that the springs likely alleviated climate shifts by providing a reliable water source thus keeping larger mammals nearby.

Overall, the Field School Block multicomponent faunal assemblage provides evidence for an increase through time of bone processing efforts. These efforts manifest as more completely broken artiodactyl bone with breaks both oblique and perpendicular to cortical surfaces. Such breaks represent marrow extraction and boiling for grease. More bone is also so thoroughly comminuted that taxonomic identification is limited to class level. Ultimately, such evidence supports a local shift from a forager economy where people gathered food daily without putting aside to a collector economy where gathering occurred daily, but food was also prepared for storage and use at a later time.

Research Questions

As previously noted, the data recovery and subsequent analyses were aimed at addressing issues regarding how humans adapted to natural changes in the environment, as well as the availability of or fluctuating food resources. Six research topics were presented and addressed with data recovered from 41HY160 during the 2001, 2002, 2003 and 2006 field schools. Special focus was placed on characterizing the prominent Middle Archaic assemblage.

Economy

- *What economic changes occurred during the prehistoric period?*

Several studies presented herein shed light on economic trends at 41HY160. The faunal bone analysis identified a decrease in small-bodied faunal remains between EA and MA. Small-bodied faunal remains were found to increase again in the PH. It was also found that Large-bodied mammals increase in occurrence during the intervening periods. The study also highlighted an increase through time of bone processing efforts and marrow extraction during the MA; this intensity remains steady through time from the MA to the PH. The intensity of bone processing beginning in the MA is interpreted as change from a foraging economy to a collecting economy.

Additionally, when we look at the lithic assemblage, observations point towards a more maintainable and curated tool kit during the Early and Middle Archaic which suggests that people visiting 41HY160 during the Early and Middle Archaic may have practiced collector strategies. However, alternative to the trends we see with the faunal assemblage, the flake tool and debitage data suggest a transition to subsistence strategies more reliant on foraging may have occurred during the Late Archaic. Furthermore, the debitage analysis revealed that tool production evidenced by billet flaking technology was most common during the Early Archaic and that this technology generally decreased through time. This trend of decreasing bifacial technology has been found to be correlated with increased amounts of relative sedentism (Andrefsky 2005).

Environment

- *How has the local and regional environment changed? How have environmental changes influenced the exploitation of plants and animals in the area? Was the resource base stable during this 12,000-year period or did the prehistoric inhabitants respond to regional fluctuations in the plant and animal populations (Dillehay 1974; Bousman 1998)? Were the changes great enough that prehistoric inhabitants had to alter their economic, mobility, or technological exploitation patterns?*

Although environmental changes are generally well understood throughout the prehistoric archaeological record of Central Texas (see Chapter 3), their precise timing and direct influences on cultural adaptations remain more theoretical. The faunal and plant studies conducted on the 2001, 2002, 2003 and 2006 field schools collection help paint a clearer picture of environmental patterns as they are evidenced within the Analytical Units studied.

Jackson's analysis of fish remains indicate that Late Archaic occupants caught fish during late summer. Timperley's faunal bone study identified a migratory bird bone (loon) in the Late Archaic-Late Prehistoric suggesting either a spring or fall hunt. Interestingly, the faunal study also identified an increasing trend of pronghorn species through time indicating an increase in prairie habitat. A similar observation was made during the analysis of faunal remains from the Ticket Kiosk Data Recovery project at 41HY160 in 2011-2012 (Lohse 2013), which concluded that the presence of antelope in an Early Archaic context suggests a gradual transition to a grasslands-like habitat surrounding Spring Lake.

The plant taxa recovered from feature samples included foods that would have been collected in autumn and could be stored and eaten through winter such as acorns, pecans and hickory nuts. Furthermore, hackberries and persimmons were identified. These fruits ripen in the fall, but persimmons are not palatable until the first frost of autumn. Wild bulbs and edible greens may have been collected from fall through spring while grapes and prickly pear fruit were likely collected and processed in the summer. Overall, the seasonality of the various plant foods recovered suggests that the occupants returned to the site during peak seasons of availability. Gatherers likely worked in seasonal patterns to obtain particular plant foods from various habitats.

Technology

- *How have prehistoric technological strategies responded to changes in economic exploitation patterns? A shift from formal and curated tools to a greater use of informal expedient tool using strategies is evident in the flake tools at Wilson-Leonard (Prillman and Bousman 1998). Are changes in cooking technology a response to economic changes and availability of foodstuffs (Wandsnider 1997)? Are similar shifts present at 41HY160? Did the prehistoric inhabitants alter their technological strategies to match the exploitation patterns?*

The analysis of the culturally altered lithic material recovered from investigations at 41HY160 during the 2001, 2002, 2003, and 2006 field school seasons was designed to address research questions that consider prehistoric technology within the context of environmental change through time at Spring Lake. Patterns in flaking technologies were identified through an analysis of the debitage and it was found that later stages of tool production evidenced by billet flaking technology was most prominent during the Early Archaic at Spring Lake and that bifacial technology in general decreases over time. Biface thinning via billet technology was the least common during the Late Prehistoric. Interestingly, notching technology, as evidenced by the ratio of notching flakes to complete flakes, was most common during the Late Archaic II.

The data on flake tools from the 41HY160 field school assemblage suggests that more people were producing and using flakes as tools during the Late Archaic I than in any other time period. Therefore, the shift from formal and curated tools to a greater use of informal expedient tool using strategies is similar to evidence at Wilson Leonard, at least until the Late Archaic I. From Late Archaic I to the Late Prehistoric, a significant decrease in expedient flake tool use occurs. Interestingly, the evidence for shifting away from formal and curated tools through time does not seem as apparent since the only 3 formal unifaces recovered were found in later time periods (Late Archaic and Late Prehistoric).

Jackson's fish study highlighted an interesting technological implication from comparing fish sizes. It was noted that the presence of small fish sizes strongly suggests seining technology was regularly employed, and all the fish taxa represented in the collection could have been captured using nets or tangled vines in shallow water. Also, the presence of catfish indicates the use of baited fish traps and trotlines, while suckers were likely speared at the surface. Comparing combined fish sizes for the two time periods, it is apparent that small fish comprise an overwhelming 81% of the Early Archaic sample. The increased exploitation of larger fish during the Middle Archaic suggests greater sedentism, with greater investment in potentially non-portable technology (fish traps). Increased use of fish traps in the

Middle Archaic is also suggested by a large increase in catfish and suckers relative to the small finfish (Perciformes) dominating the Early Archaic sample.

Mobility

- *How did changes in hunter-gatherer mobility influence technological patterns? According to Shiner (1983), we should expect to encounter evidence for semi-sedentary settlement patterns, even in the paleoindian period. McKinney (1981) and others have remarked on the intensive exploitation and occupation of spring related sites along the Balcones escarpment, but does this occupation intensity translate to sedentary mobility patterns? Did shifts in mobility patterns influence the use of curated and expedient tools? How are non-local raw materials incorporated into the technological system? Are different resources from differing areas used in specific periods?*

The lithic assemblages of the Early and Middle Archaic point towards a more maintainable and curated tool kit, which suggests that people visiting 41HY160 during the Early and Middle Archaic may have practiced collector strategies. However, alternative to the trends we see with the faunal assemblage, the flake tool and debitage data suggest a transition to subsistence strategies more reliant on foraging may have occurred during the Late Archaic. Furthermore, the debitage analysis revealed that tool production evidenced by billet flaking technology was most common during the Early Archaic and that this technology generally decreased through time. This trend of decreasing bifacial technology has been found to be correlated with increased amounts of relative sedentism (Andrefsky 2005).

A trend of increased sedentism is also evidenced by the increased exploitation of larger fish as well as the use of non-portable technology, such as fish traps, during the Middle Archaic as compared to early time periods.

Detailed raw material studies were not conducted as part of the analyses presented here. However, trends in raw material including identification of non-local raw materials could shed light on mobility patterns at the Spring Lake Site and should be considered in future research.

Habitation Structures

- *Two possible structures have been recovered from the Texas State excavations at 41HY160 and the nearby site of 41HY163 (Garber et al. 1983; Garber 1987). Other investigations in Texas demonstrate the construction of habitation structures; four structure types have been identified (Lintz et al. 1995). Ethnoarchaeological investigations of hunter-gatherer sites demonstrate the unorganized nature of sites occupied by highly mobile foragers and the more organized nature of sites occupied by semi-sedentary collectors (Binford 1986; Fisher and Strickland 1989; O'Connel 1987; Yellen 1976). Both foragers and collectors are known to construct habitations, but artifact distributions differ between these different hunter-gatherer adaptations. Recent intra-site spatial analysis of Late Archaic occupations at 41MV120 in Maverick County suggests a highly repetitive but informal use of space as would be expected on forager sites (Vierra 1998). Intra-site analysis of artifact distribution can be used to shed light on hunter-gatherer mobility patterns. If additional structures can be identified, then their use in detailed intra-site analyses of hunter gatherer camps would* *be extremely informative, particularly if investigators can gain an understanding of how site structure relates to mobility patterns. Does the internal structure of prehistoric occupations at the springs support the argument for semi-sedentary occupation?*

No habitation structures were recorded during the 2001, 2002, 2003 and 2006 field schools at 41HY160. Furthermore, no evidence was found that would suggest the presence of structures in this location during the subsequent analyses of the data recovered. It is recommended that a more detailed analysis of the "burned clay" artifact category be conducted and compared with previous and more recent data recovery excavations at 41HY160. This analysis should look for indications of molded clay, clay daub or other examples of clay construction material. Furthermore, intra-site analysis of site features and spatial patterning of activity areas would be better facilitated by increased horizontal exposure of the site.

Site Preservation

- *How has the nature of sediment accumulation affected the presence of archaeological evidence at 41HY160? Did erosion and different facies deposition inhibit the preservation of archaeological remains in specific periods? Could these different patterns of erosion and deposition account for the cultural historical record preserved at 41HY160?*

Site preservation has been addressed in the Texas Rivers Center Testing project; the present study draws complementary results from geoarchaeological interpretations. Excavations for the field schools fall into a growing block of evidence which proves problematic for Nordt's (2010) model whereby only a thin stratum of Paleoindian soils remain deeply buried just above bedrock near the San Marcos Springs. Leezer et al. (2011), Lohse et al. (2013), and the 2014 Spring Lake Data Recovery have all shown Late Paleoindian and Early archaic materials to be present within in situ soils near to the ground surface. Hooge (2013) and Chapter 10 of this report highlight a synthesis of this new data to modify the Nordt (2010) model for Spring Lake formation processes. Under this modification, the Spring Lake Peninsula between Spring Lake and Sink Creek holds high potential to contain well-stratified Paleoindian and Early archaic cultural materials within the lower 8 to 10 meters of sediment accumulating since at least as far back as 11,300 BP. Additionally, this new model shows that cultural materials from the Middle Archaic to present to likely be compressed due to a marked slowdown in sediment accumulation as a result of the exhaustion of soils eroded off the Edwards Plateau following the end of the Pleistocene.

Concluding Remarks and Recommendations

Together, the many lines of evidence from the Rivers Center Analysis project at SAL 41HY160 once again confirm the site's significance. The 2001, 2002, 2003, and 2006 field school investigations succeeded in recovering a robust artifact assemblage and dateable samples. Furthermore, the detailed analyses of the data recovered from these investigations has added greatly to our knowledge of Spring Lake's prehistory and has highlighted an outstanding and discrete Middle Archaic component.

The 2001, 2002, 2003, and 2006 field school investigations had no federal involvement and were not subject to Section 106 of the NHPA of 1966, as amended. However, it should be noted that

41HY160 has since been determined to be eligible for listing to the National Register of Historic Places (NRHP) and the Spring Lake property (also known as the Aquarena Center property) was recommended as eligible for National Register listing as a historic district in 2012 by Blanton and Associates (Reynolds and Russo 2012). Therefore, there is no question that this area is highly significant for the information it contains regarding historic and prehistoric events in Texas.

Had the University proceeded with developing this portion of the peninsula for the Rivers Center, adverse impacts would have undoubtedly occurred to this important archaeological site. However, it is difficult to determine whether the field school data recovery investigations and subsequent analyses would have sufficiently offset the data that would have been lost without a detailed review of the construction plans. Nevertheless, the resulting dataset presented here possesses great potential to contribute the overall understanding of the Spring Lake site complex and to Central Texas prehistory. In addition to addressing the above described research questions that consider prehistoric economy, technology and mobility in an environmental context, recommendations have been made for potential avenues of future archaeological research at Spring Lake. CAS also recommends that future work focus on developing a combined, standardized and relational database of all data recovery excavations that have occurred at the Spring Lake site. There remains much to be learned from the existing Spring Lake collections and advances in the field will continue to introduce new analytical methods. Therefore, the complete body of data along with the associated collections, should continue to be curated at CAS and made available to researchers for future study.

Many archaeological reports describing 41HY160 have recommended that any future construction activities or development that could adversely impact the known archeological resources at Spring Lake, should be mitigated. Although CAS continues to support this recommendation, it is imperative that we encourage avoidance first and foremost. Future work at Spring Lake should consider methods of site preservation and meaningful outreach to non-academic audiences. The future of SAL 41HY160 depends not only on the principles of cultural resource management, but also on proactive preservation planning. This preservation planning should prioritize cultural heritage management and consider Tribal connections to traditional cultural landscapes, or “sacred sites” like Spring Lake. Accordingly, future work should include consultation and coordination with Federally Recognized Native American Tribes in order to accomplish more holistic and collaborative management of the Spring Lake site. Should future development at SAL 41HY160 trigger requirements under Section 106 of the National Historic Preservation Act (NHPA), CAS recommends that a Traditional Cultural Property (TCP) survey be conducted.

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APPENDIX A: PROJECTILE POINT DATA

Early Archaic

Lerma. The Lerma dart point is a bi-pointed, lanceolate shaped point. They are relatively thick and have steep edge angles. The thickest portion of the point is at the midpoint and is typically thinned towards one of the ends. The length ranges from 55 to 100 mm with most of them being 60 to 70 mm long. The width is typically 20 to 30 mm at the center. The Lerma point dates to the Archaic, but no exact dates are known.

		N	mm
Lerma	Thickness	1	11.42
	Max L	1	71.09
	Max W	1	21.05
	Base W	1	12.88
	Weight (g)	1	15.7

San Geronimo (Late) Phase

Martindale. The Martindale is a triangular dart point that usually has convex lateral edges ranging from 35 to 70 mm in length. The shoulders are prominent and well barbed though barbs do not extend all the way to the base. The point width ranges from 25 to 45 mm wide. The stems range from nearly parallel to strongly expanding and are between 20 and 35 mm wide. The diagnostic feature of this point is its fishtail base caused by two distinct convex curves meeting in a central depression (Suhm and Jelks 1962). The Martindale point dates to the Early Archaic, San Geronimo (Late) Phase, 6750 – 5750 B.P., and extends through the Jarrell Phase(5750 – 5000 B.P.) of the Middle Archaic (Prewitt 1981*a*; 2007).

		N	mm
Martindale	Blade Th	1	6.72
	Max L	1	42.18
	Max W	1	32.96
	Stem L	1	15.68
	Neck W	1	19.53
	Base W	1	29.47
	Weight (g)	1	8.4

Merrell.

		N	mm
Merrell	Thickness	1	5.76
	Max L	1	48.55
	Max W	1	35.22
	Base W	2	25.64
	Weight (g)	3	4.73

Middle Archaic

Jarrell Phase

Andice. The Andice dart point is a large, wide, triangular shaped point. They typically have convex lateral blades and a long, rectangular shaped stem. The large barbs which extend down to the base of the point are a prominent feature of the Andice dart point. Morphologically, Andice dart points are similar to Bell dart points, yet Andice dart points are larger in size, stem length, and barb length. The Andice dart point dates to the Early-Middle Archaic, Jarrell Phase, 4050-3050 B.C. (Prewitt 1981A).

		N	mm
Andice	Thickness	1	6.76
	Max L	1	48.39
	Max W	1	50.07
	Base W	1	20.04
	Weight (g)	1	15.7

Oakalla

Taylor. Taylor dart points are often classified as Early Triangular dart points. They typically have straight to slightly concave bases with alternating beveled edges. Early Triangular (Taylor/Baird) dart points typically exhibit parallel oblique flaking patterns and occasionally exhibit serrated lateral edges (Prewitt 1981A). The Taylor dart point dates to the Middle Archaic, Oakalla phase.

		N	Mean	Min	Max	SD
Taylor	Thickness	7	6.07	5.12	7.41	.843
	Max L	7	47.3	38.78	60.81	9.68
	Max W	7	36.6	31.02	7.41	5.8

	Weight (g)	7	7.31	5	10	2.33

Baird. Baird dart points, like Taylor dart points, are often classified as Early Triangular dart points. They typically have straight to slightly concave bases with alternating beveled edges. Early Triangular (Taylor/Baird) dart points typically exhibit parallel oblique flaking patterns and occasionally exhibit serrated lateral edges (Prewitt 1981A). The Taylor dart point dates to the Middle Archaic, Oakalla phase.

		N	**Mean**	**Min**	**Max**	**SD**
Baird	Thickness	2	7.75	7.2	8.3	.777
	Max L	2	63.82	59.08	68.56	6.7
	Max W	2	29.35	26.71	32	3.74
	Weight (g)	2	13.95	13.5	14.4	.636

Clear Fork

Travis. The Travis dart point is a slender triangular blade with rounded shoulders. The lateral edges are typically straight but occasionally convex which may give the blade a leaf-shape appearance. The length ranges from 45 to 90 mm and 20 to 25 mm in width. The stem is usually square with parallel sides and is 15 to 20 mm wide. Stem length is typically uniform at 15 to 20 mm (Suhm and Jelks 1962: 251). Some Travis points have been classified as *Buda*, but these are now believed to be a local variation of the Travis point (Turner and Hester 1993). The Travis point dates to the Middle Archaic, Clear Fork Phase, 4500 – 4000 B.P. and extends into the Marshall Ford Phase (Prewitt 1981*a*).

		N	**Mean**	**Min**	**Max**	**SD**
Travis	Thickness	9	8.31	6.08	10.16	1.37
	Max L	9	61	34.85	83.22	15.78
	Max W	9	23.57	18.21	29.6	4.35
	Stem L	9	17.79	14.6	20.39	1.89
	Neck W	9	15.95	13.17	20.89	2.33
	Base W	9	16.57	13.33	20.81	2.41
	Weight (g)	9	12.56	5.1	25.2	6.29

Nolan. The Nolan dart point is a triangular blade of varying length and width. The blade edges are typically convex or recurved forming a needle-sharp tip. Shoulders are often tapered and slant towards the distal tip, but may sometimes be absent. The most distinct feature is the strong and steep beveled stem. The stem is usually parallel-edged with a square shaped base. The length ranges from 45 to 130 mm with a width of 20 to 40 mm. The stem length is typically uniform at 20 mm (Suhm and Jelks 1962: 225). The Nolan point dates to the Middle Archaic, Clear Fork Phase, 4500-4000 B.P. and extends into the Marshall Ford Phase (Prewitt 1981A).

		N	Mean	Min	Max	SD
Nolan	Thickness	11	7.82	6.54	8.92	.81
	Max L	8	75.54	64.92	90.12	8.95
	Max W	11	28.19	23.57	32.67	2.36
	Stem L	13	19.6	17.2	24.79	2.62
	Neck W	12	18.46	16.07	21.8	1.6
	Base W	14	17.28	15.41	20.37	1.3
	Weight (g)	14	14.3	2.7	22.3	6.1

Late Archaic

Marshall Ford

Bulverde. This dart point is from the Marshall Ford phase in the Late Archaic I, 4000—3400B.P. (Prewitt 1981*a*). The Bulverde point is usually triangular with straight to slightly convex edges, ranging from 45 to 90 mm in length. The shoulders are sometimes squared, but usually have short barbs. The stem is very wide, occasionally greater than ½ of the width of the point and is usually straight (Suhm and Jelks 1962: 169). The most diagnostic section of this point is its wedge shaped base. The stem is finely flaked on all sides creating a very sharp base.

		N	Mean	Min	Max	SD
Bulverde	Blade Th	6	8.12	5.48	10.89	2.07
	Max L	2	61.73	57.74	65.71	5.64
	Max W	4	42.38	33.72	54.38	9.17
	Stem L	8	15.56	12.17	20.97	3.4
	Neck W	8	20.25	14.93	26.67	4.09
	Base W	8	21.85	17.33	26.12	3.35
	Weight (g)	8	16.1	5.9	29.9	9.55

Round Rock

Pedernales. The Pedernales dart point exhibits a wide range of variation in both shape and size. It can be narrow, broad and leaf-shaped, or triangular depending on how it has been reworked. Its shoulders can be weak, abrupt right-angled, or strongly barbed. It can range from 30 to 130 mm in length and 30 to 50 mm in width (Suhm and Jelks 1962). It is possible that the larger specimens are not completed points, but rather earlier Pedernales bifacial forms in the process of reduction (Ensor and Mueller-Wille 1988: 167-8). The Pedernales is typified by a relatively parallel stem with a deeply concave base formed by the removal of two or three small longitudinal flakes or one single larger flake from both faces of the basal edge. (Suhm and Jelks 1962; Turner and Hester 1993). This point dates to the Late Archaic I, Round Rock Phase, 3400 – 2600 B.P. (Prewitt 1981*a*).

		N	**Mean**	**Min**	**Max**	**SD**
Pedernales	Thickness	7	6.92	5.31	8.54	1.18
	Max L	5	60.6	53.91	81.46	11.72
	Max W	6	32.23	27.9	38.03	4.16
	Stem L	8	18.08	15.14	22.41	2.81
	Neck W	7	18.46	15.2	21.82	2.4
	Base W	8	20.02	16.07	23.25	2.6
	Basal W	7	18.46	15.2	21.82	2.4
	Weight (g)	8	10.61	4.3	16.7	3.92

Uvalde

Marcos. The Marcos dart point is a broad triangular blade ranging from 30 to 45 mm across the barbs. It can vary dramatically in length from 45 to 100 mm. Andice points are strongly barbed with deep corner notches which angles inward at 45 degrees creating a strongly expanding stem with a straight to convex base. The stem is consistently 10 mm long (Suhm and Jelks 1962). It can be easily confused with Castroville points, but the base is usually more sharply expanding. The Marcos point dates to the Late Archaic II, Uvalde Phase, 2250 – 1750 B.P. and extends into the Twin Sisters Phase (Prewitt 1981*a*).

		N	**mm**
Marcos	Thickness	1	7.76
	Max L	1	N/A
	Max W	1	N/A
	Stem L	1	13.15
	Neck W	1	21.95
	Base W	1	30.66
	Weight (g)	1	16.8

Twin Sisters

Ellis. The Ellis dart point is typically a short, triangular blade that is between 30 and 50 mm in length. It has prominent shoulders and shallow corner notches. The blade is typically very thick, and it is often crudely flaked (Turner and Hester 1993: 113). The width across the shoulders ranges from 20 to 30 mm. It has a long, expanding stem that is typically ½ to ¼ of the total point length. The base never extends as wide as the shoulders and averages 15 mm wide (Suhm and Jelks 1962). Turner and Hester (1993) note that this point is easily confused with the Edgewood and Zavala types. This point is from the Late Archaic II, Twin Sisters Phase, 1750 – 1400 BP (Prewitt 1981*a*).

		N	Mean	Min	Max	SD
Ellis	Blade Th	2	6.23	5.7	6.7	.65
	Max L	2	50.55	45.79	55.32	6.73
	Max W	2	26.81	24.47	29.15	3.3
	Stem L	2	10.73	9.94	11.52	1.11
	Neck W	2	15.92	15.85	16	.106
	Base W	2	21.13	21.07	21.19	.08
	Weight (g)	2	7.2	7.2	7.2	0

Ensor. The Ensor dart point is fairly difficult to type because of variations in its length and width. It can range from 30 to 70 mm in length and 20 to 30 mm in width (Suhm and Jelks 1962: 189). It is a triangular point with usually straight sides. The shoulders are prominent and often squared but can be barbed. It is most often side notched which results in a wide base and a basal edge is in line with the shoulder. The bases are usually squared, and the stem is not more than 10 mm in length (Suhm and Jelks 1962). The stem neck is comparatively wide, but is thinner on corner notched varieties. It often exhibits signs of heat-treatment (Black and McGraw 1985). The Ensor point is from the Late Archaic II, Twin Sisters Phase, 1750 – 1400 BP (Prewitt 1981*a*).

		N	mm
Ensor	Thickness	1	7.08
	Max L	1	39.75
	Max W	1	25.05
	Stem L	1	12.63
	Neck W	1	18.87
	Base W	1	25.05
	Weight (g)	1	6.4

Late Pre-Historic

Austin Phase

Scallorn. The Scallorn arrow point is a small triangular point with straight or slightly convex lateral edges which range from 2.5 to 4.5 cm in length. The shoulders are usually well barbed from corner notching and range from 1.5 to 2 cm in width. The stem expands sharply, up to the width of the shoulders. The base can be square, convex, or concave (Suhm and Jelks 1962). Its edges are often finely serrated (Turner and Hester 1993). The Scallorn dates to the Late Prehistoric, Austin Phase, 1250 – 650 B.P. (Prewitt 1981*a*).

		N	Mean	Min	Max	SD
Scallorn	Blade Th	2	3.225	2.61	3.84	.869
	Max L	1	38.5	38.5	38.5	0
	Max W	1	18.57	18.57	18.57	0
	Stem L	2	5.91	5.11	6.72	1.138
	Neck W	2	6.69	6.29	7.09	.565
	Base W	1	7.91	7.91	7.91	0
	Weight (g)	2	1.25	.6	1.9	.919

Toyah Phase

Perdiz. The Perdiz arrow point exhibits more variation in size and proportions than most projectile points found within Texas. It has a triangular blade with very straight edges and ranges from 1.5 to 6 cm in length. Though the longer specimens exceed the typical range for arrow points, they are much thinner and lighter than dart points of equivalent length. The shoulders are usually well-barbed, so the width ranges from 1.2 to 3 cm. The stem is contracting, often to a sharp base. Finally, some are unifacially worked rather than bifacial (Suhm and Jelks 1962), so they can grade into *Cliffton* points (Turner and Hester 1993). The Perdiz dates to the Late Pre-historic, Toyah Phase, 650 – 200 B.P. (Prewitt 1981*a*).

		N	Mean	Min	Max	SD
Perdiz	Thickness	3	1.89	1.67	2.1	.2151
	Max L	2	30.94	29.73	32.15	1.711
	Max W	3	14.63	12.36	18.79	3.6
	Stem L	3	11.99	8.31	17.09	4.55
	Neck W	5	6.27	3.7	8.49	1.94
	Base W	3	3.65	2.77	5.13	1.28
	Weight (g)	5	.9	.3	1.1	.339

APPENDIX B: BIFACES

Table B-1. Bifaces.

Lot - Spec. No.	AU	Category	Completeness	W/Th Ratio	Use-Wear	Burned
4-3	N/A	Indeterminate	Fragment	Ind.	Y-M	N
7-1	N/A	Indeterminate	Fragment	Ind.	N	Y
7-2	N/A	Indeterminate	Fragment	Ind.	Y-M	N
8-9	N/A	Indeterminate	Fragment	Ind.	N	Y
10-2	N/A	Undiagnostic Tool	Fragment	Ind.	Y-M	N
11-2	N/A	Indeterminate	Fragment	Ind.	N	N
11-3	N/A	Indeterminate	Fragment	Ind.	N	Y
11-4	N/A	Indeterminate	Fragment	Ind.	N	N
11-5	N/A	Indeterminate	Fragment	Ind.	Y-H	N
15-4	AU 3D	Indeterminate	Fragment	Ind.	Y-L	Y
147-3	AU 3D	Indeterminate	Fragment	Ind.	N	N
147-5	AU 3D	Indeterminate	Fragment	Ind.	N	N
28-2	AU3	Indeterminate	Fragment	Ind.	Y-L	N
30-1	N/A	Indeterminate	Fragment	Ind.	N	N
30-2	N/A	Indeterminate	Fragment	Ind.	N	Y
30-3	N/A	Late Stage Preform	Fragment	Ind.	N	Y
35-1	N/A	Indeterminate	Fragment	Ind.	N	Y
35-2	N/A	Late Stage Preform	Fragment	Ind.	Y-H	N
36-1	N/A	Indeterminate	Fragment	Ind.	N	N
38-3	N/A	Indeterminate	Possible Barb Frag	Ind.	N	N
38-4	N/A	Intermediate Stage Biface	RC	3.41	Y-L	N
41-3	N/A	Indeterminate	Fragment	Ind.	N	N
42-2	N/A	Late Intermediate Stage	C	2.17	N	N
42-3	N/A	Late Stage Preform	RC	3.45	Y-L	N
42-4	N/A	Late Intermediate Stage	Fragment	Ind.	N	N
48-1	N/A	Indeterminate	Fragment	Ind.	N	Y
49-1	1C	Irregular & Asymmetrical	RC	4.8	N	N
49-2	1C	Irregular & Asymmetrical	Fragment	Ind.	N	N
52-1	N/A	Late Intermediate Stage	Fragment	Ind.	Y-L	N
53-2	AU 2	Indeterminate	Fragment	Ind.	Y-L	N
55-2	N/A	Indeterminate	Possible Barb Frag	Ind.	N	N

Table B-1. Bifaces.

Lot - Spec. No.	AU	Category	Completeness	W/Th Ratio	Use-Wear	Burned
55-3	N/A	Late Stage Preform	Fragment	Ind.	N	Y
55-4	N/A	Indeterminate	Fragment	Ind.	N	Y
57-2	N/A	Late Intermediate Stage	C	2.21	N	N
57-3	N/A	Indeterminate	Fragment	Ind.	N	N
57-4	N/A	Late Stage Preform	Fragment	Ind.	Y-L	N
59-2	N/A	Indeterminate	Fragment	Ind.	N	N
59-3	N/A	Indeterminate	Fragment	Ind.	N	N
60-2	N/A	Indeterminate	Fragment	Ind.	N	N
70-3	N/A	Indeterminate	Fragment	Ind.	Y-L	N
70-4	N/A	Indeterminate	Fragment	Ind.	N	N
70-5	N/A	Late Stage Preform	RC	5.4	N	N
72-8	N/A	Indeterminate	Fragment	Ind.	Y-L	N
72-4	N/A	Undiagnostic Tool	Fragment	Ind.	Y-M	N
74-2	N/A	Indeterminate	Fragment	Ind.	Y-L	N
74-3	N/A	Indeterminate	Fragment	Ind.	Y-M	N
74-4	N/A	Indeterminate	Fragment	Ind.	N	N
81-2	N/A	Late Stage Preform	Fragment	Ind.	Y-H	N
82-1	N/A	Indeterminate	Fragment	Ind.	N	Y
82-2	N/A	Indeterminate	Fragment	Ind.	N	N
83-4	AU 2C	Indeterminate	Fragment	Ind.	N	Y
83-5	AU 2C	Indeterminate	Fragment	Ind.	N	N
22-7	AU 2C	Indeterminate	Fragment	Ind.	N	N
86-2	N/A	Indeterminate	Fragment	Ind.	Y-M	N
100-1	AU3	Indeterminate	Fragment	Ind.	Y-L	Y
73-1	AU3	Indeterminate	Fragment	Ind.		N
124-3	AU 2	Indeterminate	Fragment	Ind.	Y-L	N
154-4	AU 2	Indeterminate	Fragment	Ind.	N	N
97-4	AU 2	Late Intermediate Stage	Fragment	Ind.	Y-M	N
124-2	AU 2	Late Intermediate Stage	Fragment	Ind.	N	N
73-2	AU3	Indeterminate	Fragment	Ind.	N	N
88-4	AU3	Indeterminate	RC	6.5	N	N
103-2	N/A	Undiagnostic Tool	Fragment	Ind.	Y	N
110-5	1C	Late Intermediate Stage	C	2.79	N	N
116-2	N/A	Late Stage Preform	Fragment	Ind.	Y-L	N
123-1	N/A	Late Intermediate Stage	C	1.81	Y-L	N

Table B-1. Bifaces.

Lot - Spec. No.	AU	Category	Completeness	W/Th Ratio	Use-Wear	Burned
97-3	AU 2	Late Stage Preform	Fragment	Ind.	Y-L	N
97-5	AU 2	Late Stage Preform	Fragment	Ind.	Y-L	N
125-1	N/A	Late Stage Preform	Fragment	Ind.	N	Y
127-1	N/A	Indeterminate	Fragment	Ind.	Y-M	Y
132-1	N/A	Indeterminate	Fragment	Ind.	Y-H	N
132-2	N/A	Indeterminate	Fragment	Ind.	N	N
140-2	N/A	Intermediate Stage Biface	RC	3.99	Y-L	N
141-1	N/A	Indeterminate	Fragment	Ind.	N	Y
146-1	N/A	Late Stage Preform	Fragment	Ind.	Y-L	N
153-1	N/A	Indeterminate	Fragment	Ind.	N	Y
153-2	N/A	Indeterminate	Fragment	Ind.	Y-M	Y
97-6	AU 2	Late Stage Preform	Fragment	Ind.	Y-M	N
155-2	N/A	Late Intermediate Stage	Fragment	Ind.	N	N
159-3	N/A	Late Stage Preform	RC	4.3	Y-M	N
160-1	N/A	Late Stage Preform	Fragment	Ind.	Y-M	N
160-2	N/A	Irregular & Asymmetrical	C	2.64	N	N
161-1	N/A	Late Intermediate Stage	Fragment	Ind.	Y-M	N
161-2	N/A	Indeterminate	Fragment	Ind.	N	N
163-2	N/A	Indeterminate	Fragment	Ind.	N	N
163-3	N/A	Intermediate Stage Biface	C	2.66	Y-L	N
164-5	N/A	Late Stage Preform	RC	3.26	Y-L	N
164-6	N/A	Late Stage Preform	RC	2.25	N	N
164-7	N/A	Indeterminate	Fragment	Ind.	Y-M	Y
164-8	N/A	Late Intermediate Stage	Fragment	Ind.	Y-M	N
112-3	AU 2C	Indeterminate	Fragment	Ind.	Y-M	N
112-8	AU 2C	Indeterminate	Fragment	Ind.	N	N
112-9	AU 2C	Indeterminate	Fragment	Ind.	N	Y
83-3	AU 2C	Irregular & Asymmetrical	Fragment	Ind.	Y-L	N
89-4	AU3	Indeterminate	Fragment	Ind.	N	N
89-5	AU3	Indeterminate	Fragment	Ind.	Y-M	N
114-1	AU3	Indeterminate	Fragment	Ind.	Y-L	N
114-2	AU3	Indeterminate	Fragment	Ind.	N	N
131-1	AU3	Indeterminate	Fragment	Ind.	Y-L	N
131-2	AU3	Indeterminate	Fragment	Ind.	Y-L	N
131-3	AU3	Indeterminate	Fragment	Ind.	Y-L	Y

Table B-1. Bifaces.

Lot - Spec. No.	AU	Category	Completeness	W/Th Ratio	Use-Wear	Burned
143-3	AU3	Indeterminate	Fragment	Ind.	N	N
143-4	AU3	Indeterminate	Fragment	Ind.	N	N
144-2	AU3	Indeterminate	Fragment	Ind.	Y-M	N
145-3	AU3	Indeterminate	Fragment	Ind.	N	N
156-1	AU3	Indeterminate	Fragment	Ind.	Y-L	N
159-4	AU3	Indeterminate	Fragment	Ind.	N	N
24-3	AU3	Indeterminate	Fragment	Ind.	N	Y
71-3	AU3	Indeterminate	Fragment	Ind.	N	Y
98-2	AU3	Indeterminate	Fragment	Ind.	N	N
26-4	AU3	Indeterminate	Fragment	Ind.	N	Y
87-3	AU3	Indeterminate	Fragment	Ind.	N	N
87-4	AU3	Indeterminate	Fragment	Ind.	Y-M	N
102-6 a	AU3	Intermediate Stage Biface	Fragment	Ind.	Y-M	N
102-6 b	AU3	Intermediate Stage Biface	Fragment	Ind.	N	N
102-6 c	AU3	Intermediate Stage Biface	Fragment	Ind.	N	N
102-2	AU3	Late Intermediate Stage	Fragment	Ind.	Y-M	N
143-2	AU3	Late Intermediate Stage	C	2.03	N	N
88-2	AU3	Late Stage Preform	RC	6	Y-H	N
89-8	AU3	Late Stage Preform	RC	2.67	Y-M	N
102-4	AU3	Late Stage Preform	RC	3.38	N	N
73-3	AU3	Late Stage Preform	RC	5.76	N	N
85-1	AU3	Late Stage Preform	Fragment	Ind.	N	Y
88-1	AU3	Late Stage Preform	C	2.79	Y-L	N
99-1	AU3	Late Stage Preform	C	3.11	N	N
102-3	AU3	Late Stage Preform	RC	5	Y-L	N
102-1	AU3	Late Stage Preform	C	2.35	Y-L	N
102-3	AU3	Late Stage Preform	C	3	N	N
113-2	AU3	Late Stage Preform	RC	3.81	N	N
26-6	AU3	Late Stage Preform	Fragment	Ind.	Y-L	N
58-1	AU3	Undiagnostic Tool	C	3.3	Y-M	N
88-3	AU3	Undiagnostic Tool	C	3.43	N	N
89-6	AU3	Undiagnostic Tool	C	4.28	N	N
71-4	AU3	Undiagnostic Tool	C	3.7	Y-M	N
26-3	AU3	Undiagnostic Tool	Fragment	Ind.	N	N
89-7	AU3	Undiagnostic Tool (Adze)	C	1.53	Y-L	N

Table B-1. Bifaces.

Lot - Spec. No.	AU	Category	Completeness	W/Th Ratio	Use-Wear	Burned
15-3	AU 3D	Late Stage Preform	RC	3.71	N	Y
15-5	AU 3D	Late Stage Preform	RC	Ind.	Y-H	Y
75-5	AU 4	Indeterminate	Fragment	Ind.	Y-M	N
75-6	AU 4	Indeterminate	Fragment	Ind.	N	Y
75-7	AU 4	Indeterminate	Fragment	Ind.	N	N
104-4	AU 4	Indeterminate	Fragment	Ind.	Y-L	N
45-93 b	AU 4	Indeterminate	Fragment	Ind.	Y-L	Y
45-93 c	AU 4	Indeterminate	Fragment	Ind.	N	N
75-8	AU 4	Irregular & Asymmetrical	C	2.79	Y-L	N
104-3	AU 4	Irregular & Asymmetrical	RC	1.6	N	N
45-4	AU 4	Late Intermediate Stage	RC	2.74	Y-M	N
75-9	AU 4	Late Intermediate Stage	RC	4.04	Y-H	N
45-3	AU 4	Late Stage Preform	C	2.95	N	N
22-8	AU 2C	Late Stage Preform	Fragment	Ind.	Y-H	N
84-5	AU 2C	Late Stage Preform	C	3.85	Y-L	N
45-93 a	AU 4	Late Stage Preform	Fragment	Ind.	Y-M	N
75-4	AU 4	Undiagnostic Tool	RC	4.14	Y-M	Y

APPENDIX C: INVENTORY OF ANALYZED DEBITAGE

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
14	3D	CAS-P-007.014.45	7	14	130-140		Lithic, Debitage	Shatter	Shatter/Chunk	10	7	
14	3D	CAS-P-007.014.46	7	14	130-140		Lithic, Debitage	Thermal spall, Ø cortex, <1 cm	Burned	1	0.3	
14	3D	CAS-P-007.014.47	7	14	130-140		Lithic, Debitage	Thermal spall, Ø cortex, 1-2 cm	Burned	2	0.5	
14	3D	CAS-P-007.014.48	7	14	130-140		Lithic, Debitage	Broken flakes, <1 cm	Broken Flakes	60	7	
14	3D	CAS-P-007.014.49	7	14	130-140		Lithic, Debitage	Broken flakes, 1-2 cm	Broken Flakes	306	109.7	
14	3D	CAS-P-007.014.50	7	14	130-140		Lithic, Debitage	Broken flakes, 2-4 cm	Broken Flakes	28	65	
14	3D	CAS-P-007.014.51	7	14	130-140		Lithic, Debitage	Notching flakes, Ø cortex, <1 cm	Complete Flakes	2	0.2	Notching
14	3D	CAS-P-007.014.52	7	14	130-140		Lithic, Debitage	Notching flakes, Ø cortex, 1-2 cm	Complete Flakes	1	0.1	Notching
14	3D	CAS-P-007.014.53	7	14	130-140		Lithic, Debitage	Normal flakes, Ø cortex, <1 cm	Complete Flakes	1	0.4	Complete Flakes
14	3D	CAS-P-007.014.54	7	14	130-140		Lithic, Debitage	Normal flakes, <25% cortex, 2-4 cm	Complete Flakes	1	1.5	Complete Flakes
14	3D	CAS-P-007.014.55	7	14	130-140		Lithic, Debitage	Normal flakes, >25% cortex, <1 cm	Complete Flakes	1	0.1	Complete Flakes
14	3D	CAS-P-007.014.56	7	14	130-140		Lithic, Debitage	Normal flakes, >25% cortex, 1-2 cm	Complete Flakes	1	0.6	Complete Flakes
14	3D	CAS-P-007.014.57	7	14	130-140		Lithic, Debitage	Normal flakes, >25% cortex, 2-4 cm	Complete Flakes	2	4.8	Complete Flakes
14	3D	CAS-P-007.014.58	7	14	130-140		Lithic, Debitage	Normal flakes, >25% cortex, 4-8 cm	Complete Flakes	1	19.2	Complete Flakes
14	3D	CAS-P-007.014.59	7	14	130-140		Lithic, Debitage	BFT flakes, Ø cortex, <1 cm	Complete Flakes	8	0.6	
14	3D	CAS-P-007.014.60	7	14	130-140		Lithic, Debitage	BFT flakes, Ø cortex, 1-2 cm	Complete Flakes	35	10.7	
14	3D	CAS-P-007.014.61	7	14	130-140		Lithic, Debitage	BFT flakes, Ø cortex, 2-4 cm	Complete Flakes	9	13.3	
14	3D	CAS-P-007.014.62	7	14	130-140		Lithic, Debitage	BFT flakes, <25% cortex, 1-2 cm	Complete Flakes	3	1.1	
14	3D	CAS-P-007.014.63	7	14	130-140		Lithic, Debitage	BFT flakes, >25% cortex, 2-4 cm	Complete Flakes	3	4.3	
14	3D	CAS-P-007.014.65	7	14	130-140		Lithic, Debitage	Shatter, not included in analysis	Shatter/Chunk	1	0.1	
15	3D	CAS-P-007.015.62	7	15	140-150		Lithic, Debitage	BFT Flakes, <25% Cortex, 1-2 cm	Complete Flakes	6	1.4	
15	3D	CAS-P-007.015.63	7	15	140-150		Lithic, Debitage	Notching flakes, Ø Cortex, <1 cm	Complete Flakes	5	0.3	Notching
15	3D	CAS-P-007.015.64	7	15	140-150		Lithic, Debitage	BFT Flakes, Ø Cortex, <1 cm	Complete Flakes	7	0.6	
15	3D	CAS-P-007.015.65	7	15	140-150		Lithic, Debitage	Normal flakes, >25% Cortex, 2-4 cm	Complete Flakes	1	9.7	Complete Flakes
15	3D	CAS-P-007.015.66	7	15	140-150		Lithic, Debitage	Normal flakes, >25% Cortex, 4-8 cm	Complete Flakes	2	34	Complete Flakes
15	3D	CAS-P-007.015.67	7	15	140-150		Lithic, Debitage	Normal flakes, <25% Cortex, 2-4 cm	Complete Flakes	1	1.9	Complete Flakes
15	3D	CAS-P-007.015.68	7	15	140-150		Lithic, Debitage	Normal flakes, >25% Cortex, 1-2 cm	Complete Flakes	3	0.8	Complete Flakes
15	3D	CAS-P-007.015.69	7	15	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	15	10.6	
15	3D	CAS-P-007.015.70	7	15	140-150		Lithic, Debitage	BFT Flakes, Ø Cortex, 2-4 cm	Complete Flakes	12	14.2	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
15	3D	CAS-P-007.015.71	7	15	140-150		Lithic, Debitage	Normal flakes, Ø Cortex, 2-4 cm	Complete Flakes	2	17.6	Complete Flakes
15	3D	CAS-P-007.015.72	7	15	140-150		Lithic, Debitage	BFT Flakes, >25% Cortex, 2-4 cm	Complete Flakes	1	1.4	
15	3D	CAS-P-007.015.73	7	15	140-150		Lithic, Debitage	Normal flakes, <25% Cortex, 1-2 cm	Complete Flakes	2	2.6	Complete Flakes
15	3D	CAS-P-007.015.74	7	15	140-150		Lithic, Debitage	Normal flakes, Ø Cortex, <1 cm	Complete Flakes	1	0.2	Complete Flakes
15	3D	CAS-P-007.015.75	7	15	140-150		Lithic, Debitage	BFT Flakes, <25% Cortex, 2-4 cm	Complete Flakes	2	3.6	
15	3D	CAS-P-007.015.76	7	15	140-150		Lithic, Debitage	Notching flakes, Ø Cortex, 1-2 cm	Complete Flakes	1	0.1	Notching
15	3D	CAS-P-007.015.77	7	15	140-150		Lithic, Debitage	Broken flakes, 1-2 cm	Broken Flakes	274	78.6	
15	3D	CAS-P-007.015.78	7	15	140-150		Lithic, Debitage	Broken flakes, <1 cm	Broken Flakes	88	9.3	
15	3D	CAS-P-007.015.79	7	15	140-150		Lithic, Debitage	Broken flakes, 4-8 cm	Broken Flakes	3	38.7	
15	3D	CAS-P-007.015.80	7	15	140-150		Lithic, Debitage	Broken flakes, 2-4 cm	Broken Flakes	81	165.1	
15	3D	CAS-P-007.015.82	7	15	140-150		Lithic, Debitage	Normal flakes, <25% Cortex, 2-4 cm	Complete Flakes	4	9.3	Complete Flakes
15	3D	CAS-P-007.015.83	7	15	140-150		Lithic, Debitage	Normal flakes, Ø Cortex, 1-2 cm	Complete Flakes	2	0.4	Complete Flakes
15	3D	CAS-P-007.015.84	7	15	140-150		Lithic, Debitage	BFT Flakes, >25% Cortex, 1-2 cm	Complete Flakes	12	4.3	
15	3D	CAS-P-007.015.85	7	15	140-150		Lithic, Debitage	BFT flakes, Ø Cortex, 1-2 cm	Complete Flakes	83	17.4	
18	1	CAS-P-007.018.03	8	3	30-40		Lithic, Debitage	Shatter	Shatter/Chunk	8	5.5	
18	1	CAS-P-007.018.15	8	3	30-40		Lithic, Debitage	Burned	Burned	27	10.1	
18	1	CAS-P-007.018.17	8	3	30-40		Lithic, Debitage	Flake Fragments	Broken Flakes	83	31.9	
18	1	CAS-P-007.018.18	8	3	30-40		Lithic, Debitage	Proximal Flakes	Proximal Flakes	42	29.6	
18	1	CAS-P-007.018.19	8	3	30-40		Lithic, Debitage	Complete Flakes	Complete Flakes	13	17	Complete Flakes
18	1	CAS-P-007.018.20	8	3	30-40		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.2	Notching
18	1	CAS-P-007.018.21	8	3	30-40		Lithic, Debitage	Flake Tool	Flake Tool	1	3	
19	1	CAS-P-007.019.03	8	4	40-50		Lithic, Debitage	Shatter	Shatter/Chunk	12	5.7	
19	1	CAS-P-007.019.04	8	4	40-50		Lithic, Debitage	Burned	Burned	17	11.4	
19	1	CAS-P-007.019.05	8	4	40-50		Lithic, Debitage	Flake Fragments	Broken Flakes	68	40.5	
19	1	CAS-P-007.019.27	8	4	40-50		Lithic, Debitage	Proximal Flakes	Proximal Flakes	28	33.8	
19	1	CAS-P-007.019.28	8	4	40-50		Lithic, Debitage	Flake Tool	Flake Tool	1	5.6	
19	1	CAS-P-007.019.29	8	4	40-50		Lithic, Debitage	Complete	Complete Flakes	18	28.4	Complete Flakes
19	1	CAS-P-007.019.30	8	4	40-50		Lithic, Debitage	Normal flakes, <25% Cortex, 4-8 cm	Complete Flakes	1	12.3	Complete Flakes
19	1	CAS-P-007.019.31	8	4	40-50		Lithic, Debitage	Broken flakes	Broken Flakes	43	6.2	
19	1	CAS-P-007.019.32	8	4	40-50		Lithic, Debitage	Shatter	Shatter/Chunk	6	3.6	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
20	2B	CAS-P-007.020.33	8	5	50-60		Lithic, Debitage	Shatter	Shatter/Chunk	6	4	
20	2B	CAS-P-007.020.34	8	5	50-60		Lithic, Debitage	Burned	Burned	32	14.6	
20	2B	CAS-P-007.020.35	8	5	50-60		Lithic, Debitage	Flake Fragments	Broken Flakes	121	67.7	
20	2B	CAS-P-007.020.36	8	5	50-60		Lithic, Debitage	Proximal Flakes	Proximal Flakes	53	47.4	
20	2B	CAS-P-007.020.37	8	5	50-60		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	2	1.8	
20	2B	CAS-P-007.020.38	8	5	50-60		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.2	
20	2B	CAS-P-007.020.39	8	5	50-60		Lithic, Debitage	Complete Flakes	Complete Flakes	28	35.4	Complete Flakes
20	2B	CAS-P-007.020.40	8	5	50-60		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	3.7	Notching
20	2B	CAS-P-007.020.41	8	5	50-60		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.6	Billet: r-flakes
20	2B	CAS-P-007.020.42	8	5	50-60		Lithic, Debitage	Flake Tool	Flake Tool	1	5.1	
20	2B	CAS-P-007.020.43	8	5	50-60		Lithic, Debitage	Broken Flakes <1 cm	Broken Flakes	78	8.5	
20	2B	CAS-P-007.020.44	8	5	50-60		Lithic, Debitage	Broken Flakes 4-8 cm	Broken Flakes	2	14.5	
20	2B	CAS-P-007.020.45	8	5	50-60		Lithic, Debitage	Shatter	Shatter/Chunk	9	11.2	
22	2C	CAS-P-007.022.40	8	7	70-80		Lithic, Debitage	Shatter	Shatter/Chunk	10	6.9	
22	2C	CAS-P-007.022.41	8	7	70-80		Lithic, Debitage	Burned	Burned	94	47.7	
22	2C	CAS-P-007.022.42	8	7	70-80		Lithic, Debitage	Flake Fragments	Broken Flakes	339	236.3	
22	2C	CAS-P-007.022.43	8	7	70-80		Lithic, Debitage	Proximal Flakes	Proximal Flakes	245	240.6	
22	2C	CAS-P-007.022.44	8	7	70-80		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	7	1.9	
22	2C	CAS-P-007.022.45	8	7	70-80		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	1	0.1	
22	2C	CAS-P-007.022.46	8	7	70-80		Lithic, Debitage	Complete Flakes	Complete Flakes	76	140.4	Complete Flakes
22	2C	CAS-P-007.022.47	8	7	70-80		Lithic, Debitage	Complete Flakes "r" Flakes	Complete Flakes	2	1.7	Billet: r-flakes
22	2C	CAS-P-007.022.48	8	7	70-80		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.2	Notching
22	2C	CAS-P-007.022.49	8	7	70-80		Lithic, Debitage	Flake Tool	Flake Tool	6	92.9	
23	2C	CAS-P-007.023.31	8	8	80-91		Lithic, Debitage	Shatter	Shatter/Chunk	20	14.5	
23	2C	CAS-P-007.023.32	8	8	80-91		Lithic, Debitage	Burned	Burned	95	53.1	
23	2C	CAS-P-007.023.33	8	8	80-91		Lithic, Debitage	Flake Fragments	Broken Flakes	373	204.5	
23	2C	CAS-P-007.023.34	8	8	80-91		Lithic, Debitage	Proximal Flakes	Proximal Flakes	257	176.3	
23	2C	CAS-P-007.023.35	8	8	80-91		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	6	1	
23	2C	CAS-P-007.023.36	8	8	80-91		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1.3	
23	2C	CAS-P-007.023.37	8	8	80-91		Lithic, Debitage	Complete Flakes	Complete Flakes	71	146.4	Complete Flakes

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
23	2C	CAS-P-007.023.38	8	8	80-91		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.2	Notching
23	2C	CAS-P-007.023.39	8	8	80-91		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.1	Billet: r-flakes
23	2C	CAS-P-007.023.40	8	8	80-91		Lithic, Debitage	Flake Tool	Flake Tool	1	33.4	
24	3A	CAS-P-007.024.37	8	9	91-101		Lithic, Debitage	Shatter	Shatter/Chunk	12	19.4	
24	3A	CAS-P-007.024.38	8	9	91-101		Lithic, Debitage	Burned	Burned	44	39.9	
24	3A	CAS-P-007.024.39	8	9	91-101		Lithic, Debitage	Flake Fragments	Broken Flakes	331	212.9	
24	3A	CAS-P-007.024.40	8	9	91-101		Lithic, Debitage	Proximal Flakes	Proximal Flakes	184	120.3	
24	3A	CAS-P-007.024.41	8	9	91-101		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	5	0.7	
24	3A	CAS-P-007.024.42	8	9	91-101		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	3.4	
24	3A	CAS-P-007.024.43	8	9	91-101		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	2	8.3	
24	3A	CAS-P-007.024.44	8	9	91-101		Lithic, Debitage	Complete Flakes	Complete Flakes	63	206.1	Complete Flakes
24	3A	CAS-P-007.024.45	8	9	91-101		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.9	Notching
24	3A	CAS-P-007.024.46	8	9	91-101		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	1.1	Billet: r-flakes
24	3A	CAS-P-007.024.47	8	9	91-101		Lithic, Debitage	Flake Tool	Flake Tool	1	17.1	
26	3B	CAS-P-007.026.50	8	11	113-119		Lithic, Debitage	Shatter	Shatter/Chunk	4	4.8	
26	3B	CAS-P-007.026.51	8	11	113-119		Lithic, Debitage	Burned	Burned	25	21.1	
26	3B	CAS-P-007.026.52	8	11	113-119		Lithic, Debitage	Flake Fragments	Broken Flakes	189	105.6	
26	3B	CAS-P-007.026.53	8	11	113-119		Lithic, Debitage	Proximal Flakes	Proximal Flakes	116	79.4	
26	3B	CAS-P-007.026.54	8	11	113-119		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	3	0.9	
26	3B	CAS-P-007.026.55	8	11	113-119		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.5	
26	3B	CAS-P-007.026.56	8	11	113-119		Lithic, Debitage	Complete Flakes	Complete Flakes	57	78.9	Complete Flakes
26	3B	CAS-P-007.026.57	8	11	113-119		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	1.6	Billet: r-flakes
26	3B	CAS-P-007.026.58	8	11	113-119		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.5	Notching
26	3B	CAS-P-007.026.59	8	11	113-119		Lithic, Debitage	Flake Tool	Flake Tool	8	51.5	
27	3	CAS-P-007.027.12	8	12	120		Lithic, Debitage	Burned	Burned	6	6.9	
27	3	CAS-P-007.027.13	8	12	120		Lithic, Debitage	Flake Fragments	Broken Flakes	42	17.6	
27	3	CAS-P-007.027.14	8	12	120		Lithic, Debitage	Proximal Flakes	Proximal Flakes	25	9.3	
27	3	CAS-P-007.027.15	8	12	120		Lithic, Debitage	Complete Flakes	Complete Flakes	8	1.7	Complete Flakes
27	3	CAS-P-007.027.16	8	12	120		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.1	Notching
27	3	CAS-P-007.027.17	8	12	120		Lithic, Debitage	Flake Tool	Flake Tool	1	7.2	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
28	3	CAS-P-007.028.40	8	13	120-130		Lithic, Debitage	Shatter	Shatter/Chunk	16	17.3	
28	3	CAS-P-007.028.41	8	13	120-130		Lithic, Debitage	Burned	Burned	28	16.1	
28	3	CAS-P-007.028.42	8	13	120-130		Lithic, Debitage	Flake Fragments	Broken Flakes	136	88.4	
28	3	CAS-P-007.028.43	8	13	120-130		Lithic, Debitage	Proximal Flakes	Proximal Flakes	115	70.4	
28	3	CAS-P-007.028.44	8	13	120-130		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.2	
28	3	CAS-P-007.028.45	8	13	120-130		Lithic, Debitage	Complete Flakes	Complete Flakes	59	71.4	Complete Flakes
28	3	CAS-P-007.028.46	8	13	120-130		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.1	Notching
28	3	CAS-P-007.028.47	8	13	120-130		Lithic, Debitage	Flake Tool	Flake Tool	1	6.7	
29	3B	CAS-P-007.029.64	8	14	130-140		Lithic, Debitage	Shatter	Shatter/Chunk	21	16.3	
29	3B	CAS-P-007.029.65	8	14	130-140		Lithic, Debitage	Burned	Burned	59	47.5	
29	3B	CAS-P-007.029.66	8	14	130-140		Lithic, Debitage	Flake Fragments	Broken Flakes	350	142	
29	3B	CAS-P-007.029.67	8	14	130-140		Lithic, Debitage	Proximal Flakes	Proximal Flakes	201	101.2	
29	3B	CAS-P-007.029.68	8	14	130-140		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	8	2.1	
29	3B	CAS-P-007.029.69	8	14	130-140		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	1.8	
29	3B	CAS-P-007.029.70	8	14	130-140		Lithic, Debitage	Complete Flakes	Complete Flakes	74	97.2	Complete Flakes
29	3B	CAS-P-007.029.71	8	14	130-140		Lithic, Debitage	Complete-"r" Flakes	Complete Flakes	2	0.8	Billet: r-flakes
29	3B	CAS-P-007.029.72	8	14	130-140		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	6	1.3	Notching
29	3B	CAS-P-007.029.73	8	14	130-140		Lithic, Debitage	Flake Tool	Flake Tool	3	27.1	
44	3B	CAS-P-007.044.49	9	14	130-140		Lithic, Debitage	Shatter	Shatter/Chunk	14	9.5	
44	3B	CAS-P-007.044.50	9	14	130-140		Lithic, Debitage	Burned	Burned	43	32.9	
44	3B	CAS-P-007.044.51	9	14	130-140		Lithic, Debitage	Flake Fragments	Broken Flakes	258	131.5	
44	3B	CAS-P-007.044.52	9	14	130-140		Lithic, Debitage	Proximal Flakes	Proximal Flakes	83	109.3	
44	3B	CAS-P-007.044.53	9	14	130-140		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	10	5.1	
44	3B	CAS-P-007.044.54	9	14	130-140		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.6	
44	3B	CAS-P-007.044.55	9	14	130-140		Lithic, Debitage	Complete Flakes	Complete Flakes	70	98.7	Complete Flakes
44	3B	CAS-P-007.044.56	9	14	130-140		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.7	Notching
44	3B	CAS-P-007.044.57	9	14	130-140		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.3	Billet: r-flakes
44	3B	CAS-P-007.044.58	9	14	130-140		Lithic, Debitage	Flake Tool	Flake Tool	2	3.8	
44	3	CAS-P-007.044.63	9	14	130-140		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	3	0.5	
45	4	CAS-P-007.045.07	9	15	140-150		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	3	0.5	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
45	3B	CAS-P-007.045.81	9	15	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	15	6.9	
45	3B	CAS-P-007.045.82	9	15	140-150		Lithic, Debitage	Burned	Burned	99	65.5	
45	3B	CAS-P-007.045.83	9	15	140-150		Lithic, Debitage	Flake Fragments	Broken Flakes	308	162.8	
45	3B	CAS-P-007.045.84	9	15	140-150		Lithic, Debitage	Proximal Flakes	Proximal Flakes	177	99	
45	3B	CAS-P-007.045.85	9	15	140-150		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	12	1.6	
45	3B	CAS-P-007.045.86	9	15	140-150		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	6	3	
45	3B	CAS-P-007.045.87	9	15	140-150		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	10.1	
45	3B	CAS-P-007.045.88	9	15	140-150		Lithic, Debitage	Complete Flakes	Complete Flakes	95	96.5	Complete Flakes
45	3B	CAS-P-007.045.89	9	15	140-150		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	3	7	Billet: r-flakes
45	3B	CAS-P-007.045.90	9	15	140-150		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0	Notching
45	3B	CAS-P-007.045.91	9	15	140-150		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	4	21.1	Billet: DEBs
45	3B	CAS-P-007.045.92	9	15	140-150		Lithic, Debitage	Flake Tool	Flake Tool	6	31.4	
49	2A	CAS-P-007.049.06	10	4	30-40		Lithic, Debitage	Shatter	Shatter/Chunk	19	14.2	
49	2A	CAS-P-007.049.07	10	4	30-40		Lithic, Debitage	Burned	Burned	54	18.2	
49	2A	CAS-P-007.049.08	10	4	30-40		Lithic, Debitage	Flake Fragments	Broken Flakes	153	59.5	
49	2A	CAS-P-007.049.09	10	4	30-40		Lithic, Debitage	Proximal Flakes	Proximal Flakes	50	63.3	
49	2A	CAS-P-007.049.10	10	4	30-40		Lithic, Debitage	Proximal Flakes- "r" Flakes	Proximal Flakes	2	0.7	
49	2A	CAS-P-007.049.11	10	4	30-40		Lithic, Debitage	Complete Flakes	Complete Flakes	23	196	Complete Flakes
49	2A	CAS-P-007.049.12	10	4	30-40		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.6	Notching
49	2A	CAS-P-007.049.13	10	4	30-40		Lithic, Debitage	Complete Flakes- "r" Flakes	Complete Flakes	1	0	Billet: r-flakes
49	2A	CAS-P-007.049.14	10	4	30-40		Lithic, Debitage	Flake Tool	Flake Tool	2	19.6	
53	2B	CAS-P-007.053.07	10	7	60-70		Lithic, Debitage	Shatter	Shatter/Chunk	25	50.9	
53	2B	CAS-P-007.053.08	10	7	60-70		Lithic, Debitage	Burned	Burned	109	39.6	
53	2B	CAS-P-007.053.09	10	7	60-70		Lithic, Debitage	Flake Fragments	Broken Flakes	291	114.4	
53	2B	CAS-P-007.053.10	10	7	60-70		Lithic, Debitage	Proximal Flakes	Proximal Flakes	161	72.7	
53	2B	CAS-P-007.053.11	10	7	60-70		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	6	1.6	
53	2B	CAS-P-007.053.12	10	7	60-70		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.3	
53	2B	CAS-P-007.053.13	10	7	60-70		Lithic, Debitage	Complete Flakes	Complete Flakes	38	15.2	Complete Flakes
53	2B	CAS-P-007.053.14	10	7	60-70		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.2	Notching
53	2B	CAS-P-007.053.15	10	7	60-70		Lithic, Debitage	Flake Tool	Flake Tool	10	116.2	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
55	3	CAS-P-007.055.51	10	9	74-83		Lithic, Debitage	Flakes with platforms	Proximal Flakes	430	457	
55	3	CAS-P-007.055.54	10	9	74-83		Lithic, Debitage	Flakes with no platforms	Broken Flakes	864	464	
55	3	CAS-P-007.055.55	10	9	74-83		Lithic, Debitage	Thermal fractures	Burned	47	22	
55	3	CAS-P-007.055.56	10	9	74-83		Lithic, Debitage	Shatter	Shatter/Chunk	29	21	
56	3A	CAS-P-007.056.08	10	10	83-93		Lithic, Debitage	Shatter	Shatter/Chunk	11	7.8	
56	3A	CAS-P-007.056.09	10	10	83-93		Lithic, Debitage	Burned	Burned	48	21.9	
56	3A	CAS-P-007.056.10	10	10	83-93		Lithic, Debitage	Flake Fragments	Broken Flakes	204	137	
56	3A	CAS-P-007.056.11	10	10	83-93		Lithic, Debitage	Proximal Flakes	Proximal Flakes	125	85.7	
56	3A	CAS-P-007.056.12	10	10	83-93		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	3.1	
56	3A	CAS-P-007.056.13	10	10	83-93		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.1	
56	3A	CAS-P-007.056.14	10	10	83-93		Lithic, Debitage	Complete Flakes	Complete Flakes	47	97.5	Complete Flakes
56	3A	CAS-P-007.056.15	10	10	83-93		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.4	Notching
56	3A	CAS-P-007.056.16	10	10	83-93		Lithic, Debitage	Flake Tool	Flake Tool	4	37.8	
56	3A	CAS-P-007.056.17	10	10	83-93		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	1	16	
56	3	CAS-P-007.056.22	10	10	83-93		Lithic, Debitage	burned flakes	Burned	2	1.9	
57	3	CAS-P-007.057.09	10	11	93-103		Lithic, Debitage	Shatter	Shatter/Chunk	34	25	
57	3	CAS-P-007.057.10	10	11	93-103		Lithic, Debitage	Heat spalls	Burned	4	<1	
57	3	CAS-P-007.057.11	10	11	93-103		Lithic, Debitage	Flakes with platforms	Proximal Flakes	236	216	
57	3	CAS-P-007.057.12	10	11	93-103		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	267	146	
58	3	CAS-P-007.058.06	10	12	117-130		Lithic, Debitage	Shatter	Shatter/Chunk	9	4.4	
58	3	CAS-P-007.058.07	10	12	117-130		Lithic, Debitage	Burned	Burned	37	30.7	
58	3	CAS-P-007.058.08	10	12	117-130		Lithic, Debitage	Flake Fragments	Broken Flakes	161	82.5	
58	3	CAS-P-007.058.09	10	12	117-130		Lithic, Debitage	Proximal Flakes	Proximal Flakes	112	84.6	
58	3	CAS-P-007.058.10	10	12	117-130		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	11	1.2	
58	3	CAS-P-007.058.11	10	12	117-130		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	2.2	
58	3	CAS-P-007.058.12	10	12	117-130		Lithic, Debitage	Complete Flakes	Complete Flakes	36	43.7	Complete Flakes
58	3	CAS-P-007.058.13	10	12	117-130		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.4	Notching
58	3	CAS-P-007.058.14	10	12	117-130		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0	Billet: r-flakes
58	3	CAS-P-007.058.15	10	12	117-130		Lithic, Debitage	Flake Tool	Flake Tool	3	28	
58	3	CAS-P-007.058.17	10	12	117-130		Lithic, Debitage	burned chert shatter	Burned	2	0.7	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
66	2A	CAS-P-007.066.02	11	5	45-55		Lithic, Debitage	Shatter	Shatter/Chunk	10	10.3	
66	2A	CAS-P-007.066.03	11	5	45-55		Lithic, Debitage	Burned	Burned	18	8.8	
66	2A	CAS-P-007.066.04	11	5	45-55		Lithic, Debitage	Flake Fragments	Broken Flakes	76	58.6	
66	2A	CAS-P-007.066.05	11	5	45-55		Lithic, Debitage	Proximal Flakes	Proximal Flakes	41	27.5	
66	2A	CAS-P-007.066.06	11	5	45-55		Lithic, Debitage	Complete Flakes	Complete Flakes	17	71	Complete Flakes
66	2A	CAS-P-007.066.07	11	5	45-55		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	5	1.3	Notching
68	2B	CAS-P-007.068.06	11	7	63-73		Lithic, Debitage	Shatter	Shatter/Chunk	13	20.4	
68	2B	CAS-P-007.068.07	11	7	63-73		Lithic, Debitage	Burned	Burned	71	61.5	
68	2B	CAS-P-007.068.08	11	7	63-73		Lithic, Debitage	Flake Fragments	Broken Flakes	221	190.1	
68	2B	CAS-P-007.068.09	11	7	63-73		Lithic, Debitage	Proximal Flakes	Proximal Flakes	143	228.3	
68	2B	CAS-P-007.068.10	11	7	63-73		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	7	1.1	
68	2B	CAS-P-007.068.11	11	7	63-73		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	1	0.4	
68	2B	CAS-P-007.068.12	11	7	63-73		Lithic, Debitage	Complete Flakes	Complete Flakes	50	97.8	Complete Flakes
68	2B	CAS-P-007.068.13	11	7	63-73		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.2	Billet: r-flakes
68	2B	CAS-P-007.068.14	11	7	63-73		Lithic, Debitage	Flake Tool	Flake Tool	4	24.3	
69	2B	CAS-P-007.069.04	11	8	73-83		Lithic, Debitage	Shatter	Shatter/Chunk	17	8.6	
69	2B	CAS-P-007.069.05	11	8	73-83		Lithic, Debitage	Burned	Burned	97	53.5	
69	2B	CAS-P-007.069.06	11	8	73-83		Lithic, Debitage	Flake Tool	Flake Tool	5	73.3	
69	2B	CAS-P-007.069.07	11	8	73-83		Lithic, Debitage	Flake Fragments	Broken Flakes	331	189.8	
69	2B	CAS-P-007.069.08	11	8	73-83		Lithic, Debitage	Proximal Flakes	Proximal Flakes	218	218.9	
69	2B	CAS-P-007.069.09	11	8	73-83		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	5	0.8	
69	2B	CAS-P-007.069.10	11	8	73-83		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	0.9	
69	2B	CAS-P-007.069.11	11	8	73-83		Lithic, Debitage	Complete Flakes	Complete Flakes	81	135.7	Complete Flakes
69	2B	CAS-P-007.069.12	11	8	73-83		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	7	1.1	Notching
69	2B	CAS-P-007.069.13	11	8	73-83		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.5	Billet: r-flakes
71	3	CAS-P-007.071.06	11	10	90-100		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	1	0.1	
71	3A	CAS-P-007.071.53	11	10	90-100		Lithic, Debitage	Shatter	Shatter/Chunk	21	23.7	
71	3A	CAS-P-007.071.54	11	10	90-100		Lithic, Debitage	Burned	Burned	67	32.5	
71	3A	CAS-P-007.071.55	11	10	90-100		Lithic, Debitage	Flake Fragments	Broken Flakes	453	317.5	
71	3A	CAS-P-007.071.56	11	10	90-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	247	160.1	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
71	3A	CAS-P-007.071.57	11	10	90-100		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1.6	
71	3A	CAS-P-007.071.58	11	10	90-100		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.7	
71	3A	CAS-P-007.071.59	11	10	90-100		Lithic, Debitage	Complete Flakes	Complete Flakes	93	253	Complete Flakes
71	3A	CAS-P-007.071.60	11	10	90-100		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	6	1.3	Notching
71	3A	CAS-P-007.071.61	11	10	90-100		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	4	1.7	Billet: r-flakes
71	3A	CAS-P-007.071.62	11	10	90-100		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	2	15.5	Billet: DEBs
71	3A	CAS-P-007.071.63	11	10	90-100		Lithic, Debitage	Flake Tool	Flake Tool	6	40.5	
73	3	CAS-P-007.073.08	11	12	120-130		Lithic, Debitage	Shatter	Shatter/Chunk	15	10.6	
73	3	CAS-P-007.073.09	11	12	120-130		Lithic, Debitage	Burned	Burned	44	35.8	
73	3	CAS-P-007.073.10	11	12	120-130		Lithic, Debitage	Flake Fragments	Broken Flakes	200	122.8	
73	3	CAS-P-007.073.11	11	12	120-130		Lithic, Debitage	Proximal Flakes	Proximal Flakes	170	158	
73	3	CAS-P-007.073.12	11	12	120-130		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.6	
73	3	CAS-P-007.073.13	11	12	120-130		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	1	0.3	
73	3	CAS-P-007.073.14	11	12	120-130		Lithic, Debitage	Complete Flakes	Complete Flakes	52	65.2	Complete Flakes
73	3	CAS-P-007.073.15	11	12	120-130		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.3	Notching
73	3	CAS-P-007.073.16	11	12	120-130		Lithic, Debitage	Flake Tool	Flake Tool	5	14.1	
73	3	CAS-P-007.073.17	11	12	120-130		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	2	18	
73	3	CAS-P-007.073.21	11	12	130-140		Lithic, Debitage	Burned flakes	Burned	2	2.9	
75	3B	CAS-P-007.075.11	11	14	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	28	19.7	
75	3B	CAS-P-007.075.12	11	14	140-150		Lithic, Debitage	Burned	Burned	82	83.1	
75	3B	CAS-P-007.075.13	11	14	140-150		Lithic, Debitage	Flake Fragments	Broken Flakes	331	242.5	
75	3B	CAS-P-007.075.14	11	14	140-150		Lithic, Debitage	Proximal Flakes	Proximal Flakes	127	102	
75	3B	CAS-P-007.075.15	11	14	140-150		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	9	2.4	
75	3B	CAS-P-007.075.16	11	14	140-150		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	7.4	
75	3B	CAS-P-007.075.17	11	14	140-150		Lithic, Debitage	Complete Flakes	Complete Flakes	83	111	Complete Flakes
75	3B	CAS-P-007.075.18	11	14	140-150		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	4	7.6	Billet: r-flakes
75	3B	CAS-P-007.075.19	11	14	140-150		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	0.5	Notching
75	3B	CAS-P-007.075.20	11	14	140-150		Lithic, Debitage	Flake Tool	Flake Tool	1	1.2	
75	3B	CAS-P-007.075.21	11	14	140-150		Lithic, Debitage	Flakes with platforms	Proximal Flakes	1	1	
75	4	CAS-P-007.075.26	11	14	140-150		Lithic, Debitage	Burned flakes	Burned	8	2.2	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
79	1	CAS-P-007.079.39	12	4	32-42		Lithic, Debitage	Burned	Burned	30	11.8	
79	1	CAS-P-007.079.40	12	4	32-42		Lithic, Debitage	Flake Fragments	Broken Flakes	109	54.2	
79	1	CAS-P-007.079.41	12	4	32-42		Lithic, Debitage	Proximal Flakes	Proximal Flakes	42	32.9	
79	1	CAS-P-007.079.42	12	4	32-42		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	1.2	
79	1	CAS-P-007.079.43	12	4	32-42		Lithic, Debitage	Proximal Flakes-"r" flakes	Proximal Flakes	1	0.3	
79	1	CAS-P-007.079.44	12	4	32-42		Lithic, Debitage	Complete Flakes	Complete Flakes	28	82.2	Complete Flakes
79	1	CAS-P-007.079.45	12	4	32-42		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	8	1.9	Notching
79	1	CAS-P-007.079.46	12	4	32-42		Lithic, Debitage	Complete Flakes-"r" flakes	Complete Flakes	1	0.6	Billet: r-flakes
79	1	CAS-P-007.079.47	12	4	32-42		Lithic, Debitage	Flake Tool	Flake Tool	2	52.6	
79	1	CAS-P-007.079.52	12	4	32-42		Lithic, Debitage	Shatter	Shatter/Chunk	33	12.2	
83	2C	CAS-P-007.083.07	12	8	73-83		Lithic, Debitage	Shatter	Shatter/Chunk	24	42.6	
83	2C	CAS-P-007.083.08	12	8	73-83		Lithic, Debitage	Burned	Burned	143	137.7	
83	2C	CAS-P-007.083.09	12	8	73-83		Lithic, Debitage	Flake Fragments	Broken Flakes	443	353	
83	2C	CAS-P-007.083.10	12	8	73-83		Lithic, Debitage	Proximal Flakes	Proximal Flakes	301	334.8	
83	2C	CAS-P-007.083.11	12	8	73-83		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	7	23.7	
83	2C	CAS-P-007.083.12	12	8	73-83		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	11	1.9	
83	2C	CAS-P-007.083.13	12	8	73-83		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1.7	
83	2C	CAS-P-007.083.14	12	8	73-83		Lithic, Debitage	Complete Flakes	Complete Flakes	79	162.8	Complete Flakes
83	2C	CAS-P-007.083.15	12	8	73-83		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	5	1.3	Notching
83	2C	CAS-P-007.083.16	12	8	73-83		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	1.2	Billet: r-flakes
83	2C	CAS-P-007.083.17	12	8	73-83		Lithic, Debitage	Flake Tool	Flake Tool	12	129.2	
84	2C	CAS-P-007.084.52	12	9	83-92		Lithic, Debitage	Shatter	Shatter/Chunk	29	49.3	
84	2C	CAS-P-007.084.53	12	9	83-92		Lithic, Debitage	Burned	Burned	131	100.7	
84	2C	CAS-P-007.084.54	12	9	83-92		Lithic, Debitage	Flake Fragments	Broken Flakes	485	254.4	
84	2C	CAS-P-007.084.55	12	9	83-92		Lithic, Debitage	Proximal Flakes	Proximal Flakes	333	242.4	
84	2C	CAS-P-007.084.56	12	9	83-92		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	13	2.2	
84	2C	CAS-P-007.084.57	12	9	83-92		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	9	6.3	
84	2C	CAS-P-007.084.58	12	9	83-92		Lithic, Debitage	Complete Flakes	Complete Flakes	102	196	Complete Flakes
84	2C	CAS-P-007.084.59	12	9	83-92		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	1.1	Notching
84	2C	CAS-P-007.084.60	12	9	83-92		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.3	Billet: r-flakes

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
84	2C	CAS-P-007.084.61	12	9	83-92		Lithic, Debitage	Flake Tool	Flake Tool	11	38.2	
85	3	CAS-P-007.085.40	12	10	92-100		Lithic, Debitage	Shatter	Shatter/Chunk	11	12.2	
85	3	CAS-P-007.085.41	12	10	92-100		Lithic, Debitage	Burned	Burned	63	21.6	
85	3	CAS-P-007.085.42	12	10	92-100		Lithic, Debitage	Flake Fragments	Broken Flakes	297	155.5	
85	3	CAS-P-007.085.43	12	10	92-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	111	96.1	
85	3	CAS-P-007.085.44	12	10	92-100		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.6	
85	3	CAS-P-007.085.45	12	10	92-100		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	3	0.5	
85	3	CAS-P-007.085.46	12	10	92-100		Lithic, Debitage	Complete Flakes	Complete Flakes	60	94.6	Complete Flakes
85	3	CAS-P-007.085.47	12	10	92-100		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.2	Notching
85	3	CAS-P-007.085.48	12	10	92-100		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	1	0.7	Billet: DEBs
85	3	CAS-P-007.085.49	12	10	92-100		Lithic, Debitage	flake with platform	Proximal Flakes	1	1	
85	3	CAS-P-007.085.57	12	10	92-100		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	1	0.1	
86	3	CAS-P-007.086.05	12	11	100-110		Lithic, Debitage	shatter	Shatter/Chunk	7	4	
86	3	CAS-P-007.086.06	12	11	100-110		Lithic, Debitage	heat spalls	Burned	3	<1	
86	3	CAS-P-007.086.07	12	11	100-110		Lithic, Debitage	Flakes with platforms	Proximal Flakes	249	196	
86	3	CAS-P-007.086.08	12	11	100-110		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	316	217	
87	3B	CAS-P-007.087.05	12	12	120-130		Lithic, Debitage	Shatter	Shatter/Chunk	6	3.3	
87	3B	CAS-P-007.087.06	12	12	120-130		Lithic, Debitage	Burned	Burned	33	41.1	
87	3B	CAS-P-007.087.07	12	12	120-130		Lithic, Debitage	Flake Fragments	Broken Flakes	279	131.9	
87	3B	CAS-P-007.087.08	12	12	120-130		Lithic, Debitage	Proximal Flakes	Proximal Flakes	161	92	
87	3B	CAS-P-007.087.09	12	12	120-130		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	5.3	
87	3B	CAS-P-007.087.10	12	12	120-130		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	12	2.5	
87	3B	CAS-P-007.087.11	12	12	120-130		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	2	5.9	
87	3B	CAS-P-007.087.12	12	12	120-130		Lithic, Debitage	Complete Flakes	Complete Flakes	52	29.6	Complete Flakes
87	3B	CAS-P-007.087.13	12	12	120-130		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.9	Notching
87	3B	CAS-P-007.087.14	12	12	120-130		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	3.6	Billet: r-flakes
87	3B	CAS-P-007.087.15	12	12	120-130		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	2	7	Billet: DEBs
87	3B	CAS-P-007.087.16	12	12	120-130		Lithic, Debitage	Flake Tool	Flake Tool	7	16.1	
88	3	CAS-P-007.088.51	12	13	130-140		Lithic, Debitage	Shatter	Shatter/Chunk	11	5	
88	3	CAS-P-007.088.52	12	13	130-140		Lithic, Debitage	Burned	Burned	41	29	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
88	3	CAS-P-007.088.53	12	13	130-140		Lithic, Debitage	Flake Fragment	Broken Flakes	219	69.7	
88	3	CAS-P-007.088.54	12	13	130-140		Lithic, Debitage	Proximal Flakes	Proximal Flakes	152	93.3	
88	3	CAS-P-007.088.55	12	13	130-140		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	2	0.4	
88	3	CAS-P-007.088.56	12	13	130-140		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.2	
88	3	CAS-P-007.088.57	12	13	130-140		Lithic, Debitage	Complete Flakes	Complete Flakes	71	89.1	Complete Flakes
88	3	CAS-P-007.088.58	12	13	130-140		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	2.8	Billet: r-flakes
89	3	CAS-P-007.089.11	12	14	140-150	29, 30	Lithic, Debitage	Shatter	Shatter/Chunk	19	19.9	
89	3	CAS-P-007.089.12	12	14	140-150	29, 30	Lithic, Debitage	Burned	Burned	62	57.5	
89	3	CAS-P-007.089.13	12	14	140-150	29, 30	Lithic, Debitage	Flake Fragments	Broken Flakes	275	221.2	
89	3	CAS-P-007.089.14	12	14	140-150	29, 30	Lithic, Debitage	Proximal Flakes	Proximal Flakes	128	131.7	
89	3	CAS-P-007.089.15	12	14	140-150	29, 30	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	8	2.7	
89	3	CAS-P-007.089.16	12	14	140-150	29, 30	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	1.2	
89	3	CAS-P-007.089.17	12	14	140-150	29, 30	Lithic, Debitage	Complete Flakes	Complete Flakes	79	134.6	Complete Flakes
89	3	CAS-P-007.089.18	12	14	140-150	29, 30	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.5	Billet: r-flakes
89	3	CAS-P-007.089.19	12	14	140-150	29, 30	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.4	Notching
89	3	CAS-P-007.089.20	12	14	140-150	29, 30	Lithic, Debitage	Flake Tool	Flake Tool	2	22	
94	2B	CAS-P-007.094.03	13	5	54-65		Lithic, Debitage	Shatter	Shatter/Chunk	16	41.4	
94	2B	CAS-P-007.094.04	13	5	54-65		Lithic, Debitage	Burned	Burned	37	29.1	
94	2B	CAS-P-007.094.05	13	5	54-65		Lithic, Debitage	Flake Fragments	Broken Flakes	109	97.9	
94	2B	CAS-P-007.094.06	13	5	54-65		Lithic, Debitage	Proximal Flakes	Proximal Flakes	69	65.8	
94	2B	CAS-P-007.094.07	13	5	54-65		Lithic, Debitage	Complete Flakes	Complete Flakes	34	54.5	Complete Flakes
94	2B	CAS-P-007.094.08	13	5	54-65		Lithic, Debitage	Flake Tool	Flake Tool	5	68.8	
95	2B	CAS-P-007.095.02	13	6	65-75		Lithic, Debitage	Shatter	Shatter/Chunk	17	14.9	
95	2B	CAS-P-007.095.03	13	6	65-75		Lithic, Debitage	Burned	Burned	69	41.8	
95	2B	CAS-P-007.095.04	13	6	65-75		Lithic, Debitage	Flake Fragments	Broken Flakes	225	126	
95	2B	CAS-P-007.095.05	13	6	65-75		Lithic, Debitage	Proximal Flakes	Proximal Flakes	149	143.4	
95	2B	CAS-P-007.095.06	13	6	65-75		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1.6	
95	2B	CAS-P-007.095.07	13	6	65-75		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.2	
95	2B	CAS-P-007.095.08	13	6	65-75		Lithic, Debitage	Complete Flakes	Complete Flakes	56	62.1	Complete Flakes
95	2B	CAS-P-007.095.09	13	6	65-75		Lithic, Debitage	Complete Flakes- "r" Flakes	Complete Flakes	1	4	Billet: r-flakes

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
96	2B	CAS-P-007.096.04	13	7	75-85		Lithic, Debitage	Shatter	Shatter/Chunk	12	4.4	
96	2B	CAS-P-007.096.05	13	7	75-85		Lithic, Debitage	Burned	Burned	74	33.7	
96	2B	CAS-P-007.096.06	13	7	75-85		Lithic, Debitage	Flake Fragments	Broken Flakes	246	115.5	
96	2B	CAS-P-007.096.07	13	7	75-85		Lithic, Debitage	Proximal Flakes	Proximal Flakes	191	101.1	
96	2B	CAS-P-007.096.08	13	7	75-85		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	7	0.9	
96	2B	CAS-P-007.096.09	13	7	75-85		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	2	6.1	
96	2B	CAS-P-007.096.10	13	7	75-85		Lithic, Debitage	Complete Flakes	Complete Flakes	40	55.7	Complete Flakes
96	2B	CAS-P-007.096.11	13	7	75-85		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.2	Notching
97	2B	CAS-P-007.097.11	13	8	85-95		Lithic, Debitage	Shatter	Shatter/Chunk	24	59.8	
97	2B	CAS-P-007.097.12	13	8	85-95		Lithic, Debitage	Burned	Burned	141	74.7	
97	2B	CAS-P-007.097.13	13	8	85-95		Lithic, Debitage	Flake Fragments	Broken Flakes	283	142.8	
97	2B	CAS-P-007.097.14	13	8	85-95		Lithic, Debitage	Proximal Flakes	Proximal Flakes	210	138.8	
97	2B	CAS-P-007.097.15	13	8	85-95		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	15	14.9	
97	2B	CAS-P-007.097.16	13	8	85-95		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	4	0.7	
97	2B	CAS-P-007.097.17	13	8	85-95		Lithic, Debitage	Complete Flakes	Complete Flakes	60	64.6	Complete Flakes
97	2B	CAS-P-007.097.18	13	8	85-95		Lithic, Debitage	Complete flakes-Notching	Complete Flakes	4	0.7	Notching
98	3A	CAS-P-007.098.04	13	9	95-105		Lithic, Debitage	Shatter	Shatter/Chunk	25	14.8	
98	3A	CAS-P-007.098.05	13	9	95-105		Lithic, Debitage	Burned	Burned	98	52.5	
98	3A	CAS-P-007.098.06	13	9	95-105		Lithic, Debitage	Flake Fragments	Broken Flakes	434	266.5	
98	3A	CAS-P-007.098.07	13	9	95-105		Lithic, Debitage	Proximal Flakes	Proximal Flakes	227	161.3	
98	3A	CAS-P-007.098.08	13	9	95-105		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	16	9.6	
98	3A	CAS-P-007.098.09	13	9	95-105		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	4	0.7	
98	3A	CAS-P-007.098.10	13	9	95-105		Lithic, Debitage	Complete Flakes	Complete Flakes	93	161.4	Complete Flakes
98	3A	CAS-P-007.098.11	13	9	95-105		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.2	Billet: r-flakes
98	3A	CAS-P-007.098.12	13	9	95-105		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.2	Notching
98	3A	CAS-P-007.098.13	13	9	95-105		Lithic, Debitage	Flake Tool	Flake Tool	6	34	
99	3	CAS-P-007.099.10	13	10	105		Lithic, Debitage	Burned	Burned	8	1.6	
99	3	CAS-P-007.099.11	13	10	105		Lithic, Debitage	Flake Fragments	Broken Flakes	57	60.9	
99	3	CAS-P-007.099.12	13	10	105		Lithic, Debitage	Proximal Flakes	Proximal Flakes	60	35.9	
99	3	CAS-P-007.099.13	13	10	105		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	1.1	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
99	3	CAS-P-007.099.14	13	10	105		Lithic, Debitage	Complete Flakes	Complete Flakes	26	42	Complete Flakes
99	3	CAS-P-007.099.15	13	10	105		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.2	Notching
99	3	CAS-P-007.099.16	13	10	105		Lithic, Debitage	Flake Tool	Flake Tool	1	2.2	
100	3	CAS-P-007.100.24	13	11	105-117		Lithic, Debitage	Shatter	Shatter/Chunk	5	3.3	
100	3	CAS-P-007.100.25	13	11	105-117		Lithic, Debitage	Burned	Burned	51	35.9	
100	3	CAS-P-007.100.26	13	11	105-117		Lithic, Debitage	Flake Fragments	Broken Flakes	155	92.5	
100	3	CAS-P-007.100.27	13	11	105-117		Lithic, Debitage	Proximal Flakes	Proximal Flakes	89	52.5	
100	3	CAS-P-007.100.28	13	11	105-117		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.3	
100	3	CAS-P-007.100.29	13	11	105-117		Lithic, Debitage	Complete Flakes	Complete Flakes	38	32.1	Complete Flakes
100	3	CAS-P-007.100.30	13	11	105-117		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	1	Notching
100	3	CAS-P-007.100.31	13	11	105-117		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	1.6	Billet: r-flakes
100	3	CAS-P-007.100.32	13	11	105-117		Lithic, Debitage	Flake Tool	Flake Tool	1	3.4	
101	3	CAS-P-007.101.26	13	12	118-120		Lithic, Debitage	Shatter	Shatter/Chunk	9	3.9	
101	3	CAS-P-007.101.27	13	12	118-120		Lithic, Debitage	Burned	Burned	13	19	
101	3	CAS-P-007.101.28	13	12	118-120		Lithic, Debitage	Flake Fragments	Broken Flakes	90	34.1	
101	3	CAS-P-007.101.29	13	12	118-120		Lithic, Debitage	Proximal Flakes	Proximal Flakes	38	38.7	
101	3	CAS-P-007.101.30	13	12	118-120		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.4	
101	3	CAS-P-007.101.31	13	12	118-120		Lithic, Debitage	Complete Flakes	Complete Flakes	19	12.4	Complete Flakes
101	3	CAS-P-007.101.32	13	12	118-120		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0	Billet: r-flakes
101	3	CAS-P-007.101.33	13	12	118-120		Lithic, Debitage	Flake Tool	Flake Tool	1	2.9	
102	3	CAS-P-007.102.07	13	13	120-130	22	Lithic, Debitage	Shatter	Shatter/Chunk	10	7.6	
102	3	CAS-P-007.102.08	13	13	120-130	22	Lithic, Debitage	Burned	Burned	26	9.9	
102	3	CAS-P-007.102.09	13	13	120-130	22	Lithic, Debitage	Flake Fragments	Broken Flakes	185	104.4	
102	3	CAS-P-007.102.10	13	13	120-130	22	Lithic, Debitage	Proximal Flakes	Proximal Flakes	114	84.8	
102	3	CAS-P-007.102.11	13	13	120-130	22	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	4	0.8	
102	3	CAS-P-007.102.12	13	13	120-130	22	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1	
102	3	CAS-P-007.102.13	13	13	120-130	22	Lithic, Debitage	Complete Flakes	Complete Flakes	45	108.9	Complete Flakes
102	3	CAS-P-007.102.14	13	13	120-130	22	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.3	Notching
102	3	CAS-P-007.102.15	13	13	120-130	22	Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	2	8.8	Billet: DEBs
102	3	CAS-P-007.102.16	13	13	120-130	22	Lithic, Debitage	Flake Tool	Flake Tool	1	18.9	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
104	4	CAS-P-007.104.56	13	15	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	16	25.9	
104	4	CAS-P-007.104.57	13	15	140-150		Lithic, Debitage	Flake Fragments	Broken Flakes	298	154	
104	4	CAS-P-007.104.58	13	15	140-150		Lithic, Debitage	Burned	Burned	86	79.9	
104	4	CAS-P-007.104.59	13	15	140-150		Lithic, Debitage	Proximal Flakes	Proximal Flakes	218	136	
104	4	CAS-P-007.104.60	13	15	140-150		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	11	4.5	
104	4	CAS-P-007.104.61	13	15	140-150		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.4	
104	4	CAS-P-007.104.62	13	15	140-150		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	6.7	
104	4	CAS-P-007.104.63	13	15	140-150		Lithic, Debitage	Complete Flakes	Complete Flakes	103	163.5	Complete Flakes
104	4	CAS-P-007.104.64	13	15	140-150		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	5	8.7	Billet: r-flakes
104	4	CAS-P-007.104.65	13	15	140-150		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.8	Notching
104	4	CAS-P-007.104.66	13	15	140-150		Lithic, Debitage	Flake Tool	Flake Tool	5	13.6	
109	1	CAS-P-007.109.32	14	5	40-50		Lithic, Debitage	Burned	Burned	29	14.2	
109	1	CAS-P-007.109.33	14	5	40-50		Lithic, Debitage	Flake Fragments	Broken Flakes	116	77.8	
109	1	CAS-P-007.109.34	14	5	40-50		Lithic, Debitage	Proximal Fragments	Proximal Flakes	46	59.6	
109	1	CAS-P-007.109.35	14	5	40-50		Lithic, Debitage	Complete Flakes	Complete Flakes	31	57.8	Complete Flakes
109	1	CAS-P-007.109.36	14	5	40-50		Lithic, Debitage	Flake Tool	Flake Tool	2	15.2	
109	1	CAS-P-007.109.37	14	5	40-50		Lithic, Debitage	Shatter	Shatter/Chunk	5	2	
110	2A	CAS-P-007.110.48	14	6	50-60		Lithic, Debitage	Shatter	Shatter/Chunk	6	4.2	
110	2A	CAS-P-007.110.49	14	6	50-60		Lithic, Debitage	Burned	Burned	34	32.3	
110	2A	CAS-P-007.110.50	14	6	50-60		Lithic, Debitage	Flake Fragments	Broken Flakes	103	152	
110	2A	CAS-P-007.110.51	14	6	50-60		Lithic, Debitage	Proximal Flakes	Proximal Flakes	104	154.6	
110	2A	CAS-P-007.110.52	14	6	50-60		Lithic, Debitage	Proximal Flakes - notching	Proximal Flakes	1	0.6	
110	2A	CAS-P-007.110.53	14	6	50-60		Lithic, Debitage	Proximal flakes - "r" flakes	Proximal Flakes	1	1.2	
110	2A	CAS-P-007.110.54	14	6	50-60		Lithic, Debitage	Complete Flakes	Complete Flakes	73	273.7	Complete Flakes
110	2A	CAS-P-007.110.55	14	6	50-60		Lithic, Debitage	Complete Flakes - Notching	Complete Flakes	4	0.4	Notching
110	2A	CAS-P-007.110.56	14	6	50-60		Lithic, Debitage	Complete Flakes - "r" flakes	Complete Flakes	1	0.5	Billet: r-flakes
111	2B	CAS-P-007.111.40	14	7	60-70		Lithic, Debitage	Shatter	Shatter/Chunk	16	11.6	
111	2B	CAS-P-007.111.41	14	7	60-70		Lithic, Debitage	Burned	Burned	68	24.7	
111	2B	CAS-P-007.111.42	14	7	60-70		Lithic, Debitage	Flake Fragments	Broken Flakes	230	133.8	
111	2B	CAS-P-007.111.43	14	7	60-70		Lithic, Debitage	Proximal Flakes	Proximal Flakes	135	98.6	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
111	2B	CAS-P-007.111.44	14	7	60-70		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	4	0.5	
111	2B	CAS-P-007.111.45	14	7	60-70		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	3	1.3	
111	2B	CAS-P-007.111.46	14	7	60-70		Lithic, Debitage	Complete Flakes	Complete Flakes	52	66.2	Complete Flakes
111	2B	CAS-P-007.111.47	14	7	60-70		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	7	0.6	Notching
111	2B	CAS-P-007.111.48	14	7	60-70		Lithic, Debitage	Flake Tool	Flake Tool	1	5.5	
112	2C	CAS-P-007.112.45	14	8	70-80		Lithic, Debitage	Shatter	Shatter/Chunk	20	14	
112	2C	CAS-P-007.112.46	14	8	70-80		Lithic, Debitage	Flake Fragments	Broken Flakes	385	223.6	
112	2C	CAS-P-007.112.47	14	8	70-80		Lithic, Debitage	Burned	Burned	107	50.6	
112	2C	CAS-P-007.112.48	14	8	70-80		Lithic, Debitage	Proximal Flakes	Proximal Flakes	218	120.7	
112	2C	CAS-P-007.112.49	14	8	70-80		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	10	1.6	
112	2C	CAS-P-007.112.50	14	8	70-80		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	3.5	
112	2C	CAS-P-007.112.51	14	8	70-80		Lithic, Debitage	Complete Flakes	Complete Flakes	68	83.2	Complete Flakes
112	2C	CAS-P-007.112.52	14	8	70-80		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	8	2	Notching
112	2C	CAS-P-007.112.53	14	8	70-80		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	2.7	Billet: r-flakes
112	2C	CAS-P-007.112.54	14	8	70-80		Lithic, Debitage	Flake Tool	Flake Tool	1	1.3	
113	3A	CAS-P-007.113.34	14	9	80-90		Lithic, Debitage	Shatter	Shatter/Chunk	19	13.3	
113	3A	CAS-P-007.113.35	14	9	80-90		Lithic, Debitage	Burned	Burned	129	65.8	
113	3A	CAS-P-007.113.36	14	9	80-90		Lithic, Debitage	Flake Fragments	Broken Flakes	502	204.4	
113	3A	CAS-P-007.113.37	14	9	80-90		Lithic, Debitage	Proximal Flakes	Proximal Flakes	195	105.7	
113	3A	CAS-P-007.113.38	14	9	80-90		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	5	0.5	
113	3A	CAS-P-007.113.39	14	9	80-90		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	3	4	
113	3A	CAS-P-007.113.40	14	9	80-90		Lithic, Debitage	Complete Flakes	Complete Flakes	68	86.2	Complete Flakes
113	3A	CAS-P-007.113.41	14	9	80-90		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.7	Notching
113	3A	CAS-P-007.113.42	14	9	80-90		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	3	1	Billet: r-flakes
113	3A	CAS-P-007.113.43	14	9	80-90		Lithic, Debitage	Flake Tool	Flake Tool	2	1	
114	3	CAS-P-007.114.40	14	10	90-100		Lithic, Debitage	Shatter	Shatter/Chunk	13	6.5	
114	3	CAS-P-007.114.41	14	10	90-100		Lithic, Debitage	Burned	Burned	84	32.2	
114	3	CAS-P-007.114.42	14	10	90-100		Lithic, Debitage	Flake Fragments	Broken Flakes	465	196.4	
114	3	CAS-P-007.114.43	14	10	90-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	254	132.2	
114	3	CAS-P-007.114.44	14	10	90-100		Lithic, Debitage	Proximal flakes-"r" Flakes	Proximal Flakes	6	1	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
114	3	CAS-P-007.114.45	14	10	90-100		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.3	
114	3	CAS-P-007.114.46	14	10	90-100		Lithic, Debitage	Complete Flakes	Complete Flakes	38	27.6	Complete Flakes
114	3	CAS-P-007.114.47	14	10	90-100		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.5	Notching
114	3	CAS-P-007.114.48	14	10	90-100		Lithic, Debitage	Flake Tool	Flake Tool	1	0.4	
115	3	CAS-P-007.115.53	14	11	100-110		Lithic, Debitage	Shatter	Shatter/Chunk	15	9.9	
115	3	CAS-P-007.115.54	14	11	100-110		Lithic, Debitage	Burned	Burned	93	116.5	
115	3	CAS-P-007.115.55	14	11	100-110		Lithic, Debitage	Flake Fragments	Broken Flakes	398	222.2	
115	3	CAS-P-007.115.56	14	11	100-110		Lithic, Debitage	Proximal Flakes	Proximal Flakes	210	140	
115	3	CAS-P-007.115.57	14	11	100-110		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	9	8.1	
115	3	CAS-P-007.115.58	14	11	100-110		Lithic, Debitage	Complete Flakes	Complete Flakes	112	168.1	Complete Flakes
115	3	CAS-P-007.115.59	14	11	100-110		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	4.9	Billet: r-flakes
115	3	CAS-P-007.115.60	14	11	100-110		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.4	Notching
115	3	CAS-P-007.115.61	14	11	100-111		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	1	5	Billet: DEBs
115	3	CAS-P-007.115.62	14	11	100-112		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	2	5.5	
115	3	CAS-P-007.115.63	14	11	100-113		Lithic, Debitage	Flake Tool	Flake Tool	1	3.6	
115	3	CAS-P-007.115.64	14	11	100-114		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.4	
122	1	CAS-P-007.122.21	15	4	44-55		Lithic, Debitage	Shatter	Shatter/Chunk	8	19.6	
122	1	CAS-P-007.122.22	15	4	44-55		Lithic, Debitage	Burned	Burned	10	8.8	
122	1	CAS-P-007.122.23	15	4	44-55		Lithic, Debitage	Flake Fragments	Broken Flakes	24	18.4	
122	1	CAS-P-007.122.24	15	4	44-55		Lithic, Debitage	Proximal Flakes	Proximal Flakes	18	20.4	
122	1	CAS-P-007.122.25	15	4	44-55		Lithic, Debitage	Proximal Flakes-"r" flakes	Proximal Flakes	2	1.1	
122	1	CAS-P-007.122.26	15	4	44-55		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	1.4	
122	1	CAS-P-007.122.27	15	4	44-55		Lithic, Debitage	Complete Flakes	Complete Flakes	7	3.1	Complete Flakes
122	1	CAS-P-007.122.28	15	4	44-55		Lithic, Debitage	Flake Tool	Flake Tool	4	16.9	
124	2B	CAS-P-007.124.43	15	6	50-65		Lithic, Debitage	Shatter	Shatter/Chunk	8	4.2	
124	2B	CAS-P-007.124.44	15	6	50-65		Lithic, Debitage	Burned	Burned	68	28.3	
124	2B	CAS-P-007.124.45	15	6	50-65		Lithic, Debitage	Flake Fragments	Broken Flakes	240	160.4	
124	2B	CAS-P-007.124.46	15	6	50-65		Lithic, Debitage	Proximal Flakes	Proximal Flakes	148	121.5	
124	2B	CAS-P-007.124.47	15	6	50-65		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.3	
124	2B	CAS-P-007.124.48	15	6	50-65		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	6	2.4	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
124	2B	CAS-P-007.124.49	15	6	50-65		Lithic, Debitage	Complete Flakes	Complete Flakes	52	83	Complete Flakes
124	2B	CAS-P-007.124.50	15	6	50-65		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	2	0.5	Notching
124	2B	CAS-P-007.124.51	15	6	50-65		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	3	6.1	Billet: r-flakes
124	2B	CAS-P-007.124.52	15	6	50-65		Lithic, Debitage	Flake Tool	Flake Tool	4	150.3	
125	2B	CAS-P-007.125.51	15	7	65-75	15	Lithic, Debitage	Shatter	Shatter/Chunk	16	17.7	
125	2B	CAS-P-007.125.52	15	7	65-75	15	Lithic, Debitage	Burned	Burned	75	41.8	
125	2B	CAS-P-007.125.53	15	7	65-75	15	Lithic, Debitage	Flake Fragments	Broken Flakes	292	230.7	
125	2B	CAS-P-007.125.54	15	7	65-75	15	Lithic, Debitage	Proximal Flakes	Proximal Flakes	226	197.1	
125	2B	CAS-P-007.125.55	15	7	65-75	15	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	2.6	
125	2B	CAS-P-007.125.56	15	7	65-75	15	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.3	
125	2B	CAS-P-007.125.57	15	7	65-75	15	Lithic, Debitage	Complete Flakes	Complete Flakes	48	95.9	Complete Flakes
125	2B	CAS-P-007.125.58	15	7	65-75	15	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	9	1.2	Notching
125	2B	CAS-P-007.125.59	15	7	65-75	15	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.7	Billet: r-flakes
125	2B	CAS-P-007.125.60	15	7	65-75	15	Lithic, Debitage	Flake Tool	Flake Tool	5	12.9	
126	2B	CAS-P-007.126.25	15	8	75-83		Lithic, Debitage	Shatter	Shatter/Chunk	12	6	
126	2B	CAS-P-007.126.26	15	8	75-83		Lithic, Debitage	Flake Fragments	Broken Flakes	200	155.3	
126	2B	CAS-P-007.126.27	15	8	75-83		Lithic, Debitage	Burned	Burned	49	22.5	
126	2B	CAS-P-007.126.28	15	8	75-83		Lithic, Debitage	Proximal Flakes	Proximal Flakes	117	103.2	
126	2B	CAS-P-007.126.29	15	8	75-83		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.5	
126	2B	CAS-P-007.126.30	15	8	75-83		Lithic, Debitage	Complete Flakes	Complete Flakes	43	49.6	Complete Flakes
126	2B	CAS-P-007.126.31	15	8	75-83		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	5	0.8	Notching
127	3	CAS-P-007.127.45	15	9	83-95		Lithic, Debitage	Shatter	Shatter/Chunk	10	5	
127	3	CAS-P-007.127.46	15	9	83-95		Lithic, Debitage	Thermal fractures	Burned	5	3	
127	3	CAS-P-007.127.47	15	9	83-95		Lithic, Debitage	Flakes with platforms	Proximal Flakes	262	287	
127	3	CAS-P-007.127.48	15	9	83-95		Lithic, Debitage	Large platform flake	Proximal Flakes	1	34	
127	3	CAS-P-007.127.49	15	9	83-95		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	286	169	
128	3	CAS-P-007.128.02	15	10	95-100		Lithic, Debitage	Shatter	Shatter/Chunk	3	0.8	
128	3	CAS-P-007.128.03	15	10	95-100		Lithic, Debitage	Burned	Burned	27	17.1	
128	3	CAS-P-007.128.04	15	10	95-100		Lithic, Debitage	Flake Fragments	Broken Flakes	121	43.5	
128	3	CAS-P-007.128.05	15	10	95-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	74	51.2	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
128	3	CAS-P-007.128.06	15	10	95-100		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	2	0.6	
128	3	CAS-P-007.128.07	15	10	95-100		Lithic, Debitage	Complete Flakes	Complete Flakes	19	22	Complete Flakes
128	3	CAS-P-007.128.08	15	10	95-100		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.1	Billet: r-flakes
129	3	CAS-P-007.129.43	15	11	100-110		Lithic, Debitage	Shatter	Shatter/Chunk	11	5.4	
129	3	CAS-P-007.129.44	15	11	100-110		Lithic, Debitage	Burned	Burned	101	62.3	
129	3	CAS-P-007.129.45	15	11	100-110		Lithic, Debitage	Flake Fragments	Broken Flakes	339	151.6	
129	3	CAS-P-007.129.46	15	11	100-110		Lithic, Debitage	Proximal Flakes	Proximal Flakes	224	106.5	
129	3	CAS-P-007.129.47	15	11	100-110		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	6	1.2	
129	3	CAS-P-007.129.48	15	11	100-110		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	6	14.4	
129	3	CAS-P-007.129.49	15	11	100-110		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	4.4	
129	3	CAS-P-007.129.50	15	11	100-110		Lithic, Debitage	Complete Flakes	Complete Flakes	79	69.5	Complete Flakes
129	3	CAS-P-007.129.51	15	11	100-110		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	0.4	Notching
129	3	CAS-P-007.129.52	15	11	100-110		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	3	8.6	Billet: DEBs
129	3	CAS-P-007.129.53	15	11	100-110		Lithic, Debitage	Flake Tool	Flake Tool	1	24.5	
130	3	CAS-P-007.130.04	15	12	110-120		Lithic, Debitage	Proximal Flakes	Proximal Flakes	55	29	
130	3	CAS-P-007.130.05	15	12	110-120		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	3	1	
130	3	CAS-P-007.130.25	15	12	110-120		Lithic, Debitage	Shatter	Shatter/Chunk	2	1.7	
130	3	CAS-P-007.130.26	15	12	110-120		Lithic, Debitage	Burned	Burned	18	12.6	
130	3	CAS-P-007.130.27	15	12	110-120		Lithic, Debitage	Flake Fragments	Broken Flakes	97	41.4	
130	3	CAS-P-007.130.28	15	12	110-120		Lithic, Debitage	Complete Flakes	Complete Flakes	18	10.4	Complete Flakes
130	3	CAS-P-007.130.29	15	12	110-120		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.5	
130	3	CAS-P-007.130.32	15	12	110-120		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	3	0.6	
131	3B	CAS-P-007.131.64	15	13	120-130	21	Lithic, Debitage	Shatter	Shatter/Chunk	6	1.5	
131	3B	CAS-P-007.131.65	15	13	120-130	21	Lithic, Debitage	Burned	Burned	21	5.6	
131	3B	CAS-P-007.131.66	15	13	120-130	21	Lithic, Debitage	Flake Fragments	Broken Flakes	310	149.7	
131	3B	CAS-P-007.131.68	15	13	120-130	21	Lithic, Debitage	Proximal Flakes	Proximal Flakes	120	82.8	
131	3B	CAS-P-007.131.69	15	13	120-130	21	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	1.3	
131	3B	CAS-P-007.131.70	15	13	120-130	21	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.4	
131	3B	CAS-P-007.131.71	15	13	120-130	21	Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	2.4	
131	3B	CAS-P-007.131.72	15	13	120-130	21	Lithic, Debitage	Complete Flakes	Complete Flakes	68	161.9	Complete Flakes

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
131	3B	CAS-P-007.131.73	15	13	120-130	21	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	3	8.6	Billet: r-flakes
131	3B	CAS-P-007.131.74	15	13	120-130	21	Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	1	5.7	Billet: DEBs
131	3B	CAS-P-007.131.75	15	13	120-130	21	Lithic, Debitage	Flake Tool	Flake Tool	3	13.8	
133	3B	CAS-P-007.133.05	15	15	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	1	7.8	
133	3B	CAS-P-007.133.83	15	15	140-150		Lithic, Debitage	Shatter	Shatter/Chunk	22	13.2	
133	3B	CAS-P-007.133.84	15	15	140-150		Lithic, Debitage	Burned	Burned	93	47.5	
133	3B	CAS-P-007.133.85	15	15	140-150		Lithic, Debitage	Flake Fragments	Broken Flakes	347	163.4	
133	3B	CAS-P-007.133.86	15	15	140-150		Lithic, Debitage	Proximal Flakes	Proximal Flakes	196	80.6	
133	3B	CAS-P-007.133.87	15	15	140-150		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	11	6.1	
133	3B	CAS-P-007.133.88	15	15	140-150		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	5	0.8	
133	3B	CAS-P-007.133.89	15	15	140-150		Lithic, Debitage	Complete Flakes	Complete Flakes	93	157.6	Complete Flakes
133	3B	CAS-P-007.133.90	15	15	140-150		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	0.4	Notching
133	3B	CAS-P-007.133.91	15	15	140-150		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0	Billet: r-flakes
133	3B	CAS-P-007.133.92	15	15	140-150		Lithic, Debitage	Flake Tool	Flake Tool	3	21.2	
137	2A	CAS-P-007.137.08	16	4	30-40		Lithic, Debitage	Burned	Burned	2	0.2	
137	2A	CAS-P-007.137.09	16	4	30-40		Lithic, Debitage	Proximal Flakes	Proximal Flakes	6	4.9	
137	2A	CAS-P-007.137.10	16	4	30-40		Lithic, Debitage	Complete Flakes	Complete Flakes	7	26.2	Complete Flakes
137	2A	CAS-P-007.137.11	16	4	30-40		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.5	Notching
138	2A	CAS-P-007.138.40	16	5	40-50		Lithic, Debitage	Shatter	Shatter/Chunk	9	50.5	
138	2A	CAS-P-007.138.41	16	5	40-50		Lithic, Debitage	Burned	Burned	30	11.3	
138	2A	CAS-P-007.138.42	16	5	40-50		Lithic, Debitage	Flake Fragments	Broken Flakes	106	55.1	
138	2A	CAS-P-007.138.43	16	5	40-50		Lithic, Debitage	Proximal Flakes	Proximal Flakes	43	45.9	
138	2A	CAS-P-007.138.44	16	5	40-50		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.7	
138	2A	CAS-P-007.138.45	16	5	40-50		Lithic, Debitage	Proximal Flakes-"r" flakes	Proximal Flakes	5	2.2	
138	2A	CAS-P-007.138.46	16	5	40-50		Lithic, Debitage	Complete Flakes	Complete Flakes	25	29.4	Complete Flakes
138	2A	CAS-P-007.138.47	16	5	40-50		Lithic, Debitage	Complete Flakes-"r" flakes	Complete Flakes	1	0.1	Billet: r-flakes
138	2A	CAS-P-007.138.48	16	5	40-50		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0	Notching
139	2A	CAS-P-007.139.43	16	6	50-65		Lithic, Debitage	Shatter	Shatter/Chunk	21	13.8	
139	2A	CAS-P-007.139.44	16	6	50-65		Lithic, Debitage	Burned	Burned	66	38.1	
139	2A	CAS-P-007.139.45	16	6	50-65		Lithic, Debitage	Flake Fragments	Broken Flakes	285	139.6	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
139	2A	CAS-P-007.139.46	16	6	50-65		Lithic, Debitage	Proximal Flakes	Proximal Flakes	151	116.1	
139	2A	CAS-P-007.139.47	16	6	50-65		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	2.5	
139	2A	CAS-P-007.139.48	16	6	50-65		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.4	
139	2A	CAS-P-007.139.49	16	6	50-65		Lithic, Debitage	Complete Flakes	Complete Flakes	71	186.5	Complete Flakes
139	2A	CAS-P-007.139.50	16	6	50-65		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	9	0.8	Notching
139	2A	CAS-P-007.139.51	16	6	50-65		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	6.3	Billet: r-flakes
139	2A	CAS-P-007.139.52	16	6	50-65		Lithic, Debitage	Flake Tool	Flake Tool	2	4.2	
142	3	CAS-P-007.142.04	16	9	80-90		Lithic, Debitage	Shatter	Shatter/Chunk	3	12.9	
142	3	CAS-P-007.142.05	16	9	80-90		Lithic, Debitage	Burned	Burned	19	7.3	
142	3	CAS-P-007.142.06	16	9	80-90		Lithic, Debitage	Flake Fragments	Broken Flakes	33	17.2	
142	3	CAS-P-007.142.07	16	9	80-90		Lithic, Debitage	Proximal Flakes	Proximal Flakes	46	43.3	
142	3	CAS-P-007.142.08	16	9	80-90		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.6	
142	3	CAS-P-007.142.09	16	9	80-90		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	9.2	
142	3	CAS-P-007.142.10	16	9	80-90		Lithic, Debitage	Complete Flakes	Complete Flakes	18	24.9	Complete Flakes
143	3	CAS-P-007.143.64	16	10	90-100		Lithic, Debitage	Shatter	Shatter/Chunk	14	5.4	
143	3	CAS-P-007.143.65	16	10	90-100		Lithic, Debitage	Burned	Burned	85	43.5	
143	3	CAS-P-007.143.66	16	10	90-100		Lithic, Debitage	Flake Fragments	Broken Flakes	428	219.1	
143	3	CAS-P-007.143.67	16	10	90-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	228	148.9	
143	3	CAS-P-007.143.68	16	10	90-100		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	8	9.8	
143	3	CAS-P-007.143.69	16	10	90-100		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	7	2.3	
143	3	CAS-P-007.143.70	16	10	90-100		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	2.8	
143	3	CAS-P-007.143.71	16	10	90-100		Lithic, Debitage	Complete Flakes	Complete Flakes	85	168.9	Complete Flakes
143	3	CAS-P-007.143.72	16	10	90-100		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.4	Billet: r-flakes
143	3	CAS-P-007.143.73	16	10	90-100		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	0.7	Notching
143	3	CAS-P-007.143.74	16	10	90-100		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	1	0.8	Billet: DEBs
143	3	CAS-P-007.143.75	16	10	90-100		Lithic, Debitage	Flake Tool	Flake Tool	2	8.7	
144	3	CAS-P-007.144.32	16	11	100-110		Lithic, Debitage	Shatter	Shatter/Chunk	20	11.3	
144	3	CAS-P-007.144.33	16	11	100-110		Lithic, Debitage	Burned	Burned	85	80.9	
144	3	CAS-P-007.144.34	16	11	100-110		Lithic, Debitage	Flake Fragments	Broken Flakes	390	186.8	
144	3	CAS-P-007.144.35	16	11	100-110		Lithic, Debitage	Proximal Flakes	Proximal Flakes	208	145.7	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
144	3	CAS-P-007.144.36	16	11	100-110		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	1.6	
144	3	CAS-P-007.144.37	16	11	100-110		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	3	0.2	
144	3	CAS-P-007.144.38	16	11	100-110		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	2	7.6	
144	3	CAS-P-007.144.39	16	11	100-110		Lithic, Debitage	Complete Flakes	Complete Flakes	74	126.3	Complete Flakes
144	3	CAS-P-007.144.40	16	11	100-110		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.3	Billet: r-flakes
144	3	CAS-P-007.144.41	16	11	100-110		Lithic, Debitage	Complete Flakes- DEB	Complete Flakes	1	8.4	Billet: DEBs
144	3	CAS-P-007.144.42	16	11	100-110		Lithic, Debitage	Flake Tool	Flake Tool	1	6.5	
145	3	CAS-P-007.145.23	16	12	120-130	24	Lithic, Debitage	Shatter	Shatter/Chunk	8	3.9	
145	3	CAS-P-007.145.24	16	12	120-130	24	Lithic, Debitage	Burned	Burned	35	42.5	
145	3	CAS-P-007.145.25	16	12	120-130	24	Lithic, Debitage	Flake Fragments	Broken Flakes	235	101.7	
145	3	CAS-P-007.145.26	16	12	120-130	24	Lithic, Debitage	Proximal Flakes	Proximal Flakes	128	96.1	
145	3	CAS-P-007.145.27	16	12	120-130	24	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.3	
145	3	CAS-P-007.145.28	16	12	120-130	24	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	2	0.3	
145	3	CAS-P-007.145.29	16	12	120-130	24	Lithic, Debitage	Complete Flakes	Complete Flakes	118	109.3	Complete Flakes
145	3	CAS-P-007.145.30	16	12	120-130	24	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.3	Billet: r-flakes
145	3	CAS-P-007.145.31	16	12	120-130	24	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0.6	Notching
145	3	CAS-P-007.145.32	16	12	120-130	24	Lithic, Debitage	Flake Tool	Flake Tool	1	0.9	
146	3	CAS-P-007.146.58	16	13	130-140		Lithic, Debitage	Shatter	Shatter/Chunk	23	41	
146	3	CAS-P-007.146.59	16	13	130-140		Lithic, Debitage	Burned	Burned	34	52.8	
146	3	CAS-P-007.146.60	16	13	130-140		Lithic, Debitage	Flake Fragments	Broken Flakes	381	142.8	
146	3	CAS-P-007.146.61	16	13	130-140		Lithic, Debitage	Proximal Flakes	Proximal Flakes	243	106.2	
146	3	CAS-P-007.146.62	16	13	130-140		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	6	9.4	
146	3	CAS-P-007.146.63	16	13	130-140		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	1.7	
146	3	CAS-P-007.146.64	16	13	130-140		Lithic, Debitage	Complete Flakes	Complete Flakes	81	72	Complete Flakes
146	3	CAS-P-007.146.65	16	13	130-140		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	0.5	Notching
146	3	CAS-P-007.146.66	16	13	130-140		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	4	7.3	Billet: r-flakes
146	3	CAS-P-007.146.67	16	13	130-140		Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	2	4.3	Billet: DEBs
146	3	CAS-P-007.146.68	16	13	130-140		Lithic, Debitage	Flake Tool	Flake Tool	5	31.3	
146	3	CAS-P-007.146.76	16	13	130-140		Lithic, Debitage	shatter, not included in analysis	Shatter/Chunk	1	0.2	
147	3B	CAS-P-007.147.75	16	14	140-150	28	Lithic, Debitage	Shatter	Shatter/Chunk	15	8.9	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
147	3B	CAS-P-007.147.76	16	14	140-150	28	Lithic, Debitage	Burned	Burned	57	26.2	
147	3B	CAS-P-007.147.77	16	14	140-150	28	Lithic, Debitage	Flake Fragments	Broken Flakes	341	114	
147	3B	CAS-P-007.147.78	16	14	140-150	28	Lithic, Debitage	Proximal Flakes	Proximal Flakes	132	69.9	
147	3B	CAS-P-007.147.79	16	14	140-150	28	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	1	0	
147	3B	CAS-P-007.147.80	16	14	140-150	28	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.2	
147	3B	CAS-P-007.147.81	16	14	140-150	28	Lithic, Debitage	Complete Flakes	Complete Flakes	73	82.3	Complete Flakes
147	3B	CAS-P-007.147.82	16	14	140-150	28	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	8	3.6	Notching
147	3B	CAS-P-007.147.83	16	14	140-150	28	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	1.9	Billet: r-flakes
147	3B	CAS-P-007.147.84	16	14	140-150	28	Lithic, Debitage	Complete Flakes-DEB	Complete Flakes	1	1.7	Billet: DEBs
147	3B	CAS-P-007.147.85	16	14	140-150	28	Lithic, Debitage	Flake Tool	Flake Tool	3	17	
151	1	CAS-P-007.151.32	17	4	40-50		Lithic, Debitage	Shatter	Shatter/Chunk	11	5.1	
151	1	CAS-P-007.151.33	17	4	40-50		Lithic, Debitage	Burned	Burned	31	12.1	
151	1	CAS-P-007.151.34	17	4	40-50		Lithic, Debitage	Flake Fragments	Broken Flakes	92	67.4	
151	1	CAS-P-007.151.35	17	4	40-50		Lithic, Debitage	Proximal Flakes	Proximal Flakes	31	28.2	
151	1	CAS-P-007.151.36	17	4	40-50		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	1	0.1	
151	1	CAS-P-007.151.37	17	4	40-50		Lithic, Debitage	Complete Flakes	Complete Flakes	17	18.5	Complete Flakes
151	1	CAS-P-007.151.38	17	4	40-50		Lithic, Debitage	Complete Flakes-"r" flakes	Complete Flakes	1	2.6	Billet: r-flakes
151	1	CAS-P-007.151.39	17	4	40-50		Lithic, Debitage	Flake Tool	Flake Tool	5	27.3	
152	1	CAS-P-007.152.48	17	5	50-60		Lithic, Debitage	Shatter	Shatter/Chunk	15	12.1	
152	1	CAS-P-007.152.49	17	5	50-60		Lithic, Debitage	Burned	Burned	32	33.8	
152	1	CAS-P-007.152.50	17	5	50-60		Lithic, Debitage	Flake Fragments	Broken Flakes	128	115.3	
152	1	CAS-P-007.152.51	17	5	50-60		Lithic, Debitage	Proximal Flakes	Proximal Flakes	72	86.2	
152	1	CAS-P-007.152.52	17	5	50-60		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	2	0.4	
152	1	CAS-P-007.152.53	17	5	50-60		Lithic, Debitage	Complete Flakes	Complete Flakes	36	58.8	Complete Flakes
152	1	CAS-P-007.152.54	17	5	50-60		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	4	0.5	Notching
153	2	CAS-P-007.153.37	17	6	60-70		Lithic, Debitage	Shatter	Shatter/Chunk	26	12	
153	2	CAS-P-007.153.38	17	6	60-70		Lithic, Debitage	Flakes with platforms	Proximal Flakes	233	298	
153	2	CAS-P-007.153.39	17	6	60-70		Lithic, Debitage	Broken flakes, no platforms	Broken Flakes	346	211	
154	2B	CAS-P-007.154.79	17	7	70-80		Lithic, Debitage	Shatter	Shatter/Chunk	25	50.2	
154	2B	CAS-P-007.154.80	17	7	70-80		Lithic, Debitage	Burned	Burned	185	167.5	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
154	2B	CAS-P-007.154.81	17	7	70-80		Lithic, Debitage	Flake Fragments	Broken Flakes	615	400.9	
154	2B	CAS-P-007.154.82	17	7	70-80		Lithic, Debitage	Proximal Flakes	Proximal Flakes	409	411.2	
154	2B	CAS-P-007.154.83	17	7	70-80		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	13	4.5	
154	2B	CAS-P-007.154.84	17	7	70-80		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	11	3.2	
154	2B	CAS-P-007.154.85	17	7	70-80		Lithic, Debitage	Complete Flakes	Complete Flakes	143	264.1	Complete Flakes
154	2B	CAS-P-007.154.86	17	7	70-80		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	11	1.8	Notching
154	2B	CAS-P-007.154.87	17	7	70-80		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	6	18.3	Billet: r-flakes
154	2B	CAS-P-007.154.88	17	7	70-80		Lithic, Debitage	Flake Tool	Flake Tool	7	20.6	
156	3	CAS-P-007.156.44	17	9	90-100		Lithic, Debitage	Shatter	Shatter/Chunk	15	17.8	
156	3	CAS-P-007.156.45	17	9	90-100		Lithic, Debitage	Burned	Burned	133	67.5	
156	3	CAS-P-007.156.46	17	9	90-100		Lithic, Debitage	Flake Fragments	Broken Flakes	599	245.8	
156	3	CAS-P-007.156.47	17	9	90-100		Lithic, Debitage	Proximal Flakes	Proximal Flakes	353	208.1	
156	3	CAS-P-007.156.48	17	9	90-100		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	5	0.6	
156	3	CAS-P-007.156.49	17	9	90-100		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	2.5	
156	3	CAS-P-007.156.50	17	9	90-100		Lithic, Debitage	Proximal Flakes-DEB	Proximal Flakes	1	1.5	
156	3	CAS-P-007.156.51	17	9	90-100		Lithic, Debitage	Complete Flakes	Complete Flakes	140	349.4	Complete Flakes
156	3	CAS-P-007.156.52	17	9	90-100		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	10	1.4	Notching
156	3	CAS-P-007.156.53	17	9	90-100		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.9	Billet: r-flakes
156	3	CAS-P-007.156.54	17	9	90-100		Lithic, Debitage	Flake Tool	Flake Tool	5	60.5	
156	3	CAS-P-007.156.63	17	9	90-100		Lithic, Debitage	broken flakes, not included in analysis	Broken Flakes	3	0.6	
157	3	CAS-P-007.157.58	17	10	100-110		Lithic, Debitage	Shatter	Shatter/Chunk	19	17.1	
157	3	CAS-P-007.157.59	17	10	100-110		Lithic, Debitage	Burned	Burned	184	102.7	
157	3	CAS-P-007.157.60	17	10	100-110		Lithic, Debitage	Flake Fragments	Broken Flakes	589	271	
157	3	CAS-P-007.157.61	17	10	100-110		Lithic, Debitage	Proximal Flakes	Proximal Flakes	355	215.4	
157	3	CAS-P-007.157.62	17	10	100-110		Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	22	3.2	
157	3	CAS-P-007.157.63	17	10	100-110		Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	4	4.9	
157	3	CAS-P-007.157.64	17	10	100-110		Lithic, Debitage	Complete Flakes	Complete Flakes	118	222.8	Complete Flakes
157	3	CAS-P-007.157.65	17	10	100-110		Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	3	1.3	Notching
157	3	CAS-P-007.157.66	17	10	100-110		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	2	0.2	Billet: r-flakes
157	3	CAS-P-007.157.67	17	10	100-110		Lithic, Debitage	Flake Tool	Flake Tool	7	153	

Table C-1. Debitage.

Lot	AU	Objectid	Unit	Level	Depth	Feature	Objname	Descrip	Analysis category	Count	weight(g)	Analysis sub-cat
158	3	CAS-P-007.158.31	17	11	110-120		Lithic, Debitage	Shatter	Shatter/Chunk	11	20	
158	3	CAS-P-007.158.32	17	11	110-120		Lithic, Debitage	Flake Tool	Flake Tool	2	5.6	
158	3	CAS-P-007.158.33	17	11	110-120		Lithic, Debitage	Burned	Burned	18	6.4	
158	3	CAS-P-007.158.34	17	11	110-120		Lithic, Debitage	Flake Fragments	Broken Flakes	180	93.1	
158	3	CAS-P-007.158.35	17	11	110-120		Lithic, Debitage	Proximal Fragments	Proximal Flakes	87	65.1	
158	3	CAS-P-007.158.36	17	11	110-120		Lithic, Debitage	Proximal Fragments-Notching	Proximal Flakes	5	1.8	
158	3	CAS-P-007.158.37	17	11	110-120		Lithic, Debitage	Proximal Fragments-"r" Flakes	Proximal Flakes	2	0.2	
158	3	CAS-P-007.158.38	17	11	110-120		Lithic, Debitage	Complete Flakes	Complete Flakes	40	55.4	Complete Flakes
158	3	CAS-P-007.158.39	17	11	110-120		Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	1	0.6	Billet: r-flakes
159	3	CAS-P-007.159.50	17	12	120-130	25	Lithic, Debitage	Shatter	Shatter/Chunk	24	18.3	
159	3	CAS-P-007.159.51	17	12	120-130	25	Lithic, Debitage	Burned	Burned	44	33.3	
159	3	CAS-P-007.159.52	17	12	120-130	25	Lithic, Debitage	Flake Fragments	Broken Flakes	341	176.3	
159	3	CAS-P-007.159.53	17	12	120-130	25	Lithic, Debitage	Proximal Flakes	Proximal Flakes	81	77.1	
159	3	CAS-P-007.159.54	17	12	120-130	25	Lithic, Debitage	Proximal Flakes-"r" Flakes	Proximal Flakes	5	14.6	
159	3	CAS-P-007.159.55	17	12	120-130	25	Lithic, Debitage	Proximal Flakes-Notching	Proximal Flakes	4	0.9	
159	3	CAS-P-007.159.56	17	12	120-130	25	Lithic, Debitage	Complete Flakes	Complete Flakes	66	70.7	Complete Flakes
159	3	CAS-P-007.159.57	17	12	120-130	25	Lithic, Debitage	Complete Flakes-"r" Flakes	Complete Flakes	4	5.6	Billet: r-flakes
159	3	CAS-P-007.159.58	17	12	120-130	25	Lithic, Debitage	Complete Flakes-Notching	Complete Flakes	1	0	Notching
159	3	CAS-P-007.159.59	17	12	120-130	25	Lithic, Debitage	Flake Tool	Flake Tool	2	12.3	

APPENDIX D: PLANT REMAINS

Table D-1. Plant Remains Recovered from Bulk Samples.

Lot Number	Unit	Level	Feature	Specimen	Sample Weight (g)	Contaminant Weight (g)	Plant Weight (g)	Wood Weight (g)	Shell Weight (g)	Bone Count	Bone Weight (g)	Lithic Count	Lithic Weight (g)	Other
4	7	4		6	0.43	0.09	0.34	0.34						
5	7	5		3	0.30	0.30	none							Burnt clay
				4	0.40		0.40	0.40						
8	7	8	2	10	0.17	0.10	0.07	0.07						
				11	1.22	0.29	none			3	0.90			
9	7	9		8	10.50	7.44	0.01	0.01	0.02	3	0.05	1	0.01	
11	7	11	6?	7	10.14	9.95	0.16	0.16	0.03					
13	7	13	23	2	0.39	0.39	none		negligible					
				3	9.26	4.44	0.01	0.01	0.09	3	4.74			
14	7	14		3	4.55	4.31	0.11	0.11	0.04			1	0.05	
15	7	15	31	9	11.90	11.54	0.21	0.21	0.13					
				10	28.66	27.80	0.60	0.60	0.15	2	0.07			
				11	3.67	3.40	0.22	0.22	0.01	1	0.03			
				12	3.88	3.79	0.02	0.02	0.06			2	0.01	Unidentifiable: 3, 0.00 g
				13	9.12	8.99	0.03	0.03	0.08					
				14	14.39	14.11	0.03	0.03	0.17	1	0.02	1	0.05	
				15	7.41	7.35	0.02	0.02	0.03					
				16	0.34		none							Conglomerate: 1, 0.34 g
19	8	4		2			0.07	0.07						PRI date: 765 ± 20
20	8	5		2			0.01	0.01						PRI date: 1790 ± 20
22	8	7		10	1.47	1.47	0.01	0.01						
				11	0.15		0.15	0.15						
24	8	9		4	0.01		0.01	0.01						
27	8	12	22	1	0.02		0.02	0.02						
28	8	13	21, 22	1.1	0.07	0.03	0.04	0.04						
28	8	13	21, 22	1.2	746.38	725.19	0.21	0.20	8.23	7	0.63	14	5.32	Hackberry, uncarbonized: 1, 0.00g; hackberry, carbonized: 2, 0.00 g; bark/hull, carbonized: 1, 0.01g

Table D-1 (continued). Plant Remains Recovered from Bulk Samples.

Lot Number	Unit	Level	Feature	Specimen	Sample Weight (g)	Contaminant Weight (g)	Plant Weight (g)	Wood Weight (g)	Shell Weight (g)	Bone Count	Bone Weight (g)	Lithic Count	Lithic Weight (g)	Other
29	8	14	27	4	0.10		0.10	0.10						
				5	0.03		0.03	0.03						
				6	0.06		0.06	0.06						
31	9	1		1	0.20	0.03	0.17	0.17						
34	9	4		3	12.18	11.81	0.29	0.29	0.05	1	0.02			
				4	16.48	16.23	0.08	0.08	0.07			2	0.05	
				5	0.93	0.91	0.02	0.02						
				6	10.05	9.95	0.04	none	0.05			1	0.03	Bulb?: 4, 0.04 g
				7	1.00	0.02	0.98	0.98						
35	9	5		4	5.79	4.98	0.78	0.78						
36	9	6	1	2	0.95	0.07	0.88	0.88						
				3	2.64	2.16	0.49	0.49						
38	9	8		5	11.34	10.45	0.67	0.67	0.19	2	0.02			
39	9	9		4	1.64	1.42	0.20	0.20	0.02					
				5	1.72	1.43	0.27	0.27						
				6	2.65	1.86	0.79	0.79						
43	9	13		1	0.40	0.39	0.02	0.02	0.01					
44	9	14		2	0.09	0.09	none							
				3	0.10	0.10	none							
				4	0.10	0.10	none							
45	9	15	30	6	0.03		0.03	none						Hickory: 1, 0.03 g
49	10	4		4			0.02	0.02						PRI date: 1245 ± 20
50	10	5		2	12.10	11.98	0.01	none	0.10	1	0.01	1	0.01	Bark cf., part carbonized: 2, 0.01 g; unidentifiable: 1, 0.00 g
52	10	6		4	8.32	7.93	0.08	0.08	0.20			1	0.11	
53	10	7		3	5.12	4.98	0.11	0.11	0.02			1	0.02	
54	10	8		3	4.35	2.66	0.45	0.45	0.05	1	1.19			
55	10	9		5			0.08	0.08						PRI date: 3840 ± 20
				6	0.14		0.09	0.09						Bark/hull, uncarbonized: 2, 0.05 g
				7	0.23	0.18	0.03	0.03	0.01					
56	10	10		4	0.07		0.07	0.07						
				5	0.31		0.31	0.31						

Table D-1 (continued). Plant Remains Recovered from Bulk Samples.

Lot Number	Unit	Level	Feature	Specimen	Sample Weight (g)	Contaminant Weight (g)	Plant Weight (g)	Wood Weight (g)	Shell Weight (g)	Bone Count	Bone Weight (g)	Lithic Count	Lithic Weight (g)	Other
57	10	11		6			0.08	0.08						PRI date: 4295 ± 20
				7	0.03		uncarbonized							Hickory hull cf., uncarbonized: 1, 0.03 g
				8	0.03		0.03	0.03						
58	10	12		2	531.66	531.60	0.02	negligible						Hickory cf.: 1; 0.01 g; unidentifiable: 1, 0.01 g
				3	35.99	35.99	uncarbonized							clumps of dirt with uncarbonized plant material: leaves, hickory nut hull, etc.
				4	0.05		uncarbonized							Hickory hull, uncarbonized: 1, 0.05 g
68	11	7	7?	1			0.25	0.25						PRI date: 2690 ± 20
69	11	8	8, 11	1	1.17	1.11	0.01	0.01	0.05					
				2	0.20	0.18	0.03	0.03						
				3			0.08	0.08						PRI date: 3320 ± 20
71	11	10		5	4.56	4.24	0.32	0.32						
73	11	12		5	0.35	0.33	uncarbonized							Hickory cf., uncarbonized: 1; 0.02 g
				6	0.63		none			1	0.63			
79	12	4		2	1.26	1.21	0.04	0.04						
82	12	7		3	0.82	0.80	negligible	negligible	0.02					
				4			0.05	0.05						PRI date: 1980 ± 20
84	12	9		7	3.57	3.43	0.14	0.14						Acorn cf: 1, 0.00 g
				8	3.56	3.45	0.11	0.11						
				9	0.39	0.38	0.01	0.01						
85	12	10	12?	3	1.92	1.83	0.08	0.08						
86	12	11	13?	4			0.04	0.04						PRI date: 4205 ± 20
89	12	14	29, 30	10	11.04	4.53	none			3	6.51			
97	13	8		7	0.08	0.01	uncarbonized							Wood, uncarbonized: 1, 0.03 g, diffuse porous; Bark/hull, uncarbonized: 1, 0.04 g
104	13	15		7	0.52		0.52	0.52						
109	14	5		1	3.02	2.43	0.04	0.04						
112	14	8		4	2.25	2.16	0.09	0.09						
				5	3.16	3.09	0.07	0.07						

Table D-1 (continued). Plant Remains Recovered from Bulk Samples.

Lot Number	Unit	Level	Feature	Specimen	Sample Weight (g)	Contaminant Weight (g)	Plant Weight (g)	Wood Weight (g)	Shell Weight (g)	Bone Count	Bone Weight (g)	Lithic Count	Lithic Weight (g)	Other
				6	1.84	1.77	0.06	0.06						
113	14	9		3	1.58	1.57	0.01	0.01						
				4	0.04		0.04	none						Bark: 1, 0.04 g
114	14	10	20?	3	8.89	8.22	0.67	0.67						
				4	0.76	0.64	0.12	0.12						
				5	0.95	0.94	0.01	0.01						
				6	0.75	0.72	0.03	0.03						
				7	0.14		0.14	0.14						
115	14	11		3	2.12	1.82	0.30	0.30						
				4	0.14		0.14	0.14						
117	14	13	24	2	1.14	1.11	0.04	0.04						
				3	21.35	19.76	0.60	0.60	0.43	8	0.52			
123	15	5	9?	2	0.21	0.13	uncarbonized							Hull, uncarbonized: 2, 0.08 g
124	15	6	11	5			0.04	0.04						PRI date: 2880 ± 20
				6	4.54	4.51	0.01	0.01	0.03					
125	15	7	15, 16	2	0.04	0.02	uncarbonized							Bark/bulb, uncarbonized: 3, 0.02 g
				3	0.12	0.11	none		0.01					
126	15	8		2	14.26	14.26	uncarbonized							uncarbonized leaf pressed into clay
127	15	9		2			0.49	0.49						PRI date: 3900 ± 20
129	15	11		2	0.35	0.24	0.09	0.09						
				3	1.31	0.32	0.98	0.98						
				4	1.00	0.77	0.23	0.23						Unidentifiable seed coat: 1, 0.00 g
				5	0.24		none			1	0.24			
				6	0.05		uncarbonized							Bark/hull, uncarbonized: 1, 0.05 g
132	15	14		5	0.01		0.01	0.01						
133	15	15		7	0.66	0.56	0.10	0.10						
140	16	7		3			0.30	0.30						PRI date: 3405 ± 20
				4			0.72	0.72						PRI date: 2080 ± 20
				5	11.16	9.96	none		0.31			2	0.82	Conglomerate: 2, 0.03 g
				6	2.42	2.37	0.01	0.01	0.02					
				7	2.47	2.35	none		0.02	3	0.11			

Table D-1 (continued). Plant Remains Recovered from Bulk Samples.

Lot Number	Unit	Level	Feature	Specimen	Sample Weight (g)	Contaminant Weight (g)	Plant Weight (g)	Wood Weight (g)	Shell Weight (g)	Bone Count	Bone Weight (g)	Lithic Count	Lithic Weight (g)	Other
				8	3.30	3.27	none		0.03	1	0.00			
142	16	9		3	0.19	0.10	0.09	0.09						
144	16	11		3	0.04		0.04	0.04						
146	16	13		5	9.37	8.87	0.41	0.41						
				6	0.31	0.31	none							
147	16	14	28, 29	6	19.32	18.90	0.41	0.41						
				7	1.19	1.12	0.08	0.08						
				8	0.05		uncarbonized							Bark, uncarbonized: 1, 0.05 g
150	17	3		1	0.27		uncarbonized							Hull/husk, uncarbonized: 1, 0.04 g; Metal, rusted: 2, 0.23 g
153	17	6		5			0.11	0.11						PRI date: 2485±20
156	17	9		2	0.23	0.19	0.04	0.04						
				3	2.16	2.07	0.09	0.09						
157	17	10		2	3.51	3.37	0.14	0.14						
				3	5.61	5.42	0.19	0.19						
				4	0.17		0.17	0.17						
158	17	11		2	0.06	0.06	negligible	negligible						
159	17	12	22, 25	5	29.63	10.64	none							dirt dauber nest: 18.94
				6	0.22	0.14	0.08	0.08						
163	General	All		4	4.89	4.49	0.04	0.04	0.23			2	0.01	
				5	0.57		0.57	0.57						

Table D-2. Plant Remains Recovered from 41HY160 Floatation Samples.

Lot Number	Feature	Plant Weight (g)	Wood Weight (g)	Common Name	Count	Weight (g)
185.10	21	0.04	0.00	Rootlets, etc, uncarbonized		0.04
185.11	21	0.17	0.00	Hackberry	3	0.00
				Hackberry, uncarbonized	8	0.17
185.12	21	0.15	0.00	Rootlets, etc, uncarbonized	0	0.15
185.13	21	0.06	0.00	Grass sheath, uncarbonized	22	0.06
185.14	21	0.68	0.00	Rootlets, etc, uncarbonized		0.68
				Wood	1	0.00
185.3	21	0.03	0.03	Hickory	2	0.00
				Unidentifiable	5	0.00
				Wood	2	0.03
185.4	21	0.11	0.10	Unidentifiable seed	1	0.00
				Unidentifiable	1	0.01
				Wood		0.10
185.5	21	0.01	0.01	Pitch	1	0.00
				Unidentifiable	2	0.00
				Unidentifiable seed	1	0.00
				Walnut family	1	0.00
				Wood	1	0.01
185.6	21	0.05	0.00	Rootlets, etc, uncarbonized	9	0.05
185.7	21	0.02	0.00	Grass sheath, uncarbonized	5	0.02
185.8	21	0.05	0.00	Rootlets, etc, uncarbonized	3	0.05
185.9	21	0.01	0.00	Rootlets, grass sheath, uncarbonized	3	0.01
186.1	22	0.07	0.06	Acorn cf.	1	0.00
				Grass family	1	0.00
				Hickory	1	0.01
				Pitch	1	0.00
				Unidentified seed a	2	0.00
				Wood	9	0.06
186.14	22	0.01	0.00	Hackberry, uncarbonized	6	0.01
186.2	22	0.10	0.10	Bark/pine cone	1	0.00
				Wood	8	0.10
186.3	22	0.07	0.06	Bedstraw	1	0.00
				Nutmeat cf.	1	0.01
				Unidentifiable seed fragment	2	0.00
				Wood	10	0.06
186.4	22	0.02	0.02	Cheno/am	1	0.00
				Pine cone	1	0.00
				Pitch	1	0.00
				Prickly pear cf.	1	0.00
				Unidentifiable seed fragment	1	0.00
				Unidentified seed	2	0.00
				Wood	4	0.02
186.5	22	0.14	0.07	Hickory	1	0.02
				Pitch	1	0.03
				Unidentifiable	2	0.02
				Wood		0.07

Table D-2 (continued). Plant Remains Recovered from 41HY160 Floatation Samples.

Lot Number	Feature	Plant Weight (g)	Wood Weight (g)	Common Name	Count	Weight (g)
186.6	22	0.02	0.01	Bedstraw	1	0.00
				Hickory	1	0.00
				Pitch	1	0.00
				Prickly pear cf.	1	0.00
				Spore clump	1	0.00
				Unidentifiable	3	0.01
				Unidentifiable seed fragment	2	0.00
				Wood	2	0.01
186.7	22	0.01	0.01	Wood	1	0.01
186.8	22	0.05	0.05	Wood		0.05
186.9	22	0.15	0.13	Bark	1	0.01
				Hickory	2	0.01
				Wood		0.13
187.1	23	0.01	0.01	Wood	2	0.01
187.2	23	0.12	0.00	Bark, etc, uncarbonized		0.12
187.3	23	0.10	0.01	Acorn	1	0.00
				Acorn cf., uncarbonized	5	0.04
				Bedstraw cf.	1	0.00
				Hickory	1	0.01
				Prickly pear cf.	3	0.00
				Unidentifiable	8	0.02
				Unidentifiable seed fragment	1	0.00
				Unidentified seed a	6	0.02
				Wood	2	0.01
187.4	23	0.01	0.01	Wood	5	0.01
187.6	23	0.04	0.01	Hickory	1	0.01
				Persimmon cf.	1	0.02
				Wood	1	0.01
188.2	24	0.08	0.06	Persimmon cf.	1	0.01
				Walnut family	2	0.01
				Wood	4	0.06
188.3	24	0.01	0.01	Persimmon cf.	3	0.00
				Unidentifiable seed	8	0.00
				Wood	1	0.01
189.2	25	0.07	0.04	Walnut family	3	0.02
				Fruit pit cf.	2	0.01
				Wood	5	0.04
189.3	25	0.10	0.10	Bedstraw cf.	1	0.00
				Stem	1	0.00
				Unidentifiable	5	0.00
				Unidentifiable seed	2	0.00
				Fruit pit cf.	1	0.00
				Wood	8	0.10
190.1	26	0.12	0.00	Rootlets, etc, uncarbonized	7	0.12
190.2	26	0.01	0.00	Hull cf., uncarbonized	1	0.01
				Unidentified seed a	1	0.00

Table D-2 (continued). Plant Remains Recovered from 41HY160 Floatation Samples.

Lot Number	Feature	Plant Weight (g)	Wood Weight (g)	Common Name	Count	Weight (g)
				Wood	2	0.00
190.3	26	0.02	0.01	Pitch	1	0.00
				Prickly pear cf.	1	0.00
				Unidentifiable seed fragment	7	0.01
				Walnut family	1	0.00
				Wood	2	0.01
190.5	26	0.02	0.01	Hull cf., uncarbonized	1	0.01
				Wood	4	0.01
190.6	26	0.07	0.04	Unidentified	2	0.01
				Walnut family	2	0.02
				Wood		0.04
191.1	27	0.05	0.05	Wood	3	0.05
191.2	27	0.07	0.07	Wood		0.07
191.3	27	0.06	0.06	Unidentifiable	3	0.00
				Wood	2	0.06
192.2	28	0.03	0.02	Unidentified seed a	3	0.00
				Walnut family cf.	1	0.01
				Wood	5	0.02
192.3	28	0.07	0.07	Wood		0.07
192.4	28	0.02	0.02	Pitch	1	0.00
				Unidentifiable seed fragment	2	0.00
				Unidentified seed a	1	0.00
				Wood		0.02
192.5	28	0.01	0.01	Acorn	1	0.00
				Hackberry	1	0.00
				Unidentifiable	1	0.00
				Unidentifiable seed fragment	9	0.00
				Walnut family	1	0.00
				Wood	3	0.01
193.2	29	0.02	0.02	Wood		0.02
193.3	29	0.08	0.08	Wood		0.08
193.4	29	0.38	0.38	Wood		0.38
193.5	29	0.05	0.04	Acorn	1	0.00
				Hickory	1	0.01
				Pitch	1	0.00
				Unidentifiable seed	6	0.00
				Wood	5	0.04
193.6	29	0.04	0.02	Grape cf.	3	0.00
				Hickory	1	0.01
				Pitch	1	0.00
				Unidentifiable seed	16	0.01
				Unidentified seed	1	0.00
				Wood		0.02
194.2	30	0.01	0.01	Wood	1	0.01
194.3	30	0.03	0.03	Wood		0.03

Table D-2 (continued). Plant Remains Recovered from 41HY160 Floatation Samples.

Lot Number	Feature	Plant Weight (g)	Wood Weight (g)	Common Name	Count	Weight (g)
194.4	30	0.01	0.01	Unidentifiable seed fragment	1	0.00
				Wood		0.01
194.5	30	0.06	0.02	Hickory	2	0.04
				Pitch	1	0.00
				Unidentifiable	1	0.00
				Unidentifiable seed	5	0.00
				Wood		0.02
195.1	31	0.01	0.01	Wood	2	0.01
195.2	31	0.14	0.10	Acorn cf.	2	0.01
				Unidentified - bulb?	3	0.02
				Walnut family	1	0.01
				Wood	13	0.10
195.3	31	0.20	0.15	Black walnut	1	0.01
				Hickory cf.	1	0.00
				Pitch	2	0.02
				Unidentified - bulb?	7	0.02
				Wood		0.15
195.4	31	0.05	0.04	Acorn cf.	1	0.00
				Prickly pear cf.	1	0.00
				Unidentified	1	0.00
				Unidentified - bulb?	2	0.01
				Unidentified seed	1	0.00
				Unidentifiable seed	11	0.00
				Wood	6	0.04
195.5	31	0.08	0.05	Acorn	1	0.00
				Unidentifiable seed	11	0.01
				Unidentified seed a	9	0.01
				Walnut family	1	0.01
				Wood		0.05
195.6	31	0.03	0.00	Juniper	1	0.03

APPENDIX E: ANALYSIS OF FISH VERTEBRATE REMAINS FROM 41HY160

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Slightly over 1200 fish bones from 41HY160 were submitted for analysis, most from unsorted flotation samples from seven features dating to Early and Middle Archaic levels of the site. Twenty percent of the sample (NISP or Number of Identified Specimens) came from ¼ inch dry screening, the rest from feature fill. Because sample size is so small, and is the result of human deposition over many thousands of years, the following discussion will focus on differences between the Early and Middle Archaic deposits, which entailed combining multiple chronological designations. Early Archaic fish samples include the following temporal designations: Early Archaic, End of Early Archaic and End of Early Archaic Beginning of Early Archaic/Middle Archaic. Middle Archaic samples are comprised of deposits dating to Early Archaic/Middle Archaic and Middle Archaic. This lumping produced two samples of 609 and 510 identified specimens.

Fish bones were identified using the comparative specimens available in the University of Southern Mississippi zooarchaeological collection, which generally covers the Mississippi River drainage well but does not include a number of species currently native to central Texas. Of particular concern is the nature of the natural lake/marsh adjacent to the site. Although the lake draws from a relatively large watershed, and, due to the presence of an artesian spring, probably never was subjected to drought conditions so severe that it completely dried up, it is a relatively isolated body of water. It is probable that it hosted unique species not found today in any drainage. The Guadalupe River drainage in Texas, for example, has a Guadalupe bass restricted to that particular river system. During the identification process it was noted that many of the bass (*Micropterus* spp.) specimens were definitely not largemouth bass (*M. salmoides*). It is possible that they are from spotted bass (*M. punctulatus*), a specimen not in the USM collection, but might also be an unknown fossil species. Similarly, some of the sucker bones identified only to class (Catastomidae) most closely resembled the Northern hog sucker (*Hypentelium nigricans*), a species distributed widely in eastern North America but currently no closer to the site than extreme northeastern Texas east of the Red River. As a result of this uncertainty, identifications were frequently to family or genus rather than species.

Quantitative methods used in the following discussions are primarily NISP. Minimum number of Individuals (MNI) was deemed unrealistic since it compensates for the possibility of overestimating the importance of a species by separating multiple bones from a single organism. Given the depth of these deposits, and the time period covered, it is unlikely that many of these bones are from a single individual. The database in Appendix 1 includes all data so MNI can be calculated. Likewise, weight is recorded but not used in the discussions since the entire sample weighed less than 50 grams, and many fragments were attributed a weight of 0.1 gram even though they weighed less.

The species identified in the samples include gar (*Lepisosteus* cf. *osseus*), shad (Clupeidae), minnow (Cyprinidae) river carpsucker (*Carpiodes carpio*), spotted sucker (*Minytrema melanops*), redhorse (*Moxostoma* cf. *congestum*), and probable white bass (*Morone cf. chrysops*). In addition, numerous catfishes were present including small yellow (*Ameiuris natalis*) and brown (*A. melas*) bullheads and larger (occasional) channel dwellers such as flathead (*Pylodictis olivaris*), channel (*Ictalurus punctatus*), and blue (*I. furcatus*) catfish. Numerous bass (*Micropterus* sp.), including largemouth bass (*M. salmoides*), were identified along with undifferentiated sunfish (*Lepomis* spp.).

These taxa could have been procured using a variety of methods, though small fish size, generally, strongly suggests seining was regularly employed. All of the fish represented could have been captured using nets or tangled vines in shallow water (Rostlund 1952). Baited fish traps would have been selective for both catfish, which are most active while feeding at night, and suckers. Baited trot lines are also effective at capturing catfish, though not suckers, which rarely take a hook. It is possible some of the fish were speared at the surface. Many suckers school at the surface in the spring and early summer to spawn, and in late summer gar rise to the surface to take in atmospheric oxygen under conditions of low dissolved oxygen. Shad and minnows are unlikely to have been procured via any means other than nets, unless poisoning small pools was employed on occasion.

Comparing combined fish sizes for the two time periods (Figures 1 and 2), it is apparent that small fish (<20cm SL, vertebral diameter 1-4mm) make up the majority of both deposits, but comprise an overwhelming 81% of the Early Archaic sample, dropping to 59% in the Middle Archaic deposit. Medium sized fish (20-40cmSL, vertebral diameter 5-6mm) are much more common in the Middle Archaic sample (26.8% versus 11%) as are large fish (>40cmSL, vertebral diameter>7mm) which comprise 14.2% of the later sample and only 8.2% of the Early Archaic sample. The increased exploitation of larger fish suggests greater sedentism, with greater investment in potentially non-portable technology (fish traps). Increased use of fish traps in the Middle Archaic is also suggested by a large increase in catfish and suckers relative to the small finfish (Perciformes) dominating the Early Archaic sample (Figures 3 and 4).

Although it is rare to encounter a specific fish available only seasonally, it is likely that fishing at the site was largely a seasonal endeavor. Fish are more active during warm weather and thus easier to procure. However, there were a few very well preserved fish vertebrae in the samples of very young fish (<3 years old) that clearly exhibited annulus formation typical of midsummer growth.

It is highly unlikely that fish consumption at 41HY160 was ever a serious contributor to subsistence. It is more likely to have been a welcome break from more abundant terrestrial prey. This small sample does suggests that there was a slight shift in technology between the Early and Middle Archaic with fish traps supplementing seining in the later period. The very small size of the individuals making up the majority of both samples, however, clearly indicates a non-selective, casual approach to procurement.