SUBSISTENCE, TECHNOLOGY, AND SITE USE THROUGH TIME AT 41HY160,

THE TEE BOX SIX LOCALE

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ABSTRACT

SUBSISTENCE, TECHNOLOGY, AND SITE USE THROUGH TIME AT 41HY160

THE TEE BOX SIX LOCALE

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With a culture history of over 11,000 years the Springs Lake archaeological region in San Marcos is one of the most unique prehistoric archaeological areas in the state of Texas. Five archeological sites make up the core of this culture-rich region: 41HY37, 41HY147, 41HY160, 41HY161 and 41HY165. All are multi-component sites and, as such, offer extensive data on the area's exploitation history as a continuously utilized freshwater spring site locale located at the interface of the Hill Country and the Blackland Prairies.

41HY160, known as the Tee Box Six Site, was the location for archaeological field schools in 1982 and 1983 conducted under the direction of Dr. Jim Garber. From

these investigations it was determined that 41HY160 was a 200 m x 300 m x 2.4 m prehistoric campsite with occupations that date from the Early Archaic to the Late Prehistoric. Additionally, Paleo-Indian projectile points of Golondrina and Scottsbluff types were recovered, although their presence has been attributed to fill dirt brought in from another area in association with the construction of a golf course under which the site now lies. Artifacts recovered from the site include approximately 500 stone tools, 35,000 pieces of lithic debitage and an abundance of faunal remains. Prior to this Thesis, no analysis of this material had been attempted and the only published material on this site is a short article in *La Tierra* and a report synthesis was needed for these early investigations to add to the growing base of knowledge for this important archaeological locale. While literature regarding Site 41HY160 is lacking, other sites at Aquarena Springs have been the subject of recent work, including geoarchaeological studies of the immediate Spring Lake area. These studies suggest that the soil deposits at site 41HY160 were the result of continual deposition over time and that the thicker alluvial soils at 41HY160 have great potential for the segregation of archaeological materials with deposits that date from, at least, the Early Archaic to the Historic Period.

With representative elements from the Early, Middle, Late Archaic I and Late Archaic II time periods as well as from the Late Prehistoric I, and Late Prehistoric II, lithic and faunal data collected during the 1982 and 1983 field school sessions were utilized in this thesis to identify assemblage variation in order to diachronically compare site-use at the Tee Box Six locale of 41HY160. As a continuously inhabited site, 41HY160 lends itself to such an examination because location and raw material availability remain fixed constants. The governing theoretical approach of this study is that technological organization, as identified through lithic analysis, is a proxy indicator of practiced mobility, site use, and, when correlated faunal data, subsistence exploitation strategy.

For the Early Archaic it is hypothesized that 41HY160 was utilized by highly mobile hunters and gathering peoples as a short-term logistical site. During this time, early stage reduction was conducted at 41HY1670 with blanks and early stage bifaces manufactured for use elsewhere. At the same time, there is evidence of moderate amounts of late stage biface production and/or rejuvenation. High mobility is again posited for the Middle Archaic, although the lithic and faunal assemblages indicate a move away from logistical towards residential site use with lithic data suggesting expedient tools utilized locally with bifaces manufactured locally but utilized as tools as flake tool sources elsewhere. With bison only appearing in the Middle Archaic faunal assemblage for 41HY160, it is suggested that they were pursued, butchered, and consumed at locales away from 41HY160. Large-sized mammals such as deer and pronghorn antelope were acquired and processed and consumed locally.

Lithic analysis suggests that during the Late Archaic I, the inhabitants of 41HY160 were still highly mobile with biface technology utilized more intensively than expedient core technology with less intensive initial reduction occurring at 41HY160. Although high numbers of late stage bifaces are represented in the assemblage, debitage analysis suggests that mid and late stage core reduction and expedient tool production was utilized at 41HY160. Co-varying with the significant low amounts of these extra-large sized mammals in the faunal assemblage is evidence for increased sedentism and expedient core reduction and simple flake tool use. Sometime during the Late Archaic II, bison return in greater numbers and their logistical exploitation apparently covarys with observed changes in the lithic technological organization of this time period with evidence of increased biface manufacture intended for use at locales away from 41HY160. At the same time, expedient flake tools are utilized at 41HY160, suggesting that while logistical forays occurred, intensive site use and decreased residential mobility occurred during the Late Archaic II.

It is posited that the increase of fragmented deer and/or pronghorn bone observed at 41HY160 during the Late Prehistoric I is an indicator of an increase in duration of occupation, an increase in the number of inhabitants, or both, possibly in association with a waning presence of bison. This time period bears first witness to localized use of non-expedient flake tools in large numbers. With abraded platforms, that may have resulted post-detachment, there may be a correlation between these tools and increased bone fragmentation.

During the Late Prehistoric II-Historic, we see the exploitation of the bison in its highest numbers. Still, the evidence suggests that bone processing intensified further. Together this is taken as evidence for increased site use or as an indicator of population growth. While expedient tool use continued at 41HY160, the lithic assemblage indicates that bifaces were both manufactured and used locally as well as away at logistical sites with very high significant numbers of complex platformed flake tools and large size abraded platforms dominating the debitage assemblage. Still, significant amounts of large-sized debris and large flat platformed flakes may be indicative of intensive core reduction, although the lack of cortical platformed flakes suggests initial decortication was done off-site.

CHAPTER 1

INTRODUCTION

Located in Hays County, the Tee-Box Six site (41HY160) is one of a handful of sites that have been recorded in the immediate vicinity of the San Marcos Springs. Although, investigated numerous times throughout the years, this thesis deals with the two earliest excavations, conducted in 1982 and 1983 as field schools by students of Southwest Texas State University under the supervision of Dr. James Garber. Included in this thesis are a description of the site, a reconstruction of the excavation procedures and findings, a hypothesized depositional model for 41HY160 and the Sink Creek area, and an analysis of selected lithic and faunal data collected during the 1982 and 1983 field school excavations. As necessary background information and baseline data, chapters are included that cover both the past and present natural setting, the cultural chronology for Central Texas, and the previous investigations at 41HY160 and surrounding sites.

An attempt to report on excavations for which one has no involvement is a bit of a challenge. To do so for excavations that were carried out nearly three decades ago is even more of a challenge, as was the case for 41HY160. The foremost reason for this is that the initial theoretical and methodological concerns focused on the establishment of a cultural chronology for the San Marcos Springs area, with an emphasis on the more recent deposits, while instructing students, many working in the field for the first time, in proper excavation and recording technique. Amplifying the challenge was data loss over time in the form of level records, maps, and artifacts; diagnostic projectile points particular. Nevertheless, a set of research questions regarding temporal changes in technological organization, subsistence practices, and site use were generated, and addressed utilizing what remained of the 1982 and 1983 field school collections.

Thesis Organization

This thesis is comprised of 11 Chapters. Following this introduction, Chapter 2 outlines the natural setting of 41HY160, including a detailed paleoenvironmental reconstruction for the Central Texas area. In compiling the data on past environs it was often necessary, for comparative and contextual reasons, to include information from areas just beyond what is generally considered Central Texas. Chapter 3 presents background on the cultural chronology for Central Texas by temporal period with particulars on technological organization, settlement pattern, site types and subsistence. Chapter 4 summarizes previous archeological and geoarcheological investigations conducted in the immediate vicinity of San Marcos Springs. Particulars culled from the original 1982 and 1983 field school unit level forms, field notes, profiles and plan views, and lab data sheets are summarized in Chapter 5 with an emphasis on establishing depths for carbon samples, projectile points, and archaeological features. Chapter 6 describes the governing theoretical perspective behind the research design and analytical methods discussed in Chapter 7. In Chapter 8 a hypothesized depositional model utilizing carbon dates and the OxCal program (v4.0) is presented. This model is later used to place analytical units and their lithic and faunal assemblages, whose analyses are subsequently discussed in Chapters 9 and 10, into temporal contexts. Chapter 11 offers diachronic and synchronic interpretations of these analyses in relation to the environmental and cultural information given in Chapters 2 and 3 and closes with words concerning future research at 41HY160. Scans of selected projectile points recovered during the 1982 and 1983 field schools and their identification comprises Appendix A. Appendix B is tabulated lithic data and Appendix C contains faunal data as originally provided by the University of Tennessee at Knoxville. Appendix D presents radiocarbon data used in this thesis. A list of references cited in this thesis concludes this work.

CHAPTER 2

NATURAL SETTING AND LATE QUATERNARY PALEOENVIRONMENTS

The Tee-Box Six portion of the Spring Lake locale (41HY160) is located in southwestern Hays County in the city of San Marcos at $29^0$53’36” North latitude and $97^0$55’43” West longitude (**Figure 1**). The site is situated north of the confluence of Sink Creek and the San Marcos River at the headwaters of the San Marcos Springs. The Balcones Fault Zone, running northeast to southwest, bisects the area. This fault zone acts as a major ecotonal and physiographic demarcation between the Edwards Plateau, to the north and west, and the Blackland Prairie, to the south and east (Woodruff and Abbott 1986). This resource-rich ecotonal swath that cuts through central Texas, along the mesic margins of the Balcones Canyonlands, has been dubbed “the Crescent” by Lee Roy Johnson (1991:149) due to its scimitar like shape.

Climate

Site 41HY160 lies at the interface of the semi-arid and subtropical eastern half of the Edwards Plateau and the humid subtropical Gulf Coastal Plain. Presently, the local climate of Hays County is marked by long, hot summers with high temperature averages of 35-degrees Celsius and short, dry, mild winters with a low temperature average of 12-degress Celsius (Larkin and Bomar 1983). From spring to fall, the area’s climate is primarily influenced by marine climatological variations from the Gulf of Mexico and the

Pacific Ocean (Slade 1986). During the winter months, the agents of climate variation are Arctic currents and Pacific air masses (Bomar 1985).

Annual precipitation averages 85 centimeters (cms), which falls mostly during two distinct periods occurring in the early summer and in the fall. During the months of May and June and, later, September, prevailing warm moisture carrying winds from the Gulf front with cooler and drier northern winds. When they interface above the Balcones Escarpment, often heavy thunder storms result (Carr 1967). During these wetter months, rainfall averages about 9 cms. Between November and March precipitation is at its lowest, dropping to an average of approximately 5.3 inches a month (Larkin and Bomar 1983).

It is reported that the potential incidence of high-magnitude flooding is greater for the Balcones Escarpment area of Central Texas than for any other region of the United States (Caran and Baker 1986). In part, this is due to the climatic provenance of Central Texas; the area lies within a convergence zone of high and low pressure air masses. Additionally, tropical storms and hurricanes penetrate into the area from the Gulf of Mexico and the Pacific Ocean, producing some of the areas heaviest rainfalls (Patton and Baker 1976). Once rainfall hits the ground, runoff absorption rates become a function of an areas physiography. Along the Balcones Escarpment, valleys are narrow, slopes are sparsely covered by vegetation and the surface is variably exposed bedrock or overlain by thin upland soils. Below the Escarpment, on the Blackland Prairie, soils with low-infiltration capacity severely limit absorption rates (Caran and Baker 1986; Patton and Baker 1976). Interacting together, these factors greatly increase runoff and drainage discharge.

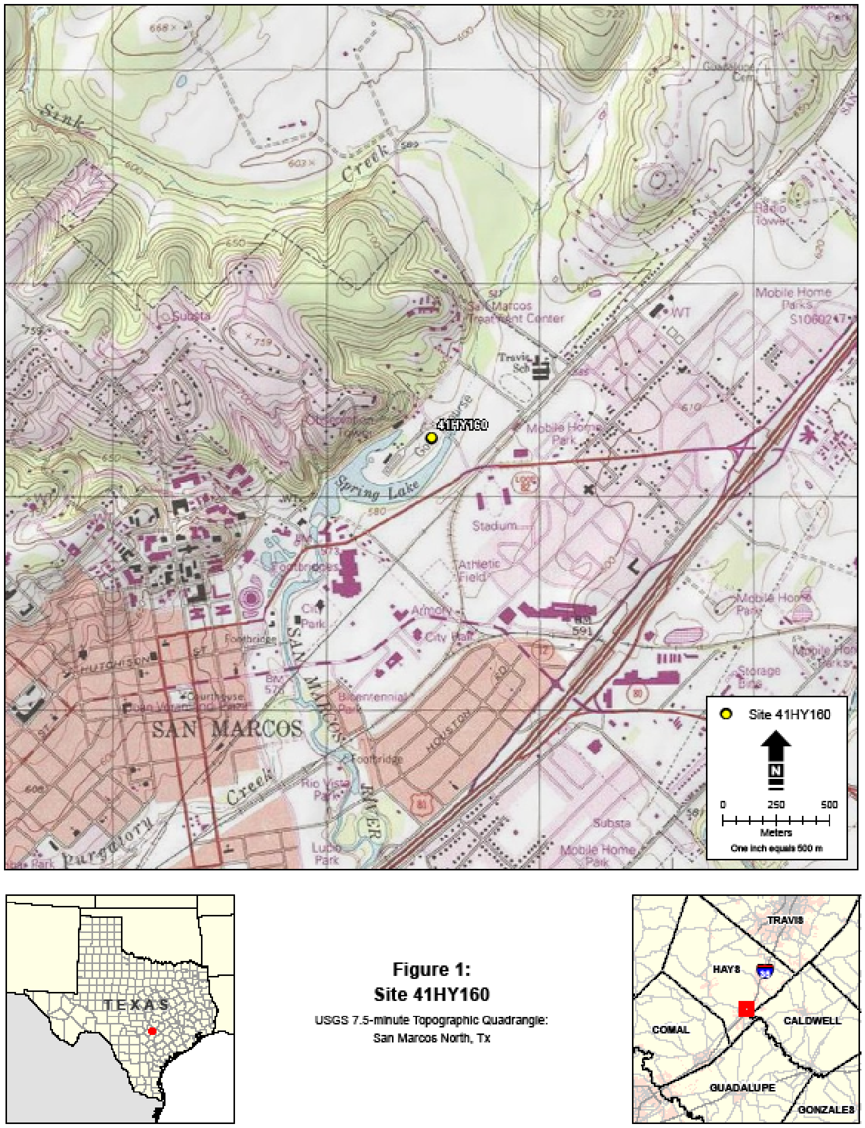

Figure 1. Location of the Tee-Box Six site (41HY160).

Geology, Pedology and Physiography

Geologically, the various landforms found in any given area reflect the underlying lithology. A locale's lithology significantly influences the surrounding topography, hydrology, and environment. The Central Texas area encompasses a number of geologic settings and landforms that resulted from a long history of sedimentary activity. Travelling west to east over this varied topography, the age of bedrock formations becomes younger. Predominantly, the bedrock of the region is limestone although other sedimentary rock formations such as dolostone, marl, chalk, siltstone, sandstone and shale are also present. In isolated areas there are occasions of igneous (granite, basalt) and metamorphic (schist, gneiss and quartzite) rock. Differential erosion and weathering creates enough variation in the topography of the Edwards Plateau to divide it into four physiographical subdivisions: the Lampasas Cut Plain, the Llano Uplift, the Central Edwards Plateau, and the Balcones Canyonlands (Riskind and Diamond 1986).

The northern extent of the Central Texas area is characterized by a terrain of rolling hills with low buttes and mesas that are, on occasion, cut by steep divides, a topography formed by extensive erosion during geologic formation. This region is known as the Lampasas Cut Plain. Here, the underlying lithology is comprised of both the Glen Rose and Fredericksburg Formations of the Upper and Lower Comanche Series (Spearing 1991). Valley slopes exhibit shallow calcareous soils derived predominantly from limestone which, when broken up, gives the soil a stony texture. Within the valleys, soils are usually of the clayey vertisol variety, while mollisols are found on mesa tops and slopes (Riskind and Diamond 1986; Spearing 1991).

South of the Lampasas Cut Plain is a low-relief topographic zone known as the Llano Uplift region (Sellards et al. 1932; Sheldon 1979). Here, the Cretaceous rock has eroded away to expose the billion-year-old Pre-Cambrian and Paleozoic rocks which, structurally, is an ovoidal deformational dome of dipping anticlines (Sellards and Baker 1935). Across the Llano Uplift are extensive outcrops of granite that form a rolling terrain over an extensive upland that is moderately dissected by stream divides generally flowing southeasterly. Some of the more prominent granitic outcrops are the Enchanted

Rock batholiths near the Fredricksburg in Gillespie County and Granite Mountain located outside of the Marble Falls in Burnet County (Black 1989a; Goldich 1941; Walters and Wyatt 1982). Other notable rock outcroppings include gneiss, schist, and mica. These parent materials weather into inceptisols sometimes overlain with acidic alfisols. Within the Llano Uplift region, sandy soils predominate in contrast to the clays and clay loams found across the majority of the Central Texas area.

Just south of the Llano Uplift and the Lampasas Cut Plain and north and west of the Balcones fault system and Blackland Prairie, lays the Edwards Plateau. The southernmost expression of the North American Great Plains, this plateau is an uplifted and dissected expanse of Cretaceous sedimentary rock formations (Barnes 1981; Riskind and Diamond 1986). The topography along the Edwards Plateau is mapped as flat to light rolling upland plains with rounded hills and wide east to southeast oriented stream divides. The Edwards Plateau is a large tableland formed of Upper Cretaceous marine carbonate rocks (Stricklin et al. 1971; Barnes 1981). Underneath the Plateau surface, often exposed in river valleys are couplets of Lower Cretaceous non-marine sandstones and marine carbonates and Precambrian crystalline basement (Barnes 1981). Isolated Precambrian rock outcrops occasionally occur throughout the southern and eastern margins of the plateau (McNab and Avers 1994). Soils on the Plateau are commonly shallow, having been subject to erosion over a long course of time. Generally, on the flats and valleys they are classified as mollisols and along the slopes as inceptisols (Riskind and Diamond 1986). Within the Edwards Plateau area there are numerous caves, caverns and fault lines formed in the limestone bedrock (Smith and Veni 1994). The most complex series of these fault zones comprise the region known as the Balcones Canyonlands.

South and east of the Central Edwards Plateau, the Balcones Canyonlands, also known as the Hill Country, divides the jagged, undulating uplands from the relatively flat Coastal Plain. This escarpment extends from the North-Central area of Texas down to just outside of the Trans-Pecos region. This steep fault face represents the remains of the Ouachita Mountains that once extended from Arkansas to Mexico at the end of the Paleozoic Era (Anaya 2004). During the Miocene, faulting along this range spurned regional uplift which created the Balcones Fault Zone (Woodruff and Abbott 1986). Centuries of down-cutting through the upper Cretaceous deposits of Edwards limestone have shaped the landscape into what we see today. Bedrock is mapped as older Cretaceous deposits of the Glen Rose Formation. This area's name is derived from Balcones Creek located in northern Bexar County (Blair 1950).

Travelling east from the Balcones Canyonlands below the down-thrust side of the Escarpment, elevations drop drastically to less than 190 meters as one enters the Blackland Prairie. The Blackland Prairie is the westernmost strip of the broader Gulf Coastal Plain and stretches approximately three hundred miles southward to San Antonio where it bleeds into the brush lands of the Rio Grande Plains (Telfair 1999). The west boundary of the Blackland Prairie is the Edwards Plateau/Balcones Escarpment, save to the north where it separates from Grand Prairie by the East Cross Timbers. The east margin of the Blackland Prairie is the interface with the Post Oak Savannah.

The Blackland Prairie is a low relief physiographic and vegetation unit that is comprised of sedimentary deposits formed through episodes of transgression and regression of an old Cretaceous sea (Fenneman 1931). A southern extension of the Midwest True Prairie, the Blackland Prairie encompasses an area that is roughly 47,860 square kilometers in size and makes up about 6.5% of the land area in Texas (Riskind and Collins 1975). The Blackland Prairie region is a tall grass prairie that, along with the Grand Prairie, extends from Northeast Texas southward into the Central Texas region between the Edwards Plateau and the Gulf Coastal Plain and is one part of a prairie system that stretches as far north as Manitoba (Ricketts et al. 1999). Topographically, there is no noticeable distinction between the Coastal Plain and the Blackland Prairie. However, there is a marked shift in vegetation between the two physiographic regions (Swanson 1995:27). This vegetation shift is attributed to a difference in soils; whereas soils of the Gulf Coastal Plain are formed from decomposing Cenozoic sediments, the deep black soils of the Blackland Prairie are derived from chalk limestones, shales and marls (Weniger 1984). This heavy clay, "black waxy" soil is where the areas name is derived. The Blackland Prairie band overlays five Upper Cretaceous geologic formations: the Eagle Ford, Austin Chalk, Taylor, Navarro, and Midway formations.

Geology and Pedology within the Vicinity of Site 41HY160

Issuing from limestones of the Edwards Group, the San Marcos Springs is located at the head of the San Marcos River near the base of the Balcones Escarpment. The springs issue from Edwards Group limestones along the San Marcos Springs Fault. This fault displaces the Austin and Taylor Groups against the Person (upper) Formation of the Edwards Group, Georgetown, and Del Rio Formations (Guyton et al. 1979).

To the southeast of the San Marcos Springs Fault, the ground is faulted again along the Comal Springs Fault. Formations in the vicinity include the Person Formation, Georgetown Formation, Del Rio Formation, and Buda Formation, as well as rocks of the Eagle Ford Group. Quaternary colluvium accumulates locally on hillsides. Broad surface deposits of Quaternary alluvium cover areas southeast of the San Marcos Springs Fault, concealing the local bedrock. The elevation of the top of the Edwards Group varies from approximately 575 feet msl northwest of the San Marcos Springs Fault to 230 feet msl just southeast of the fault, and to approximately 40 feet below sea level southeast of the Comal Springs Fault (Guyton et al. 1979). Within the immediate vicinity of 41HY160, the geology is mapped as Eagle Ford Group and Buda Limestone undivided. The Buda Formation sits atop the Del Rio. The Buda has a hard, fine-grained, bioclastic limestone lower section and an upper section that consists of very fine-grained, porcelaneous limestone. The Eagle Ford Group overlies the Buda Formation and is reposed of shale, siltstone, and limestone. The lower part of the Eagle ford is thinly bedded calcareous shale while the middle of the unit is characteristically a sequence of sandy, flaggy limestone overlain by compact and silty shale (Guyton et al.1979).

Table 1. Surface geology, San Marcos Springs and vicinity.

Formation/Group	General Description
Quaternary alluvium	Floodplain deposits including low terrace deposits; organic matter, gravel, sand, silt and clay with local caliche in overbank areas; thickness varies; covers areas southeast of San Marcos Springs Fault
Quaternary colluvium	Hillside erosional deposits; poorly sorted to unsorted cobbles, gravel, sand, silt, and clay; thickness varies; found on hillsides northwest of fault
Eagle Ford Group	Cretaceous-aged shale and limestone; upper part—shale, silty, 10 feet thick; middle part—limestone, sandy, flaggy, 4 to 5 feet thick; lower part—shale, calcareous 7 feet thick; total thickness 23 to 32 feet; exposed on hilltops northwest of fault
Buda Formation	Buda Limestone; Cretaceous-aged limestone, fine grained, hard, fossiliferous, commonly glauconitic, thickness 30 to 60 feet; forms the majority of surface bedrock on hills northwest of fault
Del Rio Formation	Del Rio Clay; Cretaceous-aged clay, calcareous and gypsiferous; some thin beds of siltstone; some thin limestone beds of fossils; thickness 40 to 60 feet; exposed strata on hillsides northwest of fault
Georgetown Formation	Mostly limestone, fine grained, nodular, moderately indurated; some shale, calcareous; thickness 10 to 45 feet; exposed on hillsides northwest of fault
Edwards Group	Limestone, dolomite, and chert; limestone, fine grained, chalky to hard, alternating beds of dolomite, fine to very fine grained, porous; thickness approximately 800 feet; locally exposed in streambeds; source of springs

Modified from Barnes 1974.

Soils in the vicinity of San Marcos Springs are primarily silty clays and loams of terraces and floodplains (**Table 2**). These soils are generally well drained, allowing for rapid surface water runoff. Thick layers of fluviatile deposits (Qal) are present in the San Marcos River floodplain, which may aid local base flow (Crowe 1994). Within the immediate vicinity of 41HY160, these deposits are described as Oakalla clay loams and Tinn clays (Batte 1984). The Oakalla Series is deep, well-drained, loamy soils of nearly level floodplains formed in calcareous, loamy alluvium (Batte 1984). Oakalla soils (frequently flooded) are the predominant soil type in and along the San Marcos River. These soils are usually dark grayish brown in color with a surface texture that varies from loam or clay loam to silty clay or silty clay loam. Coloring of the upper 100 centimeters (cms) is typically dark grayish brown. From 100 cms to approximately 130 cms soil color changes to a light yellowish brown that transitions to very pale brown clay to 200 cms (Batte 1984:34).

The Tinn Series soils are deep, somewhat poorly drained, clayey soils found in floodplains and formed in calcareous clayey alluvium (Batte 1984). Tinn Series soils in the vicinity of San Marcos Springs include Tinn clay (frequently flooded). From surface to about 65 cms color is typically dark gray. After 65 cms color becomes grayish brown to approximately 200 cms. Tinn clays have moderate alkalinity and can be calcareous throughout (Batte 1984). The structure of Tinn clay ranges from a moderate, medium blocky and subangular blocky to a weak medium blocky structure, and there is high potential for shrinking and swelling (Batte 1984; Crow 1984)

Table 2. Properties of Soils within the Immediate Vicinity of 41HY160.

Soil Type (Map Symbol)	Depth (Cms)	Hydraulic Conductivity (Cms/hour)	Shrink/Swell Potential	Water Capacity (inches/inch soil)
Oakalla soils (frequently flooded) (Ok)	0 to 200	1.5 to 5.1	Moderate	0.3 to 0.5
Tinn clay (Tn)	0 to 25	0.2 to 0.5	High	0.4 to 0.5

Modified from Crowe 1994.

Hydrology

Along the Balcones Escarpment, there are numerous springs and artesian water sources distributed fairly evenly along the fault zone. Some of the largest and historically significant of these springs originate from the highly prolific Edwards Aquifer (Brune 1975). This underground reservoir is essentially a series of interconnected caverns formed in Edwards limestone, Austin Chalk and Taylor Marl. This karstic system discharges as springs and seeps, and recharges as surface precipitation and overland flow enters the recharge zone.

With approximately 200 springs and an average discharge of 4,300 liters per second (lps), the San Marcos Springs (also known as Aquarena Springs) is the second largest spring system in Texas, second only to Comal Springs (Brune 1985:10). Since 1892 when records began to be kept, the largest recorded discharge from San Marcos Springs was recorded on June 12, 1975 at 8,490 liters per second (lps). The lowest recorded discharge was 1,300 lps on August 15, 1956 (Brune 1985:224). The discharge from these springs headwaters the San Marcos River, one of the more prominent waterways of the Guadalupe River drainage system. The San Marcos flows in a general southeast direction. Approximately 8-9 kilometers downstream of the spring head the San Marcos intersects with the Blanco River, its primary tributary. Sixty-four kilometers further downstream the San Marcos merges with the waters of the Guadalupe River west of the city of Gonzalez. Other local tributaries of the San Marcos River include Sink Creek, Sessoms Creek, Purgatory Creek, and Willow Springs Creek.

Biota

Flora. Within all its vastness, Texas houses an enormous diversity of environments for plant and animal life. Variability in these environments is primarily the result of topographic and climatic controls (Blair 1950). Due largely to its geographic position in Texas and, for that matter, North America, the Central Texas region is home to a diverse array of vegetation communities. Of the flora, Van Auken (1988) noted that the composition appeared mixed "with some species having eastern affinities and some having western affinities." Regarding the Edwards Plateau, Weniger (1988) refers to the location as a "biotic crossroads" of regional vegetation.

Where the Great Plains grade into the northern and western reaches of the Plateau, there are semi-open grasslands, grassland-shrubland and grassland-woodland mosaics (McMahan et al. 1984). Mid and shortgrass species such as blue grama (*Bouteloua gracilis*) cane bluestem (*Bothriochloa barbinodis*), silver bluestem (*B. saccharoide*), Texas wintergrass (*Nasella leucotricha*), fall witchgrass (*Leptoloma cognatum*) and tobasa (*Hilaria mutica*) thrive in communities along the northwestern region of Central Texas. In sympatry, woody and shrubland niches are intermittent among the grasslands. On the arid flats west of the Upper Devils River, shrubby mesquite and Redberry (*Juniperus pinchotii*) and Ashe Junipers (*Juniperus ashei*) are found. In this area mid and tall grasses give way to short grasses, better suited to the shallow and rock soils. Identified shortgrass species include black grama (*Bouteloua eriopoda*) and bush muhly (*Muhlenbergia porter*). On the far western margins of the Edwards Plateau, succulents such as lechuguilla (*Agave lechuguilla*), sotol (*Dasylirion wheeleri*), and agave (*Agave americana*) commonly occur. More eastward, towards the Hill Country, where conditions are more mesic, slopes and floodplains are home to evergreens and deciduous trees. While mesquites dominate to the west, oaks and junipers are abundant in the east.

The granite outcrops of the Llano Uplift are close to being devoid of woody vegetation. Interspersed between barren outcrops are tree communities of Plateau live oak (*Quercus virginiana*), blackjack oak (*Q. marilandica*), oak–black hickory (*Carya texana*), and pecan (*Carya illinoinensis*) with honey mesquite (*Prosopis glandulosa*) and white brush (*Aloysia gratissima*) also present. Where soils are sandy, grasslands of little bluestem (*Schizachyrium scoparium*) dominate although indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), love grass (*Eragrostis* spp.), silver bluestem and fall witchgrass are also represented (McMahan et al. 1984). In loamy soils of the Uplift, midgrasses such as silver bluestem, sideoats grama (*Bouteloua curtipendula*), California cottontop (*Digitaria californica*) and buffalograss (*Buchloe dactyloides*) mingle with the mesquite.

Along the flat topography of the Lampasas Cut Plain, where there are fewer drainages, woodland communities are more open (McMahan et al. 1984). These woodlands contain more northern elements from the Western Cross Timbers such as post and blackjack oak (Riskind and Diamond 1986). Occasionally, ashe juniper are found in breaks on the limestone scarps. Tall, mid and shortgrasses on the Cut Plain resemble those of the Mixed Prairie. Little bluestem, Indian grass (*Sorgastrum nutans*), big bluestem (*Andropogon gerardii*), silver bluestem (*B. saccharoides*), Texas wintergrass, tall dropseed (*Sporobolus asper*) and sideoats grama are all present. These grasslands are patchy, a result of grazing, past cultivation and mesquite brush clearing (Riskind and Diamond 1988).

Primarily, the vegetation of the Balcones Canyonlands is forested woodlands with grassland communities generally restricted to broad drainage divides and valleys (Riskind and Diamond (1988). Deciduous woods include Texas oak (*Quercus texana*), plateau live oak, lacey oak (*Q.* glaucoides), scalybark oak (*Q.* sinuate), ashe juniper and Texas ash (*Fraxinus texensis*). Less dominant, but still present, are cedar elms (*Ulmus crassifolia*), sugarberry (*Celtis laevigata*) and netleaf hackberry (*Celtis reticulate*). Woodland communities among the Canyonlands support understories of yaupon *(Ilex vomitoria*), American beautyberry (*Callicarpa Americana*), hoptree *(Ptelea trifoliata*), and deciduous holly (*Ilex decidua*). Along the western canyon lands, xerophytic shrubs and succulents such as sotol (*Dasylrion texanum*) are not uncommon, appearing in good numbers.

The better watered uplands of the Canyonlands are home to tallgrass communities of little bluestem, Texas wintergrass, white tridens (*Tridens muticus*), Texas cupgrass (*Eriochloa sericea*) and sideoats grama (*Bouteloua sericea*). In areas of dry soil and overgrazing short grasses such as Texas grama (*Bouteloua rigidiseta*), red grama (*B. trifida*), and hairy grama (*B. hirsuta*) occur with more frequency (Blair 1950).

Typical vegetation of the Blackland Prairie region includes southern hackberry (*Celtis laevigata*), cedar elm (*Ulmus crassifolia*), post oak (*Quercus stellata*), bur oak (*Quercus macrocarpa*), blackjack oak (*Quercus marilandica*) with an understory of bunch grasses, shrubs, laurel greenbriar (*Smilax laurifolia*), yaupon holly (*Ilex vomitoria*), American beautyberry (*Callicarpa Americana*) and coralbean (*Erythrina herbacea*) (Kutac and Caran 1994).

Both ethnohistorians and archeologists have sometimes erroneously assumed that the contemporary distribution of flora and fauna and environmental conditions were the same during antiquity. This could not be further from the truth. For instance the Blackland Prairie was once a medium-tall, rather dense and varied grassland with strong groves of deciduous trees. Now, three original plant communities face local extinction: gamagrass (*Tripsacum dactyloides*) –switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*) -indiangrass (*Sorghastrum nutans*) and silveanus dropseed (*Sporobolus silveanus*).

Of the 12 million acres of prairie, these communities account for less than 1% of contemporary coverage (Telfair 1999:17). Over-cultivation and grazing has contributed to soil depletion and tall bunch grasses now give way to brush and short grasses (Telfair 1999). Once, this prairie was home to large of numbers of bison, pronghorn, plains gray wolf, red wolf and the greater prairie chicken; now, they too are expatriated (Telfair 1999).

Fauna. Johnson’s ecotonal “Crescent” marks an area of interface of three faunal provinces: the Balconian, Texan and Tamaulipan (**Figure 2**). The majority of the central Texas region falls within the Balconian Biotic Province, a term coined by W. Frank Blair (1950) to define the unique distribution of fauna within and proximal to the Balcones Fault Zone. Both the Balconian and Texan provinces are regions of transition between Sonoran and Austroriparian biotas (Blair 1950; Cope 1880). Cope (1880) describes the Sonoran fauna as adapted to the xeric conditions that today are present in the southwestern United States and northern Mexico and, more locally, in the Chihuahuan and Navahonian biotic provinces of Trans-Pecos Texas. Mammal species are dominated by heteromyids and various sciuromorphs, members of the *Rodentia* family. Numerous species of reptiles are here present while amphibians are rare. Anurans (frogs and toads) such as genera *Bufo* and *Scaphiopus* are common. In contrast to the arid Sonoran zone, the Austroriparian fauna are adapted to mesic conditions found in the Piney Woods and the northern extent of the Gulf Prairies and Marshes. In these zones, heteromyid rodents occur infrequently while cricetines (rats and mice of the new world) are predominate among mammalia (Blair 1950). For reptiles, snakes and turtles are plentiful but lizards, not so much. Urodeles (amphibians of the order Caudata, including the salamanders and newts) are noted in high numbers as are anurans, especially the ranids (frogs) and hylids (tree frogs).

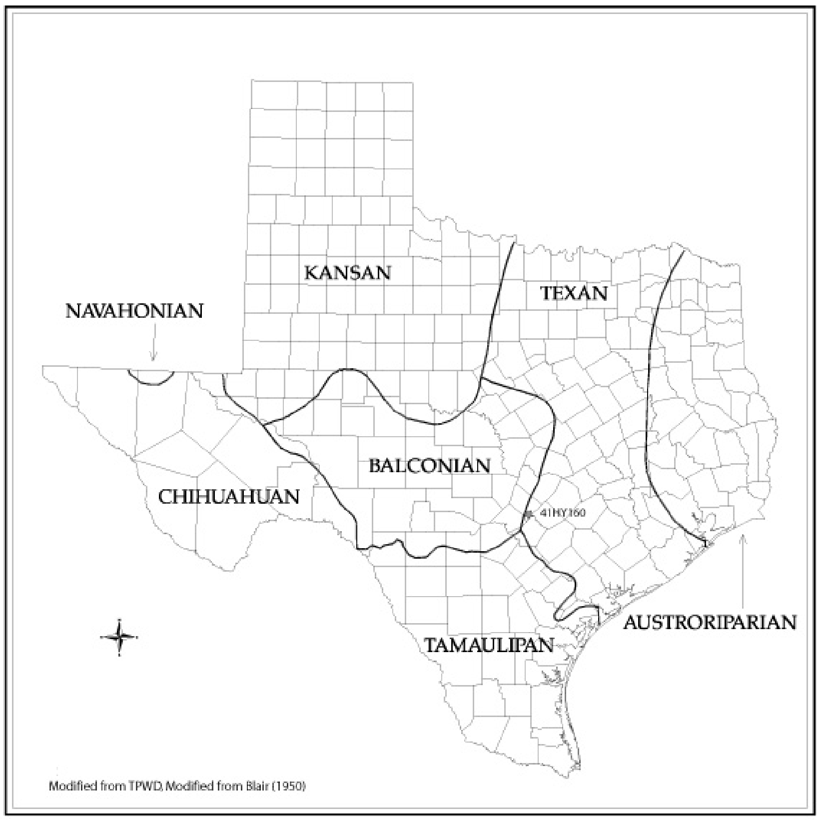

Figure 2. Biotic Provinces of Texas.

Telfair (1999) notes that there are three discontinuities in the distribution of vertebrates within Texas. The first, an east-west discontinuity can be demarcated with a north-south line that extends south from Fort Worth down to Austin where it follows the

Balcones Escarpment to San Antonio where it extends to Corpus Christi. Along this line, faunal distribution patterns shift with the abrupt change in elevation that coincides with a more mesic clime. The second follows a line from Corpus Christi to San Antonio and westward to Del Rio. Telfair (1999) notes that this prominent faunal discontinuity can be attributed largely to edaphic (soil) factors. The third discontinuity occurs along a line the stretches from Georgetown to San Saba and out to Odessa, loosely corresponding to the irregular northern edge of the Edward's Plateau and the southern limit of the Great Plains.

Generally, one would expect a combination of Sonoran and Austroriparian fauna to be present in the giant ecotone that is Central Texas. Species of the Sonoran sort would be present in greater numbers as one travels west across the Edwards Plateau while the opposite would be expected for fauna of Austroriparian association. Blair (1950:95) notes that logical westward dispersal routes for fauna would be the waterways that cut through Central Texas, as their floodplains would encourage mesic conditions and associated flora. Similarly, uplands that jut eastward onto prairieland would support environments not altogether alien to Sonoran fauna.

Blair (1950) recognizes at least 49 species of mammals associated with the Texan province, 41 of which also occur in the Austroriparian. These include: opposum (*Didelphis virgiana),* eastern mole (*Scalopus aquaticus*), fox squirrel (*Sciurus niger*), pocket gopher (*Geomys breviceps*), harvest mouse (*Reithrodontomys fulvescens*), white-footed mouse (*Peromyscus leucopus),* hispid cotton rat *(Sigmodon hispidus),* eastern cottontail (*Sylvilagus floridanus*), swamp rabbit (*Sylvilagus aquaticus*), white tailed deer (*Odocoileus virginianus*), short tailed shrew (*Crypotis parva*), beaver (*Castor*

Canadensis), ground squirrel (*Citellus tridecemlineatus*) and the black-tailed jackrabbit (*Lepus californicus*).

Numerous reptiles occur, with 39 species of snakes identified including: the northern black racer (*Coluber constrictor*), coachwhip *(Coluber flagellum)*, black rat snake (*Elaphe obsolete*), California glossy snake (*Arizona elegans*), the timber rattlesnake (*Crotalus horridus*), the northern copperhead (*Agkistrodon mokasen*) as well as the eastern diamondback (*Crotalus atrox*). A few species of urodele fauna are also present and include the smallmouth salamander (*Ambystoma texanum*), and the tiger salamander (*Ambystoma* tigrinum). Anurans common to the Texan province include the eastern spadefoot toad (*Scaphiopus holbrookii*), the Gulf Coast toad (*Bufo valliceps*), Woodhouse's toad (*Bufo woodhousii*), the southern cricket frog (*Acris gryllus*), the North American bullfrog (*Rana catesbeiana*), northern leopard frog (*Rana pipiens*), the green tree frog (*Hyla cinerea*), Couch's spadefoot (*Scaphiopus couchii*), and Strecker's chorus frog (*Pseudacris streckeri*). Blair (1950) notes that most of these species are also found in the Austroriparian province, while a few have western associations.

The Balconian biotic province in shape strongly follows the outline of Central Texas, encompassing the Edwards Plateau, the Lampasas Cut Plain, the Llano Uplift and the Balcones Canyonlands. This area is characterized by the intermixing of fauna of Austroriparian, Chihuahuan, Tamaulipan, and Kansan species with the majority from the former two provinces (Blair 1950). Blair (1950:113) writes that while 57 species are known from this province, "no species is restricted to this province." Mammals with a Chihuahuan association include the pallid bat (*Antrozous pallidus*), the ringtail raccoon (*Bassariscus astutus*), the common hog-nosed skunk (*Conepatus mesoleucus*), grey ground squirrel (*Citellus variegatusI*), the brush mouse (*Peromyscus boylii*) and the white ankle mouse (*P. pectoralis*). Among the mammals with Austroriparian associations found within the Balconian province are the Virginia oppossum, the eastern pipistrelle (*Pipistrellus subflavus*), eastern fox squirrel (*Sciurus niger*) and the eastern cottontail rabbit. Mammal species found here with Tamaulipan affinities are the ocelot (*Felis pardalis*), the jaguar (*F. onca*), collared peccary (*Tayassu angulatum),* nine-banded armadillo (*Dasypus novemcinctus)* and the Mexican ground squirrel (*Citellus mexicanus*). The American badger (*Taxidea Taxus*) and the plains harvest mouse (*Reithrodontomys montanus*) range widely across the area from the Kansan province while the black-tailed prairie dog (*Cynomys ludovicianus*) is found only in the northwestern quadrant (Blair 1950).

Lizards of the Balconian province are the Texas banded gecko (*Coleonyx brevis*), the lesser earless lizard (*Holbrookia maculate*), crevice spiny lizard (*Sceloporus poinsettia*), the Texas spiny lizard (*S. olivaceus*), Texas alligator lizard (*Gerrhonotus liocephalus*), collared lizard (*Crotaphytus collaris*), the Great Plains skink (*Eumeces obsoletus*), Texas spotted whiptail (*Cnemidophorus gularis*) and the six-lined runner (*C. sexlineatus*). The majority of these are widely distributed Chihuahuan species reaching their limits eastward although at least one, the Texas Spiny Lizard (*Gerrhonotus liocephalusi*) should be considered a Balconian species which reaches its western limits in the Chihuahuan province (Blair 1950). The lone land turtle species reported by Blair (1950) for the Balconian province is the widely distributed is the ornate box turtle (*Terrapene ornate*).

The vast majority of the thirty six species of snakes Blair (1950) reports as known from the Balconian have wide distributions that range over several biotic provinces across western North America. Some snakes of the area are the Mexican garter snake (*Thamnophis eques*), black-tailed rattlesnake (*Crotalus molossus*), the rough green snake (*Opheodrys aestivus*), ringneck snake (*Diadphis punctatus*), hognose snake (*Heterodon contortrix*), the black racer, the northern copperhead, the eastern cottonmouth (*A. piscivorus*), the coachwhip (*Coluber flagellum*), red-bellied water snake (*Natrix erythrogaster*), diamond-back water snake (*N. rhombifera*) and the diamond-back rattlesnake. Fifteen species of anurans inhabit the province with two, the Texas cliff frog (*Eleutherodactylus latrans*) and the cliff chirping frog (*Syrrhophus marnockii*) ranging into the area from the Chihuahuan province and four, the Gulf Coast toad, southern cricket frog (*Acris gryllus*), gray tree frog (*Hyla versicolo*) and the great North American bullfrog (*Rana catesbeiana*) ranging in from the Austroriparian province (Blair 1950). Other anurans found within the Balconian include: Strecker's chorus frog, Clark's tree frog, Gulf Coast toad, eastern green toad (*Bufo debilis*) and the red-spotted toad (*B. punctatus*). Blair (1950) reports that there are seven species of urodeles that are found within the Balconian province. Five of which are endemic: the Texas blind salamander (*Typhlomolge rathbuni*), San Marcos salamander (*Eurycea nana*), Texas salamander (*E. neotenes*), the Cascade Caves salamander (*E. latitans*) and the fern bank salamander (*E. pterophila*).

Paleoenvironmental Reconstruction

During the last 20 years, bolstered by the development of new techniques and the accumulation of larger data sets with better spatial and temporal coverage, archaeologists, geoarchaeologists, palynologists, and paleontologists have begun to investigate, with earnest, climate and environmental change during the Late Pleistocene and Holocene in an effort to better understand its influence on human lifeways. At present, models for a paleoenvironmental reconstruction for the Texas region are largely based on Collins and Bousman's (1993;1998a) synthesis of pollen data from the Weakly, Boriack, South Soefje, and Hershop bog locales and Toomey's (1993) faunal sequence reconstructions from the Hall's Cave locale (Figure 3). Recent research has amplified these efforts and contributed greatly toward an understanding of the paleoenvironment of Texas (eg., Bousman 1998a; Brown 1998; Caran 1998; Frederick 1998; Fredlund et al. 1998; Karbula et al. 2007; Kibler 1998; Nickels and Mauldin 2001; Nordt et al. 2002; Ricklis and Cox 1998).

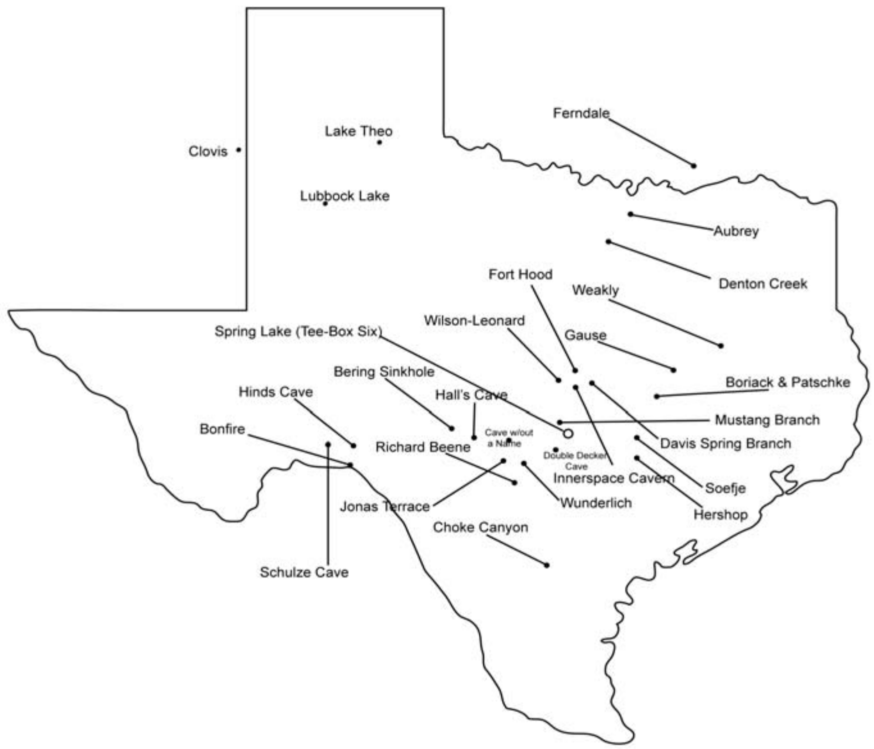

Figure 3. Selected localities mentioned in text.

Full-glacial (ca. 20-14,000 B.P.)

Data from South-Central United States suggest that during the last glacial maximum, regional temperatures were significantly lower than at present, perhaps as much as 6 degrees Celsius cooler during the summer months (Bryant and Holloway 1985; Delcourt and Delcourt 1985; Toomey et al. 1993). Fossil beetles recovered from sediments at the Aubrey Clovis site in North Texas have been interpreted to suggest a climate that, seasonally, may have averaged 10 degrees Celsius lower than present as late as 14,200 B.P. (Elias 1994). Mandel's and others' (2007) recent investigations at the Richard Beene site (41BX831) in southern Bexar County, corroborates these earlier studies. Here, the carbon isotopic composition, reflecting decomposed plant coverage, has been measured in buried paleosols (Mandel et al. 2007). Data dated ca. 15,500 and 14,000 B.P. show little C_4 productivity , an indication of cool climatic conditions. Mandel et al. (2007:59) suggest that this is representative of an influx of glacial meltwater into the Gulf of Mexico affecting conditions in South-Central Texas. In a similar fashion, Nordt et al. (2002) compared variations in relative C_3-C_4 plant productivity from a location on the Medina River in South-Central Texas. At this locale, a reduction in C_4 plant values was correlated with two Pleistocene era glacial meltwater pulses. Low periods of C_4 productivity were noted as occurring between 15,500 -14,000 B.P. and 13,000-11,000 B.P. (Nordt et al. 2002:185). For these same periods, episodic influxes of meltwater from the Laurentide ice sheet into the Gulf of Mexico via the Mississippi has been documented (Fairbanks 1989; Kennett et al. 1985; Leventer et al. 1982; Spero and Williams 1990). Hence, cold water inputs into the Gulf catalyzed cooler climate conditions on the Texas mainland.

During the height of the Full-glacial, massive northern glaciers formed a natural barrier for cold arctic air resulting in winters that were most likely relatively mild and comparable to those of the modern day (Toomey et al. 1993). In addition to now extinct megafauna, animals which now inhabit cooler and moister niches to the north and east shared the Edwards Plateau with animals that, today, are at the northern extent of their range. Graham and Lundelius (1984) suggest that this is evidence for reduced seasonality during the Full-glacial.

Pollen studies from Patschke and, later, Gause and Franklin Bogs in East-Central Texas were conducted by J.E. Potzger and B.C. Tharp (1943, 1947 and 1954). The presence of spruce (*Picea*) pollen, a species that typically favors cooler climes, was inferred to indicate a boreal forest across central Texas for much of the Pleistocene. A later increase in the frequency of grass (*Gramineae*) and oak (*Quercus*) was interpreted as a shift to a warm and dry climate. While novel, Potzger and Tharp's work predated radiocarbon dating and, hence, lacks absolute ages.

In 1991, Camper reanalyzed Potzger and Tharp's data and provided raw pollen grain counts for Patschke for 51 separate levels, supported by radiocarbon dates. Because Camper's (1991) grain counts were sufficiently high, Nickels and Mauldin (2001) were able to eliminate misleading local marsh taxa pollen, in order to provide a regional reconstruction of past environments dating as far back as 17,000 B.P. based on pollen percentages. From 17,000-15,500 B.P., this pollen sequence suggests the presence of a cool grassland environment. At the end of the Full-glacial, from 15,000-14,000 B.P., Patschke evidences a rapid decline in this environ.

Due to a regular accumulation of deposits that span nearly 17,000 years, Boriack Bog provides one of the more informative pollen sequences for the central Texas region (Bryant 1977). At this locale, in east central Texas, pollen data are bolstered by radiocarbon dates (Bryant 1977; Holloway and Bryant 1984). At ~17,000-15,000 B.P. low frequencies of spruce pollen were noted in the record and were identified by Holloway and Bryant (1984) as *Picea glauca*, a species that is now found in areas with mean summer temperatures around 21 degrees Celsius, again suggesting comparably cooler temperatures during the Full-Glacial for at least the summer months.

Variations in growth rates of speleothems (cave dripstones) have been demonstrated to be causally linked to patterns of hydrologic recharge and rainfall (Lauritzen and Lundberg 1999). Because they are well suited to uranium-series dating, speleothems can provide high-resolution paleoclimate histories. Musgrove et al. (2001) detailed the growth records of four stalagmites from three central Texas caves (Inner Space Cavern, Double Decker Cave and Cave without a Name) to assess temporal changes in hydrology and climate. Three periods of rapid growth were identified: 71-60,000 B.P., 39-33,000 B.P., and 24-12,000 B.P. The last identified growth period corresponds with models that propose a wetter period for central Texas during the full-glacial.

The equable seasonal climate that prevailed during the Full Glacial resulted in landscape stability and periods of soil formation (Cooke 2005). Widespread thick soils across Central Texas would likely have supported an environment that was quite different than today. Toomey (1993) reports that limestone fragments rarely occur in the Hall's Cave deposit before 12,000 B.P. suggesting that there was very little exposed bedrock in the area. Faunal remains from burrowing species noted in the deposits in various Texas cave sites would seem to confirm that soils were most likely much thicker, supporting lush plant communities and different fauna than today (Toomey 1993). Thicker soils and increased foliage may have reduced flash flooding and enhanced local aquifer recharge (Blum et al. 1994).

Late-Glacial (ca. 14,000-ca. 10,000 B.P.)

For much of the globe, a thousand year long cold spell, the Younger Dryas, occurs ca. 12,600-11,600 B.P. In Central and South Texas, this cold episode has not yet been reported in the proxy climatic records (Nordt et al. 2002)). Instead, data from the region suggest a warming and/or drying trend (Bousman et al. 1990; Bousman 1992; Hall 1981, Holloway and Bryant 1984; Toomey 1991, 1992; Toomey et al. 1993).

Faunal evidence from the Edwards Plateau indicates that sometime after 15,000 years ago, average temperatures (particularly summer temperatures) increased rapidly (Hall 1981; Toomey 1991, 1992; Toomey et al. 1993). By 14,500 B.P., the masked shrew (*Sorex cinerus/haydeni*), adapted to cooler summer temperatures, disappears from the faunal record at Hall's cave. By 12,500 B.P. the cotton rat (*Sigmodon hispidus*), adapted to warm summer temperatures, appears within the same record. Toomey (1991, 1992) posits that, at this time, summer temperatures approached to within 3^0C of contemporary values. Stable oxygen isotope ratios from pedogenic carbonates and freshwater marls from southern Texas provide collaborative evidence for this warming trend (Bousman et al. 1990; Bousman 1992).

In addition to an average temperature increase, faunal evidence suggests that effective moisture oscillated noticeably from 14,000-10,500 B.P. (Toomey et al. 1993). The disappearance of the bog lemming (*Synaptomys cooperi*) from the record at Hall's

Cave, ca. 14,000 B.P., suggests a decrease in effective moisture. A comparison of the represented amounts of the desert shrew (*Notiosorex crawfordi*), which is more tolerant of dry conditions, to the least shrew (*Cryptotis parva*), which requires considerable moisture, at Hall's Cave, illustrates vacillations in effective moisture after 14,000 B.P. From 12,500 to 10,500 B.P., the desert shrew increases in abundance when compared to the least shrew, indicating a decrease in effective moisture.

After 10,500 B.P., the relative numbers of the desert shrew compared to the least shrew decreases, indicating a return to wetter conditions. Other species adapted to cooler, dryer climates, such as the Eastern Chipmunk (*Tamias striatus*) also disappear from the Central Texas environmental record, further supporting a warming/drying hypothesis (Graham 1984). An increase in the carbon and nitrogen isotope compositions observed in sediments and fossils from Hall's Cave support an increase in aridity between 14,000 and 11,000 B.P. (Cooke 2005). Similarly supporting faunal materials from as far south as Mexico's Chihuahuan Desert indicate that the geographic extent of this warming trend reaches far beyond Central Texas (Presley 2003:68-70).

Pollen data from Ferndale Bog located in the Ouachita Mountains of southeastern Oklahoma indicate that at the end of the Pleistocene, the area was dominated by grasses and *Ambrosia* with moderate amounts of oak and birch. *Ambrosia* reaches its peak ca. 11,000 B.P. while grass dominance peaks a thousand years later (Ferring 1995). Ferring (1995) interprets these data as an indication the local environment was one of open grasslands, a trend that carried into the Early Holocene. Further south, in Central Texas, pollen records from peat bog deposits indicate that there was a Late-Glacial vegetation shift from deciduous forest towards a landscape that was increasingly grassland dominant

(Bryant and Holloway 1985). In a reinterpretation of Potzger and Tharp's (1947) fossil pollen record analysis from Patschke Bog, Bryant and Holloway (1985: 52) posit that the "warm-dry cycle indicated by high percentages of oak and grass fossil pollen" noted by Potzger and Tharp as following a cool-wet period, dates to the Late-Glacial period. Save for a short spike at 13,200 B.P. Nickels and Mauldin's (2001) pollen analysis of Camper's Patschke data notes low grass frequencies for this area from 14,000 B.P. until approximately 10,500 B.P. At Boriack Bog in Lee County, the pollen record for the Late-Glacial period illustrates that there was a steady reduction in represented arboreal taxa with *Picea, Corylus, Myrica, Tilia,* and *Acer* becoming virtually locally extinct and *Salix, Fraxinus,* and *Bertula* becoming rare (Bryant 1977; Bryant and Holloway 1985). At Gause Bog, in addition to *Ostrya/Carpinus, Picea, Corylus,* and *Tilia* , disappear (Bryant 1977).

Correlating with the local faunal and pollen data from Central Texas that suggest a marked, perhaps intense, climate shift to increased aridity, Blum et al. (1994) note widespread erosion of alluvial sediments in river valleys within the Edwards Plateau area from ca. 13,000-12,000 B.P. Both Blum and Valastro (1989) and Nordt (1992, 1993) document channel entrenchment/cutting as occurring respectively within the Pedernales River and at Fort Hood. A similar "scouring" is noted for the same time period at the Wilson-Leonard site (Goldberg and Holliday 1998). Additionally, a flood scour event has likewise been documented at the Richard Beene site by Mandel and others (2007) ca. 9600 B.P. Hence, the thick soil mantle that was once widespread over the Edwards Plateau was subject to erosion during the end of the Pleistocene as a result of climate instability (Cooke 2005).

At Spring Lake, in San Marcos, Nordt (2010) notes that, locally, an episode of channel entrenchment occurred prior to 11,450 B.P. This erosional event exposed the bedrock floor. Nordt (2010) documents that the oldest dated sediments within Spring Lake's immediate vicinity were originally gravelly alluvium deposited on top of this scoured surface. As fluvial flooding slowed, this gravel bed was slowly covered by organic rich marsh deposits.

Early Holocene (ca. 10,000-8000 B.P.)

By the advent of the Holocene, circa 10,000 B.P., the pollen record at Boriack Bog evidences a return to a woodland environment that thrives for half a millennium (Bousman 1998a). Then, sometime after 9500 B.P., there is a return to prominence of open grassland communities (Bousman 1998a). Bousman (1998a:211) hypothesizes that by 7000 B.P., the eastern margin of central Texas was dominated by open plant communities, a theory that is supported by the pollen sequence from Patschke Bog (Nickels and Mauldin 2001). Glen Fredlund's (1998) phytolith analysis involving woodland-grassland ratios for the Wilson-Leonard site demonstrates a similar grassland expansion that began ca. 9500 B.P. and lasted until ca. 4000 B.P. Additionally, at Wilson-Leonard, there was a spike in the grassland phytoliths that suggests a dramatic grassland expansion around 8700 B.P., with a change in composition from mesic-adapted tall grasses to xeric-adapted short grasses (Fredlund 1988).

The frequent presence of prairie dogs, pocket gophers and badgers reported by Graham (1987) and Toomey (1990, 1992) for the faunal record of the Edwards Plateau through much of the Early Holocene, correlates well with Bousman's (1998a) and Fredlund's (1998) interpretations of grassland dominance. Pollen deposits from Bonfire

Rockshelter suggest this increased dominance of grassland communities extended to the southwest region of Texas (Bryant and Holloway 1985).

Pollen data from Hershop Bog, located just outside of Palmetto State Park in Gonzalez County, indicate that by 10,500 B.P. there was a marked decline in arboreal pollen and an increase in grass pollen (Larson et al. 1972). Larson and others (1972) interpret this as evidence for a local shift from parkland to a savanna environment along local uplands with a coeval shift from a closed canopy forest to an open canopy forest within area floodplains. In a reanalysis of the palynological data of Gause and Boriack Bogs, Bryant (1977) concluded that the post-glacial period for Central Texas was characterized by a gradual shift to a less mesic environment. Save for *Quercus*, both Gause and Boriack evidence a decrease in arboreal pollen counts and an increase in non-arboreal pollen. An analysis of carbonized plant remains from Wilson Leonard illustrates that, in addition to oak (*Quercus*), Juniper is present in Central Texas, at least in isolated contexts, as early as 10,000 B.P. (Dering 1998). Phytolith analysis from the Varga site (41ED28), located near the southwestern extent of the Edwards Plateau, provides further insight into the paleoclimate and environment for the region. During the Early Archaic period cool season C_3 Pooideae grasses appear to have been dominate with an average of less than 15 percent of warm season C_4 grasses (Quigg 2008:479).

The faunal record at Hall's Cave demonstrates that taxa associated with mesic conditions (the eastern mole, salamanders, eastern shrew, and eastern chipmunk) become locally extinct during the Early Holocene, indicating a gradual trend towards drier conditions (Toomey 1990, 1992; Toomey et al. 1993; Graham 1984). Molluscan data reported by Dale Hudler (2000) from Winston Cave in Bexar County, along the southern extent of the Edwards Plateau, evidence a drying trend from 10,000 B.P.-6500 B.P. Additionally, at the same location, the presence of *Promenetus exacuous*, in a column section dated to 10,000 B.P., suggests an increase in mean temperature. Paleoclimate models for the region suggest continued regular, cyclonic precipitation for the region with both tropical and convectional storms of limited magnitude (Toomey et al. 1993).

Middle Holocene (ca. 8000-4000 B.P.)

The beginning of the Middle Holocene is often considered the beginning of an Altithermal event characterized by a reduction in rainfall and a rise in temperatures (Antevs 1952, 1955; Ellis et al. 1995; Johnson and Goode 1994; Nordt 1992) with a slight respite from xeric extremes occurring during the mid-Middle Holocene (Collins 2004). At Boriack Bog, the continuous recession of the woodlands observed during the Early Holocene was temporally halted around 6000-5000 B.P., after which the frequency of arboreal pollen increased, coinciding with the onset of a wetter climate (Bousman 1994:80). This wetter interval is also represented in the grass pollen sequence for Patschke as presented by Nickels and Mauldin (2001). Further, pollen from cold adapted arboreal plants disappears from this sequence after 8000 B.P. Data presented by Nordt et al. (1994) from Fort Hood collaborate this Mid-Holocene period (6000 to 4800 B.P.) of aridity indicated at Boriack Bog. In north-central Texas, at the Aubrey Clovis site, Humphrey and Ferring (1994) report evidence for the same arid period with duration of 6500-4000 B.P.; although they note that the oxygen isotope data show no evidence that mean temperatures exceeded those of today.

Within the Texas Panhandle, there is an ample amount of proxy evidence for increased xeric conditions during the Middle Holocene. Haas' et al. (1986) analysis of carbon isotopes from the Lubbock Lake locality indicate that a shift toward C4 plant taxa occurred between 8000 and 5200 B.P. Just south of the Panhandle, at Mustang Springs, carbon-isotope analysis evidences a shift from a lacustrine mesic environment to one dominated by xeric supported grasses (Meltzer 1991). Molluscan remains, spanning a range from 12,000 B.P. to 950 B.P, from the Lake Theo site at the base of the Caprock Escarpment, were analyzed by Neck (1987). Results show that after the Early Holocene, there occurred extirpations of northern species and eastern mesic species.

Beyond migratory exodus, the shift to a C4 short grass dominant ecosystem is posited to have catalyzed speciation, particularly in bison (Lewis et al. 2007). A study by Lewis and others (2007) examined the fused metapodials from the remains of Southern Plains bison. Noted in this study was that a change in bison morphology, from larger to smaller, occurred between 8000 and 6500 B.P., with long periods of stasis before and after. Further, for specimens dating more recent than 8000 B.P. there is a decrease in bone robusticity (Lewis et al. 2007:199). The decrease in body size occurs at the same time as C3 tall grasses are replaced by C4 short grasses on the Southern High Plains. Howe (2000) reports that C4 grasses are more productive per acre then C3 grasses. This denser productivity may have resulted in a reduction in necessary grazing range for the bison which is evidenced by the decreased robustness observed in metapodials. While C4 grasses would have been more abundant following 8000 B.P. they yield less protein per mass than C3 grasses. This decrease in protein transfer would account for the decrease in the overall body mass as an agency of natural selection; smaller animals have reduced protein demands (Calder 1984). Adaptation to a new environment brought on by climate shift affected bison significantly with the result that sometime between 8000 and 6500 B.P. anatomically modern *Bison bison* appear on the Southern High Plains.

Manifestations within the archeological record of the Southern High Plains of Texas and New Mexico provide additional evidence of drought like conditions during the Middle Holocene. At the Mustang Springs site, Meltzer (1999) has identified 60 dug wells in various draws were an extended period of aridity would likely have limited supply of surface water. Where ground water was available, aeolian sands may have filled draws, necessitating exploration (Holliday 1995). Additional wells have been documented at Clovis (Haynes and Agogino, 1966), Marks Beach, and Rattlesnake Draw (Holliday 1989).

At Hind's Cave, pollen records dated to ca. 8700-6000 B.P. indicate that there were significant increases in xerophytic vegetation (Bryant and Holloway 1985). At Boriack Bog, between 8000 B.P. and 7000 B.P., there was a rapid transition to a grassland community highlighted by a significant reduction in arboreal pollen. Bousman (1998a) suggests that this shift may be a local expression of the Altithermal event. At Boriack, there is evidence for a brief, 500 year, amelioration of xeric extremes; at approximately 6000 B.P., there is a brief spike in frequency of arboreal pollen indicating a temporary increase in effective moisture. At the Varga site, during the Middle Archaic, sample content for C_4 grass phytoliths increases to 22 percent. This gradual increase continues during the Late Archaic and reaches a maximum content of 38 percent during the end of the Late Prehistoric period around 200-300 years ago.

The xeric conditions that were so pervasive during the Middle Holocene significantly controlled patterns of erosion and stability within the river valleys of Central

Texas. Down cutting was prevalent and, as a consequence, left former valley floors high above the flood plain. Such events, dating to approximately 5,000 years ago have been documented along the Pedernales River by Blum and Valastro (1989), the Sabinal (Mear 1995), and the upper Brushy Creek area (Mear 1998). For large amounts of time, these stable surfaces remained uncapped by deposition creating palimpsests of great duration (Collins 2004a). Secondary deposits observed in various caves in Texas indicate that upland landforms, subject to gradual, steady erosion, downwashing, and dissection over the previous millennia essentially were exhausted of available soils sometime between 8000 and 4000 B.P., with modern conditions in uplands in place by the end of the Middle Holocene (Cooke et al. 2003; Toomey et al. 1993).

Late Holocene (ca. 4000 B.P.-Present Day)

The beginning of the Late Holocene period is characterized by the culmination of the overall gradual decrease in effective moisture from the Early Holocene, marking the period, outside of the Altithermal, as the driest in the last 20,000 years (Toomey et al. 1993). Within the Hall’s Cave faunal record, at this time, there is a disappearance of the eastern pipistrelle bat (*Pipistrellus subflavus*) and the woodland vole (*Microtus pinetorium*). In addition, at Hall’s Cave, reflecting the height of xeric conditions, the represented numbers of the least shrew, *Cryptotis*, an animal that requires a highly moist habitat, reaches its nadir. At Schulze Cave, in strata dated with a radiocarbon age of ca. 3800 B.P., the xeric favoring desert shrew, *Notiosorex*, is represented in large numbers while here, at the same time, faunal remains for the least shrew are absent (Dalquest et al. 1969). Bement (1994) reports that the record for terrestrial gastropods at the Bering Sinkhole locale, ca.4000 to 2500 B.P., is another indicator that effective moisture was minimal. A similar trend is observed at the Richard Beene site in Bexar County, where soil organic carbon data suggest that the hot and dry period that may have lasted until 1500 B.P. (Mandel et al. 2007).

A reexamination of pollen sequences from Gause and Boriack Bogs, led Bryant (1977) to surmise that the present-day oak-savanna vegetation patterns of Central Texas (Gould 1975) where established sometime after 3000 B.P., and their distributions remained stable. From pollen analysis of deposits collected at Weakly Bog, Holloway et al. (1987) suggest that the present-day oak-savannah distribution was not established until 1500 B.P.

Starting at approximately 3000 B.P., grass and oak pollen are equally represented in the Weakly Bog sequence. The pollen frequencies signify that communities of oak woodland were replaced by communities of oak-hickory woodland. In contradiction to an interpretation by Holloway et al. (1987), Bousman (1998a) concludes this change signals a shift towards a progressively moister climate. Bousman (1998a) reports two spikes of grass pollen from Weakly Bog; one dated to 1550 B.P. and another “estimated” to ca. 400-500 B.P. These high frequency occurrences are interpreted by Bousman to be indicators for either periods of high aridity or high temperature. Further, Bousman (1998a) notes that these spikes in grass pollen frequency correlates with alluvial pedogenesis at close by Buffalo Creek and Lambs Creek, suggesting that, locally, dry grassy intervals are related to floodplain stability. This assertion seems to be in line with other geomorphological investigations from Central Texas. Investigations at the Pedernales River, which drains the eastern margins of the Edwards Plateau, indicate that from the beginning of the Late Holocene to about 1,000 B.P., the river was an aggrading, meandering stream (Blum and Valastro 1989).

Trends in the grass pollen sequences from Boriack (Bousman 1998a) Patschke (Nickels and Mauldin 2001) are similar for the Late Holocene with a oscillating but overall dry period. After 1000 B.P., at Patschke, increasing mesic conditions are suggested by exponential declines in grass pollen counts (Nickels and Mauldin 2001). The data from Patschke does not show a similar spike at 400-500 B.P. that is seen at Weakly Bog.

At the Davis Spring Branch site, pollen data change sharply from dense woodland canopy before 5000 B.P. to open grasslands, which predominate until approximately 1500 B.P. when woodlands again take hold (Karbula et al. 2007). Similar trends are noted from climatic data at the Richard Beene site in Bexar County. Soil organic carbon data from the Richard Beene site suggest that the hot and dry period that prevailed during the Middle Holocene continued until around 1500 B.P. A cooling trend then began and lasted for about 1,000 years to about 500 B.P. (Mandel et al. 2007). Phytolith data from Wilson-Leonard confirm that sometime after 2000 B.P., there was a regional re-expansion of woodlands (Fredlund 1998). Specimens of burned juniper wood and mesquite were recovered from the lower part of a burned rock midden at the Jonas Terrace (41ME29) site located northwest of San Antonio along the Balcones Escarpment (Johnson 1995). The lower portion of the strata has been radiocarbon dated to approximately 3400 B.P. suggesting that sometime near the beginning of the Late Holocene, there were communities of these plants in Central Texas, and that they are not recent intrusions-correlating with the macrobotanical data from Wilson Leonard (Dering 1998).

Sometime between 2500-1000 B.P., the woodland vole and eastern pipistrelle bat reappear in the faunal record at Hall's Cave, indicating a return to more mesic conditions (Toomey et al. 1993). Pollen and land snail data from Ferndale South-Central Oklahoma conform to this model, suggesting that the shift towards mesic conditions may have occurred between 2500-2000 B.P. (Hall 1998). Data from the Gulf Coast region suggest more mesic conditions in the Late Holocene. Ricklis and Cox's (1998) study of oyster-growth patterns on the Texas Gulf coast tentatively implies a shift to a cooler climate at ca. 3000 B.P., emerging out of a much warmer Middle Holocene.

Excavations along North Texas' Denton Creek (41DL270) provide indications of brief fluctuations of climate at the site beginning sometime between 2250 and 1400 B.P. At the site archeologists noted a direct, inverse relationship between large mammal bone fragments (considered by the authors to be high priority food sources) to aquatic, avian, and reptilian resources (considered lower preference food sources and likely indicators of food stress). At Denton Creek, deer are in abundance from 2250 B.P. until a marked, distinct drop at approximately 1400 B.P., which corresponds to increases in turtle, bird and mussel shell quantities. This drop shifts again back to deer dominance shortly thereafter (Anthony and Brown 1994). Higher isotope values occurring in mussel shells from dated contexts in North-Central Texas suggests a cool and wet climate around 3500 B.P. changes to a warm, dry climate by 2850 B.P., then cooling off and becoming wetter between 2500 and 1500 B.P., and finally a warming trend occurring after 1500 B.P. (Brown 1998).

At Wilson-Leonard, the modern balance of woodlands and grasslands seems to have reached levels of modern balance during the Late Holocene. From 4000 B.P. on, the vegetation composition is similar to modern leaf-litter assemblages from Central Texas woodlands with identifiable arboreal phytoliths including oaks, elms and hackberry (Fredlund 1998). Locally, the data suggest that after 2000 B.P. the Wilson-Leonard locale saw an increase in the amount of canopy cover within the site's vicinity.

Toward the end of the Late Holocene, the pollen and faunal indicators become incongruous for Central Texas. This may be reflective of a strong west to east trend that grades from the xeric to the mesic. It may also be an indication of relatively significant variability of weather conditions. Along the southwestern margins of the Edwards Plateau the absence of pronghorn antelope (*Antilocapra Americana*) in the faunal remains is a good indicator that semi-desert scrub prevailed there (Toomey 1993). At Hall's Cave the faunal record include taxa that are indicative of short grass environments. Along the eastern edge of the Plateau, the presence of *Antilocapra* sp. at the Wunderlich site (Graham 1987), Mustang Branch (Ricklis and Collins 1994) Armstrong (Schroeder and Oksanen 2002), and at the Tee-Box Six site (Schaffer 2010) suggests that mixed grasslands prevailed along the Balcones Escarpment and perhaps beyond, into the Blackland Prairie.

Weather patterns in the Late Holocene were generally considered comparable to those of the present day with rainfall peaks in the late spring and early fall, intense uplift storms in the summer, and periodic inflows of heavy tropical storms from the warm Gulf Coast region (Toomey et al. 1993).

Conclusion

Over time, the paleoenvironment of Texas has varied considerably. During the Pleistocene average temperatures were much cooler than present-day, although due it's location below the ice sheets, winters were considerably more mild and the lack of temperature extremes would have made the region preferable for both animal and man. At the end of the Pleistocene, the environment transitioned from one that was cooler and wetter to one that steadily trended towards warmer and drier and marked by increased seasonality punctuated by intermittent mesic episodes with a xeric episode that lasted for nearly 3000 years beginning about 6000 B.P. Beginning at about 3000 B.P. the climate approaches that of today, with xeric and mesic intervals and hot summers and cold winters. While these climate changes created variable landscapes, the most drastic has occurred recently due to widespread ranching and livestock grazing, logging, the ever increasing pumping of water from Texas' aquifers and rivers, and the relentless expansion of infrastructure.

CHAPTER 3

CULTURAL CONTEXT

Central Texas Archaeological Region

As defined by Prewitt (1981) and later modified by Collins (1995), the Central Texas archaeological region encompasses an area that is nearly 84,300 square kilometers (**Figure 4**). This region extends from the city of Uvalde northwestward to Sonora and, from here, northward to just beyond the city of Paint Rock onto the Grand and Rolling Plains. Moving northeast from Paint Rock, the city of Cleburne marks the northern most point of the Central Texas archeological region. From here, the area extends southeast, beyond Waco into the Blackland Prairie and further south to just north of the city of Floresville. Like most other archaeological regions, the boundaries for the Central Texas region are ephemeral, subject to reinterpretation as more and more work is done. Ellis and Black (1997:25) discuss the ephemeral nature in defining exact boundaries for a Central Texas "archeological region" citing inherent difficulties due to "considerable environmental diversity". Implicit with these difficulties is the danger of assuming for the area a single ethnic or cultural identity. In all of its various iterations the core of the Central Texas Archaeological region has always been the Edwards Plateau (Hester 1989).

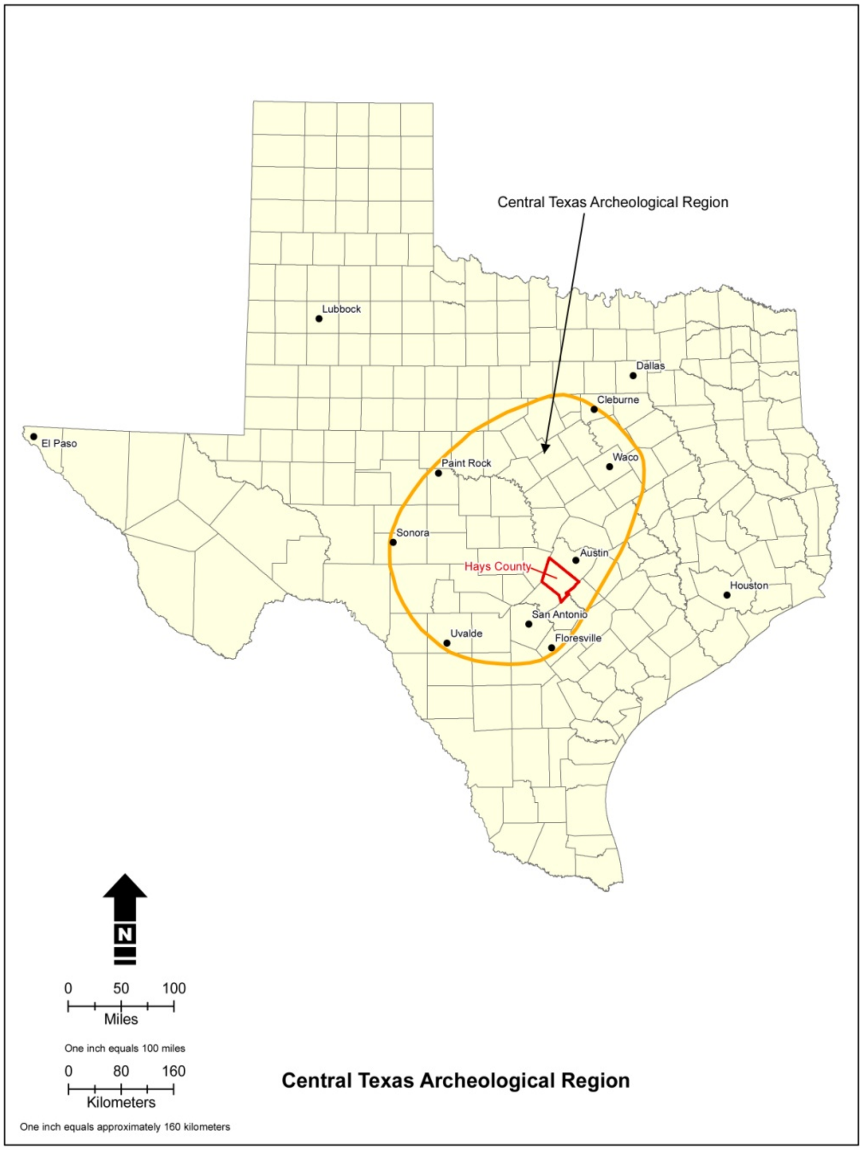

Figure 4. Central Texas Archeological Region modified from Prewitt (1981).

Prehistoric Chronology

For close to a century the chronological framework for Central Texas has been revised again and again (Collins 2004; Houk et al. 2009; Johnson et al. 1962; Johnson and Goode 1994; Kelly 1947a, 1947b, 1959; Pearce 1919, 1932; Prewitt 1981; Sayles 1935; Sollberger and Hester 1972; Sorrow et al. 1967; Suhm et al. 1954; Weir 1976).

Several scholars have offered sound but differing arguments for cultural chronologies for Central Texas. Integral to these chronologies was a reliance on morphological differences in projectile points that were ordered synchronically and diachronically. While a chronology based on projectile point typology is limiting in that it implicitly creates static demarcations in both literature and practice of what is conceptually fluid, other avenues are hampered by the paucity of data. When dealing with the temporal vastness of prehistory, most data are material, and of this material none remains in the archaeological record of Central Texas in greater numbers than stone tools and their by-products. Further, investigations of stratified sites in the Central Texas archeological region have indicated that projectile points are “sensitive and reliable” chronological markers (Prewitt 1981:65).

Early works by Pearce (1919, 1932), Sayles (1935) and Kelly (1947a, 1947b) offered increasingly complex chronological schemes. While these novel attempts provided the framework necessary to begin an earnest discussion of chronology, they have long since been discarded in favor of more recent attempts. During the 1950’s, these efforts were initially based on McKern’s (1939) taxonomic system and, later, a cultural-developmental method proposed by Willey and Phillips (1953, 1955, 1958). McKern’s (1939) “Midwestern Taxonomic Method” proposed a four-stage classification system of focus, aspect, phase, and pattern in which to order the American archaeological record. The term “focus” referred to a group of sites or components that shared material traits while an “aspect” grouped together similar foci. Aspects that shared traits were ordered into a “phase” and the largest classification of pattern was intended to group together similar phases. Essentially, this methodology was an attempt to identify distinct cultural manifestations over the backdrop of classifiable environments and reflects a cultural ecological approach. Initially, this scheme was utilized without regard for chronological or spatial controls, considerations that were later added, largely due to the work of James Ford and Gordon Willey in the Mississippi River Valley (1952).

Recognizing an increased emphasis on taxonomy and cultural reconstruction, Willey and Phillips (1953:618) sought a chronological model that was both “broad and flexible” enough to “incorporate past research in all fields of American archaeology” and “provide for current and feature investigations”. To this end, they proposed a developmental sequential model for the America’s divided into five generalized stages: Early Lithic, Archaic, Preformative, Classic, and Postclassic (the latter two being absent from North America and largely based on what was known of the Aztec and Incan empires). In addition to material remains, these stages were based on economic data, art traditions and settlement patterns culled from a synthesis of the work that had been done in the American Southwest, the Eastern Woodlands, Mesoamerica and Peru. Implicit in this model was the synonymity of “developmental stage” with “culture stage”.

In the 1954 publication of the Bulletin of the Texas Archaeological Society, *An Introductory Handbook of Texas Archeology* was introduced. This seminal work by Suhm and colleagues (1954) synthesized current regional interpretations of the state’s archeology into a single, comprehensive source. Additionally, the authors sequentially organized the projectile point and ceramic types found within Texas, an ordering which is the foundation of the contemporary schema. In the *Handbook*, Suhm et al. (1954) proposed four developmental stages that were later modified by Johnson et al. (1962), wherein Suhm’s original Paleoindian and Historic stages were left intact, her proposed

Archaic Stage was subdivided into the Early, Middle, Late, and Transitional, and the Neo-American Stage was divided into the Austin and Toyah foci. Still, these sequential divisions encompassed widespread adaptations over broad spans of time and more constrained sequential divisions were sought. Towards this end, Sorrow and others (1967) proposed a series of 10 "Local Phases" intended to characterize and carve up the temporal stages into more refined units based on patterns of uniformity that mirrored McKern's (1939) model. Largely, components, phases, and distinct cultural units were identified through projectile point typology (Sorrow et al. 1967). Critics of this early attempt in identifying a cultural chronology for Central Texas note that the described phases were not based on clear occupational components and material remains of distinct groups but on stratigraphic differences in a "long sequence of more or less mixed and inseparable occupations" (Johnson 1968:401).

Using the earlier works of Suhm et al. (1954), Johnson et al. (1962), and Sorrow et al. (1967) as a springboard, Weir (1976) and Prewitt (1981, 1985) sorted through the archaeological data from Central Texas and established a chronology defined by phases with the end goal of identifying cultural expressions and traits. Weir's (1976:4) cultural sequence of the Central Texas region divided the Archaic into five named chronological phases: San Geronimo, Clear Fork, Round Rock, San Marcos, and Twin Sisters. Weir (1976:3) envisioned each of these phases as periods of cultural stability or equilibrium identified by a homogenous assemblage content based on projectile point styles, other tool forms, and certain features. Prewitt's (1981a) proposed Central Texas Chronology added an additional six phases to the scheme proposed by Weir. In order from oldest to youngest these are: Circleville, San Geronimo, Jarrell, Oakalla, Clear Fork, Marshall

Ford, Round Rock, San Marcos, Uvalde, Twin Sisters, and Driftwood. As an informal periodicity marker, Prewitt championed the use of the term Neoarchaic over Late Prehistoric and Neo-American for the temporal range that encapsulates the Austin and Toyah foci. In this manner, cultures that adopted bow and ceramic technology but maintained a hunting and gathering subsistence could be distinguished from those who adopted agriculture.

The above described attempts to further divide the temporal stages of Central Texas into distinct phases encountered resistance. In *Toward a Statistical Overview of the Archaic Cultures of Central and Southwestern Texas*, Johnson (1967) noted that early attempts to establish refined conceptualized *units* (Johnson's catch-all term for phase, foci, aspect, etc.) for Central Texas had failed and that then-current field work was doing little to remedy the situation. In 1987, Johnson revisited this critique noting that the archeological materials that were used to identify Central Texas phases rarely were demonstrated to be in reliable dated association. A few years later, Johnson would write that "it may well be that a series of valid Archaic and Post-Archaic phases of the sociocultural sort will someday be defined for the Edwards Plateau, but that day lies beyond the horizon (Johnson and Goode 1994:18)."

In 1994, Johnson (1994:10-11) describes Texas archaeology since the mid-twentieth century as being a "tightly circumscribed discipline of narrow scope that has had three main interests": the defining of cultural units, the placement of these units into cultural periods, and the application of increasingly refined dating techniques to determine the calendric age of occupations. In the same year, Johnson and Goode (1994) produced "A New Try at Dating and Characterizing Holocene Climates, as well as

Archeological Periods, on the Eastern Edwards Plateau". In this work, the authors present a regional cultural chronology that meshes with the area's paleoclimate data drawn from multiple and sources. In this reconstruction, dates for the Early and Middle Archaic, which had remained unchanged since Sorrow et al. (1964), were set back in time, the Late Archaic was divided into two sub-periods and the term Post-Archaic was suggested in place of Neo-Archaic. Not surprisingly, further division into phases was altogether avoided.

The most recent regional synthesis and chronology for the Central Texas area is provided by Collins (2004). This attempt closely follows the scheme proposed by Johnson and Goode (1994) with a slight revision in the calendric dates for archeological eras and associated projectile points. Although his synthesis is partially derived from Weir (1976) and Prewitt (1981), Collins eschews the use of the term "phase" and its associated implications regarding culture. On the chronologies previously provided by his predecessors, Collins (2004) writes that, largely, they had been developed utilizing data acquired from sites whose stratigraphic nature lacked good chronological control. In contrast, localities where low-energy deposition occurs during or following periods of human occupation provide enhanced conditions for housing discrete assemblages. Collins (2004:113) identifies 31 such sites with 61 known isolated components within Texas and uses these to characterize temporal periods and subperiods as well as projectile point style intervals. The following chronology is largely derived from Johnson and Goode (1994), Collins (1995; 2004), and Bousman et al. (2004) with some minor additions culled from various sources.

Pre-Clovis

About 35,000 radiocarbon years ago, anatomically modern humans, or *Homo sapiens sapiens*, expanded their range, moving into the arctic plains of Asia and Siberia from Eastern Europe and the Ukraine (Fagan 2000:69). They came to hunt mammoth, woolly rhinoceros, musk ox, steppe bison, reindeer and wild horse, all large animals which subsisted in sparse numbers off of steppe-tundra grasses and brush.

A reconstruction of the geologic history of Berengia has been provided through deep-sea core analysis (Fagan 2000). These deep-sea cores indicate that the last glaciations began about 100,000 years ago and that the Bering Land Bridge was exposed during a cooling trend ca. 75,000 to 45,000 years ago. During a warming trend, that occurred about 45,000 to 25,000 radiocarbon years ago this bridge became more ephemeral, perhaps no more than a strip of land that was oft flooded. When the climate trended back to cold about 25,000 years ago until 11,000 radiocarbon years ago, sea levels fell, again exposing the land bridge. At approximately 18,000 B.P., at the height of the Last Glacial Maximum, sea levels worldwide were nearly 100 meters lower than they are at present. It was possible to cross from Asia into the Americas via Berengia but a further descent past Alaska would have been blocked by the Cordilleran and Laurentide ice sheets (Elias et al. 1996).

Convincing evidence for a Pleistocene human occupation of the Americas was first accepted on August 29, 1927 at Folsom, New Mexico. Here, a fluted projectile point was discovered *in situ* embedded in the ribcage remains of a *Bison taylori*, an animal that had disappeared near the end of the Last Ice Age (Boldurian and Cotter 1999; Figgins 1931; Meltzer 2006). This stratigraphical association between bison bone and projectile points at Folsom now placed man in lower North America during the Pleistocene. Soon after, discoveries at Clovis, New Mexico, would push back dates for a human presence in North America even further.

North American archaeology is not without debate among its practitioners and participants. One area of great contention is that of the possible existence of a pre-Clovis culture in the Americas. While still scrutinized, the idea that the initial colonizing of the Western Hemisphere was not Clovis has gained increasing favor among contemporary archaeologists (Waters and Stafford 2007). The "Clovis first" theory posits a peopling of the Americas by hunters who followed game across a land bridge from Siberia to Alaska and south into the Great Plains (Marshall 2001). Hypothetically, this migration was made possible by the melting of glaciers during the Last Ice Age which occurred no earlier than approximately 13,000 years before the present (B.P.). Hence, the "Clovis first" hypothesis has firm geological support: no corridor, no migration. A handful of recently discovered sites in the Americas have provided evidence for a possible pre-Clovis migration. In North America these are: Bluefish Caves (dated to 16,500 B.P.), Kenosha (13,500 B.P.), Meadowcroft (19,000 B.P.), Cactus Hill (15,000 B.P.), Topper (13,000 B.P.), Clovis (11,800 B.P.) and Daisy Cave (10,500 B.P.) (Marshall 2001). In South America, sites with claims to pre-Clovis cultural components include Pedra Furada and Serra Da Capivara in Brazil, Taima-Taima in Venezuela and Monte Verde in Chile (Dillehay 1989, 1997, 2000). None of these sites are without their detractors. Common criticisms include questionable stratigraphy and dates: two of these sites, though, Meadowcroft Rockshelter and Monte Verde have seemingly stood up to the scrutiny.

While Clovis Paleoindian occupations in Texas are well documented and dated (Bousman et al. 2004; Waters 2011) claims for pre-Clovis sites have, in Texas, been few, and when claims have been made, they often lack credibility. For example, the claims for a pre-Clovis occupation at Levi Rock Shelter are tainted by inconsistencies in both stratigraphic context and radiocarbon dates (Collins 2004). The absence of credible pre-Clovis sites in Texas can largely be attributed to the absence of preserved geological deposits that date between 18-12,000 years ago (Bousman and Skinner 2007). In Texas, valley alluvial deposits were affected by widespread erosion which occurred 13-12,000 years ago, severely diminishing the possibility of locating pre-Clovis deposits in fluvial contexts (Collins 2004). Further, upland landforms often provide poor stratigraphic context, while rock shelters of great age are often heavily degraded. Evidence for pre-Clovis occupations would thus be limited to certain regions.

One such geographical area within Texas that does exhibit intact Late Pleistocene sediments is the North Sulphur River Valley (Rainey 1974). Masters work done by Mary Rainey indicates two distinct episodes of degradation-aggradation occurred during the Late Pleistocene. Rainey divides these formations into the Upper Sulphur River Formation and the Lower Sulphur River Formation. Fortuitously, these alluvial deposits are separated from the Holocene by a lens of truncated soil, resulting in easy distinction between the two. Undisturbed Quaternary deposits dating to near 17,000 years ago exists within the North Sulphur River Valley (Bousman and Skinner 2007). In May and August of 2005, the North Sulphur River was examined by Bousman and Skinner to test for the possibility of in situ Paleoindian artifacts. Ten cut bank and backhoe profiles were done as well as a field reconnaissance of the area. While amplifying what was known on the chronological scheme for alluvial deposits of the North Sulphur River, the contestable context of the limited number of artifacts recovered during this investigation has left the possibility of a pre-Clovis occupation in this Texas locale as an unconfirmed possibility.

Another such possibility for a pre-Clovis archeological site is the Petronila Creek site (41NU246) located near the town of Driscoll, thirty kilometers west of Corpus Christi and the southern Texas coast (**Figure 5**). Discovered here in a cut-bank exposure five meters below the modern ground surface, was a mixed accumulation of faunal bone radiocarbon dated to ca. 18,000 years ago (Lewis 2009). This date is supported by stratigraphical, climatological, and faunal correlations, albeit perhaps loosely.

The principle archeological feature at the Petronila Creek site is its bone bed. This bone bed is a primary deposit comprised of multiple elements from many different individual animals (an adult mammoth, gar, large turtle, and a mylodont sloth). Mostly through a process of elimination, Lewis (2009) concludes that human activity was responsible for the accumulation of the bone pile. In support of this conclusion are cut marks on some of the bone and evidence that suggests some of the bone were used as tools. Further evidence of a human causality for the bone bed are flakes of chert found within the bone-bed sand. Additionally, located within creek bed sediments adjacent to the bone bed were two broken projectile points (Lewis 2009). Still, the bulk of the evidence for a pre-Clovis context occupation at Petronila Creek is, at best, *a priori*, and much more work needs to be done before anything definitive can be assumed.

Perhaps the site with the most potential to contain well stratified and datable pre-Clovis artifacts is one that is best known as a Clovis site. The Gault site in Bell County, Texas, has provided by far the largest Clovis assemblage in all of North America, and with artifacts stratigraphically positioned beneath the Clovis components, likely has the best chances of providing conclusive evidence for a pre-Clovis culture in Texas (Adavasio and Page 2002; Collins and Brown 2000; Collins 2009).

Pre-Clovis Assemblages

While archaeological sites that date earlier than Clovis have been increasingly gaining acceptance there is little agreement on what constitutes a pre-Clovis site or assemblage. Early supporters of a pre-Clovis existence in the Americas envisioned a less specialized technology system than that of the big game hunters (Dillehay 2000). According to this paradigm, pre-Clovis peoples were foragers and scavengers who travelled in small bands and exploited whatever the local environment offered. Their technology is posited to be characterized by simple percussion-flaked tools that are both large and crude with choppers and expedient unifaces. This generalized technology would likewise be devoid of diagnostic projectile points and, hence, assemblages would be hard to identify. At the Meadowcroft and Cactus Hill sites components identified as being pre-Clovis contained small, unfluted bifacially flaked projectile points and prismatic blades. Although similar in style to Clovis lithic technology, these items were described by Collins (2004b) as “not Clovis”.

Recent studies have linked bone-working technology to millennia prior to the Clovis era (Holen 2006; Johnson 2005). There may be an overdependence on chipped stone as an indicator of technology for pre-Clovis cultures and the widespread use of flaked tools (Thoms et al. 2007). In Texas, the best evidence for this bone quarrying technology might be in the Post Oak Savannah/Blackland Prairie region as evidenced in such sites as Richard Beene, San Antonio River, and Munger Branch (Thoms et al. 2007).

The widespread and, in some cases, abundant mega-fauna remains in many of Texas' ecological zones points to a likelihood of well-developed, pre-Clovis predator-prey and scavenger relationships during the waning stage of the Last Glacial Maximum (Collins 2004b). In short, it seems likely that the southwestern margin of the continent's expansive oak, hickory, and pine forest, may have afforded an ideal human habitat prior to and during Clovis times.

Paleoindian (11,500-8800 B.P.)

Scholars divide the Paleoindian period in North America by Geological epochs. Pleistocene era peoples that inhabited North America from ca. 12,000-10,000 B.P. are referred to as Early Paleoindian with the advent of the Holocene as the arbitrary temporal demarcation between Early and Late Paleoindian periods (Collins 1995, 2004). The people of the Late Paleoindian period (10,000-8800 B.P.) utilized a similar lanceolate point technology and practiced lifestyles that were in many ways the same as the Early Paleoindian period. Diagnostic artifacts for the Early Paleoindian period include lanceolate-shaped, fluted projectile points such as Clovis, Folsom, and Plainview. Early projectile points were utilized as tips on atlatls and spears and were used in the hunting of big game such as mammoth, mastodon, bison, horse and camel (Black 1989a). The shift from the Early to the Late Paleoindian subperiod is marked by the appearance of several unfluted projectile point styles such as the Dalton and San Patrice types and "Plainview like" points that are similar to Plainview points but differ in flaking technology and are noticeably thicker through the midsection (Collins 2004). The appearance of Golondrina-Barber, and Saint Mary's Hall point types postdate Dalton and San Patrice types (Collins 2004). Along with chipped stone artifact assemblages characterized by Clovis and

Folsom points, artifact assemblages for Early Paleoindian peoples in Central Texas include engraved stones, exotic lithic materials such as obsidian, and ochre stained artifacts (Collins et al. 1991). During the Paleoindian period, a hunter-gatherer adaptation strategy was employed with an increase in the harvesting of flora and in the hunting of small game as big game died off towards the end of the Pleistocene.

Early Paleoindian (Clovis, Folsom and Plainview Traditions)

Well-dated Clovis sites in North America fall within a time range of 250 calendar years from ~11,050 to 10,800 B.P., and overlap with non-Clovis sites from North and South America (Waters and Stafford 2007). Within Texas, Clovis points have been found and documented in 149 of 254 counties (Bever and Meltzer 2007). At last report, Bever and Meltzer's (2007:65) Texas Clovis Fluted Point Survey (TCFPS) numbered 544 points. According to the TCFPS, there is a high amount of Clovis points reported for three regions: Plains/Panhandle, Central Texas and the Texas Coast (although the heavy concentration of points at McFaddin Beach skews the data). Within Central Texas, the majority of these points are distributed in an arc-like pattern, beginning in Abilene in the north and swinging south, clockwise through Austin and San Antonio, ending in Uvalde County. This arc roughly follows the same line as the Balcones Escarpment. Just below the Balcones Escarpment, lies the Gault site, the most expansive Clovis site discovered to date. The western half of the Edwards Plateau is nearly devoid of Clovis points (Bever and Meltzer 2007). The widespread abundance of Clovis points throughout Texas is consistent with the paradigm that human occupation was established regionally well before 11,200 B.P. Further, the wide distribution of Clovis-type points across most of

North America and even into Central America suggests a wide dispersal range or interaction sphere with the people who made them (Kelly 1993; Wenke 1990).

The defining characteristic of Clovis lithic technology is the manufacture of large, bifacial projectile points which, through studies, have established their effectiveness in the slaying of large prey (Frison 1989). Characteristics of the Clovis lithic tradition include large bifacially-shaped preforms that often were knapped into knives and fluted points. Other lithic artifacts include tools fashioned from regular flakes and bifacial thinning flakes, polyhedral blade cores and prismatic blades (Bradley 1991; Collins 1999). Collins and others (2007) note that the majority of bifacial forms found among Clovis assemblages are lanceolate-shaped Clovis point preforms. Direct soft-hammer percussion is evident for all but the final pressure flake edge trimming in the production of Clovis bifaces and projectile points. As biface preforms were shaped, a controlled overshot flake removal technique was utilized to remove imperfections along bifacial edges by extending across the piece rather than chipping away directly at the irregularities. Collins (1999) suggests that prismatic blade technology was a formal component of the Clovis lithic tradition. Blades manufactured from these cores are typically elongated with small platforms, indistinct bulbs of percussion and a strong curvature (Bousman et al. 2004). These blades were often fashioned into and utilized as endscrapers, scrapers and burins. In addition to an emphasis on biface production, Clovis assemblages exhibit an extensive use of exotic lithic raw materials. For instance, a Clovis point that was made from obsidian sourced to Central Mexico was recovered 1,000 km to the north at Kincaid rockshelter (Hester et al. 1985). Other artifacts associated with the Clovis culture include prismatic blades, engraved stones, bone and ivory points, stone bolas, ochre, and shaft straighteners. Clovis site types include killsites, quarries, caches, open campsites, ritual sites, and burial sites (Collins 1995; Hester 1995).

Once thought to be exclusive big-game hunters in constant pursuit of mammoth, new evidence now paints a somewhat different picture of the Clovis lifeway. Faunal analysis from both the Aubrey and Lewisville sites indicate the Clovis peoples exploited a wide range of animals in addition to mammoth, including: bison, horse, camel, deer, rabbit, pocket gopher, vole, squirrel, rat, prairie dog, various birds, snakes, lizards, fish, turtles, and lizards. At Lubbock Lake, mammoth remains are well represented in the faunal assemblage. This locale exhibits evidence of processing, secondary butchering, marrow extraction, and bone quarrying. Additionally, there is good evidence for the exploitation of a broad range of smaller taxa (E. Johnson 1987). It should be noted that while we now know Clovis peoples were not exclusively big-game hunters, all well dated and accepted Clovis sites contain the faunal remains of large-bodied species such as mammoth, mastodon, camel, elk, and/or bison. Conversely, Clovis points are not found with any consistency in deposits associated with *only* medium or small taxa. Based on an analysis of 33 faunal assemblages, Waguespack and Surovell (2003) note that Clovis hunting behaviors do appear aligned toward a specialized strategy. The most consistent faunal components within the examined assemblages were bison, mammoth and mastodon. Other taxa with large representations were turtles and tortoises. Considerably less common were high handling cost small-sized species such as rabbits and hares.

Folsom/Midland/Plainview

The most representative expression of a nomadic, big-game hunting, lifeway is known as the Folsom tradition (Collins 2004b). The Folsom interval follows the Clovis with most archaeologists dating the Folsom tradition as lasting from 10,900 B.P. to 10,200 B.P. Folsom artifacts are fairly common in both Central and South Texas (Collins et al. 2003; Hester 1995). Sites identified as Folsom are generally located in, or adjacent to, grasslands, from which bison could be pursued.

Initially, early twentieth-century archaeologists did distinguish between Clovis and Folsom points with the connotates “Folsom-like” and “True Folsom”, respectively. Eventually, it was recognized that distinct types existed in the then current collection (Howard 1943; Krieger 1947). In contrast to Clovis points, Folsom points were recognized as having longer flutes, a finer flaking pattern and thinner cross sections. Evidence strongly suggests the lithic technology of Folsom groups centered on the production and curation of large, thin bifaces (Boldurian 1991). From these bifaces, large thinning flakes were detached and used as blanks for points, bifaces, scrapers and other tools associated with butchering and hide-working. The curation of large thin bifaces is widely believed to favor patterns of high mobility and an associated subsistence strategy where big game was hunted. In contrast to Clovis technology, documentation indicates that blade production was rare in Folsom technology, if not altogether alien.

On some occasions, the unfluted Midland Point type is found in association with Folsom points, although they have been discovered alone as well. Amick (1995) and Hofman et al. (1990) believe that these two stylistically similar points are part of the same technological system. Since, the production of Folsom fluted points was prone to failure, as groups moved away from raw materials (i.e. onto the plains) they would increasingly expend their raw materials. When these materials became scarce, a switch to the manufacture of unfluted points would, sensically, encourage conservation of raw material.

Sites such as Lake Theo, Lipscomb, Lubbock Lake, Lubbock Landfill, Scharbauer, and Shifting Sands all link Folsom (and, in some cases, Midland as well) technology with the hunting and processing of bison, evidence that is much in line with the "high mobility-specialized big game hunter" paradigm. However, some sites with Folsom association indicate wider subsistence strategies. For example, the Folsom component at Lubbock Lake contains evidence for muskrat, fish, and turtle exploitation in addition to bison processing (Johnson 1987). At the Lubbock Landfill site, with multiple Folsom occupations, there is evidence for a varied diet of bison, catfish, pond slider, frog, ground squirrel, prairie dog, pocket gopher, vole, and muskrat.

Plainview

First described by Kreiger (1947) from the Plainview site, Plainview points are unfluted parallel-flaked lanceolates with concave bases and rounded corners. The edges of Plainview points are usually ground down while basal thinning was done by the removal of small vertical flakes (Turner and Hester 1993). Krieger noted that these points exhibited two flaking styles: irregular flaking over convex surfaces and collateral flaking of near equal size, meeting at a medial ridge. In contrast to Folsom sites, the Plainview sites from Texas predominantly reflect bison procurement to the exclusion of other species. However, this may be due to excavation and screening techniques associated with earlier excavations of such sites (Bousman et al. 2004).

It has been suggested that the morphology of Plainview points (parallel-sided, thin convex surfaces, ground down edges form base to midpoint or beyond) indicates that they were deeply set in socketed hafts to be used as projectiles designed to kill large animals, such as bison (Kelly 1982). In contrast, Golondrina points, hafted in a split-stem style, appear to be best utilized in the hunting of medium sized game, such as deer or antelope. Kay's (1998) use-wear analysis of Golondrina points from the Wilson-Leonard site illustrates that Golondrina points were also used as butchering tools.

Late Paleoindian (10,000-8800 B.P.)

The Late Paleoindian archaeological record shows evidence for diversification of projectile point styles and overall changes in lithic technology relative to the Early Paleoindian periods. Unfluted point styles associated with the Late Paleoindian time period dating from ~10,200 or 10,000 B.P. to 8800 B.P. include San Patrice, Cody/Scottsbluff, Golondrina-Barber, St. Mary's Hall, Wilson, and Angostura (Collins 2004). Along with a change in technology, the shift to the Late Paleoindian period is often characterized as a shift in adaptive strategies from a focus on Pleistocene big game hunting and high mobility to a strategy that was more reliant on local resources and limited mobility (Anderson 1996; Haynes 1980; Stanford 1999). We know now that Paleoindian adaptive strategies were more complex than before thought (Bousman et al. 2004; Collins 2004). For Central and South Texas, Hester (1976:9) noted that the "terminal Pleistocene in Texas appears to have a wide range of adaptations, reflecting the use of fairly localized environments and resources, and leading to the development of regional lithic specializations". The reorganization of plants and animals in response to climate change at the end of the Pleistocene may have resulted in the adoption of multiple strategies across different regions of the continent. The decline of fluted point traditions may be attributed to these varied adaptations to this environmental change (Newby et al. 2004).

San Patrice, Scottsbluff, Angostura and Golondrina

Within Texas there are only three excavated and dated sites that have produced San Patrice projectile points: Wilson-Leonard, Horn Shelter and Rex Rodgers. Together these three sites suggest that the San Patrice tradition dates between 10,300 and 9000 B.P. (Bousman et al. 2004). Scottsbluff points have been found at Wilson-Leonard (Bousman 1998b), Buckner Ranch (Sellards 1940) and at Landa Park in New Braunfels (Arnn and Bousman 1997). General distribution patterns for San Patrice and Scottsbluff points show a strong tendency toward a concentration in the eastern half of the state of Texas, among the prairies and woodlands (Bousman et al. 2004), while Angostura, considered by Bousman and others (2004) to be a terminal Paleoindian point type, tends to occur more commonly in the southern half of the state.

At the Devil's Mouth site, Leroy Johnson (1964) noted a projectile point with a similar style to Plainview. This he named Plainview-Golondrina, later to become Golondrina. These lanceolates have distinctive flared basal corners, deep basal concavities, crescent-shaped basal thinning scars and more random flaking patterns. Generally, Golondrinas are wider and heavier then Plainview points. While Plainview is represented from all parts of Texas, Golondrina points are distributed primarily in south and Central Texas as well as the Lower Pecos (Turner and Hester 1993). Turner and Hester estimate the Plainview point type as predating Golondrina by as much as 1,000 years. Bousman and others (2004) date this point type to 9500- 9000 B.P. It is possible that Golondrina points are a more southern variant of Dalton points, which is a very similar form with a more northeastern distribution (Bousman et al. 2004).

Site and Assemblage Patterns

With the exception of the Bone Bed, Lubbock Lake, and Wilson-Leonard, most Paleoindian locales on record for Texas have low artifact counts (Bousman et al. 2004). Compared to other regions in the state, Central Texas sites tend to be larger in size, although this could well be a result of the high number of artifacts recovered at Wilson-Leonard skewing the data. Excavated sites from the Lower Pecos are smaller while excavated sites from the Plains area are smaller still (Bousman et al. 2004). Predominantly, sites that have been discovered in Central Texas have been described as camp sites (Wilson-Leonard, Loeve-Fox, Richard Beene, and Levi Rock Shelter). In contrast, sites along the Plains are recorded as being short-term occupation kill/butchery sites. Generally, an assemblage associated with a Paleoindian campsite will have more cobble and pebble raw materials, burin spalls and groundstone tools, while kill/butchery sites seem to have comparatively higher numbers of projectile points. Early Paleoindian assemblages are mostly known from the Plains where their assemblages are dominated by projectile points and unifacial tools. At Lubbock Lake, the Early Paleoindian record shows a high frequency of chopping tools within the Clovis assemblage. Late Paleoindian assemblages, especially in the Central Texas and Lower Pecos regions, have a marked decrease in projectile point frequency with a more equitable distribution of tool types. Rarely have Paleoindian sites been found with intact features, and burned rock is scarce (Collins 2004b).

Within Central Texas, most Paleoindian finds have consisted of surface lithic scatters located on upland terraces and ridges (Black 1989a). Additionally, Paleoindian components have been discovered in deep alluvial contexts, such as at Berclair Terrace (Sellards 1940), Kincaid Rockshelter (Collins et al. 1989), Wilson-Leonard (Collins et al. 1993; Collins 1998), and at excavations conducted south of San Antonio at the Richard Beene site (Thoms et al. 1996). As of 2004, Collins (2004a) recognizes three sites within Central Texas that contain high-integrity Paleoindian components: Kincaid Rockshelter, Horn Shelter, and Wilson-Leonard. In addition to deposits at Horn Shelter and Wilson-Leonard, Collins (2004a:113) notes that the Pavo Real site has a Paleoindian component of moderate integrity.

At Wilson-Leonard the deeply stratified record of human occupation spans a period of approximately 11,000 years B.P., from the Early Paleoindian period to the Late Prehistoric (Collins 1998). As such, it contains the most complete prehistoric temporal sequence in Central Texas. Within this long record there occurs at least two superimposed Wilson occupations, respectively dated to 10,000 B.P.-9500 B.P. and 9500 B.P.-8400 B.P. (Bousman 1998b:161). From the first occupation (labeled the “Wilson Component” by Bousman), solid evidence is provided for a foraging lifestyle, one where a wide range of fauna (bison, deer, rabbits, raccoons, squirrels, turtles, a variety of birds, fish and snakes) were exploited. In addition to a “more Archaic” subsistence pattern, the Wilson Component contained tool forms that are characteristic of Archaic assemblages: gouges, burins, and scrapers (Bousman 1998b; Bousman et al. 2002). Further, sourcing of lithic material suggests a narrower exploitation range than previous occupations at Wilson-Leonard. In all, the evidence illustrates that Archaic-type like strategies began by the advent of the Holocene. Whereas the Early Paleoindian occupations hunted large fauna the Wilson Component utilized a wider array of animal resources and practiced technologies that are typical of cultures 2500 years more recent (Bousman et al. 2002). This demonstrates that embedded subsistence strategies developed not in synchronicity but with extreme temporal and spatial variability.

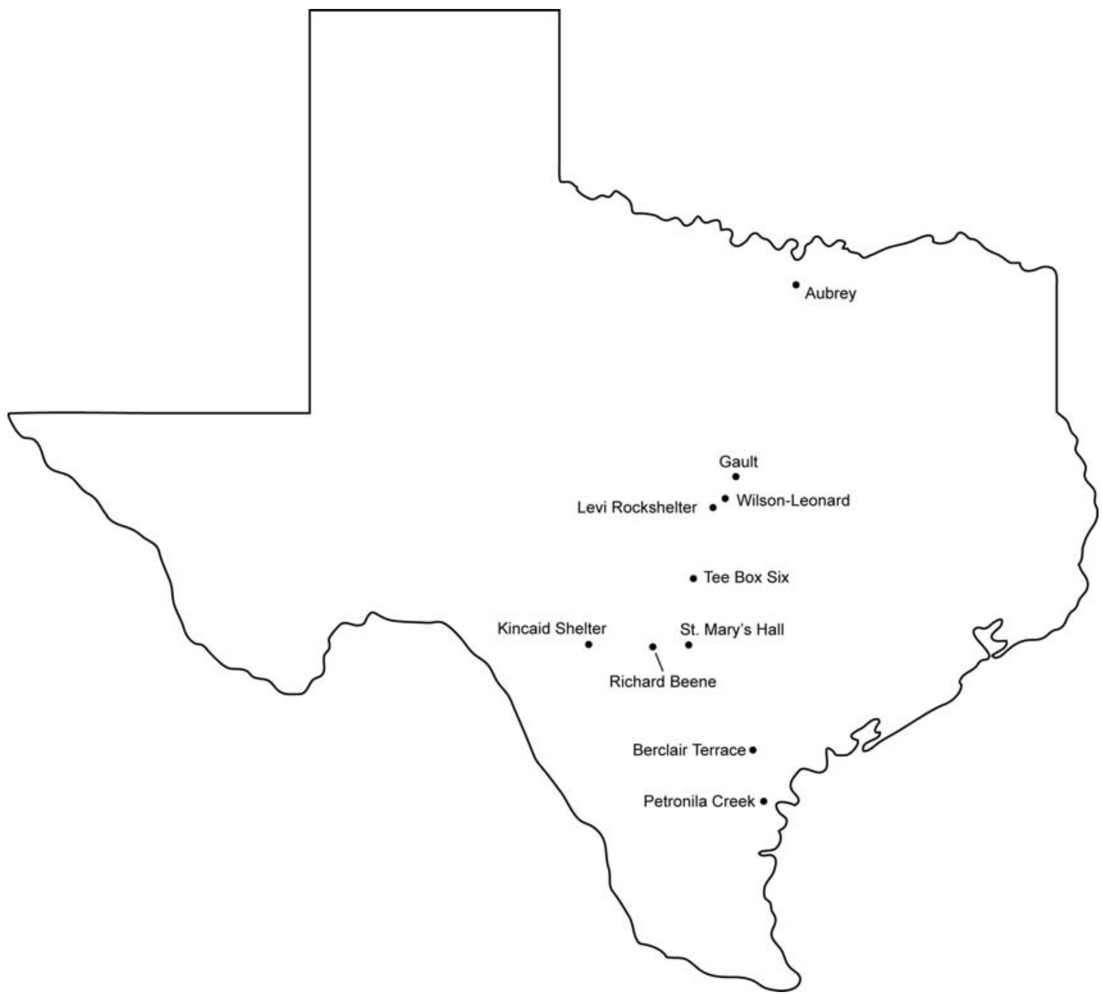

Figure 5. Selected Pre-Clovis and Paleoindian sites mentioned in text.

The Archaic Period

As the warming trend that marks the transition from Pleistocene to Holocene climates began to take effect in Texas, prehistoric inhabitants adapted with changes in lifestyle. Material culture became more diverse with the increased exploitation of diverse flora evidenced by the use of burned rock middens. This climatic shift is also marked by the decline and extinction of mammoth, mastodon, horse, camel, and giant bison *(Bison antiquus)* that began at the end of the Early Paleoindian period and reached a zenith during the advent of the Archaic. With the possible exception of Berclair Terrace (Sellards 1940), archaeological evidence suggests that sometime after 11000 B.P., large gregarious game animals were extinct in Texas, except for the bison. These extinctions would have forced hunters to concentrate on deer, antelope, and other medium-sized or smaller game. Changes in the subsistence base required technological shifts that began during the Late Paleoindian period and continued into Archaic. Dates for the Archaic period in Central Texas are from 8800 to 1200 B.P. (Collins 1995, 2004; Johnson and Goode 1994). Both Collins (2004) and Johnson and Goode (1994) divide the Archaic into Early, Middle, and Late sub-periods.

While the data and resulting models concerning environmental change during the Paleolithic-Holocene transition are robust, cultural adaptations for the same period are still unclear. This is especially true for Texas (McKinney 1981). Historically, the primary difference between Paleoindian and Early Archaic peoples was in associated subsistence strategies, and, by extrapolation, mobility patterns and lithic technology; Early Paleoindians were envisioned as nomadic specialized big game hunters while Archaic humans followed a migratory hunting and gathering lifeway (Suhm et al. 1954; Willey and Phillips 1958). Locally, the long Archaic Period was envisioned as a transitional time between nomadic hunters and sedentary, pottery producing, agriculturalists (Suhm et al. 1954). However, as discussed above, the idea of exclusive big-game hunting cultures is no longer apropos when describing the entirety of the material assemblages or subsistence strategies of the Paleoindian time period. Adaptations that were once wholly ascribed to the Archaic have manifestations that date before 8800 B.P. Likewise, “survivals” of past adaptations should and would be expected to infiltrate the Early Archaic.

Recognizing this fluidity, there are still several trends that can be safely identified with the Archaic. First, the hunting and gathering of local resources was greatly intensified (Collins 2004). Second, there is a much greater diversity in material culture, particularly the varied and widespread use of groundstone. Third, the Archaic is marked by a pervasive and extensive use of heated rock in the form of hearths, ovens, middens, scatters, and other similar features (Collins 2004). Finally, particularly towards the end of the Archaic, the use of widespread and revisited cemeteries is noted with recent work at Buckeye Knoll suggesting that the use of established cemeteries spans the entire Archaic (Bousman, personal communication). These trends are hallmarks of a lifeway that prevailed within Central Texas for over 7500 years.

Within the Central Texas archeological region, many sites have been well preserved, buried within the first order/level terrace’s (T1) along the many water-ways that run through the area (Baker 2003; Collins 1995; Mear 1998). Largely, this fortuitous preservation of Archaic sites is the result of long-term precipitation patterns and the resulting sediment deposition that occurred during the early half of the Holocene (Baker 2003).

Early Archaic (8800-6000 B.P.)

Hester (1995) identified the advent of the Early Archaic with Early Corner-Notched and Early Basal-Notched dart points, roughly dating the period between 7950 to 4450 B.P., while Story (1990) and Prewitt (1981) date the Early Archaic as beginning at 8000 B.P. Collins (1995:383) dates the Early Archaic from 8800 to 6000 B.P. in Central Texas, with three divisions, or intervals based on three projectile point styles: Angostura, early split-stem, and Martindale-Uvalde. Both Johnson (1991) and Prikryl (1990) see Early Archaic points as representative of two broad styles, the Early Barbed and the Early Split-Stem traditions. Johnson (1995:85) notes that these traditions "did not obviously develop from the region's Paleoindian points" and that Archaic peoples knapped in an "Archaic as opposed to a Paleoindian mode". Like the Clovis tradition, the Early Split Stem style was widespread across the North American continent. Fiedel (1992) notes that this point type ranges east into Alabama, up to West Virginia, and into New York. Additionally, Early Split Stem points are found throughout the American West, where they are most commonly referred to as Pinto points.

Once dated exclusively to the Paleoindian period, some scholars today correlate the beginning of the Early Archaic with the unstemmed Angostura projectile point (Prewitt 1981). Others place this type near the end of the Paleoindian period (Bousman et al. 2004; Thoms 1994). While Collins (1995) recognizes their presence within Late Paleoindian assemblages, his preference is to order Angostura into the Early Archaic and associate any temporal overlap as evidence for a transitional overlap of technology that occurred at the beginning of the Early Holocene. Analysis from Wilson Leonard further suggests that Late Paleoindian dart points were utilized alongside stemmed points during the very early years of the Early Archaic (Dial et al. 1998). Collins' position seems justified: one of the largest collections of *in situ* cultural materials associated with Angostura projectile points in North America was recovered from the Richard Beene site (41BX831), in occupations dated to ca. 8700 B.P. (Thoms et al. 1996:8). Larger still, the collection of Angostura points at Wilson Leonard was recovered in contexts with similar reported dates (Bousman, personal communication). By about 8000 B.P. unstemmed points loose prominence to stemmed varieties such as Gower, Hoxie, Jetta, Martindale, and Uvalde (Collins 1995).

Other prevalent tool forms associated with the Early Archaic are specialized woodworking tools such as Guadalupe and Nueces bifaces, (Collins 1995) and Clear Fork gouges (Turner and Hester 1993). At Levi Rock Shelter, numerous burins were noted in association with Angostura points in contexts dated to the Early Archaic (Epstein 1960) - although there geological context is questionable (Bousman-personal communication). Also, during the Early Archaic, notched stones appear in assemblages with their use posited as fishing net weights or as bola components (Boyd and Shafer 1997). Hinting at their use in fishing, these stones are also, at least regionally, referred to as "Waco Sinkers" (Chandler 1999).

Johnson (1991, 1994) recognizes that while there may have been continuities in basic subsistence practices across aboriginal societies through time, different groups of humans utilized dissimilar tool forms and methods for creating them. Further, while lithic technology is often (and rightly) linked with subsistence, Johnson (1994:161-162) notes that several factors can account for debitage variability including different communities inheriting different stone-working traditions. Although aware that isolating discreet highly constrained temporal knapping traditions is highly complicated, Johnson (1994) sees enough variability to comment on large scale knapping trends throughout the Archaic. During the earliest part of the Early Archaic, Johnson (1994) notes a trend where knapping was oriented towards the production of usable cutting and scraping flakes that were often utilized with little or no edge modification and projectile points were created from thin flakes or by further reduction of cobble preforms. Similar to a Paleoindian tradition, within Early Archaic assemblages, one finds large flakes that have been worked unifacially along one or both margins for use as scraping or cutting tools. Towards the end of the Early Archaic and into the Middle Archaic, billet-chipped small bifacial knives appear in considerable numbers in the Central Texas archaeological record (Johnson 1994).

Skinner (1974) and Weir (1976) speculates that population density during the Early Archaic was low and that hunter and gatherer groups were small and highly mobile. This inference was based on the fact that Early Archaic sites are thinly distributed across the landscape and that diagnostic projectile point types are reported across a wide area, including most of Texas and northern Mexico. Story (1985) believes that population densities were low during the Early Archaic, and that groups consisted of related individuals in small bands with "few constraints on their mobility" (Story 1985:39). Several authors note that during the Early Archaic there is a clustering of archaeological components along the eastern and southern margins of the Edwards Plateau (Black 1989b; Ellis 1994; Johnson 1991; Johnson and Goode 1994; McKinney 1981). According to Collins (1995), site distribution data for Central Texas reflects that Early Archaic peoples were living in the better-watered areas of the live-oak savanna habitats of Central Texas. Both McKinney (1981) and Story (1985) suggest that this concentration along water-ways may have been an adaptive response to an arid climatic interval. Recent work at Camp Swift in Bastrop County, east of the Edward Plateau indicates that the Central Texas prairie area was infrequently used during the Early Archaic and the preceding Paleoindian, abandoned during the Middle Archaic and frequently during the Late Archaic and Late Prehistoric (Bousman et al. 2010). Further, this same work suggests that much of what has been assumed regarding settlement patterns and population density may be more of a function of survey methodology than accurately representative of the facts.

For the most part highly populated camps are absent from the Early Archaic. Instead it appears that small term camps were revisited and reused by family like units or by small, possibly lineal, bands. A noted exception in this pattern within the Central Texas Archaeological Region is documented at site 41BX47, adjacent to Upper Leon Creek. Here, the large number of burned rock hearth features recorded in similar temporal and spatial contexts contrasts with the general pattern assumed for the Early Archaic (Hard and Bousman, 1996:55). Collins (1995) notes that for much of the earliest Early Archaic subsistence practices were geared towards the hunting and processing of deer, and small animals. However, the Early Archaic artifact assemblage, with large numbers of ground stone, at the Sleeper site (41BC65), suggests a subsistence focused on the collecting and processing of local plant resources (Johnson 1991). In Central Texas, beginning sometime after 9000 B.P., a shift occurs and sites post-dating this shift are increasingly characterized by the presence of fire-cracked rocks in high quantity. Tethered to this shift is the intensive exploitation of local habitats associated with a range reduction in residential mobility. In order with a more constrained exploitation range, then, one would expect to find limited numbers of exotic materials in Early Archaic components and an increased reliance on local lithic material. Also consistent with the concept of reduced mobility is the increase in abundance of woodworking tools such as adzes, gravers, drills and spokeshave-like tools consistent with the manufacture of wooden implements, tools and residences, arbors, and storage platforms.

Considered a hallmark of the Holocene peoples in Texas, burial sites with numerous interments are increasingly documented from the Early Archaic into the Late Prehistoric. Along the Edwards Plateau region, the largest number of burial sites yet recovered occur in vertical shaft sinkholes (Bement 1994). However, in comparison with the number of other documented site types, there is a marked paucity of known burial sites for Central Texas. This may be due in part to the physiographical nature of the Edwards Plateau; the landscape has numerous karst features, many of which have filled in with sediment making detection difficult. Still, when interments have been discovered, they have provided important insights into past cultures.

Human skeletal material recovered from Bering Sinkhole (41KR241) in Kerr County, dated between 7676 B.P and 6708 B.P., indicate a low rate of human tooth-enamel hypoplasia with a relatively low rate of caries suggesting that there was little weaning stress and a diet low in carbohydrates during the Early Archaic (Turpin 1985). Ratios for stable carbon isotopes show that there was a low reliance on C_3 plants such as sotol and acorns that were both widely available in the area at this time (Bement 1994; Bousman and Quigg 2006). Instead, it appears that there was a greater reliance on C_4 or CAM plants (Bement 1994). Associated with the extinction of megafauna that occurred at the beginning of the Holocene, bison (when present) and deer were hunted and there was a trend towards a wide exploitation of an array of small animals and fish (Collins 1995; Dillehay 1974).

Burial arrangements at the Mason Ranch Burial Cave (41UV4) would seem to imply that by the Early Archaic period, time was invested in the placement of individual interments by a group of people who would have had to plan and coordinate descents into the near unscalable vertical shaft (Benfer and Benfer 1981). Worked bone and shell recovered with human burials at Hitzfelder Cave in Bexar County, some of which may date to the Early Archaic, also note the ritual importance of grave-goods among Archaic peoples (Collins 1970).

Beyond Central Texas south into the Coastal Plain, the Buckeye Knoll site, located in Victoria County, with a component dating the Early Archaic, attests to similar behavior. At Buckeye Knoll at least 200 systematic interments have been documented. Buried with the human remains were elaborate grave goods such as polished bannerstones, plummets, and quartzite along with grave-goods made of non-local materials (Texas Beyond History n.d.). Beyond investment in mortuary ritual these items suggest interaction with Archaic peoples of the greater Southeastern U.S. and possibly, territorialism in at least some parts of Texas by approximately 7000 B.P. Similar systematic burial of the dead is known for other parts of North America, particularly the eastern United States (Doran et al. 1990).

Common site types of the Early Archaic are open campsites such as Loeve, Wilson Leonard, Richard Beene, Sleeper, Jetta Court, Youngsport, Camp Pearl Wheat, and Landslide, and rock shelters like Kincaid and Hall’s Cave (**Figure 6**). Less common, but well dated to this period are cache sites (Lindner) and locales with oven structures (Turkey Bend Ranch) (Collins 1995). Within the buried terraces of the Edward's Plateau area, Early Archaic materials are found contextually segregated and in relative isolation from other later prehistoric components (Baker 2003; Prewitt 1981). Collins (2004a) identifies seven sites that have high integrity gisements components dating to the Early Archaic: Loeve, Richard Beene, Camp Pearl Wheat, Sleeper, Jetta Court and Youngsport. Sites with moderate integrity components are Wilson-Leonard, Hall's Cave and the Landslide site. Recent investigations at the Icehouse site in San Marcos indicate that this site has a moderate to high integrity Early Archaic component (Oksanen 2008).

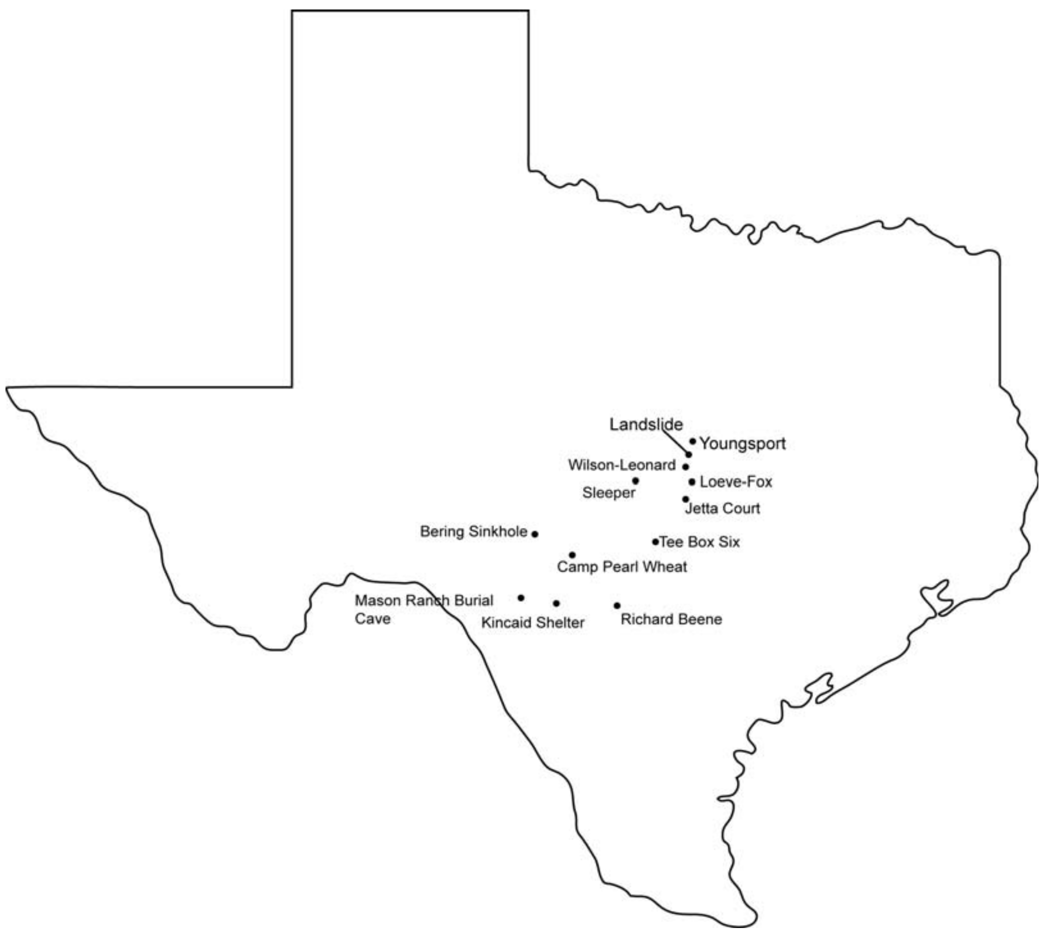

Figure 6. Selected Early Archaic sites mentioned in text.

Middle Archaic (6000-4000 B.P.)

Collins (1995) defines this intermediate period of the Archaic as lasting from approximately 6000 to 4000 B.P. in Central Texas. Based on the large number of documented sites from this period, the Middle Archaic appears to have been a time of regional population increase (Story 1985; Weir 1976). The reasons for this increase are not known, but Weir (1976:126) suggests that thriving deer and acorn communities attracted groups, at least seasonally, from all other regions of Texas. McKinney (1981) posits that as the climates became drier, Central Texas groups, as well as groups from other regions used to arid conditions, moved into the area.

Collins (1995) divides the Middle Archaic sub-period into intervals based on three projectile point styles: the Andice-Bell-Calf Creek variants (herein termed Andice for continuity), the Taylor point type, and the Travis-Nolan types. Collins (1995) identifies the Andice/Bell/Calf Creek projectile point variant as being the first dart point style of the Middle Archaic. Johnson and Goode (1994) believe that this point style represents an intrusion into the region by peoples from the Eastern Woodlands margin of northeast Texas and southern Oklahoma. Presumably, these interlopers came to hunt bison who were returning to the area in greater numbers. An unnotched triangular point, the Taylor point, commonly known as Early Triangular, style is similar to the Andice-Bell-Calf Creek types. Both types are thin bladed forms with long thinning flakes emanating bifacially from the base (Collins 2004). Collins (2004:120) notes that these forms would "serve equally well as knives or as tips of lances, spears, or darts". Collectively, the Andice and Taylor point styles reflect a shift from the lithic technology of the Early Archaic. Some scholars believe that Andice projectile points were part of a specialized hunting tool kit geared towards bison exploitation (Johnson and Goode 1994; Collins 2004). During the Andice interval, there was an apparent increase in the diversity of tool forms associated with bone and wood working, and milling (Collins 2004). Cultural materials associated with sites dated to these times reflect a diversification in function. Also, during this time, there is a noted increase in large, burned rock features. Additionally, Andice components exhibit less intensive use which may be indicative of an increase in mobility, again possibly in correlation with bison hunting (Collins 2004). Together, the wide variation in projectile point styles and other tools evident during the Middle Archaic may imply “a time of ethnic and cultural variety, as well as group movement and immigration” (Johnson 1995).

Another technological shift is noted by the appearance of the Nolan-Travis style interval (Collins 2004; Johnson and Goode 1994). Compared to Taylor and Andice points, these blades are thick and often narrow with stems and shoulders without the deep basal notching seen in Andice-Bell-Calf Creek points (Collins 1995). The stems of Travis points are usually rectangular with parallel edges while Nolan points have steep, alternate beveling along their stem edges (Turner and Hester 1993). Prewitt, in Johnson and Goode (1994:88), notes that the Nolan and Travis dart point styles may have been borrowed from the Lower Pecos region where similar beveled stem points, such as Pandale points, pre-date their occurrence in Central Texas.

The Nolan-Travis interval correlates well with a posited period of regional bison scarcity and a climate shift towards more xeric conditions (Dillehay 1974). During the Nolan-Travis interval (ca. 4000-5000 B.P.), there is a marked return to long-term and intensive site use. This intensification is exemplified during this time by the appearance of large burned rock middens and the increasingly widespread use of earth ovens, a culmination of years and years of heated stone technology.

Burned Rock Middens

Weir (1976) suggests that an expansion of oak on the Edwards Plateau and Balcones Escarpment facilitated intensive plant gathering and acorn processing. Bands that were widely scattered during the Early Archaic now began to aggregate into large groups in order to share in the now intensive gathering and processing work load. Creel's (1986) dissertation noted a spatial association with oak savanna and burned rock midden sites which corroborates with Weir's (1976) assertions that acorns were a major food resource and that, in addition to earth oven baking, such sites may represent large scale boiling and leaching of acorns. More recent investigations doubt this conclusion, with research suggesting that burnt rock middens largely arose from multiple episodes of intensive plant-baking (Black and Creel 1997; Goode 1991).

It is not much of an intuitive leap to think that rocks become burned for a number of reasons and that burned rock middens arise from a diverse set of subsistence behaviors. In addition to acorns, burned rock middens in Central Texas have been well associated with the bulk processing of certain starch-based plants such as sotol, lily-family bulbs, camas, onion, and prickly pear. Also, large ovens would have been conducive to the cooking of a variety of available meats, from small to large-game species. The common presence of deer remains in burned rock middens encourages the view that deer processing took place at burned rock midden sites (Black and McGraw 1985; Nickels et al. 1998). There has been a tendency to equate the utilization of burned rock middens with the absence of bison (Prewitt 1981); however, examinations of several recent faunal reports show that after about 4500 B.P. bison and burned rock middens are contemporaneous, at least in the southern Edwards Plateau and the northern South Texas Plains (Meissner 1993). Further, bison bone has been noted in archaeological sites in Central and South Texas, at least occasionally, during all but the very earliest part of the Middle Archaic (Dillehay 1974). Archaeological, ethnographic and ethnohistoric data from different regions across the globe, suggest that burned rock midden features accumulated as a result of a multitude of processes and that not all of these processes were directly linked with subsistence.

Reflective of the varied patterns of resource exploitation associated with burned rock middens are the variations in form that such middens assume. Along the western margins of the Plateau, small to medium-sized middens with a characteristic central depression and steep sides are commonly found (Treece et al. 1993). Near the Southern extent of the Plateau and in the Lampasas Cut Plain, middens are reported from small to large in size, often without discernable central depressions (Black and Ellis 1997; Quigg and Ellis 1994). In the eastern Plateau area, burned rock middens are generally large sized and lack a central depression. Collins (1991) notes that throughout Central Texas, middens take on two forms: a domed form that is dominant on the eastern reaches of the Plateau and an annular ring-shaped form that becomes more prevalent as one travels west. Weir (1976) adds that a third midden configuration exists: a “sheet” midden characterized by a thin accumulation of burned rocks. It is suggested that sheet middens were short term use features (Voellinger and Gearhart 1987), annular middens were used by small-family band groups (Shafer 1986) and large dome-shaped middens are signatures of population coalescence (Collins 1973; Johnson 1991; Weir 1976).

Reviewing approximately 80 years worth of data on burned rock middens, Black and Creel (1997), conclude that the vast majority of recorded middens in Central Texas are annular features that served as central-focused ovens. Further, they posit that domed and structureless middens began as annular in structure, with their shape distorted by erosion and other disturbances or, simply, inadequately recorded. Regarding distribution of shapes, they note that domed and annular middens share overlapping geographical ranges in Central Texas, reflecting complex patterns of the distribution and acquisition of resources with increasing midden size possibly reflecting the growth of social groups from the Middle to the Late Archaic.

While most researchers today recognize, minimally, the domed midden and the annular, or ring, midden as distinctive shapes there has been disagreement to how they formed (Collins 1994; Mauldin et al. 2003). Pearce (1918, 1938) suggested that the midden was itself a central cooking facility with the fire located at high-center and the surrounding rock a result of replacement after fracture. Kelley and Campbell (1942:320) too see the midden as a central cooking facility but suggest multiple, often overlapping, hearth locations that created a “complex assemblage of superimposed and intersecting hearths”. While the central cooking model sets the midden as the locale of human activity, both Sorrow (1969) and Hester (1970, 1971) see these features as discard piles away from the hearth/cooking area. Research by Black and Creel (1997) has seemingly settled this matter, concluding that burned rock middens are not the result of repeated communal dumping events. In line with the “central cooking facility”, Leach and Bousman (2001) offer that burned rock middens resulted from repeated use of a single earth oven, where rock was cleaned out and replaced from the center outward, forming a mounded dome with an earthen cap across its surface. Because this earth-cap was formed from fine-grained soils and sediments extracted from adjacent to the feature, its fabrication could introduce older cultural or organic material into the midden, confusing feature dating and cultural association.

Once considered indicative of the Middle Archaic in Central Texas (see Prewitt 1991), a synthesis of radiocarbon data notes that burned rock middens were is use well before this time (Black and Creel 1997). Additionally, this data synthesis notes that burned rock middens were in use after the Middle Archaic during the Late Archaic and throughout the Late Prehistoric.

Owing to the fact to a marked decrease in alluvial deposition rates, many of the terrace locations where there is good temporal integrity for buried deposits exhibit an intermingling of later Middle Archaic artifacts, sometimes with Late Archaic artifacts. Collins (1995: Table 2) recognizes only one site in Central Texas that has a high-integrity Middle Archaic component resting on a stable landform: the Landslide site. Moderate integrity sites are listed as Wounded Eye, 41GL190 (Panther Springs), and the Gibson site (**Figure 7**).

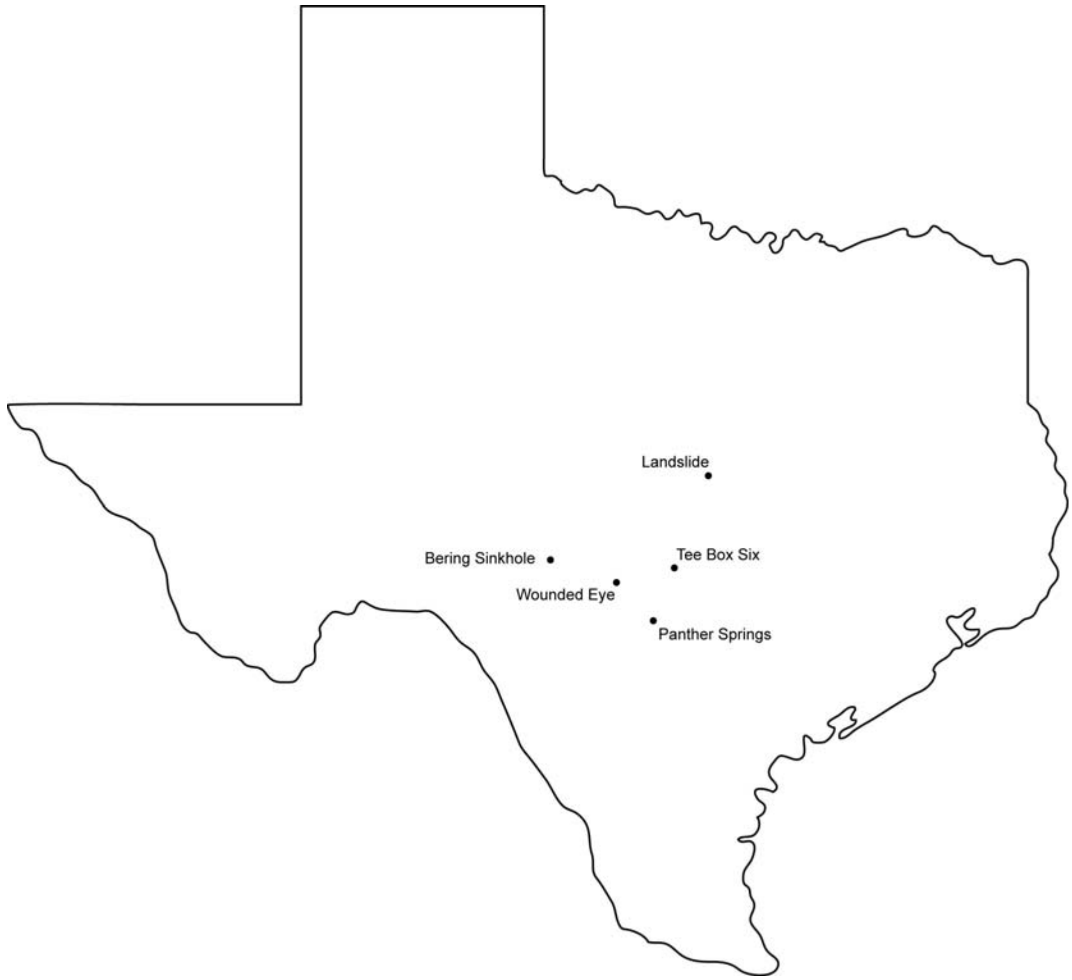

Figure 7. Selected Middle Archaic sites mentioned in text.

Late Archaic (4000-1200 B.P.)

Collins (1995:384) dates the final period of the Archaic in Central Texas to approximately 4000–1300 B.P. The Late Archaic is characterized by a gradual shift from an environment that was extremely xeric to one that was, by comparison, a great deal more mesic. Collins (2004:113) proposes that there are six dart point style intervals for the Late Archaic. Characteristic dart points, from earliest to recent, for these intervals are Bulverde, Pedernales, Kinney, Marshall, Lange, Williams, Castroville, Montell, Marcos, Ensor, Frio, Fairland and Darl. Predominately, the style intervals of the Late Archaic are well represented by investigated sites, many in good stratified contexts (Collins 2004). Noted exceptions are the Bulverde style interval (Collins 2004), the earliest interval of the Late Archaic and the Montell style point (Bousman and Nickels 2001). Information on Montell components is particularly lacking, with two sites, 41TG91 and the Loeve-Fox site (41WM230), the only locales with moderate to high integrity and associated radiocarbon assays (Creel 1990a; Prewitt 1974, 1982). A Montell component has been documented at Culebra Creek (41BX126) in association with intact rock hearts and other chipped stone tools. It is posited, with some authority, that these deposits are/were in high integrity (Bousman and Nickels 2001; Bousman, personal communication). Unfortunately, investigations to date of this component have been minimal and the site is now destroyed by a TxDOT roadway without a reasonable level of investigation. In addition to diverse dart point styles, Late Archaic artifacts include “corner-tanged” knives, cylindrical stone pipes, and marine shell ornaments. Caches of large bifaces occur and burned rock middens continue as a site type, and are particularly prominent during the Pedernales style interval (Collins 2004).

Late Archaic I

Based on changes in projectile point styles, changing environmental conditions, and the influx of religious and social influences from eastern North America, Johnson and Goode (1994) subdivide the Late Archaic in Central Texas into two sub-periods: Late Archaic I and Late Archaic II. Like Collins (1995, 2004), Johnson and Goode (1994) recognize the appearance of Bulverde points as marking the beginning of the Late Archaic I, although they date the inception some hundreds of years earlier than Collins, lasting from ~ 4200 B.P. to 2500 B.P. (Johnson and Goode 1994:89). Johnson and

Goode (1995) suggest that the Bulverde point may be a style intrusion from the prairies of northern or northeastern Texas. In addition to the Bulverde, Johnson and Goode organize the projectile point types of Pedernales, Marshall, Montell and Castroville into the Late Archaic I sub-period. While the appearance of the Bulverde style interval is associated with the beginning of the Late Archaic period, the Pedernales point seems to be more quintessential to the Edwards Plateau and the surrounding area. In fact, this style point may represent a technology that originated and radiated outward from the Plateau (Johnson and Goode 1995). Further, the Pedernales point may be antecedent of the similar Montell and Castroville points (Denton 1976; Johnson and Goode 1994; Suhm et al. 1954). For Johnson (1995:90), this connection is strong enough to suggest that during the Late Archaic I, the eastern Edwards Plateau was predominantly occupied by *"ein volk"*, or one people. Associated with both Pedernales and Montell artifact assemblages are thin billet-fashioned (billet thinning is widespread during the Late Archaic I), almond shaped knives and numerous manos and metates (Johnson 1995).

After 2500 B.P., with a mesic induced decline in xeric vegetation, the use and size of burned rock middens decline in the eastern parts of Central Texas (Black and Creel 1997). In contrast, in the western reaches of Central Texas, where more xeric conditions prevailed, earth ovens were continuously used into the Late Prehistoric period (Black et al. 1997; Goode 1991). The prevalent cooking of starchy carbohydrates seems to have increased the rate of caries observed in interments dated to the Late Archaic (Bement 1994).

Hall (1998) notes that the middle reaches of the Guadalupe and San Antonio rivers are areas were pecan, acorn, and hickory nut resources are concentrated, most notably in the Post Oak area, adjacent to the Blackland Prairie. Further, Hall (1998:6) suggests that inhabitants of the Central Texas area, were "strategically positioned" to utilize the resources of adjacent regions and that in years when nut resources were abundant, symbiotic resource alliances were formed with neighbors, particularly to the south. Cabeza de Vaca's historical account of the Mariame's variable exploitation of resources as they moved from Central Texas to South Texas into the prickly pear fields illustrates how seasonal floral resources could have influenced Late Archaic hunter-gatherer settlement patterns (Campbell and Campbell 1981). Hall (1998) asserts that the exotic grave inclusions found accompanying Archaic-era graves on the coastal plain is further evidence for reciprocal alliances and territorial resource control.

Late Archaic II

Johnson and Goode (1994) see the Late Archaic II period as lasting 1200 years from approximately 2550 B.P. to 1350 B.P., while Collins has the Late Archaic terminating at 1200 B.P. This time frame roughly aligns with the Middle Woodland period of eastern North America, and, locally, coincides with the return of mesic conditions. The first projectile point identified with this sub-period is the Marcos point (Collins 1995). This point type appears to be a departure from the Pedernales-Montell-Castroville continuum, and bears a stylistic similarity to points of the same age found in the assemblages of buffalo hunters along the southern plains (Hughes 1989; Johnson and Goode 1994). This similarity could be evidence for immigration into Central Texas by other peoples or of an adoption of technique and technology by already entrenched residents (Johnson and Goode 1994).

The Marcos point type is followed by the Frio and Ensor intervals. Both of these later point types may have affiliations with the eastern United States, although the level and direction of influence is still unclear (Johnson and Goode 1994). Johnson (1995) suggests that by the Late Archaic II subperiod, cultural influences were permeating Central Texas from the Eastern Woodland complexes by way of eastern Texas and the Gulf Coastal Plain. Evidence for this influence are exotic burials, foreign copper, bone ornaments, Gulf Whelk shell decoratives, and exotic stone used as atlatl weights: all trade items of eastern cultures.

The final point type of the Late Archaic period is recognized as Darl (Collins 1995). The transitional nature of this point type is well established, having been recorded in the same deposits as arrow points (Johnson et al. 1962; Pearce 1932). However, the lack of Darl components in isolated and well dated deposits has made date ranges for this point type hard to pin down. Suhm et al. (1954) originally offered a broad range of 1950-950 years B.P. for this point type while Prewitt (1981) offered a more constrained range of 1400-1200 B.P. Artifacts associated with the Darl interval are Hare bifaces, small concave unifaces, gravers, freshwater mussel shell pendants, bone beads, and bone awls (Prewitt 1981).

By about 1450 B.P., bison had again declined in numbers (Dillehay 1974). Subsistence is assumed to have become less specialized on acorns in favor of a broad spectrum subsistence base (Black 1989a:30). Although inhabitants of the South Texas Plain near Brownsville and Rockport had begun to make pottery by about 1750 B.P., the northern part of the plain was still “pre-ceramic” until 1,000 years later (Story 1985:45–47). Late Archaic points tend to be much smaller than Middle Archaic points. The most common are Ensor and Frio types (Turner and Hester 1993:114,122), both of which are short, triangular points with side notches. The Frio point also has a notched base (Turner and Hester 1993:122).

Both Prewitt (1981) and Weir (1976) believe that populations increased throughout the Late Archaic while Story (1985:44–45) believes the presence of cemeteries at sites such as Ernest Witte in Austin County (Hall 1981), Hitzfelder Cave in Bexar County (Givens 1968a, 1968b), and Olmos Dam, also in Bexar County (Lukowski 1988), is evidence that Late Archaic populations in Central Texas increased in numbers. Additionally, Story (1985) posits that these cemeteries indicated that indigenous groups were becoming more territorial at this time then compared to the Middle Archaic. Others connect these cemeteries with increased sedentism as well as with increased trade and exchange (Black 1989a).

Human remains dating to the Late Archaic have been recovered from at least five sites within Central Texas: Mason Ranch Burial Cave, Hitzfelder Cave, Heireman Cave, Stiver Ranch Burial Sinkhole, and Bering Sinkhole. At Bering Sinkhole, interments, likely dating to Late Archaic I, evidence a high rate of enamel hypoplasia and a high caries rate (Bement 1994). The presence of hypoplasia may be due to weaning stress that occurs in large populations. A high caries rate is often linked to diets that are high in carbohydrates and sugars. A diet that was based on sotol, yucca, agave, acorns and starchy bulbs would be such a diet; In contrast to earlier burials from this location, stable-carbon isotope ratios from the Late Archaic I remains, indicate a greater reliance on C_3 plants.

While Early and Middle Archaic components often are found in segregated contexts, there seems to be more contextual compression between Middle and Late Archaic sites. Representative sites of the Central Texas Late Archaic include Anthon and Loeve Fox sites, the Beaver Head site, and the Bessie Kruse site (Collins 1995) (**Figure 8**). Collins (1995: Table 2) recognizes three sites within Central Texas with high-integrity Late Archaic components resting on stable landforms: Anthon, Loeve-Fox, and 41TG91.

The transition from the Archaic into the Late Prehistoric is marked by a good deal of obfuscation. Interestingly, the end of the Archaic, represented by Darl components, seems to witness a departure from regional trends within Central Texas. Through the Late Archaic, the general pattern is one that moves towards a diversification of subsistence strategies and increasing complexity and increased interaction between different groups of people (Collins 1995; Johnson and Goode 1994). In contrast the Darl interval seems to represent a period of low-level socio-political organization conducive to a high mobility lifestyle, a lifestyle that maintained earlier technologies in the face of the new (Carpenter 2006).

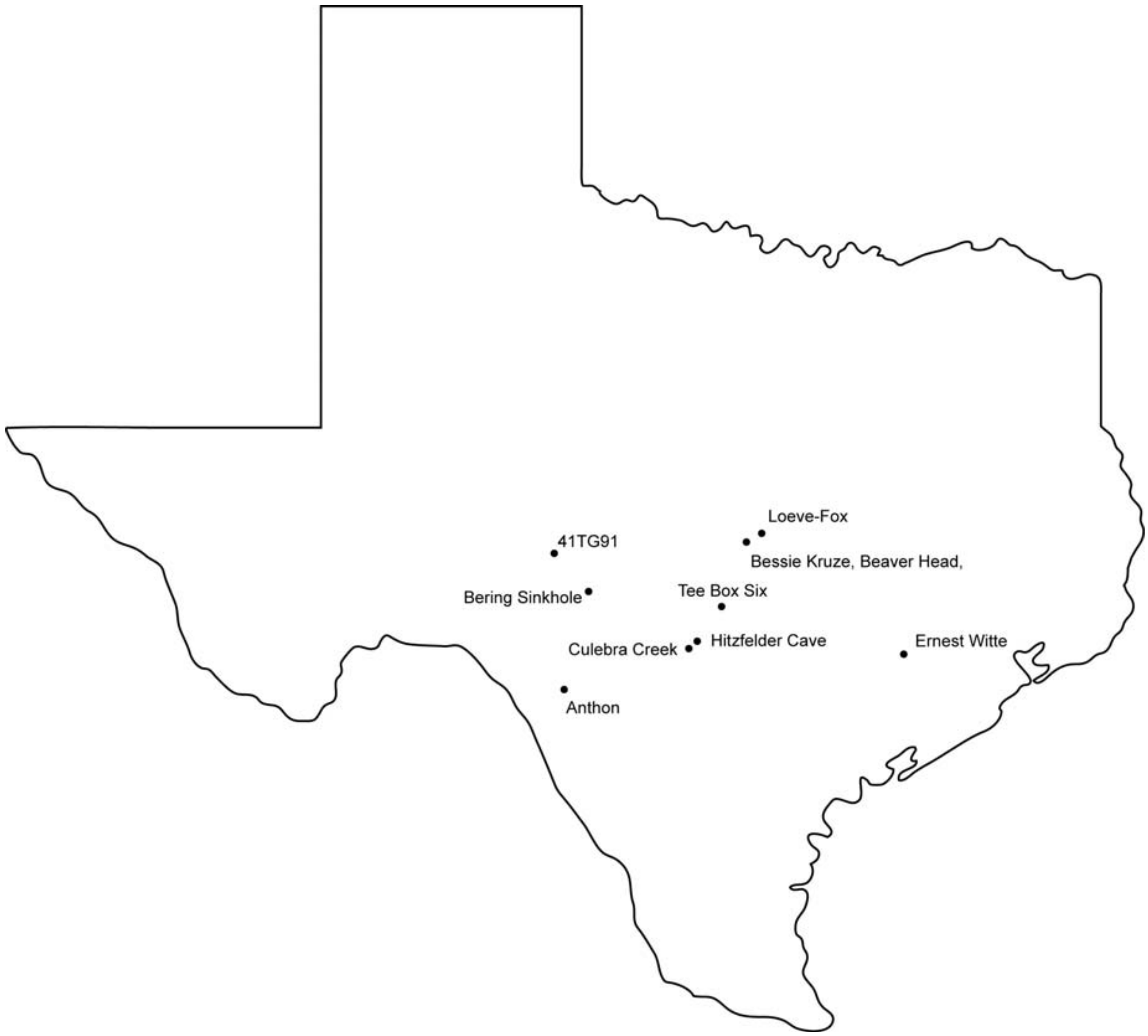

Figure 8. Selected Late Archaic sites mentioned in text.

Late Prehistoric (1200-420 B.P.)

For Central Texas, the period of transition from the long Archaic period to what Collins (1995) labels the “Late Prehistoric” is one mired in ambiguity. Cultural traits that prevailed in other regions of Texas, such as the adoption of the bow and arrow, the use of pottery, and the practice of agriculture, were expected to reveal themselves, with time, in the Central Texas archaeological record (Suhm et al. 1954). In anticipation of these findings, early scholars had adopted the term “Neo-American” to describe post-Archaic life-ways. Others, recognizing the anomalous continuation of a basic hunting and gathering subsistence strategy, coined terms such as “Neo-Archaic” (Prewitt 1981) and “Post-Archaic’ (Johnson and Goode 1994). Bow and arrow technology appears to have indeed been adapted ca. 1200 B.P. (Collins 1995). Pottery is too utilized, but much later and is not as widespread as is seen in other regions of Texas. Evidence for agriculture for the area is minimal and by all accounts, comes into use comparably late.

Johnson and Goode (1994) write that the Sabinal and Edwards arrowheads may have been the first arrowhead styles to appear on the eastern Edwards Plateau at about 1200 B.P. This date is slightly more recent than the earliest accepted dates, ca. 1450 B.P., for the advent of bow technology in eastern North America (Shott 1993), although Odell (1988) argues that flakes and bifaces were utilized as arrow points during the Archaic period. It is widely believed that the bow and arrow entered into eastern North America from an arctic source (Shott 1997). Reasons for the adoption of this new technology are still being examined, with conventional assumptions that regarded the bow as being more efficient for hunting now being questioned (Larralde 1990; Shott 1993). Within Central Texas, there appears to be a correlation of Edwards, and, later, Scallorn type arrowheads with conflict and warfare (Johnson and Goode 1994; Prewitt 1982).

Late Prehistoric I: Austin Phase

While recognizing that a predominantly Archaic lifestyle persisted for Central Texas for far longer than neighboring regions, Collins (2004), like Jelks (1962) before him, organizes the Late Prehistoric into two subperiods. These subperiods correspond with the Austin and Toyah intervals that are distinguished by changes in projectile point styles. The Austin subperiod, or interval, is dated from ~1200 B.P. to 650 B.P. by Collins (1995). Associated with this subperiod are Scallorn and Edwards point types. Save for the adoption of bow technology, the material culture associated with the Austin subperiod is similar to that of the Late Archaic (Johnson and Goode 1994). As representative of such assemblages, Prewitt (1981:83) lists Clear Fork gouges, scrapers, small concave unifaces, grinding and hammer stones, bone awls and beads and marine shell beads and pendants. Johnson and Goode (1994) add that bifacial flint knives, although usually smaller than those with Archaic associations, are also commonly found during the Late Archaic I.

Subsistence practices also seem to be very similar to those practiced during the Late Archaic. Regarding resource exploitation, Prewitt (1981:74) states that the "emphasis seems to be on gathering a balanced variety of plant foods rather than on hunting, although a slight increase occurs in the overall importance of hunting". Additionally, burned rock middens have been dated to the Austin subperiod (Goode 1991; Houk and Lohse 1993). During the Austin subperiod, there is marked widespread appearance of "true" cemeteries (Prewitt 1981).

Late Prehistoric II: Toyah Interval

Both Collins (1995) and Johnson and Goode (1994) tentatively date the Toyah interval from ~ 650 B.P. to 200 B.P. This time period is one of the better documented and understood of the prehistoric culture-historical time periods within and adjacent to Central Texas. This is because there are large numbers of well documented Toyah sites, many of which are short lived, isolated occupations (Black 1986; Johnson 1994; Karbula 2003; Quigg and Peck 1995; Ricklis and Collins 1994). During the Toyah interval, the climate continued trending towards the mesic norms prevalent today and buffalo were returning to the area in numbers (Johnson and Goode 1994). In consort, Toyah subsistence aligns toward bison procurement and there is an increased emphasis on hunting compared to the Austin subperiod (Prewitt 1981).

Toyah has been variably described as an interval, a phase, and a horizon. While the ascribed labels may vary, the intent seems to be the same: to identify a distinct cultural expression that abruptly appears across the Edwards Plateau, Rio Grande Plains, and the Lower Pecos. Largely this identification is based on two sets of unique material remains that appear in the Central Texas archeological record during the 14^{th} Century: a unique toolkit and earthenware pottery. It has been noted that technical and stylistic changes from the Austin phase to the Toyah phase was more pronounced than between the Late Archaic and initial Prehistoric period (Story and Shafer 1965).

Although not restricted to Toyah, perhaps the most recognized element of the Toyah stone toolkit is the Perdiz Point. In addition to the ubiquitous Perdiz point, the Toyah phase lithic assemblages include Clifton points and a variety of flaked tools oriented towards bison processing (Karbula 2003). Directly percussed flake blades are found in Toyah assemblages and represent a blade technology that was absent during the preceding Austin Phase (Johnson and Goode 1994). Other hallmarks of this time are sandstone abraders, beveled-edged Harahey and Covington knives, gravers, small drills often fashioned from small flakes, stone side scrapers, deer bone spatulas, grass basketry/mats, mussel shell pendants, bone awls and beads.

While there has been pottery found in association with sites that are pre-Toyah, it is during this period that ceramics first appear in the Central Texas archaeological record in numbers. Locally manufactured ceramic-types are known as Leon Plain, a bone tempered plain ware, and Doss Redware with slips that were decorated with red ochre. Occasionally, these vessels exhibit incised decorations, beveled rims, and an application of a fine wash to their interiors (Johnson 1994). In addition to these styles, ceramics were acquired from the Eastern Woodlands (Collins 1995). Occasionally, asphaltum-coated sherds are found and are likely intrusions from the Texas Gulf Coast tradition of the Karankawans. Within the archaeological record, most of the remnants of Toyah age pottery are fragmented potsherds, a consequence of weathering the low-firing technique of Toyah ceramic manufacture. When reconstruction of vessels has been possible, most appear to be utilitarian water jugs and simple bowls.

Johnson (1994) documents that most of the lithic tools found in Toyah assemblages were fabricated from either flakes or blades, although, bifacial reduction was, on occasion, also utilized. The fabrication of pointed-stem, barbed arrowheads from flint blades was new to Central Texas (Johnson 1994, Tunnell 1989). These points typically began as small blades, some as small as 70 mm in length extracted from block or rounded nodules. Sub-cubical shapes make ideal blade cores because they already have flat surfaces for striking platforms. After an initial flake detachment, a series of blades can be detached by rotating the core to access fresh platforms (Johnson 1994). Generally, the detached blades would be thicker along its longitudinal axis with extremely thin lateral edges. In order to prepare this preform for pressure flaking, the lateral edges were abruptly retouched. Johnson (1994) notes that previously identified Cliffton points were in actuality Perdiz preforms.

Studies suggest that bison presence in Central Texas reached its height during the Late Prehistoric (Barsness 1985; Dillehay 1974; McDonald 1981). Across North America, this increase in bison numbers is often correlated with the "Little Ice Age" which brought in wetter conditions that brought about widespread vegetative growth (McDonald 1981). Within Texas, the Blackland Prairie with its high density of grasses such as little bluestem, Indian grass, buffalo grass and switch grass would have served the bison well, while the forested Post Oak region may also have been a suitable habitat, particularly for *Bison athabascae*, a large-sized bison today found within the boreal forests of northeastern British Columbia up into the eastern half of Alaska (Dickens and Weiderhold 2003). Robust and wide-ranging, bison likely moved throughout the Central Texas region exploiting ecotones just as humans did.

While bison were again hunted in great numbers, several excavated sites from the South Texas Plains show that deer remained the number one big game acquisition (Texas Beyond History n.d). Additionally, evidence from 41JW8, the Hinojosa site, in south Texas shows that local plant sources were also utilized for subsistence (Black 1986). Here, in multiple Toyah contexts, charred hackberry and chenopodium seeds were recovered as were fragments of grinding stone. Additionally, large concentrations of rabdotus shell may indicate that these snails, in addition to fresh water mussels, were used to supplement the diet.

While documenting the Hinojosa site explorations, Black (1986:255) noted that the Toyah "phase" may best be described as an archeological "horizon". The original intent of the "phase" designation was to note homogenous cultural manifestations within a geographical region (Willey and Phillips 1958). In contrast Toyah, or Toyah-like sites, have been recorded from many different environmental zones and reflects a broader range of similar assemblages and cultural traits than conferred by the “phase” appellation (Black 1986). In a more recent evaluation of Toyah traits, Ricklis (1994) notes that while there is a similarity in lithic assemblages over a vast geographical region during Toyah times, only certain aspects seem to persist, and these may be a convergence of technologies directed towards the procurement and processing of bison. In an attempt to order these assemblage discrepancies, Johnson (1994) suggests a division into a more regionally constrained “classic Toyah” and a more widespread non-classic Toyah cultural complex with traits and artifactual styles conscripted from nearby regions. The spread of their culture is linked to the Toyah folks moving into new regions to hunt buffalo that were returning “after many centuries of absence” (Johnson 1994:271). Until more is known, in place of either “phase” or “horizon” the term “interval” has been suggested to describe the Toyah tradition (Karbula 2003; Ricklis and Collins 1994). No matter the ascribed nomenclature, the last interval of the Late Prehistoric witnessed a return to high mobility, perhaps reaching levels that approached Folsom times (Collins 2004).

Historic Period (ca. A.D. 1600-1870)

The Historic Period for Texas is variable by area and dependent on when written accounts were first generated. Initially, as Europeans and indigenous groups first encountered each other, documentation concerning Texas was sparse and intermittent (Collins 2004). Generally, Alvarez de Pineda’s journey down the Gulf Coast from Florida in 1519 is considered the first of the Anglo-European explorations of Texas (Fox 1989). Pineda’s favorable accounts led to unsuccessful attempts at settlements at the mouth of the Rio Grande. The first European to explore the Texas interior was likely

Nunez Cabeza de Vaca's five year trek across Texas beginning in 1528. Coronado crossed into the Texas Panhandle region in 1541, the same year members of the de Soto expedition encountered Caddoan-speaking peoples southeast of the Panhandle (Flint and Flint 1997; Swanton 1985).

Within Central Texas, one of the earliest native peoples to be discussed in literature were the Jumano, who have been documented in texts dating as far back as 1583 A.D. (Kenmotsu 2001:28). Although Spanish colonization and Apache intrusion would eventually displace them across Texas and the Southwest, the Jumano homeland is considered to stretch from the confluence of the Concho and Colorado Rivers in the western region of the Edwards Plateau to the Pecos River area in far west Texas, just south of the southern plains (Kenmotsu 2001).

Once thought to be native to the area, research now suggests the Tonkawa moved into Blackland Prairie region from north of the Red River in the seventeenth century where they persisted until the mid-nineteenth century (Hester 1989:82). The Tonkawa's were hunter and gatherers who often emphasized the hunting of bison and were likely pushed out of the Great Plains because of conflict with other Native Americans, likely Apache aggressors (Prikryl 2001). Encamped along the Blackland Prairie would have allowed the Tonkawa to simultaneously pursue a plains hunting lifestyle through the pursuit and exploitation of bison for food, tools, and hides while exploiting the woodland resources of the Post Oak Savannah.

The Payaya, one of the northernmost groups the Spanish labeled as Coahiltecas, undoubtedly ranged into and across the Central Texas from their homeland southwest of San Antonio. According to Campbell (1975) the Payaya were hunting and gathering group who lived in temporary settlements in natural open spaces of wooded areas adjacent to springs and/or streams and likely took advantage of the abundant game, including buffalo that, were ubiquitous across the central and south Texas landscape. Historic accounts by Espinosa dating to 1709 mention a Payaya encampment along the Medina River that gathered pecans in high quantities, some of which were stored underground.

During the mid-sixteenth century, the Spanish brought horses into North America. By the early seventeenth century, the Apaches had adopted the horse, using the animal to raid central Texas from the mountains and plains to the north (Boyd and Peck 1992). In the eighteenth century the Comanches too raided the central Texas area. Together, these raids forced most of native peoples out of the region: some fled south, others eastward into the Caddo homelands and a few sought refuge among the Spanish missions (Black 1989a:33). Save for the few who assimilated into the mission communities, the native peoples of the area were largely extinct by the early nineteenth century.

By the late 1740's the Spanish established three missions along the San Gabriel River, north of present-day Austin, with the intent of missionizing the Tonkawa Indians (Bolton 1915; Prikryl 2001). This attempt met with little success as the Tonkawa, at this time, were concentrated further northeast, towards the Trinity River (Newcomb 1993). By the late 1760s, evidence suggests that the Tonkawa were ranging south, moving closer to the Brazos. Prikryl (2001) reports an account by the Spanish missionary Solis, dated to 1768, that has the Tonkawa situated on the Brazos near present-day Bryan along with members of the Mayeye, and Yojuane, smaller tribes who would later assimilate with the Tonkawa for defense against the Apache.

The first Europeans to visit the San Marcos area were probably members of the 1691 Domingo Teran de los Rios expedition. This expedition camped at the springs from June 20-25, 1691 and they recorded seeing numbers of buffalo in the area (Hatcher 1932). On June 23 of the same year, Cantona Indians, numbering approximately 60 individuals visited the Spanish camp and recorded their name for the San Marcos Springs as *Canocanayestatetlo,* or “hot water”. Later, members of the Espinosa-Olivares-Aguirre expedition of 1709 visited the San Marcos Springs (Brune n.d.). In 1755, the Spaniards established the mission San Xavier on the San Marcos River and the presidio of San Francisco Xavier which quickly succumbed to Indian attacks. The area remained unsettled for another half-century. In the early 19th century, the Spaniards made a second attempt with the settlement San Marcos de Neve. This settlement lasted until 1812 when unrelenting Comanche raids and floods forced abandonment of the settlement (Greene n.d.). The springs remained a stop on the Old San Antonio Road that ran between Northern New Mexico and Nacogdoches. Between the 1830s and 1840s, the first white settlers moved into the area (Greene n.d.b). The San Marcos Springs allowed the settlers to rapidly industrialize their efforts by harnessing its power to operate mills and gins. Cattle and cotton became the predominant industry in the area. On March 1, 1848, Hays County was organized, and the young community of San Marcos was designated the county seat. The small town continued to grow up around the springs, and it became a trade center between Austin and San Antonio (Greene n.d.).

CHAPTER 4

BACKGROUND (PREVIOUS INVESTIGATIONS)

Located at the interface of the Hill Country and Blackland Prairie, San Marcos Springs/Spring Lake is one of the most unique prehistoric archaeological areas in the state of Texas with a cultural history of over 11,000 years (Garber et al. 1983; Shiner 1983). According to Jones (2003), five sites make up the core of the Aquarena Springs/Springs Lake archaeological region: 41HY37, 41HY147, 41HY160, 41HY161 and 41HY165. All are multi-component sites and offer extensive data on the area's cultural history as a continuously utilized freshwater spring locale. Two other sites, 41HY306 and 41HY317 lie adjacent and just east, respectively, of Sink Creek and likely have associations with the occupations at San Marcos Springs.

41HY161 and 41HY147

Perhaps the most ambitious investigations at Spring Lake were among the earliest. Beginning in 1978, two underwater sites, 41HY161 and 41HY147, were intermittently investigated by Dr. Joel Shiner until his death in 1988. Initially, Shiner focused his work on 41HY161, known now as the Ice House site, located just below the dam at Spring Lake (Shiner 1979). Later, enticed by an array of diagnostic Paleoindian, Archaic, Late Prehistoric and Historic artifacts Shiner shifted his underwater excavations to site 41HY147, also referred to as the Terrace Locality, in Spring Lake (Takac 1991).

Paleoindian points recovered during Shiner's investigations include Clovis, Folsom, San Patrice, Dalton, Golondrina and Saint Mary's Hall varieties (Shiner 1983; Bousman, personal observation 2010). Additionally, faunal remains of mammoth (*Mammuthus),* mastodon (*Mammut)* and bison (possibly *Bison antiquus*) were recovered (Shiner 1983; Takac 1991). Work was briefly resumed at 41HY147 by Paul Takac for his PhD research in 1991 with the intent of fine tuning the site's stratigraphic sequence. Takac abandoned this attempt in 1993.

In an article published in *Plains Anthropologist*, Shiner (1983) noted that his investigations at Spring Lake recovered a glaringly high number of artifacts of Paleoindian and Archaic origin. This abundance of artifacts led Shiner (1983:2) to posit that this area was a site "where Clovis Indians and their successors maintained an almost sedentary hunting and gathering existence"; a lifestyle theoretically made possible by the springs and the array of flora and fauna supported by their consistent flow at a consistent temperature. Hence, edible flora and small fauna would likely have been available year round and the locale would have been attractive to large migratory fauna during cold and/or dry seasons. Additional evidence for increased sedentism was reported by Shiner (1979) in an initial write-up of the underwater excavations at the Ice House site. Within an artifact assemblage dated to ~3000 B.P. to 5500 B.P. through projectile point chronology, there are non-local items which Shiner labels "exotics". These exotics consisted of marine shells, quartz and calcite crystals and pebbles. Shiner (1979) believes the collecting of such non-technological imports is an indication of a more settled lifeway; one that may be unique to Central Texas. "Along the Balcones Fault", Shiner (1984) writes "it seems to be abundance, dependability, and temperature of the water that contributes to long-term settlements."

Site 41HY161 was investigated terrestrially in 1997 and again in 1998 by the Center for Archaeological Research (CAR) (Ford and Lyle 1998; Lyle et al. 2000). Although no diagnostic artifacts were recovered during the limited undertaking in 1997, the investigators noted that the upper 40 centimeters of deposition was substantially disturbed during historic times, resulting in a mixing of artifacts from different temporal periods (Ford and Lyle 1998). The 1998 investigations recovered Early Archaic split stemmed projectile points in association with highly oxidized reddish-brown alluvial sediment just above what may be a buried paleosol (Ringstaff 2000, personal communication). Additionally, during the 1998 investigations, a Late Archaic component was discovered in stratigraphical context just above a Late Paleoindian component.

Site 41HY161 was also the subject of a 2008 Masters thesis by Texas State University graduate student Eric Oksanen. Oksanen's work focused on the Early Archaic period occupations dated to 7700-6500 B.P. (Oksanen 2008). Using soil magnetic susceptibility, the vertical distribution of artifacts, and radiocarbon dating, Oksanen (2008) determined that at 41HY161 there were three distinct Early Archaic occupations (a fourth occupation dated to the Late Archaic period). Measurements of debitage and tool counts indicate that there was a decrease in site use as the Early Archaic progressed (Oksanen 2008:175). Faunal NISP and weight comparisons for 41HY161 support this trend (Oksanen 2008:176). Additionally, the faunal analysis showed that there was a shift in subsistence strategy. From the earliest to the latest Early Archaic occupations there was a shift from a strategy that concentrated on the exploitation of large game to one that relied increasingly on small game. Of interest is that bison were relatively well represented among the faunal assemblage at the Ice House site during the occupation period dated to ca. 7700 B.P (Oksanen 2008:143). Models by Dillehay (1974) propose that at this time, within the Central Texas region, the presence of bison was rare, but Oksanen's excavations seem to support a progressive declining exploitation of bison.

41HY37

Located northeast of 41HY160, site 41HY37 was first documented by W.L. McClure in 1970 who noted that the site was a "prehistoric site of unknown age" (Arnn and Kibler 1999). In 1979, a historic component, the General Edward Burleson's homestead was added to the site inventory. As part of two field school excavations of 41HY160, investigations were conducted at 41HY37 by Dr. James Garber in 1983 (Garber and Orloff 1984). Located within an upland setting, artifacts at this site were recovered from the limestone surface and within a thin soil that varied from 8 to 40 centimeters in depth (Garber and Orloff 1984). Diagnostic artifacts (eg. Pedernales, Montell and Edgewood projectile points and a Clear Fork tool) suggest that the site was utilized, at least intermittently, throughout the Late Archaic and likely was an area of high activity and lithic procurement associated with base camps at 41HY160 and 41HY147 (Garber and Orloff 1984). Surface survey revealed that the site's boundary was quite vast, encompassing an area that was "at least 400 m east to west by 200 m north to south". The historic component of 41HY37, General Burleson's homestead was the subject of the 2000 Texas State field school (Bousman et al. 2003). During this time it was noted that a Late Prehistoric, possibly Toyah, component was present here as well.

In 1999, Prewitt and Associates tested site 41HY37. While Garber's (1984) investigations were confined to the upland portion of this site, Prewitt's investigation centered on an alluvial toe-slope. Here, it was noted that sedimentation extended to depths of 80 centimeters (Arnn and Kibbler 1999). As a result of this investigation, the boundaries of 41HY37 were extended to include artifacts recovered along the base of the Balcones Escarpment (Arnn and Kibbler 1999). Following this investigation, Godwin et al. (2000) conducted data recovery excavations at the site with the result that diagnostic projectile points dating to the Early, Middle, and Late Archaic periods were recovered in association with burned rock features.

41HY165

41HY165 lies approximately 200 meters southwest of 41HY160 at the confluence of the headwaters of the San Marcos River and Sink Creek. This site was first recorded by Garber in 1984 as a prehistoric site containing cultural materials that date from the Paleoindian period to the Late Prehistoric with a noted absence of components dated to the Middle Archaic (Ringstaff 2000). This site was further investigated in 1984 as the focus of a SWT archaeological field school. In 1988, site 41HY165 was again investigated by David Driver as a Southwest Texas State University (SWT) field school under the supervision of Dr. James Garber. Results of these investigations have yet to be synthesized or published (Ringstaff 2000).

During three consecutive summers, from 1996 to 1998, SWT held field schools at the 41HY165 locale (Ringstaff 2000). Faunal remains recovered during the 1996 and 1997 excavations were the subject of a preliminary analysis by Jennifer Giesecke (1998). Giesecke's (1998) work focused on shifts in bison populations through time and highlights the Middle Archaic as the period of greatest concentration. Data from all three field schools were utilized by Christopher Ringstaff, a SWT graduate student as the subject for a Master's thesis in geography.

Ringstaff's (2000) Master's Thesis, "A Study of Landform Evolution and Archaeological Preservation at 41HY165 San Marcos, Texas" examines the interaction of cultural and geomorphic factors on site formation processes. Perhaps more importantly, Ringstaff's (2000) work provided a preliminary geochronological scheme for the Aquarena Springs/Springs Lake area with local and regional comparisons. Ringstaff (2000) notes that at site 41HY165, episodic erosion removed sediments that potentially contained Middle Archaic cultural components.

41HY160

41HY160, divided into the Tee Box Six and Pecan Orchard localities, was the location for archaeological field schools conducted in 1982 and in 1983 under the direction of Dr. Garber at the Tee Box Six locality (Garber et al. 1983; Jones 2003). From this investigation it was determined that 41HY160 is a 200 m x 300 m x 2.4 m prehistoric campsite with occupations that date from the Middle to the Late Prehistoric period (Garber et al. 1983). Temporally diagnostic projectile points recovered from the Tee-Box Six site include Nolan, Pedernales, Castroville, Frio, Darl, Scallorn, and Perdiz varieties. Additionally, Paleo-Indian projectile points of Golondrina and Scottsbluff types were recovered, although their presence has been attributed to fill dirt brought in from a nearby area in association with the construction of a swimming pool in front of the original 1929 hotel (Jones 2003). Other artifacts recovered from the site include approximately 500 stone tools, 35,000 pieces of lithic debitage and an abundance of faunal remains (Garber et al. 1983; Garber, personal communication 2008; Jones 2003). Additionally, thirteen features were documented including: two burned rock middens, five hearths, three alignments constructed of stone, a posthole, a trash pit, and ceramic production area. Within some excavation units, explorations reached depths of 2.4 meters below ground surface before water intrusion halted their progress. To date, only a limited and preliminary analysis of this material has been attempted and the only published material regarding these excavations is a short article in *La Tierra* (Garber et al. 1983; Garber, personal communication 2008). During the 1990's, two additional field schools were conducted at 41HY160: one directed by David Driver in 1991 and another by Katherine Brown in 1998 (Jones 2003). Nothing has yet been published concerning the results of these field schools and, according to Jones (2003), "a report synthesis is needed for these investigations, so as to add to the growing base of knowledge for this important archaeological site".

In 2001, in association with the Texas Rivers Center Project, the Center for Archaeological Studies (CAS) performed additional test excavations at the Pecan Orchard locality of site 41HY160. Within the upper levels of this excavation, Late Archaic and Late Prehistoric components were noted. Within the deepest level, at a depth of 170 centimeters below ground surface, a Middle Archaic Nolan component was discovered (Bousman and Nickels 2010).

In the summer of years 2001, 2002, 2003 and 2006, field schools were held at site 41HY160 under the direction of Britt Bousman. Lithics recovered at 41HY160 during these field schools were utilized by Deidra Aery (2007) to interpret the technological organization of this site for the Middle Archaic period. To do so, Aery utilized a theoretical perspective that is rooted in optimal foraging theory and relies on previous applications of this model by Bleed (1986), Torrence (1989), Bousman (1993) and Bamforth and Bleed (1997).

By examining the amount of re-sharpening on recovered projectile points from this assemblage, Aery attempted to establish an estimate of maintainability. Her analysis indicates that the Middle Archaic period exhibited greater variability than both the Early and Late Archaic periods. Aery's (2007) analysis illustrates that, during the Middle Archaic, the trend was one of a reduction in projectile point re-sharpening from the beginning of the Middle Archaic to the end of the Middle Archaic. Lithic analysis by Aery (2007:151-153) strongly suggests that the Early Archaic occupation of site 41HY160 was one that followed a forager-like organization. The transition from the Early to Middle Archaic is associated with a more collector-like organization. A short time after this transition there was a brief but marked switch back to more of a foraging organization. Following this, there is a gradual move back towards an organization that is comparatively more collector. At the end of the Middle Archaic there is another gradual shift. This time the shift is towards a foraging organization. According to Aery (2007:151), this shift possibly extends into the Late Archaic period.

Using regional comparisons, Aery, posits that, temporally, the gradual trend during the Middle Archaic towards a collector organization may be due to a decrease in residential mobility (Aery 2007:152). Meltzer (1999) notes that along the Southern Plains during the altithermal a reduction in reliable and permanent water sources resulted in reduced territory and a decrease in residential mobility. Hence, in correlation, it is implied that the trend towards a collector organization was a coping mechanism for environmental change during the Altithermal.

Geoarchaeological Investigations

In addition to excavations conducted during field schools and data recovery efforts associated with infrastructure expansion, the immediate vicinity of 41HY160 has undergone geoarchaeological investigations intended to illuminate the nature and depth of the sub-surface archaeological deposits (Goelz 1999; Gunter 1999) and to reconstruct the depositional history of Spring Lake and Sink Creek (Nordt 2010).

In 1999 Prewitt & Associates placed a series of seventeen cores, down to a depth of approximately nine meters, in the Spring Lake vicinity in order to assess the Late Quaternary geological history of the area (Goelz 1999). From these cores, Goelz (1999: 5-6) determined that there were two distinct stratigraphic units, each comprised of two distinct depositional facies. The lower stratigraphic unit is divided into a thick gravel facies, the resulting deposition of a high energy fluvial system, overlain by a thinner and discontinuous loam facies. A radiocarbon sample, taken at a depth of 8.6 m, was obtained from the southern-most core, Core 15 (Goelz 1999) and provides a date for this lower unit. This assay returned a calibrated age of 11470 ±100 (Beta 132062). Bousman (2010) suggests that the latter is the "backswamp" marsh deposits that Nordt (2010) later describes. The second stratigraphic unit noted by Goelz (1999) also consists of two facies: a fine grained alluvial floodplain deposit and a course grained colluvial deposit more pronounced towards the escarpment. A radiocarbon date from this unit provided by one of the cores dates this buried soil to 3660 ±50B.P. (Beta 132061), within the Late Archaic period. This sample was taken at approximately 2.4 m below ground surface.

Together, the radiocarbon dates suggest that within the Spring Lake vicinity, there are deep and intact alluvial deposits that run the full timeline of human occupation in Central Texas.

A high number of the cores extracted during the 1999 investigations by Prewitt and Associates were found to contain cultural materials. The deepest of these cultural deposits was estimated to be 6.5 m below the ground surface. Generally, the recovery of cultural materials in such small cores is uncommon, to have many such positive cores, within the same vicinity, is a rarity.

Recently, Nordt (2010) conducted investigations within Sink Creek valley in the vicinity of the San Marcos Springs. In order to asses prehistoric site distribution and preservation potential, 22 cores and six test units were utilized. In most cases, core samples were taken down to bedrock before being transported to the Department of Geologic Stratigraphy laboratory at Baylor University, where they were described under guidelines of the Soil Survey Division Staff (1993). Based on these descriptions, Nordt (2010) noted that the alluvial stratigraphy of the Sink Creek valley is comprised of five unconformably bound units. From oldest to youngest, these units are labeled A through E.

The oldest stratigraphic zone, Unit A, extends from 2 to 2.5 m above the bedrock floor of the Sink Creek valley. Unit A consists of channel gravels contained within a yellowish brown to brownish yellow mud matrix. In some areas, overbank deposits of a similar color cap this unit. Near the springhead at Aquarena, Unit A lies under marsh deposits that range in color from dark gray to black. Two radiocarbon ages date the marsh deposits from ~11,470 to 9585 B.P. to radio carbon years B.P. (Goeltz 1999; Nordt 2010). These marsh deposits likely followed the period of widespread down cutting and channel entrenchment that has been posited to have occurred between 11,000 and 15,000 years ago (Blum and Valastro 1989; Nordt 1992). The removal of soil and sediment left a low lying flood plain in the immediate vicinity of San Marcos Springs and the Sink Creek valley. Flow from the springs combined with flood waters from Sink Creek to create a widespread littoral zone.

Stratigraphic Unit B lies adjacent to the northwest of Unit A in the area surrounding the springhead. The bulk of the deposits in this unit are marsh deposits that have been described as calcareous clays and silty clays. Here, down cutting and entrenchment terminated the floodplain stability and marsh formation that characterize Unit A (Nordt 2010). This entrenchment occurred after 9585 radiocarbon years B.P., after which, Unit B was deposited until ~7365 radiocarbon years B.P. Following this period of aggradization, there was a brief erosional episode.

Between Sink Creek and Spring Lake Units A and B are overlain by Unit C composed of channel gravels enveloped in a reddish brown to strong brown mud matrix (Nordt 2010). In the vicinity of the springhead, this matrix is capped by marsh deposits that are described as very dark gray or black calcareous clays and clay loams. Nordt (2010) reports that these higher marsh deposits are both "thicker and more complex" than the previously recorded marsh deposits, with two of its layers indicative of a shallow water littoral zone. East of the Sink Creek basin, Unit C is absent in Nordt's study area.

In contrast to Units A, B, and C, Unit D appears in all Nordt's test cores, unconformably capping the three older stratigraphic zones. Near the springhead, as flood deposits, Unit D interfingers with the littoral zone, eventually burying it. Nordt (2010) notes that formation of Unit D began sometime after 5900 radiocarbon years B.P. and continued steadily to at least 3300 B.P. After 3300 B.P., the accumulation rates slowed enough to where horizons were decalcified.

This period of landscape stability promoted pedogenesis, in the form of a cumulic A horizon. Although alleviation must have been nearly halted at this time, colluviation was still ongoing, especially towards the Balcones Escarpment. Only parts of the Unit D floodplain surface are covered with Late Holocene sediment, with the result that much of the Late Prehistoric and Late Archaic deposits are likely in a palimpsest context.

The last unit detailed by Nordt is Unit E, a cut-and-fill sediment incised into the older Unit D. This unit occurs within two areas of the Sink Creek valley: adjacent to the springhead, both above and butted up to Unit D, and within the current channel of Sink Creek (Nordt 2010). Unit E sediments near the springhead are described as an “over thickened and black, calcareous, clay to clay-loam surface horizon” that grade into a Bk horizon (Nordt 2010.). At this location, Unit E, overlays Unit D, separated by a dark gray zone that Nordt believes has been modified by prehistoric activity.

Conclusion

Investigations at Spring Lake have spanned nearly half a century and still there is much to be learned. Largely, this is because the bulk of what has been collected and documented has been shelved and filed, without analysis, without report. The current evidence suggests that this locale was a favored location, inhabited if not continuously, then, consistently intermittently for at least 11,500 years. Excavations and geoarchaeological investigations conducted in the Spring Lake vicinity indicate that archaeological materials and features are well-preserved in stratigraphical contexts. Save for a brief erosional event dated ca. 9500 B.P. depositional rates appear to be high for the time period dated between 11,500 B.P. and 3700 B.P, increasing the potential for high-resolution isolable components. Collins (2004:113) list of high and moderate integrity *gisements* in Central Texas is lacking in numbers and notes the need for the identification and study of more such locales. Nordt's (2010) reconstruction of the area's depositional history suggests that 41HY160 may be such a locale. Further, if, as the evidence to-date seems to suggest, there indeed are multitudes of such components from all known periods of Texas prehistory, then the Spring Lake area may rival Gault and Wilson Leonard in its archeological potential.

CHAPTER 5

THEORETICAL PERSPECTIVE

The general approach utilized in this study is that the examination of changes in technological organization can elucidate behavioral changes in prehistoric societies over time (Kelly 1988:717). As a continuously inhabited site, 41HY160 lends itself to such an examination because site location and, hence, raw material availability remain fixed constants. Following Torrence (2001:74-75), technology is defined herein as "comprising physical actions by knowledgeable actors who use carefully chosen materials to produce a desired outcome".

As a research domain in archaeology, the reconstruction of cultural processes and change is rooted in the development of "cultural ecology" by Julian Steward (1955). Steward noted that beyond interacting with each other, cultures interacted with the environment as well and that human behavior, in terms of adaptive strategies designed to cope with environmental, technological, or socio-demographic stressors, could best be understood within an ecological framework. Further, depending on how human populations adapted to various environments, this interaction could bring about culture change. Theoretically, then, it follows that cultures can be viewed as adaptive systems that can both affect and be effected by a surrounding ecosystem. This emphasis on the inter-relationship between culture and the environment is quintessential to the comprehension of hunter-gatherer behavior. As adaptive responses to a given ecosystem, changes in hunter-gatherer behavior can be addressed and compared synchronically and diachronically as manifestations in the organization of mobility, technology, and resource exploitation.

Mobility

Steward's ecological approach to studying past cultures influenced Gordon Willey and his seminal efforts in the Viru Valley of Peru. Here, in a pioneering settlement pattern study, Willey established dates for hundreds of pre-Colombian sites and plotted their geographical distribution in time and space against the changing local environment. Implicit in this study is the concept that man moved across his landscape and that these movements were, in some way, conditioned by the local environment; change in mobility precipitates change in subsistence patterns, trade, territoriality, and the acquisition and use of raw material, as well as possibly conditioning cultural perspectives (Kelly 1992; Sahlins 1972).

While mobility has long been recognized as a key component to the study of hunter and gatherers (Lee and Devore 1968; Murdock 1967), archaeologists have long struggled with identifying different types and levels of movement. By incorporating middle range theory and concepts of mobility, Binford (1980) approached exploration of hunter and gatherer behavior by characterizing the strategies that different groups utilized during resource exploitation. Strategies of foraging and collecting were characterized by the kind of mobility, defined as either residential or logistical, that was practiced. Residential mobility moves an entire band or local group from one base camp to another base camp to get closer to food resources, while a logistical mobility entails small task groups leaving, collecting food, and returning with food or other resources to the same base camp (Binford 1980). Foragers move base camps often, utilizing short daily forays, to move people to resources. Generally, the length of base camps occupation is dependent on resource depletion. Such movements across the landscape would expectedly produce ephemeral short term sites and associated assemblages would likely be dominated by expedient assemblages (Dillehay 2000:86).

Collectors move residentially less often, sometimes storing food, and utilizing long range logistical forays to acquire resources that are incongruently distributed across a diverse landscape and/or are only periodically available. Long-range forays solve spatial and temporal conflicts by acquiring resources and transporting them back to residential camps for consumption, often with the intent of storing resources for later use. Camps of collectors would be expected to contain “highly diagnostic tool kits” with evidence of task-specific items such as curated bifaces- Bleed’s (1987) “reliable tools” (Dillehay 2000:86-87).

In the 30 years since Binford’s conceptualization of hunter and gatherer mobility, these concepts have been used as if-than, either-or, diametrically opposed types, often erroneously in their reporting and interpretation, underestimating the fluidity of different adaptive strategies as a continuum. As two extremes, the forager-collector continuum can be used to generate expectations concerning mobility strategies, site use, and subsistence patterns and archeological assemblage signatures.

Mobility and Lithic Assemblages

Influenced by Binford, questions of mobility organization were pursued by Kelly (1982, 1988, 1992) who outlined basic parameters for foraging populations using ethnography, and Shott (1986) who examined mobility frequency and distance as adaptive strategies of foraging groups. These seminal works provided the necessary foundation for the correlation of lithic assemblages with variations in mobility organization (Odell 2003).

As defined by Andrefsky (1998:144) cores are pieces which are utilized as sources of raw material. Hence, a core can be considered a “modified nucleus of chippable stone rather than a tool with some particular kind of function” (Andrefsky 1998:82). Formalized cores may exhibit several different stages of preparation while expedient cores may undergo little or no preparation with usable pieces being detached opportunistically. Cores can be typographically separated into unidirectional cores and multidirectional cores. Unidirectional cores can be classed as having a single flat surface or striking platform while multidirectional cores exhibit multiple platforms (Andrefsky 1998). Bifacial cores and bipolar cores are examples of multidirectional cores.

It has been posited (Andrefsky 1998; Kelly 1988; Parry and Kelly 1987) that populations which practice more mobility would prefer the more formalized bifacial cores over other varieties. This is because bifacial cores are multifunctional, easily modified and considerably more portable than informal cores. Bifaces can be used as both cores and as tools and can be recycled multiple times reducing the time mobile groups must spend replenishing tool kits, qualities support the hypothesis that the biface was a highly preferred tool of mobile populations. Kelly (1988:719) outlines three different organizational roles for bifaces: as cores, as long use-life tools and as a by-product of the shaping process. Accordingly, the use of bifaces in any of the aforementioned roles would result in varied “distributions of and associations between” the bi-products of manufacture and use, differentiating between residential sites where bifaces were produced and used as cores, residential sites where bifacial cores are produced to be used at logistical sites, instances where bifaces are manufactured for use as long use-life tools, and sites where biface manufacture were the results of the shaping process (Kelly 1988:721). Kelly posits that, hypothetically, these associations would be detectable by differing patterns in lithic assemblages. These patterns are presented below in **Table 3**.

Table 3. Lithic signatures for site type. Modified from Kelly 1988.

Site Type	Debitage	Tools	Conditions
Residential w/ bifaces used locally	High amounts of debris with high numbers of bifacial flake debris.	High numbers of bifaces/biface fragments. High numbers of utilized bifacial flakes. Low numbers of unprepared cores. Low incidences of cortical flakes.	High residential/low logistical mobility w/ hunter & gatherers occupying an area of low material density for an extended time.
Residential w/ bifaces used away at logistical sites	High amounts of bifacial debris.	Low amounts of utilized bifacial flakes compared to simple flake tools. Biface fragments.	Unreliable area resources and when anticipated tasks and destination are undefined. Long forays (see below).
Logistical sites	Small bifacial retouch flakes, Low amounts of non-bifacial debris. Moderate amounts of large bifacial debris.	High amounts of utilized bifacial flakes. Utilized bifaces and depleted bifacial cores.	Acquiring resources a day or more away from the site. Moving away from stone resource. Unsure of destination.
Bifaces as long use life tools (low residential mobility in areas of material scarcity)	High percentage of small biface reduction/ rejuvenation flakes. Some bipolar flakes.	High correlation of tool fragments and bifacial debris. Low unifacial examples of tool type (ex. proj. points). Tools from other areas or periods.	Times of raw material scarcity.
Bifaces as a bi-product of the manufacturing process	Concentration of bifacial debris w/ high amounts of small retouch flakes..	Low incidences of utilized bifacial reduction flakes. High unifacial examples of tool type. Maintenance of hafted tools.	Logistical acquisition of specific resource (s) available short term. Tied in with the importance of hafting and/or a more reliable technology.

Kelly (1988) contextualizes the benefit of utilizing bifaces as cores as a function of mobility. During times of residential mobility and long logistical forays, hunter and gatherers, as they travelled long distances, would spatially separate themselves and use of stone tools from areas of raw material availability. Since, bifaces, by design, maximize the ratio of available cutting edge(s) to the amount of stone that had to be transported, lithic assemblages at hunter-gatherer campsites during times of preparation for residential moves or lengthy logistical forays should then contain strong evidence of biface reduction. In general, bifacial tools and/or cores are associated with frequent residential or logistical movements while expedient flake tools and bipolar reduction cores are associated with infrequent residential moves, or an increase in sedentism as it is hypothesized that this technique conserves material (Kelly 1992:55).

Kelly (1988) demonstrated that bifacial cores, with less weight in proportion to cutting edge, were more efficient and reliable than either nodules or flake blanks. Because of this, it is hypothesized that hunters and gatherers who practiced high mobility reduced risks associated with uncertainty by transporting formalized cores with them (Andrefsky 1991; Kelly 1988; Parry and Kelly 1987). Because reduction on different kinds of objective pieces produces characteristically different flakes, an analysis of a debitage assemblage can be used to illuminate changes in technological organization preferences over time.

Technological Organization and Temporality

On a macroscale level, technological organization can be viewed as existing along a production continuum from an informal technology to a formal technology (Andrefsky 1998; Odell 2003). An informal technology is comprised mainly of expediently produced tools with relatively short use lives. Binford (1979) termed such tools as "situational gear" where creation for their use was reactive rather than proactive. According to Andrefsky (1998) an informal technology produces "simple tools".

Correlations between a diachronic trend towards an expedient core technology and increased sedentism in prehistoric North America were examined by Parry and Kelly (1987). Based on ethnographic accounts the authors outlined traits for an expedient core technology (Parry and Kelly 1987:286-288). First, since flaking technique is not intended to control the morphology of the produced flake, utilized cores are not prepared or preformed. Second, each detachment could be a potential tool. In contrast, since they required more skill and effort to make and could be reused for a multitude of tasks, Parry and Kelly (1988) associated the biface with a curated, or formal, technology.

To test their assumptions, Parry and Kelly (1987) selected from five distinct ratio/percentage tests and applied them to data sets from differing archeological regions (Mesoamerican, the Plains, Eastern Woodlands, and the Southwest). Data sets for the different regions were selected so each region's assemblages could be compared diachronically. Compared were: the ratio of bifaces to cores, percentage of tools with bifacial and unifacial retouch, percentage of proximal flakes identified as biface thinning, percentage of proximal flakes with faceted platforms and the percentage of proximal flakes with abraded platforms. All four regions showed a decrease in the ratio of bifaces to cores, save for one incidence, and drops in observed percentages over time (Parry and Kelly 1987:285-304).

Regarding stone tool technologies, Kelly (1992:55) defines *organization* as "the selection and integration of strategies for making, using, transporting, and discarding tools and materials needed for their manufacture and maintenance." Kelly (1992) also notes that although a number of factors can affect the organization of stone tool technologies, mobility "takes precedence in research" largely because it is "universal, variable, and multidimensional" and "because of the way people move exert strong influences on their culture and society". Some notable exceptions are Torrence (1983), who relates differences in technological organization to the comparable amounts of risk involved in the capturing of prey, Bamforth (1986) and Andrefsky (1986), both who argue that raw material availability affects tool design and Tomka (2001) who argues that variance in both tool form and reduction strategy is a function of processing requirements associated with the hunting of different sized game.

An essential element of Tomka's (2001) argument is that formal tools would be preferable over expedient tools in the processing of large mammals because they would have been far more operable in terms of pressure and leverage. According to Tomka (2001:211), hafting of these formalized tools would be considerably more comfortable during use by transferring "the strain from the smaller muscle groups of the fingers to the larger and stronger muscles of the forearm". In instances where large numbers of animals had to be processed in a short time frame, hafting would theoretically reduce strain on and energy expended by the processor and that hafted tools required a greater degree of preparation/fashioning than did non-hafted tools (Tomka:2001).

To support his hypothesis, Tomka (2001) uses archaeological data from the Southern Plains, Central and West Texas. Temporally, for Central Texas region, Tomka confines himself largely to examinations of assemblages from the Late Prehistoric Toyah phase, a phase that is associated with large scale bison hunting and processing (Prewitt 1981) and to the Late Archaic, again, when bison flourished.

While a number of archeologists (Andrefsky 1998; Bettinger and Baumhoff 1982; Kelly 1988, 1992; Parry and Kelly 1989) support the correlation of increasingly expedient technologies and increased sedentism, there is no hard consensus on the implied relationship. For instance, as discussed above, Tomka (2001) suggests that the primary factor on choice between formalized and expedient tool manufacture is the difference in processing requirements of different sized game. As theoretical constructs, these models are often approached as competing hypotheses (Mauldin et al. 2004; Tomka 2001), where the validation of the latter seemingly suggests the invalidity of the former.

Debitage

Most often, debitage will comprise the bulk of lithic material recovered from archeological sites. As a oft used term, “debitage” refers to both broken stone objects of man made construct that possess a platform and a bulb (Crabtree’s “flakes”: 1972), as well as those knapped products which lack platforms and distinguishable ventral and dorsal surfaces (Crabtree’s “debris”: 1972). Regarding debitage, Shott (1994) notes that if only for its sheer abundance alone, there is great potential in its study. Without question, debitage assemblages can be culturally and chronologically diagnostic (Flenniken 1984; Odell 1989). Further, while there few infallibly absolute diagnostic types, general characteristics of the debitage assemblage can be indicators of production stage, and technological organization (Johnson 2001). For instance, core debitage assemblages are distinguishable from biface debitage assemblages through flake facet counts, scars and size (Bradbury and Carr 1995, 1999).

Approaches to debitage analysis can be on an individual scale (raw material, length, edge angle, etc.) or on the assemblage scale (counts per category). Historically, approaches to debitage analysis typically falls under three broad categories: aggregate analysis, typological approaches, and the attribute analysis of individual flakes

(Andrefsky 1998, 2001). Aggregate analysis separates the debitage by selected uniform criteria in order to compare the assemblage through representative proportions within differing analytical units, separated by either time or space or both (Ahler and Van Ness 1985; Stahle and Dunn 1982). Most often, aggregate counts of weight and/or size attributes are utilized to determine various stages of reduction and tool production. Since tool production is a reductive endeavor, this approach is both sensical and temporally economical when faced with debitage assemblages of great numbers. However, recent work has demonstrated that while aggregate analysis provides reliable results in non-mixed assemblages, their analytical utility is questionable when dealing with mixed assemblages. Unfortunately, more often than not, due to contemporary excavation techniques in most settings, most recovered assemblages will have, minimally, a modicum of mixed elements.

An early, and highly influential, flake typology was one proposed by Sullivan and Rosen (1985) in an effort to create "interpretation-free categories to enhance objectivity and reliability"; the authors contend that then contemporary categories utilized in debitage analysis were erroneously linked *a priori* to specific inferences concerning technological production and reduction strategy. The resultant Sullivan and Rosen typology, or SRT, measured variation in debitage assemblages by classifying individual flakes into four distinct categories based on their "completeness" using a "hierarchical key" ordered through staged dichotomous attributes: debris, flake fragment, broken flake, and complete flake (**Figure 9**). If a single interior surface was discernable by the presence of ripple marks, force lines, or bulbs of percussion, the examined specimen was determined to be a flake. If lacking a discernable interior surface, the specimen was considered debris. Flakes without a discernable striking platform denoting the point of applied force were categorized as flake fragments. Non fragmented flakes without an intact margin, noted by the absence of hinge or feather terminations following Crabtree (1972:63) were categorized as broken flakes. Flake specimens with intact margins were then categorized as complete flakes. Following this method, all debitage within an assemblage thus ordered would fall into one of four categories.

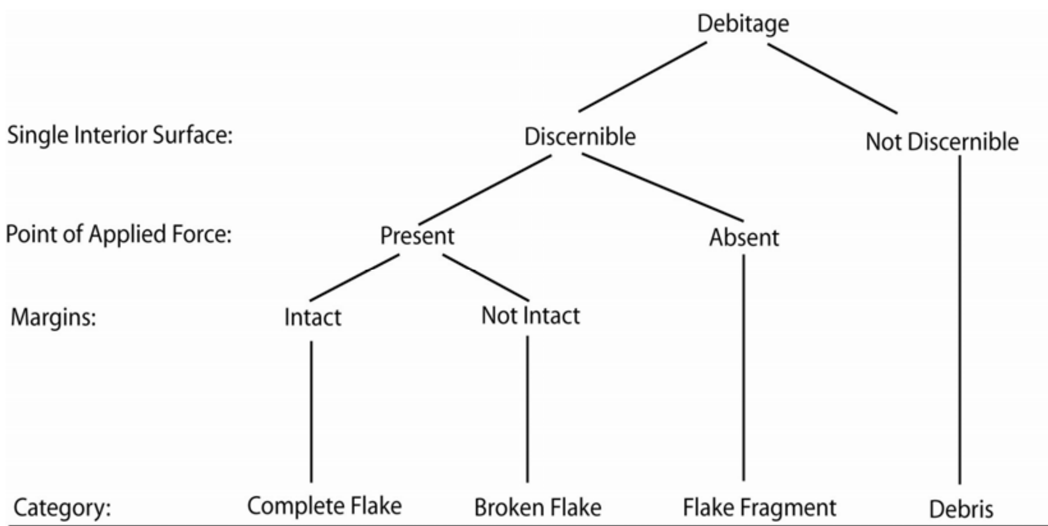

Figure 9. Sullivan and Rozens' typological key. Adapted from Sullivan and Rozen 1988 and Andrefsky 1998.

Sullivan and Rosen (1985) used data from two separate projects to test the utility of their purposed typology. From this, they deduced that shaped tool manufacture results in a comparatively high percentage of flake fragments and broken flakes while generalized core reduction produces high proportions of complete flakes and debris. Further, extremely high proportions of complete flakes with an accompanying very low percentage of broken flakes and flake fragments indicate un-intensive, highly expedient core reduction (Sullivan and Rosen 1985:762). Likewise, a high percentage of debris within an assemblage is indicative of intensive core reduction. These inferences were then tested against correlations between flake size, thickness, cortex percentage, and platform faceting and lipping with tool manufacture and reduction strategy (Frison 1968; Jelinek 1966, 1977; Neumann and Johnson 1979).

In the decade following the introduction of the SRT, there was much debate on the validity of this methodology (Ensor and Roemer 1989; Mauldin and Amick 1989; Shott 1994). Prentiss (1998) both restored and broadened the usefulness of the SRT by adding a size grade element to the original methodology. In so doing, differentiation between core and biface production increased in reliability and validity. Further, this modified SRT (MSRT) has utility in recognizing effects of percussor types, platform preparation, and applied force. In fact, the benefits of combining individual flake analysis with mass analysis in any debitage analysis are extreme enough that Magne (2001:23) suggests that "any large debitage set should include these two basic methods as an inclusive analytical tool." A multiple lines of evidence approach serves to strengthen inferences; if different avenues suggest the same pattern than conclusions derived from these data are more likely to be correct.

Typically with the intent of analyzing the distribution of attributes over entire assemblages or between assemblages, attribute analysis records selected characteristics of debitage (Andrefsky 2001). To date, the bulk of attribute studies has been directed towards technology, type of objective piece from which the debitage was produced, and reduction stages. Frequent attributes used in analysis are cortex (reduction stages), size based on weight (multidirectional vs. unidirectional core reduction), and platform characteristics (biface core reduction vs. platformed core reduction) (Andrefsky 1998;

Magne 1985; Parry and Kelly 1987). Many believe that platform morphology is a highly effective and key attribute in assessing technological organization (Morrow 1984; Odell 1989; Shott 1994). Shott (1994:80-81) describes a fundamental set of descriptive attributes for platforms as discerning between cortex, single/flat platforms, and multi-faceted platforms (Shott cautions that subdividing the latter based on exact number and/or orientation is an invitation to error). To these attributes can be added that of abraded (Andrefsky 2001). Additionally, the presence of lipping on a flake platform has been linked with soft-hammer percussion (Frison 1968).

Commonly accepted as representing detached pieces from a biface, bifacial thinning flakes are defined by attributes such as platform striking type, relative thickness, shape, and size (Odell 2003). Characteristics of biface thinning flakes are: curved longitudinal cross-sections, extremely acute lateral and distal edge angles, feathered flake terminations, narrow lipped faceted striking platforms, little or no cortex, and a diffuse bulb of percussion (Odell 2003:121).

Subsistence

As mentioned above, at the crux of the governing theoretical approach of this work is the tenant that the surrounding environment is the primary context that determines allowances and constraints to which hunter-gatherer mobility, technology, and subsistence organization represent responses. A change in any sub-system of a given environ, be it climatological, hydrological, geographical, can be a causal factor in human adaptive response. Regarding ecosystems on the local-scale, the seasonal availability and distribution of fauna resources affect hunter and gatherer behavior. Further, the represented specimens within a faunal assemblage is representative of this behavior as it relates to subsistence, prey choice, prey availability, mobility. Also, when organized temporally and measured between samples, faunal remains can act as proxy indicators of changes in the environment (Lyman 1994). Generally, the presence of large-sized animals at an archeological site is due to man, and only provides a broad measure of the environment. Small-sized mammals, such as rodents, which are far less wide-ranging, can be indicators of more specific ecological constraints. Inter and Intra-assemblage comparisons begin with the identification of the taxa that comprise an assemblage, after which, it is often necessary to measure the abundance of each taxon, and identify and count the skeletal elements of each taxon.

In comparison of two or more faunal samples, Klein and Cruze-Uribe (1984) note measures of taphonomic abundance is critical and that without this quantification there is no way to ascertain if differences or similarities are due to environmental or cultural agents. While there are various proposed methods to quantify the taxonomic abundance of the faunal assemblage, number of identified specimens (NISP) and minimum number of individuals (MNI) are the most prevalent among zooarcheologists. NISP quantifies the number of bone elements that are assignable to each identifiable taxon. Advantages of NISP its calculation can occur simultaneously with bone identification and initial sorting of the assemblage and that the values are additive and easily updated. The primary disadvantage of NISP quantification is that it exaggerates counts for species that have more skeletal parts and those that reached the archeological site intact. Most importantly, NISP counts are sensitive to bone fragmentation where highly and differentially fragmented assemblages.

Calculation of MNI measures the number of individuals necessary to account for the identified bones of an assemblage (White 1953). Because of its method, MNI will never be larger the NISP of the same sample and will typically be smaller. Although occasionally modified, MNI is derived by separating the most abundant element of each species into right and left components and taking the higher of the two counts as the number of represented species. A benefit to this method is that one species cannot be represented more than another simply due to a difference in the number of animal skeletal parts or in off-site butchering and transport methods (Klein and Cruz-Uribe 1984). However, when assemblages are highly fragmented, wherein the majority of elements are unidentifiable to specific type (i.e. left humerus vs. long bone fragment), MNI calculations can severely lead to an underrepresentation of taxons.

Moving from what Klein and Cruze-Uribe (1984:3) term the life assemblage (the community of living animals from which the assemblage is drawn) to the sample assemblage (the excavated and collected assemblage), other factors can influence and bias the interpretations of faunal assemblages. Pre-depositional factors include prey choice, butchering practices, part selection for transport, and carnivore scavenging. Post-depositional leaching and profile compaction/fragmentation may alter an assemblage prior to recovery while excavation, screening, and collection methods will affect an assemblage during recovery.

In hunter and gatherer subsistence, animal fat was a sought after commodity that ensured adequate nutrition (Speth 1983). In temperate environments fat availability is seasonally dependent with fat more readily available during wet and warm seasons and less so during cold and dry seasons when animals metabolize more of their reserves.

Mammals store their reserves in four general locations: beneath the skin, in muscle tissue, in the kidneys, and in the medullary cavities of their skeleton, with the latter being the last of the stores to be metabolized (Bar-Oz and Munro 2006). Medullary cavities are not found within all bones, typically limited to long bones, metatarsals, metacarpals, mandibles, scapulas and first and second phalanges. The extraction of marrow from these elements often results in intensive fragmentation. Because the identification of bone marrow extraction can provide insights into carcass selection and butchering practices as well as subsistence stress as experienced by past peoples, identifying the source of bone fragmentation within assemblages holds high value.

Conclusion

Presented above are the general theoretical constructs that govern the following chapters on research design (Chapter 7), lithic analysis (Chapter 8), faunal analysis (Chapter 9), and the resultant conclusions (Chapter 10). While an attempt was made to utilize these constructs equitably for all represented time periods among the analyzed assemblages, the available data sets are more generous for certain temporal periods and less for others.

CHAPTER 6

RESEARCH DESIGN AND METHODS

Research Questions

Regarding both the faunal and lithic analysis for 41HY160, several correlated questions were formulated in order to address diachronic change in hunter and gatherer behavior. Specifically, the scope of the following research design is intended to examine mobility, site use, and subsistence practices over time, as reflected through technological organization and faunal exploitation.

As discussed previously in Chapter 5, increased mobility among hunters and gatherers would be evidenced by a more formalized assemblage. Previous lithic analysis conducted on 41HY160 by Aery (2007) illustrated that there were detectable shifts between expedient and formal technologies from the Early to Middle Archaic and during the Middle Archaic. Therefore, we would expect that the assemblage used in the proposed analysis to vary over time from a more formalized technology to an expedient one and/or vice versa.

Research Question 1: Does the technological organization at site 41HY160 exhibit marked shifts along the expedient/formalized continuum based on simple core reduction and/or biface reduction?

Material Corollary 1: Lithic assemblages assigned to temporal analytical units (discussed in further detail in the following Chapters 5 and 6) were analyzed to determine if they reflect simple core reduction or bifacial core reduction.

Research Question 2: Can differential site use be determined through lithic analysis?

Material Corollary 2: The degree of simple core reduction vs. biface reduction in the lithic assemblages were compared to the “site types” as proposed by Kelly (1988) and as discussed in the previous chapter.

Research Question 3: Is technological organization and/or “site type” related to subsistence practice, especially when the focus is on the procurement of medium to large sized game?

Material Corollary 3: If periods of intense biface reduction oriented technologies are directly linked to the acquisition and processing of medium to large game than there should be a noticeable increase of the remains of these animals in the faunal record when compared to periods characterized by a less formal, or expedient, technology.

Research Question 4: Is there a pattern/correlation between technological strategies and the faunal remains?

Material Corollary 4: When compared with the faunal data and regional climate models for the area (Nordt various, Toomey various, Bryant 1977, Bousman 1998a, Brown 1998), do periods of formalized technologies and specific site types evidence a correlation with shifts in subsistence. Further, as a response to climatic stress, is there a noticeable change in exploited taxa among the faunal remains with an expected increase in lower ranked resources.

Methods

Analytical Units. In order to illuminate technological change over time for site 41HY160, it was imperative to separate the assemblage into meaningful analytical units (AUs). While it would have been preferable for analytical purposes to have every artifact, including debitage, point plotted three-dimensionally, the immense amount of time such an endeavor would necessitate made this impracticality during excavation. The vast majority of lithics, bone, burned rock, and carbon collected during the 1982 and 1983 field schools were collected during unit level screening. Predominantly, these excavation levels were dug in 10 centimeter increments although, due to a desire to move through top-fill or through levels with little to no artifacts, unit levels occasionally were dug as a 15 or 20 centimeter level. During field school, excavation units were dug in 2 x 2 meter or 1 x 1 meter blocks. In the case of the former, a north, south, east, or west quad designation was assigned effectively reducing its size to a 1 x 1 for interpretive purposes. Hence, in most cases AU's were assigned to each 10 centimeter level from 1 x 1 meter excavation blocks. As an essential element of this thesis, this vertical distribution of data was organized temporally by archaeological periods and sub-periods utilizing date ranges provided by Collins (2004:113) for diagnostic projectile points (see Chapter 7). Additionally, carbon samples taken during the field school excavations were submitted for dating. These dates were correlated with date ranges provided by projectile points to further order AUs into discrete cultural strata (see Chapter 8).

Classification. A classification scheme initially separated the lithic assemblage based on macroscopic analysis into two primary groups: debitage and tools. All chipped stone pieces that showed evidence of intentional modification and flake detachments that exhibited visible use wear were classified as tools. For analytical purposes, Andrefsky's (1998) morphological typology approach was utilized to further divide tools into two distinct sub-categories: bifacial tools and non-bifacial tools. Bifaces that exhibited evidence of hafting through use-wear analysis and/or the presence of notches, stems or shoulders were then classed as hafted bifaces. Those without noticeable hafting elements were classified as un-hafted bifaces. Using this method, it was expected that the hafted biface category would, by definition, include arrow points, spear points, hafted knives and hafted drills (Andrefsky 1998:77).

Non-biface tools were organized into two groups by the presence or absence of certain characteristics. Those tools which were observed as made from alterations on a flake were classified as flake tools, while those that were not thus observed were classified as core tools. Additionally, flakes that were unmodified but exhibited evidence of use wear were ordered into the flake tool category. All non-tool chipped stone artifacts were classified as debitage.

Debitage Analysis

Regarding debitage analysis, a typological approach was utilized in consort with an aggregate analysis because of its ability to indentify variation, in their absence, among tool and core type within an assemblage (Andrefsky 2001:6). The primary goal of the debitage analysis was the identification of bifacial reduction flakes and reduction stage. Due to the large amounts of debitage in the assemblage, a representative sample was utilized. This sample was selected from the collected debitage with the intent that all present temporal periods would be equitably represented. Preference was given to debitage sample sets that could be reasonably identified as being under good chronological control.

Size Grading

After arrangement into analytical units but prior to typing, all sampled non-tool debitage was sorted by maximum length using “U.S.A. standard sized sieve” geological screens as provided by Humboldt Manufacturing. Using these screens, debitage from each AU was divided into four size categories: $\geq$25 mm, 12.5-25 mm, 6.3-12.5 mm, and 3.17-6.3 mm. It should be noted that during analysis the 3.17-6.3 mm debitage size class was found to be underrepresented, most likely a result of an excavation methodology that employed ¼” mesh or wire to collect artifacts during screening.

Flake Typology

Following size-grading, sampled debitage was subjected to a typological categorization. The typology analysis for the sampled debitage was modified from Sullivan and Rosen’s (1985) suggested flake classification (as outlined in Chapter 5). Following the SRT, flakes were ordered into four categories: debris, flake fragment, broken flake, and complete flake. By definition both broken and complete flakes have a platform presence. Modifying the SRT, during classification, flake platforms were identified and organized into four states: cortical, flat, complex, and abraded (**Figure 10)**. Cortical striking platforms were identified as being composed of an unmodified cortical surface. Flat striking platforms were identified as having a smooth flat surface. Striking surfaces with a rounded surface and/or multiple flake scars were classed as complex platforms. Platforms with evidence of abrasion or rubbing were classed as being abraded. Generally, by definition, complete flakes exhibit intact lateral margins and broken flakes do not. Further adding to Sullivan and Rosen's original flake typology, platform lipping was tallied separately for complete and broken flakes by analytical unit during flake classification.

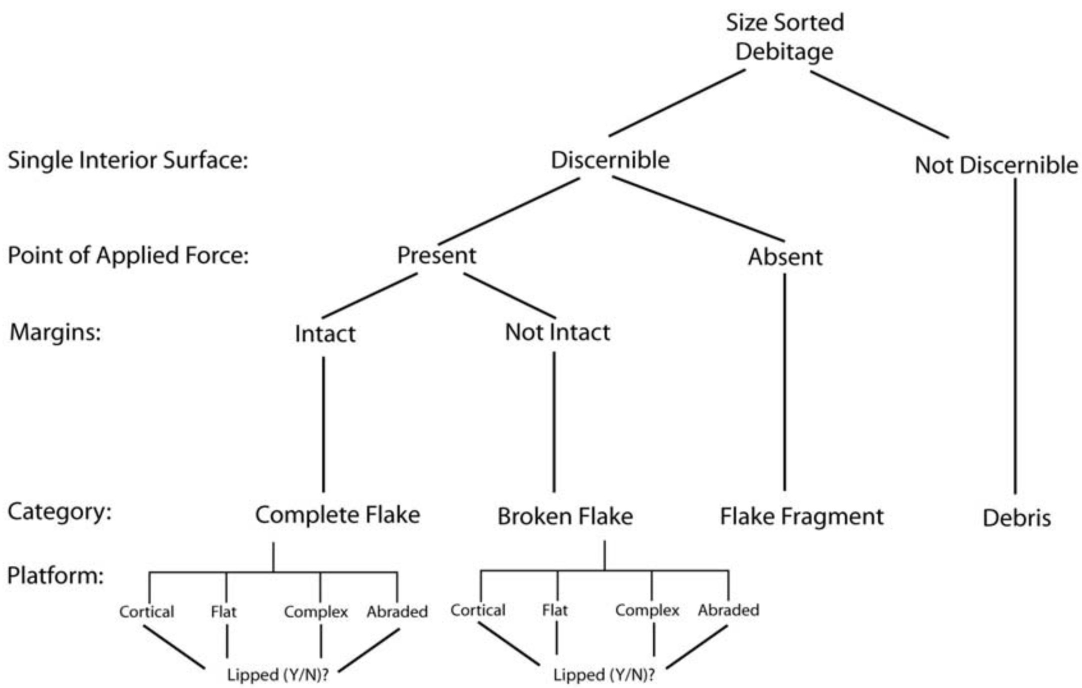

Figure 10. Modified SRT chart utilized in debitage classification.

Reduction Strategy

In order to differentiate site use by temporal periods, it will be necessary to identify reduction technique (Kelly 1988:724). The three reduction categories (Kelly 1988; also see Magne 1985) of simple percussion flake, early stage biface reduction, late stage biface production will be utilized. Simple percussion flakes will be identified as having zero or few (1-2) flake scars on the platform, no lipping nor faceting. Early stage biface reduction flakes will be identified as having two to three facets on their striking platforms. Late stage biface reduction flakes will be identified as having feathered terminations, lipped platforms and a length to width ratio approaching two to one.

Core Tool and Biface Analysis

Cores are objective pieces that have had flakes removed from their surfaces without the characteristics which would otherwise classify them as flake or bifacial tools (Andrefsky 1998:81). Based on a morphological typology approach, cores were separated into unidirectional or multidirectional classes (Andrefsky 1998:76). Cores that exhibited single flat surfaces or striking platforms with detachments following the same alignment were organized into the unidirectional class, while cores that displayed evidence of multidirectional flake removal and the use of more than one striking platform were ordered into the latter class. Multidirectional cores that have been, through reduction, shaped into a disc with two faces that converge to form an edge were classified as bifacial cores (Andrefsky 1998:16).

Biface Analysis

In this analysis, bifaces included both flakes and core blanks with evidence of flaking on both sides. Bifacial tools were initially separated by morphology into the categories of bifaces, perforators and burin spalls. Following, bifaces were classed according to a five stage manufacturing scheme (Callahan 1974, 1976). Also, bifaces will be measured by hand caliper for width, length and thickness. Further, basal modification, if present will be assessed as unifacial thinning, bifacial thinning, beveled, simple retouch, multiple hinge/step flaking, dulling and indeterminate.

Non Projectile Point Biface Metrics

Max length: observed maximum length was measured directly from each biface using hand-held calipers and was recorded to the nearest whole millimeter. Generally, the maximum length of any measured biface is expected to be along the long axis perpendicular to both its maximum width and perpendicular to the flake scar patterns of non-hafted portions.

Max Width: observed maximum width was measured directly from each biface using hand-held calipers and was recorded to the nearest whole millimeter. Maximum biface width was measured from one lateral edge to the other, perpendicular to its length. By definition this measurement can occur along the entirety of the measured tool, but, typically is expected to fall within its quarter points.

Maximum Thickness: observed maximum thickness was measured directly from each biface using hand-held calipers and was recorded to the nearest whole millimeter. Maximum thickness was measured from one surface to the other and, like width, can occur along the entirety of the biface.

Weight: Weights for were recorded for each individual biface to the nearest whole gram using a digital scale. While it is expected that weight measurements from incomplete and fragmented bifaces will have little utility in tool analyses, weights were taken for all individual bifaces, regardless of completeness to facilitate curation and future identification.

Non Projectile Point Biface Attributes

While Muto (1971) very well may be correct in his conception of biface manufacture as a continuum from raw material acquisition, there is still much preference in utilizing fixed reduction stages in describing biface production (Callahan 1979; Frison and Bradley 1980; Whitaker 1994). While constructs that assign individual tools into static stages may oversimplify the manufacture process in terms of cultural, ecological, and individual idiosyncrancies, nevertheless stage models do allow for diachronic and synchronic comparisons and facilitate analysis.

In order to classify bifaces into stages, a reduction trajectory following Callahan (1974, 1979) and Whitaker (1994) as consolidated by Andrefsky (1998) was utilized. Following this schema, bifaces were organized into five distinct stages: (1) blank, (2) edged biface, (3) thinned biface, (4) preform, (5) finished biface. A Stage 1 blank is defined as an object piece (flake, cobble, or chunk of raw material), with minimal flake removals, that often retains much of its original cortex. Initial edging of the objective piece occurs during Stage 2 and the squared or rounded edges are removed. A Stage 2 biface is typically recognized by a tool with a few flake scars on either surface and an edge morphology that is irregular. Stage 3 is recognized by additional cortex removal and the initiation of biface thinning by flake scars that stretch to the tool's center. Stage 4 is characterized as a secondary thinning stage, during which flake removal often carries beyond the center of the object piece and edges are abraded and grounded to form striking platforms that encourage precision. During Stage 5, refined flake removal occurs, particularly along the edge.

Identification of a Hafting Element or Backing

Additionally, during Stage 5 haft preparation occurs. Since the identification of hafting was limited to a macroscopic approach, hafting elements were identified on non projectile point bifaces through visual identification of basal thinning perpendicular to the general flaking pattern present on the tool in question, lateral edge dulling towards the proximal end, and/or the residual presence of adhesive aids and masticates such as asphaltum. Additionally, a goniometer was utilized in consort with a cross section examination of the object piece to qualify the presence of a haft section. In contrast to preparing a biface for hafting, a biface may be "backed" for hand-held use. In such cases, the proximal end may evidence intentional dulling along one or two lateral margins and the proximal end with or without a noticeable change in the tool's cross section.

Object Piece Identification

When possible, through visual inspection, an assessment of each biface derivative form as either core-based or flake detachment was attempted. Core based bifaces were noted as those which were constructed from direct reduction of the original core rather than a flake detachment. Flake detachment origination was assigned when a biface was observed to retain characteristics that would identify production of the tool from a detached flake. Remnant bulb of percussions, striking platforms, or identifiable ventral surfaces are such characteristics.

Flake Tool Analysis

Non-bifacial tools that, through visual assessment, were assessed as originating from a flake detachment were classified as flake tools. These tools are pieces that have been created from a flake blank that exhibit some form of modification , either through retouch or use wear (Andrefsky 1998:78-79). Functional requirements relate to specific task requirements and the flake tool analysis will be done to ascertain tasks performed. Edge angles will be measured; very acute edge angels are associated with the cutting of soft materials such as meat while edge angles that range from 75-90^0 would have been preferred for the scraping of hides (Andrefsky 1998:161).

Flake Tool Metrics

Max length: observed maximum length was measured directly from complete flake tool using hand-held calipers and was recorded to the nearest whole millimeter. This measurement was taken from perpendicular to the striking platform width to the distal end.

Width measurements: width measurements were taken at the quarter, half, and three-quarter marks perpendicular to each flakes tool's length. These measurements were taken using hand-held calipers and were recorded to the nearest whole millimeter.

Thickness measurements: flake tool thickness was measured at the quarter, half, and three-quarter marks perpendicular to the dorsal plane. Measurements were taken using hand held calipers and were recorded to the nearest whole millimeter.

Weight: Weights for each flake tool was recorded to the nearest whole gram using a digital scale. While it is expected that weight measurements from incomplete flake tools will have little utility in tool analyses, weights were taken for all flake tools, regardless of completeness to facilitate curation and future identification.

The difference in detached flakes from unidirectional and multidirectional cores can be further highlighted by measuring the flakes. Thickness, and width measurements will be recorded at the quarter, half and three-quarters mark along the length (longitudinal axis) of the flake. Relatively uniform values are associated with removals from unidirectional cores (Andrefsky 2005:165).

Non-Metric Flake Tool Analysis

Dorsal Scar Orientation. The orientation of flake scars on the dorsal surface of a detachment can be utilized to determine whether or not the object piece was a unidirectional or multidirectional core (Andrefsky 1998; Baumler 1988). Following a technique described by Baumler (1988), each flake tool's dorsal surface was divided into 4 quadrants and positive or negative values were assigned to each quadrant by the orientation of flake scars within each quadrant (**Figure 11**). Quadrant 1 received a positive value if it contained flake scars that were oriented in the same direction as the detached flake tool. Quadrant 2 received a positive value for flake scars originating from the right margin. A positive value was assigned to quadrant 3 for flake scars oriented *opposite* to the detachment. Quadrant 4 received a positive value for flake scars that originating from the left margin. Using the aforementioned method, each flake tool was assigned a quadrant point value (QPV) from 1 to 4. Because they likely originated after detachment, flake scars resulting from retouch were not included in the QPV count. Relating to core technology, detachments with a QPV of 4 were detached from multidirectional cores, while those with QPVs of 1 were detached from unidirectional cores. Due to limitations in the applied methodology, only complete or near-complete flake tools were assigned a QPV.

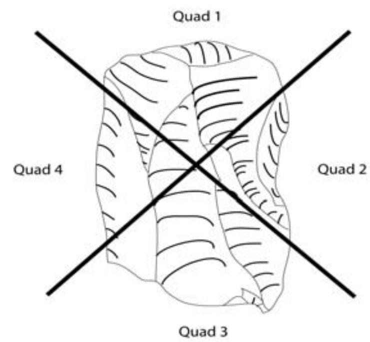

Figure 11. Quad diagram utilized for QPV assessment. Modified from Baumler 1988.

Platform Presence, Cortex, and Retouch. When possible, platform type (cortical, flat, complex, and abraded) was recorded for each flake tool detachment using an attribute model (**Figure 12)**. Further, the presence of platform lipping was noted. Additionally, the amount of cortex present on the dorsal surface was estimated through visual assessment for each flake tool. The presence or absence of retouch along each flake tool's margins and ends was determined with the aid of a low power microscope and recorded.

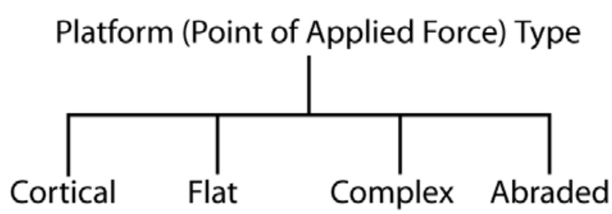

Figure 12. Platform type model.

Use Wear Analysis

The surfaces and edges of the assemblage bifaces, unifaces and sampled flakes will be examined for use wear using a low power hand magnifier (Odell 2003; Vaughan 1985). Again, because of importance to the proposed research design, the primary goal of the use wear analysis will be to identify un-retouched flakes that show evidence of utilization. Additionally, emphasis will be placed on noting the presence of prehensile use wear on bifaces and unifaces.

Projectile Points

Projectile points were identified utilizing a typology as described by Suhm et al. (1954) and Turner and Hester (1993) and, as defined by Collins (2004) and Johnson and Goode (1994), chronologically ordered into temporal periods. No further analysis of projectile points was attempted.

CHAPTER 7

PARTICULARS ON EXCAVATION BLOCKS, UNITS, FEATURES, AND ARTIFACTS

Background

As described in the preceding chapter, numerous archaeological investigations were conducted over the years at 41HY160. Data recovered from the two earliest excavations, the 1982 and 1983 field school sessions, were used for this study. Beyond instructing students in the proper techniques of recordation and excavation, initial goals of these field schools were to identify prehistoric occupations and collect carbon samples in order to date these occupations (Garber n.d.). The specific location selected for excavation is situated adjacent to the head waters of San Marcos Springs to the southeast (Garber et al. 1982) (**Figure 13**). During the 1982 field school, the site was named Tee Box Six, as Tee 6 of the nine-holed Aquarena Springs golf course is situated adjacent to the excavation area. While nothing was published or presented concerning the 1983 excavations, a paper given at the 1982 Texas Archeological Society (TAS) meetings reveals that, in terms of recovered artifact quantity, the 1982 field school was extremely productive. Among the recovered artifacts, Garber et al. (1982) report a total of 504 stone tools: 75 projectile points (53 of which were deemed “identifiable”), 31 cores, 9 choppers, 45 scrapers, 103 bifaces, and 241 utilized flakes. In addition to these lithic tools, three bone tools are reported: a bone awl 20 cm long constructed from an unidentified long bone, another awl fashioned from a deer metapodial, and an “incomplete flesher with a beveled edge” (Garber et al. 1982). Within the upper excavation levels, three groundstone tools,described as “sandstone grinding slabs”, were recovered as were 26 ceramic sherds, most of which are described as being of the Leon Plain variety. While there is no report for the 1983 excavations, a perusal of the original field notes indicates that the number of recovered artifacts was equally abundant.

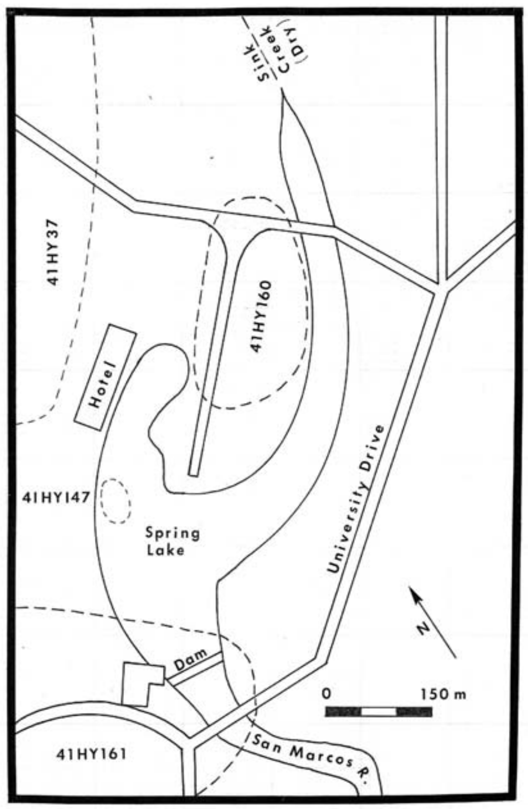

Figure 13. Original site map of 41HY160 (Garber n.d.).

Unfortunately, what today remains from both the 1982 and 1983 field school collections numbers fewer than what was originally reported. From the 1982 field school there are 20 tangible and identifiable projectile points and 13 unidentifiable points. This number is bolstered slightly by eight slide-photos of a handful of the now-missing projectile points. Sixty-nine bifaces and biface fragments, and 41 cores remain from the 1982 collection. Slide photos of both bone awls are available. Because much has changed in projectile point typologies in the past 30 years, non-photographed missing diagnostics, even when identified on field notes, are not included in the following discussion.

While fire-cracked rock (FCR) was noted throughout the excavations, only very dense concentrations were considered features. During the 1982 field school, a total of 13 features were identified: five hearths, two burned rock middens (BRMs), three stone alignments of unknown use but could well be structural in nature, one posthole, one trash pit, and a possible ceramic production area.

While several archaeological sites were then known for the San Marcos area, as of 1982, none had been dated utilizing C^{14}. Following the 1982 and 1983 field schools, nine carbon samples were chosen for submission for laboratory analysis (five were sent to the University of Texas Radiocarbon Laboratory in Austin, Texas and four were sent to Beta Analytic in Coral Gables, Florida). Of the results, Garber noted:

> "The carbon samples were collected from several areas of the site at various levels. There were no stratigraphic inversions- in other words, the older samples were found at the deeper levels and the more recent ones were recovered closer to the surface. This indicates that the deposits at this major site are relatively undisturbed by cultural or natural events and that mixing of the archaeological deposits had not occurred."

To amplify this set of carbon dates two additional charcoal samples were submitted to the Center for Applied Isotope Studies at the University of George for AMS dating by the author.

In order to place the diagnostics, features, and radiocarbon dates in meaningful contexts a reconstruction of the excavation units was accomplished by sleuthing through old site forms and laboratory log sheets and comparing them to original plan views, profiles, site maps and slide photos. When pertinent, plan views of unit levels are presented below, displaying locations and depths of features, such as hearths. It should be noted that artifacts, including diagnostics, carbon samples and faunal remains were rarely recorded as point provenienced *in situ* and are assigned ranges in centimeters below ground surface (cmbgs).

Excavation Blocks

During the 1982 field school 12 excavation units (XU's) were opened for explorations into 41HY160 (**Figure 14**). Four of these units (XU's 1,8,10 and 12) were 1 x 1 meter units. Seven of these units (XU's 2-7 and 11) were 2 x 2 meter units. A single unit, XU9 measured 1 x 2 meters. Excavation Units 1 and 10 were placed adjacent to each other and represent the southern reach of the 1982 investigations. Consolidated, Excavation units 1 and 10 comprise Excavation Block One (XB1). Excavation Units 4, 5, 6, 7 were excavated in consort as quarter units of a larger 4 x 4 meter block excavation. Excavation Unit 8 was opened up adjacent to the northwest wall of XU5 in order to better reveal a cluster of burned logs that were unearthed in the third level of XU8. Together, within the following discussion, these units collectively will be referred to as Excavation Block Two (XB2). Excavation Units 2 and 3 were initially excavated as a 1 x 2 meter block approximately eight meters east of XB2. Later, XU9 was opened up adjacent to the northeast wall of XU3. Later still, XU11 was placed adjacent to the northeast wall of XU2. Together these units represent Excavation Block Three (XB3).

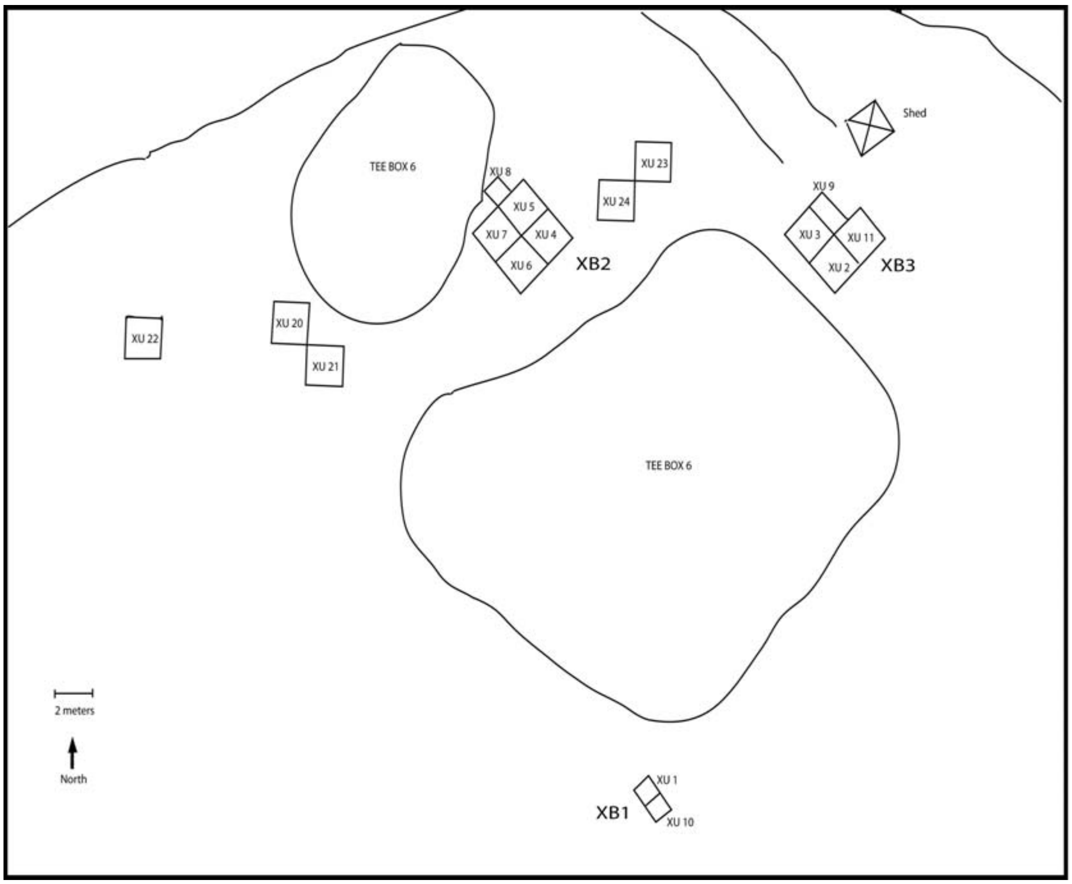

Figure 14. Location of the 1982 field school excavation units at the Tee-Box Six Site (41HY160).

Excavation Block One

During the 1982 field school excavations, 34 square meters were excavated to differing depths. The deepest excavations were within XU1, extending to a depth of approximately 2.65 meters. Excavation Unit 10, adjacent to XU1, extends to a depth of 1.25 meters and was terminated in a near sterile level. Within XU1, at 2.65 meters, excavations were terminated due to the presence of the water table and the associated logistical problems that continued excavation would present (Garber n.d.). Garber's profile of the northeast wall of XB1 provides an overview of the site's stratigraphy (**Figure 15**). As recorded in the level forms for XU's 1 and 10, the first 15 centimeters excavated below ground surface (cmbgs) contained modern and historic debris such as golf tees, cigarette butts mixed in with lithic debitage, burned rock and bone. Just below 15 centimeters a hearth feature was encountered (labeled F1:XU1) with associated charcoal and fire-cracked rock (FCR). From point plots of the FCR obtained from the original field notes this feature extends from an approximate depth of 14 cmbgs to 25 cmbgs. Due to the absence of modern or historic debris within the feature matrix, it was determined that this hearth and artifacts below 15 centimeters had been undisturbed during historic times or during golf course construction. Although, FCR was noted at the same depths within XU 10, it is unclear if feature F1:XU1 extends south of XU1. Within XU10 a Darl Point was recovered in situ at approximately 20 cmbgs and provides a cultural/dating context for the hearth feature (see **Appendix A** for projectile point descriptions and photos). Additionally, according to field school notes, scrapers and flakes were found in association with **F1:XU1** (**Figures 16 and 17**).

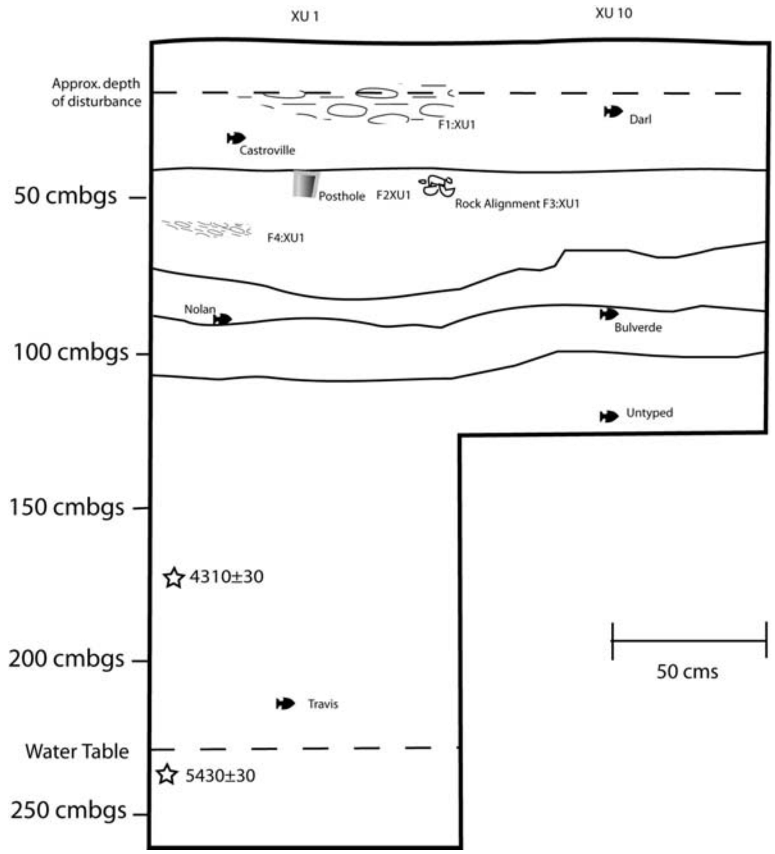

Figure 15. Profile of northeast wall, Excavation Block One (XB1). Adapted from Garber (1982).

Figure 16. Feature 1 in Excavation Unit 1 (F1:XU1).

Figure 17. Scraper recovered from Unit 1, level 2.

Between 35-45 cmbgs, two additional features were encountered in XU1: a single “post-hole” alignment, labeled F2:XU1 and a “rock alignment”, F3:XU1. The post-hole feature was first observed at an approximate depth of 26 cmbgs and extends into subsequent levels to approximated depths of between 47 and 49 cmbgs. The rock alignment feature is located west of the post hole at an approximate depth of 49 cmbgs and extends “north-south in an arc” across the XU1 (**Figure 18**). Beyond 49 centimeters, the field school notes report that there is a drop off of in charcoal flecking and a slight red tinting of the soil. In possible association with these features, a Castroville point was recovered within level 3 from a depth between 25-35 cmbgs.

Another hearth feature (F4:XU1) was encountered within the northern corner of XU1 at an approximated depth of 54-62 cmbgs. The feature record for F1:XU1 notes that faunal bone was located both within and outside of this hearth feature along with ash and charcoal.

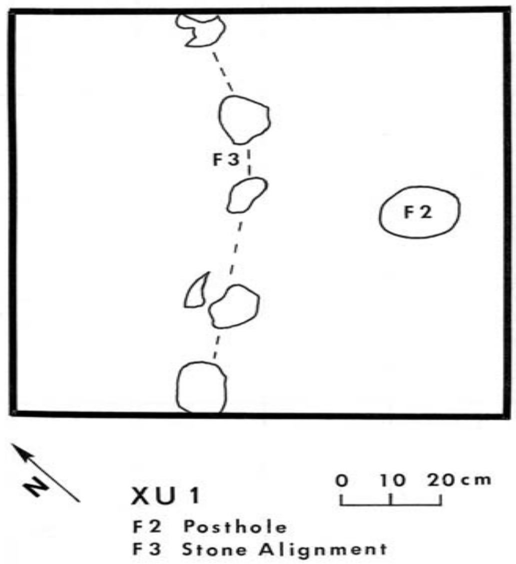

Figure 18. Orignal profile of features 2 and 3 within Unit 1 (F2:XU1 and F3XU1). From Garber (1982).

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At 54 cmbgs, another feature was unearthed in XU1 (**Figure 19**). This feature consisted of a tight and articulated cluster of FCR, ash and charcoal within the northern quadrant of this unit. Recorded as a hearth feature, F4:XU1 ranged in depth from approximately 54 cmbgs to 63 cmbgs. Deer bones were noted from around the hearth area as well as a scatter of “fire charred rocks”, which were red in color.

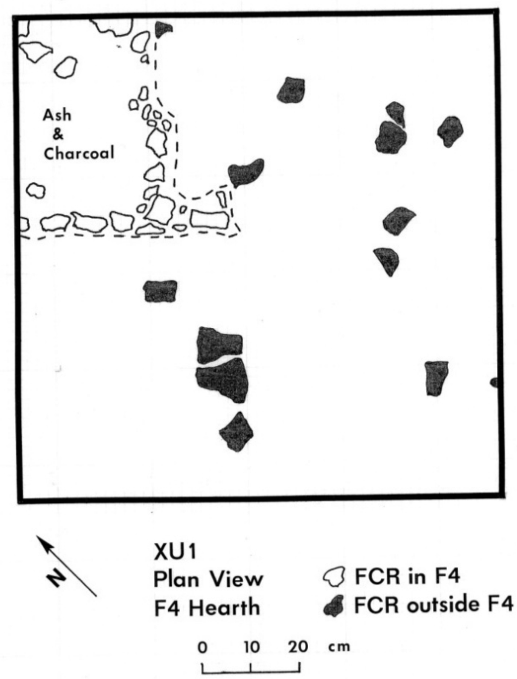

Figure 19. Orignal plan view of feauture 4 within Excavation Unit 1 (F4:XU1). From Garber (1982).

Other than a comment on the unit level summary form which notes that there were large-sized bones collected from 65-75 cmbgs within level 7 of XU1, the general trend from Excavation Block One seems to be a decrease in the amount of artifacts after 80 cmbgs, with a brief respite in XU1 from between 85-95 cmbgs, from which a Bulverde point was recovered. Just below this, at a depth ranging between 95-105 cmbgs, a Nolan point was encountered during excavation. Below this, at a depth between 115-125 cmbgs, an untyped point was located in XU10. Otherwise, the nearly sterile sediment seemingly extends to 165 cmbgs, after which there is a noted increase in debitage amounts with an associated Travis Point located in XU1 from level 19 (205-225 cmbgs).

At 245 cmbgs, excavations in XU1 (digging ceased in XU10 at 125 cmbgs, presumably due to temporal constraints) hit the water table. At 265 cmbgs, due to logistical constraints, excavations are halted within XU1. Two carbon samples collected during the 1982 excavations were submitted for dating: one sample was collected from between 185-205 cmbgs (UGAMS 6833) the other from between 245 and 265 cmbgs (UGAMS 6834).

Excavation Block Two

Excavation Block 2 (XB2) is comprised of Units 4,5,6,7 and 8. Units 4-7 (XUs4-7) were set up as 2 x 2 meter excavation units adjacent to each other (**Figure 14, above**). Unit 8, measuring 1 x 2 meters, was opened up adjacent to XU5's northeast wall in order to explore a hearth feature. Garber's original illustration of the first 10 cmbgs of XB2 is characterized by inclusions of modern debris, predominantly associated with golfing: can ring tabs, cigarette butts and tees. As noted on the unit level summary forms, mixed in with this modern era trash, were Perdiz and Scallorn projectile points, a high amount of burned rock, pottery shards, and numerous amounts of debitage. Throughout XB2, at approximately 10 centimeters below ground surface, excavations had cleared the bulk of modern disturbance and preserved charcoal was first observed in consistent amounts.

Unit 4

Unit 4 (XU4) comprises the southeastern quad of XB2 and was excavated to a depth of approximately 60 cmbgs (**Figure 20**). In comparison to Units 5,6,7, and 8, there was considerable less modern debris noted during excavation of this XU4. Counts for fire cracked rock and lithic debitage were high from 0 to 20 cmbgs. Ceramic sherds were also recovered from the first 20 cmbgs with some noted as being of the Leon Plain variety. Projectile points recovered from this excavation block include a Scallorn/Cuney variety arrow point located between 0 and 10 cmbgs, a Fairland/Ensor type base from 20-30 cmbgs, and a Marcos point from 50-60 cmbgs. Two charcoal samples were submitted for carbon dating: one collected from 40-50 cmbgs (UT-5060) and one charcoal collected between 50-60 cmbgs (UT-5061).

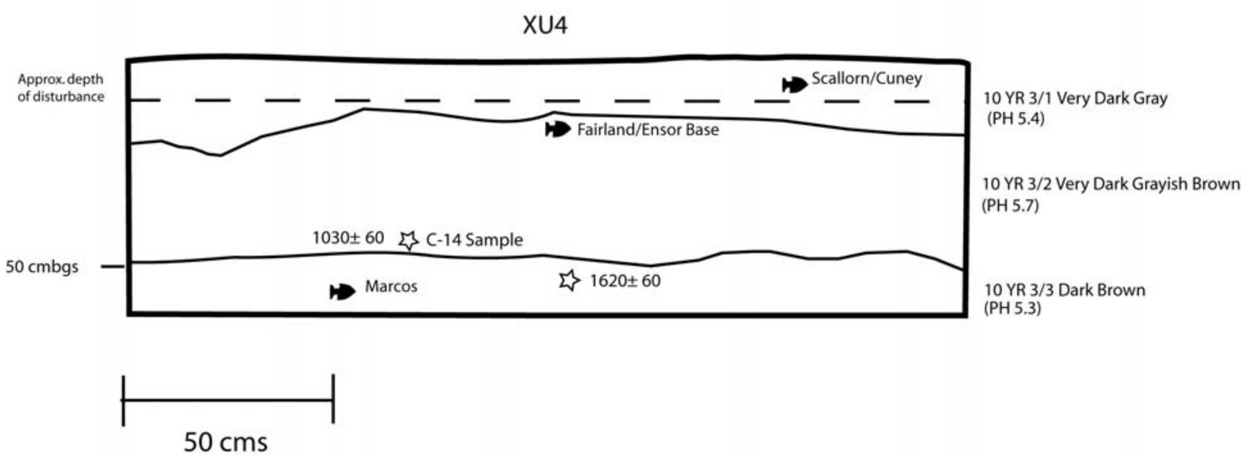

Figure 20. Profile of northeast wall of Excavation Unit 4 (XU4). Adapted from 1982 field school profiles and notes.

Unit 5

Unit 5 was placed adjacent to the northwest wall of XU4 and, in its southern extent, reached a depth of 90 cmbgs. Like XU4, the first 10 cmbgs of excavation Unit 5 (XU5) contains modern debris. Near the base of level 2, at approximately 18 cmbgs, scattered charcoal was noted throughout the unit as well as burnt clay and possible bison bone. In similar context, a Fairland projectile point was recovered between the depths of 10 and 20 cmbgs (**Figure 21**). During excavation of the subsequent level a concentrated hearth feature (F1:XU5/8) was noted comprised of charcoal, somewhat intact burned wood logs, and burned rock. This feature was noted as extending from approximately 21 cmbgs to 39 cmbgs into the following unit level. Seemingly associated with this hearth feature, are two concentrations of clay, approximately 30 centimeters apart from each other. A Scallorn projectile point was recovered between 30-40 cmbgs between these clay conglomerations, lay a large charcoal stain (**Figures 22 and 23**). This feature was later exposed at the same depths in XU8, a 1 x 1 meter unit opened adjacent to the north of XU5. A charcoal sample was collected from this feature at a depth of 30 cmbgs and submitted for carbon dating (UT-5059).

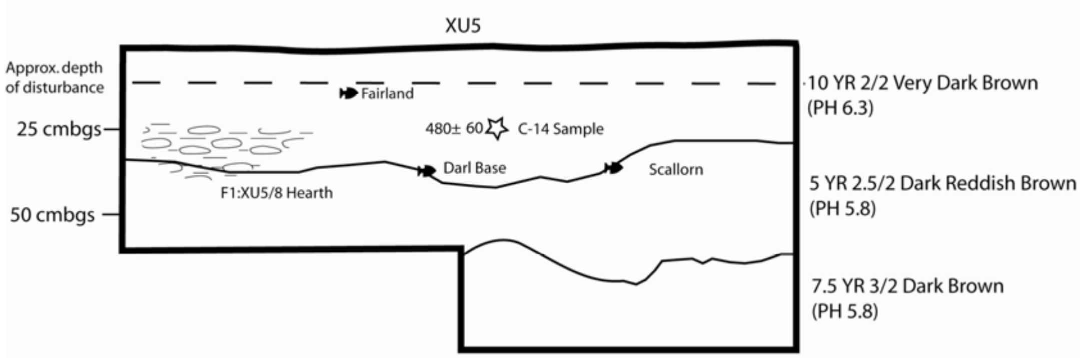

Figure 21. Northeast wall profile of Excavation Unit 8 (XU8). Adapted from 1982 field school profiles and notes.

Figure 22. Plan view photo of Feature 1 in Excavation Units 5 and 8 (F1:XU5/8).

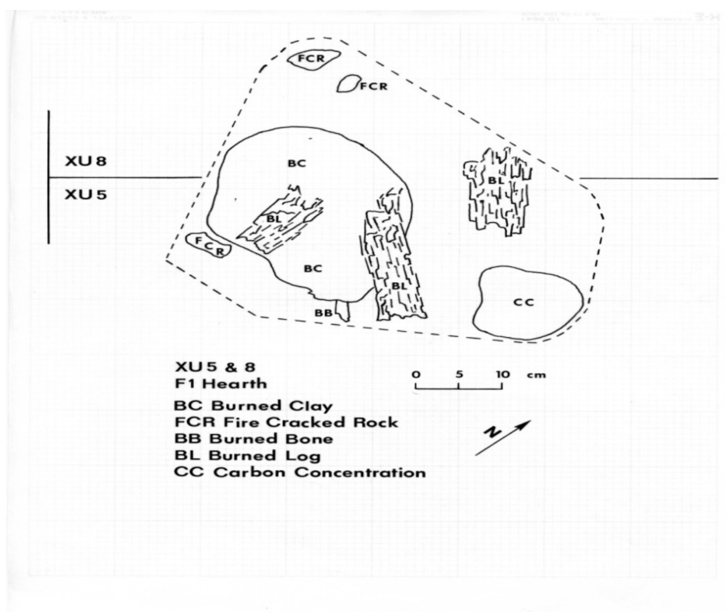

Figure 23. Original plan view sketch of Feature 1 in Unit 5 and Unit 8.

Also recovered within the same unit from depths of 30-40 cmbgs were the proximal halves of a Scallorn and a Darl point and these may well be associated with F1:XU5/8. Below, at approximately 40-50 cmbgs a conglomeration of burned rock was noted as a hearth feature (F2:XU5), although no plan views currently exist. From the 1982 field notes, it appears that over-night torrential rains may have displaced this feature, preventing an accurate rendering during excavation. Subsequent levels below this feature evidence a reduction in both debitage and FCR. Unit 5 was terminated at a depth of 90 cmbgs.

Unit 6

Excavated to a depth of 130 cmbgs, Unit 6 (XU6) is the deepest reaching unit within XB2. In terms of quantity, this XU6 was particularly productive. Mixed in with modern debris, a stem from a Perdiz point was recovered from 0 to 10 cmbgs. From the first seven levels, large amounts of FCR and debitage were noted. Additionally, from the field notes, it appears that bison bone may have been present in level 2. Note worthy tools obtained from the excavation of XU6 include a lithic drill (**Figure 24**) and a bone awl (**Figure 25**), both of which were recovered in level 4 between 30 and 40 cmbgs.

Two features were documented for XU6. The first feature, F1:XU6, is described as a conglomerate of burned rock patterned in an ovoidal manner. These burned rocks where concentrated within the south, west, and east quads of XU6 near the floor (50 cmbgs) of level 5. The second hearth, F2:XU6, is a small, tight circular cluster of large-sized burned rock with associated bone, including what is posited to be a canine tooth, and charcoal concentrated outside of the rock ring located between 60 and 70 cmbgs (**Figure 26**). Charcoal collected from between 70 cmbgs and 80 cmbgs from F2:XU6 was submitted for carbon dating. For XU6, a profile drawing has been made of the southeast wall that displays the general stratigraphy, recovered projectile points and sampled charcoal (**Figure 27**).

Figure 24. Drill fragment recovered in level 4 of XU6.

Figure 25. Bone awl recovered in level 4 of XU6.

Figure 26. Photo of Feature 2 within Excavation Unit 6 (F2:XU6), with trowel pointing north.

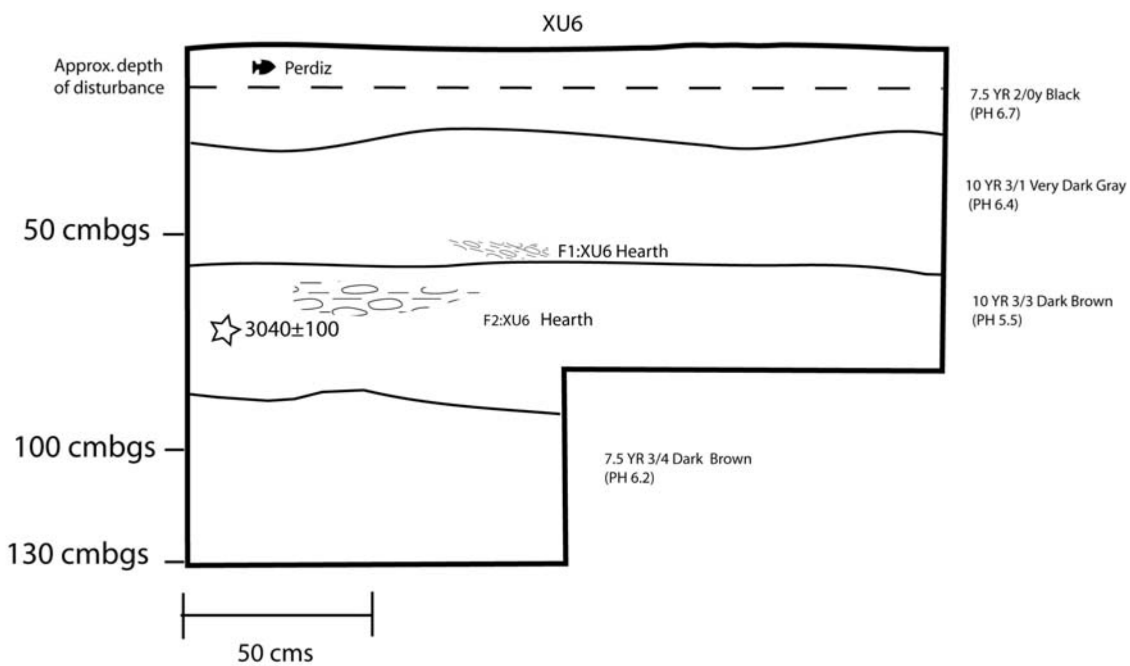

Figure 27. Profile of southwest wall of Excavation Unit 6 (XU6).

Unit 7

In comparison to the other units of XB2, excavation of Unit 7 (XU 7) seemed relatively uneventful. The usual burned rock, lithic debitage and faunal bone was recovered in moderate amounts until level 5, where between 40 and 50 cmbgs, there was a noticeable drop off in counts. A single Ensor point was recovered from level 3 at a depth of 20-30 cmbgs. No features were recorded for XU7 and the stratigraphy is similar to that depicted for XU6 above. Unit 7 was terminated at a depth of 60 cmbgs.

Unit 8

As previously mentioned, Unit 8 (XU8) was opened up to explore the hearth feature (F1:XU5/8) exposed in XU5. The first 10 centimeters of excavated sediment evidenced the ubiquitous modern debris, including golf tees, cigarette butts, pull tabs, and glass shards. As expected, approximately 19 to 20 cmbgs, burned wood from F1:XU5/XU8 was revealed and was noted as extending into level 4 to a depth approaching 40 cmbgs. While there was a noticeable increase in the amount of lithic debitage from level 6 (50-60 cmbgs), XU8 was terminated at 60 cmbgs. Other than F1:XU5/XU8, no features nor diagnostic artifacts were encountered during excavation of this unit.

Excavation Block Three

Excavation Block 3 (XB3) consists of Units 2, 3, 9, and 11. Units 2, 3, and 11 were originally set us as 2 x 2 meter units. Unit 9 was set up as a 1 x 2 meter unit with this unit's southwest wall adjacent to the northeast wall of Unit 2. Two units, XUs 3 and11, were excavated to depths of 50 centimeters below ground surface. Another, XU9, was excavated to 60 centimeters, while XU2 was terminated at 100 cmbgs. All levels throughout XB2 were excavated in 10 cm levels. While modern debris was occasionally noted through to the second level of this excavation block, much like XB1 and XB2, these intrusions are largely confined to within the first 10 centimeters below surface level. Within the first level of Unit 3, an abundant amount of modern land fill gravel was noted, with its presence attributed to the presence of a water faucet located 1 meter north of this excavation block.

Unit 2

Measuring 2 x 2 meters in width, Excavation Unit 2 (XU2) is located on the southwestern extent of XB2. Below the zone of modern debris, between 10 and 20 cmbgs of level 2, large numbers of lithic debitage was recovered along with pot sherds, two projectile point tips and a Young variant arrow point. Artifact density was consistently high through levels 3-6 with both an Ensor point and Marcos (no photo or specimen available) recovered between 30-40 cmbgs, as well as an apparent base of a Bulverde point from 80-90 cmbgs (**Figure 28**). Two burned rock features were encountered in XU2. The first feature (F1:XU2) was noted during excavation of level 6 as a large concentration of burned rock with an associated sizable burned log (**Figure 29**). Charcoal collected from this area, at a depth between 50 cmbgs and 60 cmbgs, was submitted for carbon dating (Beta-9497). Also, providing a chronological marker for F1:XU2, a Pedernales point was recovered from a depth of between 40-50 cmbgs in this unit. The second burned rock feature (2:XU2) extends from approximately just below 60 cmbgs to 75 cmbgs (**Figure 30**). Both of these burned rock features were concentrated along the western extent of XU2 and could in fact be a single feature or represent an opportunistic recycling event Groundstone was recovered from 60 to 70 cmbgs and may be associated with F2:XU2.

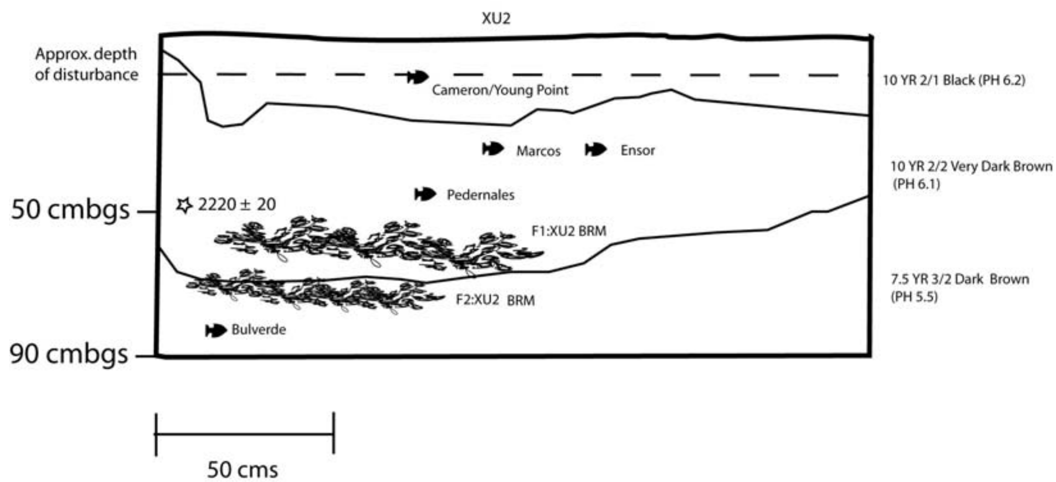

Figure 28. Profile of west wall of Unit 2. Adapted from the 1982 field notes and profiles.


Figure 29. Feature 1 in XU2 (F1:XU2), burned rock, with trowel pointing north.

Figure 30. Top of Feature 2 (F2 :XU2), burned rock in level 7.

Unit 3

Excavation Unit 3 (XU3) was placed adjacent to the northwest wall of XU2. What was originally described as a “bunt red clay hearth with some charcoal” during excavation was observed in XU3 at a depth of 20 cmbgs, measuring approximately 30 cm x 90 cm across (field notes 1982). Later, it was determined that this area was, in fact, a ceramic production area (F1:XU3/XU9). This determination was aided by the recovery of a palm sized clay “chunk” that had been tempered with shell. Based on color (tan, gray, and red) three different types of clay are present within this production area. This feature extends beyond the northeast wall of XU3 into XU9 (**Figure 31**). A single charcoal sample was collected from level 3 at a depth between 20 and 30 cmbgs and was submitted for carbon dating.

Two projectile points were recovered in level 2 from depths ranging between 10 cmbgs and 20 cmbgs: a Perdiz arrow point with missing stems and a Darl Point. A third projectile point, a Fairland was provenienced at 20 cmbgs. Below the hearth feature a Golondrina point was recovered at a depth of 33.5 cmbgs. This find, a point typically associated with the Paleoindian period, is problematic. It's inclusion in level 4 could be due to disturbance resulting from imported fill associated with underground water pipe construction and maintenance, a manuport recycling event from another locale, or bioturbation. Unit 3 was terminated at a depth of 50 cmbgs.

Unit 9

Excavation Unit 9 (XU9) was opened up adjacent to the northeast corner of XU3 in order to fully expose the ceramic production area encountered in XU3 (F1:XU3/XU9). The first 7 centimeters of this level have been documented as compact fill dirt that contained a large amount of construction gravel. While moving vertically towards this feature, a Perdiz projectile point was recovered in level 2 from a depth between 10 cmbgs and 20 cmbgs. Below this, from level 3 at 20 to 30 cmbgs, an Ensor/Frio variant (cf.) point was recovered. Burnt clay was encountered within level 4 from between 30 and 40 cmbgs and this was determined to be an extension of F1:XU3.

Below the extension of F1:XU3/XU9 in Unit 9, another feature was discovered in level 5 (F1:XU9). This feature is described as a circular pattern of burnt red clay and was noted as being a possible post hole (field notes). This feature extended into level six, the last level excavated within XU9, and terminated at a depth between 50 cmbgs and 60 cmbgs (plan views detailing this feature are unavailable).

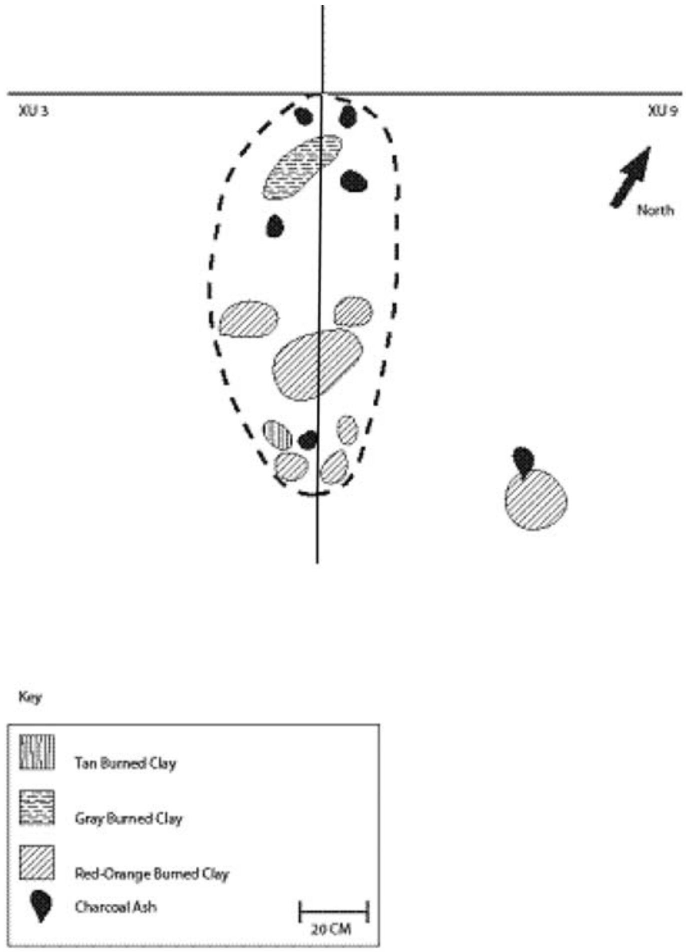

Figure 31. Feature 1 in Units 3 and 9 (F1:XU3/XU9). Adapted from Garber (1982).

Located adjacent to the southeast wall of XU9 and the northeast wall of XU2, Excavation Unit 11 (XU11) extends to a depth of 50 cmbgs. In addition to the typical modern debris (cigarette butts, ring tabs, and golf tees) the first 5 cm of excavated sediment contained gravels that are similar to the construction fill encountered during the excavation of XU9. A single Fairland point was recovered within level one at a depth of 0 cmbgs to 10 cmbgs. What is described in the field notes as a possible bison tooth was recovered during the excavation of level 3 and was point plotted at a depth of 29 cmbgs. Level 4 contained large amounts of charcoal ranging from “marble to golf ball sized” and fire cracked rock concentrated along the south side of the unit. This hearth feature (F1:XU11) extended from approximately 35 to 50 cmbgs. A charcoal sample was collected at 50 cmbgs and was submitted for carbon dating (UT-5057). Excavation Unit 11 was terminated at 50 cmbgs. No profile is available for XU11.

Excavation Blocks from the 1983 Field Schools

Data from two excavation units (XU's 13 and 14) dug during the 1983 field school year were selected for inclusion to augment the 1982 data in order to bolster the interpretations. Reasons being: Both XU 13 and 14 were excavated to great depths (310 centimeters and 220 centimeters respectively) and provide data on the Middle Archaic occupations of Tee-Box Six. Additionally, two charcoal samples taken from XU13 were submitted for carbon dating. Finally, a number of the projectile points still remaining with the collection were recovered from these units. While there is no map that depicts the exact location of these units, an inspection of slide photos taken during the field school indicates that they were excavated in the immediate vicinity of XB2 and XB3.

Unit 13

Excavated to a depth of 310 cmbgs, XU13 represents the deepest explorations undertaken during either the 1982 or 1983 field schools. This unit was originally begun as 1 x2 meter unit. However, upon completion of the excavation of the third level (30 cmbgs), XU13 was expanded to the southeast as a 2 x 2 meter unit. During excavation of the first ten centimeters modern disturbance was noted by the presence of golf tees, pull tabs, cigarette butts, and glass. No modern debris was noted during the excavation of level 2 (10-20 cmbgs). Pottery sherds were recovered from this level. During the excavation of level 3 (20-30 cmbgs), a large area of charcoal was discovered, beginning at an approximate depth of 25 cmbgs, from northwest corner of the unit. A sample was collected from this concentration and submitted for carbon dating (UT-5058). Although not considered a feature during excavation, this charcoal concentration was observed to extend into level 4, although to what exact depth is un-ascertainable. A Frio projectile point was recovered from level 4 at a depth between 30-40 cmbgs. During excavation of level 5(40-50 cmbgs), an increase in FCR amounts was observed and it was concluded that this was the beginning of a hearth feature (F1:XU6) which was fully exposed within level 6 at a depth that extended in some areas to 58 cmbgs. A second feature, a BRM, was encountered in XU13 during the excavation extending from approximately 80-100 cmbgs. During recordation it was posited that this feature (F2:XU6) is a continued expression of the BRM recorded at similar depth from other units. Charcoal collected from this feature at 93 cmbgs was submitted for carbon dating (Beta-9500). Between F1:XU6 and F2:XU6 the base of a Marshall projectile point was recovered in level 7 at a depth of 60-70 cmbgs. In level 19 (250-270 cmbgs) the water table was first noted. Because of the difficulties associated with excavating below the water table, XU13 was terminated at 310 cmbgs. No profiles of XU13 are available for reconstruction.

Unit 14

The first level (0-10 cmbgs) of Excavation Unit 14 (XU14) contains similar modern debris documented for the entirety of 41HY160. Two projectile points were recovered within level 2 at depths of between 10-20 cmbgs: the base of a Perdiz arrow point and an Alba arrow point. A single feature (F1:XU14), a burned rock midden, was encountered between depths of 80 and 100 cmbgs and is associated with the burned rock that is pervasive in other units throughout 41HY160 at corresponding depths. After 90-100 cmbgs, the field notes for XU14 report a continued decline in the number of recovered artifacts recovered. From 140-220 cmbgs, excavated levels are nearly sterile. Excavation of XU14 was halted at 220 cmbgs (**Figure 32**).

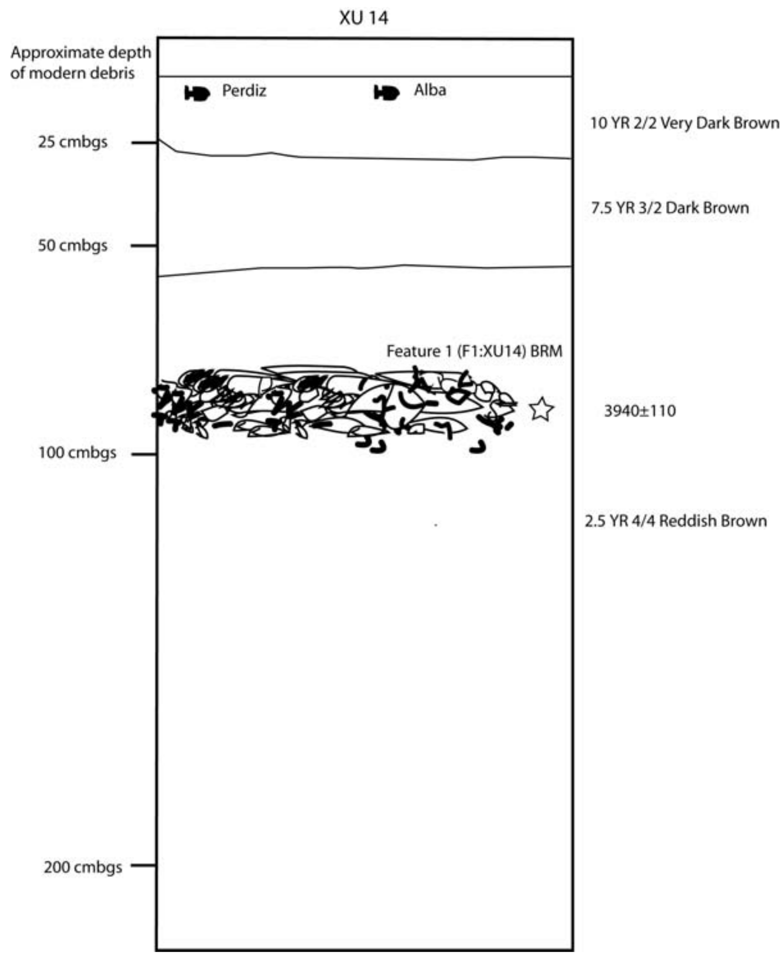

Figure 32. Profile of the south wall of Unit 14. Adapted from field school notes and profiles.

CHAPTER 8

A DEPOSITIONAL MODEL FOR 41HY160

Dating the Site through Radiocarbon Assays

During the 1982 field season, the excavation crew recovered numerous samples of charcoal. Nine of these samples were selected for analysis; five were sent to the University of Texas at Austin Radiocarbon Laboratory, and four were sent to Beta-Analytic in Coral Gables, Florida. While a small portion of these samples have a three dimensional provenience, it seems the bulk of these samples were collected during screening, or in-situ but without provenience. The processing of these charcoal submissions predates the utilization of accelerator mass spectrometry (AMS) dating and, by necessity, submitted samples would have been large in size. In most cases, a culling of old notes, sketches and photos was all that was required to place these samples within centimeters of their likely original position. Commenting on their context, Garber (n.d.) noted that while “the carbon samples were collected from several areas of the site…there were no stratigraphic inversions.” An indication that the samples were in stratigraphic order and that the deposits at 41HY160 are relatively undisturbed. It is worth mentioning that while, by 1982, several sites in the San Marcos area had been investigated these dates were the first attempt to provide a temporal context for cultural deposits beyond those assigned by projectile point chronology.

Undoubtedly, this initial attempt at carbon dating at 41HY160 was a big step forward in establishing the site chronology for 41HY160, although by design it was incomplete. The original intent was to establish a chronology for the upper depositional units; in some areas excavations reached 285 centimeters below ground, while the deepest carbon sample submitted for dating following the 1982 and 1983 field schools was obtained at a depth of approximately 100 centimeters. Dating of the older deposits was left to subsequent research and investigations. Following, two additional samples that were taken during the 1982 field school were submitted to the Center for Applied Isotope Studies at the University of Georgia in 2010 by the author of this thesis. The first carbon sample was collected from level 17 in Unit 1, at an approximate depth of 175 centimeters. The second, from the very same unit, was obtained in level 20 at a depth of 245 centimeters. There is no carbon samples recovered during the 1982 and 1983 excavations that were lower than the latter. Together, these dates are presented in the table below along with Garber's carbon dates (**Table 4**).

Table 4. Carbon Dates from Garber (n.d) and Haefner (this volume).

Sample Number	XB	Unit	Depth	Adjusted Depth	Radiocarbon Years BP	Material	Association
UT5058	n/a	13	20-30	25	1210±50	Charcoal	NFC
Beta-9498	3	3	20-30	25	2240±100	Charcoal	NFC
UT5059	3	5	30	30	480±60	Charcoal	Feature 1 XU5
UT5060	2	4	40-50	45	1030±60	Charcoal	NFC
UT5057	3	11	50	50	3400±50	Charcoal	Feature 1 XU11
UT5061	2	4	50-60	55	1620±60	Charcoal	Feature 1 XU4
Beta-9497	3	2	50-60	55	2220±70	Charcoal	Feature 1 XU2
Beta-9499	2	6	70-80	75	3040±100	Charcoal	NFC
Beta-9500	n/a	13	90-100	95	3940±110	Charcoal	NFC
UGAMS#06833	1	1	185-205	195	4310±30	Charcoal	NFC
UGAMS#06834	1	1	245-265	235	5430±30	Charcoal	NFC

Arriving at a Chronostratigraphical Model for 41HY160

Spurred by years of advancements into the reconstruction of global climate variability, there is an increasing interest in the establishment of regional, local, and site-specific climate models. Specifically, an avenue to this end has resulted in the creation of high-precision age based models for sedimentary sequences using radiocarbon dates (Blockley et al. 2007). While there are differing approaches to these models, Blockley et al. (2007) have demonstrated that by utilizing a range of Bayesian modeling, chronological resolution is achievable on the centennial scale in many scenarios. If done by hand calculation, the mathematics of the aforementioned approach would be well beyond the scope of this thesis. Fortuitously, the OxCal (v4.0) program provides all the necessary models imbedded, and, with careful manipulation, chronostratigraphical model of moderate integrity is possible for 41HY160.

An examination of stratigraphical associations between returned carbon dates and accepted dates for projectile points from Collins (1995) indicates that a few are likely erroneous. At 20-30 cmbgs, Beta-9498, with a calibrated date of 1948-2695 B.P. is slightly earlier then an associated Marcos projectile point and too early for an associated Ensor point (both recovered from the same block at 25-30 cmbgs). Because of this, Beta-9498 is not selected for use in the chronostratigraphical model. Also, UT5058 taken from a depth of 20-30 cmbgs also seems erroneous when compared to dates and depths for UT5059 and UT5060. As with Beta-9498, contamination is suspected and this date is rejected for utilization with the deposition model.

Another carbon sample, UT5057, taken from a burned rock midden feature is marginally incongruous with the others. However, dates of 3827-3485 cal B.P., at a depth of 50 cmbgs, are not entirely out-of-line with the accepted range for a Pedernales point recovered from the same block between depths of 40-50 cmbgs. Here it is posited that UT5057 is returning an older date because rocks used in the BRM construction were recycled from earlier hearth and BRM features. Because of this possibility, sample UT5057 was not selected for use in creating the depositional model. Thusly, from the original dated carbon samples collected during the 1982 and 1983 field school years, six dates were selected for use in model construction. To this number, were added data regarding the two samples submitted by the author in 2010, and four from Nordt (2010) and one from Goeltz (1999) (**Table 5**).

Table 5. AMS Radiocarbon ages from stratigraphic cores and test units from the Sink Creek area. Adopted from Nordt (2010) and Goeltz (1999).

Sample Number	Core	Test Unit	Depth	Adjusted Depth	Radiocarbon Years BP	Material
CAMS-85781	E	6	70-80	75	3550±40	Charcoal
CAMS-85782	C	4	170-180	175	4325±40	Charcoal
CAMS-85778	O	n/a	585-597	591	5975±40	Wood
CAMS-85776	F	n/a	700-724	712	7365±40	Plant Fragment
Beta-132062	D	n/a	874-884	879	11470±100	Bulk Humate

Following Bronk Ramsey (2007), with the intent of finding a set of possible ages for each depth point mathematically, these 13 carbon samples were entered as calibrated date distributions into an OxCal (v4.0) P-*sequence* deposition model. The *P-sequence* deposition model was favored because it is expected that the deposition process at Sink Creek has been random with rates of sediment accumulation variable throughout time.

Within the model, the entered radiocarbon dates represent known dating information, and, in Bayesian terms, represent the models *likelihoods* (Ramsey 2007:43). The Oxcal (v4.0) output for the resulting deposition model is presented below as **Figure 33**.

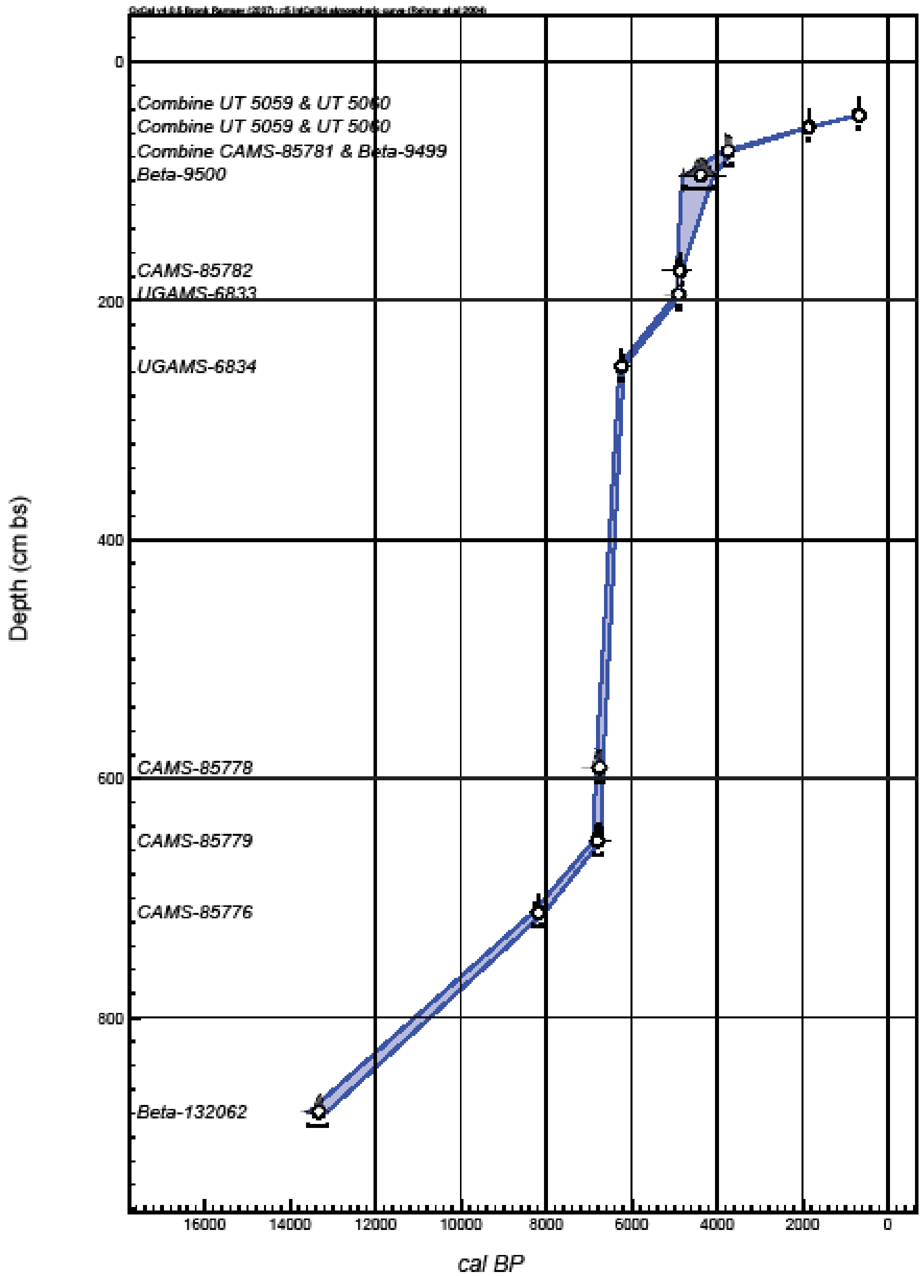

Figure 33. Deposition model generated in OxCal (v4.0) for 41HY160.

According to the depth plot, from 13,350 B.P. to 8150 B.P. the deposition rate for the Sink Creek area was relatively moderate, with approximately 230 centimeters of sediment accumulating over a span of 5200 years, an average rate of .044 centimeters per year (cmpy) or nearly 4.5 centimeters in a hundred-year period. From 8150 B.P. to 6200 B.P., the deposition rate spikes dramatically with approximately 400 centimeters of sediment accumulating over a 1950 year period, an average rate of .21 cmpy, or 21 centimeters per hundred year period, over 4.6 times that of the preceding accumulation rate. Following, for a 1200 year period, until approximately 5000 B.P., the deposition rate returns to a moderate rate of 0.05 cmpy, accumulating 60 centimeters over that span. For the next 600 years with 100 centimeters of accumulated sediment, this rate increases to .16 cmpy. According to the deposition model, after 4400 B.P., this rate slows to .014 cmpy (or 1.4 centimeters in a hundred year period) until approximately 400 B.P., the most temporally recent plotted sample. While more data would allow for an increased resolution of this model, by plotting the *x* and *y* intercepts, we can estimate temporal periods for central Texas by depth. These deposition rates are plotted against dates provided for the cultural periods accepted for Central Texas and presented below in **Table 6**.

Table 6. Depth by Archaeological Period.

Archaeological Period	Depth (cmbgs)
Late Prehistoric II	0-20
Late Prehistoric I	20-30
Late Archaic II	30-60
Late Archaic I	60-90
Middle Archaic	90-245
Early Archaic	245-660

When compared to the temporal periods provided by projectile points for the site examined by the author (**Table 7**), the depths appear to be in well in line with known projectile point chronology with the exception of the Late Prehistoric, which has a noticeable overlap of Late Archaic points with both Late Prehistoric and the depositional model generated in OxCal (v4.0). There appears to be a palimpsest of cultural materials at 41HY160 during the Late Archaic II/Late Prehistoric transition period, with minimal sediment deposition possibly lasting through much of the Late Prehistoric II period. This observation is in-line with Nordt's (2010) description of Stratigraphic Unit E for the San Marcos Springs locale (see Chapter 4).

Table 7. Projectile points identified by author from original specimen or photo.

Point Type	Excavation Unit	Level	Depth (cmbgs)	Temporal Period	Approx. Radiocarbon Years B.P.	Agreement
Perdiz Stem	6	1	0-10	Late Prehistoric II	260-600	Good
Scallorn/Cuney	4	1	0-10	Late Prehistoric I	600-1200	Moderate
Perdiz	14	2	10-20	Late Prehistoric II	260-600	Moderate
Perdiz	9	2	10-20	Late Prehistoric II	260-600	Moderate
Alba	14	2	10-20	Late Prehistoric	260-1200	Moderate
Perdiz Base	3	2	10-20	Late Prehistoric	260-1200	Moderate
Darl	3	2	10-20	Late Archaic	1200-1300	Moderate
Fairland	5	2	10-20	Late Archaic	1200-1500	Moderate
Darl	10	2	20	Late Archaic	1200-1300	Moderate
Fairland	3	2	20	Late Archaic	1300-1500	Moderate
Ensor	7	3	20-30	Late Archaic	1300-1500	Moderate
Fairland/Ensor Base	4	3	20-30	Late Archaic	1300-1500	Moderate
Ensor/Frio	9	3	20-30	Late Archaic	1100-1300	Good
Castroville	1	3	25-35	Late Archaic	1600-2100	Poor
Scallorn	5	4	30-40	Late Prehistoric I	600-1200	Good
Darl	5	4	30-40	Late Archaic	1200-1300	Moderate
Marcos	4	6	50-60	Late Archaic	1500-2100	Good
Marshall	13	7	60-70	Late Archaic	6000-7000	Moderate
Bulverde	10	9	85-95	Late Archaic	3200-4000	Good
Nolan	1	10	95-105	Middle Archaic	4000-4500	Good
Travis	1	19	205-225	Middle Archaic	4000-4500	Moderate

Conclusion

While there are obvious resolution issues with the deposition model that need to be refined for future work, the deposition model provides an initial, if still rudimentary, model that allows for the contextualization of the archeological deposits at 41HY160. Simplified, rates for sediment accumulation are moderate for the entirety of the Paleoindian period up into the first quarter of the Early Archaic when accumulation rates increase exponentially to the end of the Early Archaic. From the beginning to the middle of the Middle Archaic, accumulation rates return to a more moderate rate and then spike until the beginning of the Late Archaic. At this point, rates for sediment accumulation slow considerably. This depositional model indicates that, at 41HY160, two temporal periods provide highly favorable conditions to contain isolable components of high integrity: the entirety of the Early Archaic (8800-6600 B.P.) and a portion of the first half of the Middle Archaic (5000-4400 B.P.). Accordingly, two periods exhibit potential to house isolable components of moderate integrity: the Paleoindian period (11,500-8800 B.P.) and the latter half of the Middle Archaic (6000-5000 B.P.). By identifying the time periods of high and moderate integrity, the forthcoming diachronic comparison of technological organization at 41HY160 is bolstered a great deal.

CHAPTER 9

LITHIC ANALYSIS

Based on the depositional model proposed for 41HY160 in Chapter 8, radiocarbon dates and chronological assignment of projectile points, excavation units (XUs) were organized into analytical units (AUs) using their corresponding temporal period. In this case, there are AUs representing the Early Archaic, Middle Archaic, Late Archaic I, Late Archaic II, Late Prehistoric I, and the Late Prehistoric II-Historic (**Appendix B**), the last being a hybrid appellate due to the posited palimpsest/disturbed context of this assemblage as discussed in previous chapters . It is cautioned that the latter is a slight misnomer as both evidence and logic suggest that this AU has witnessed considerable post-depositional disturbance and, most probably, contains artifacts dating to the advent of the Historic Period. Nevertheless, further temporal partitioning of the Late Prehistoric II-Historic AU is currently impossible with the data at hand and the appellate will have to suffice.

Initially, lithics were organized according to the methodology presented in Chapter 8. Following, analysis focused on the distribution of flake type by AUs and their represented temporal period as defined by the chronostratigraphical model presented in Chapter 8 (**Table 8**). After debitage analysis and interpretation, the same was done for cores, then bifaces, and finally, flakes tools. To finish, interpretations were consolidated for examined tool types and debitage and used collectively to posit changes in mobility and site use of the inhabitants of 41HY160 over the wide expanse of time.

Table 8. Time Period by depth.

Archaeological Period	Depth (cmbgs)
Late Prehistoric II-Historic	0-20
Late Prehistoric I	20-30
Late Archaic II	30-60
Late Archaic I	60-90
Middle Archaic	90-245
Early Archaic	245-660

Early Archaic

With only 212 specimens, the debitage assemblage assigned to the Early Archaic time period is, by far, the least robust. Because of this, all of these specimens were selected for analysis. Thirty-two percent (*n*=67) of these specimens were categorized as debris, thirty-six percent (*n*=78) as flake fragments, thirteen percent as broken flakes (*n*=27), and nineteen percent (*n*=40) as complete flakes. Eleven percent (*n*=3) of the specimens organized into the broken flake category were noted as having a lipped platform, while twenty percent (*n*=8) of the complete flakes were noted as being lipped. **Table 9**, below, presents this data when further organized by size-category.

Table 9. Early Archaic debitage sample.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	>25	12	8	5	12	0	1
	12.5-25	28	43	14	22	1	6
	6.3-12.5	27	27	8	6	2	1
	3.37-6.3	0	0	0	0	0	0
Totals:		67	78	27	40	3	8

Middle Archaic

The representative sample for the Middle Archaic debitage assemblage totals 1290 specimens (**Table 10**). Of these, debris accounts for 27-percent (*n*=355) of the total amount, flake fragments account for 47-percent (*n*=606), broken flakes, nine-percent (*n*=116), and complete flakes (*n*=213), 17-percent. Further, of the broken flakes, 33-percent (*n*=38) were recorded has having lipped platforms. Regarding complete flakes, 30-percent (*n*=65) of the specimens were noted as being lipped.

Table 10. Middle Archaic debitage sample.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	>25	43	63	19	51	4	13
	12.5-25	218	322	63	124	19	39
	6.3-12.5	273	219	34	38	15	13
	3.37-6.3	1	2	0	0	0	0
Totals:		535	606	116	213	38	65

Late Archaic I

For the Late Archaic I sub-period, 1409 specimens of debitage were randomly selected for analysis (**Table 11**). Combining all size grades in order to compare the percentages of flake types we note that debris (*n*=438) accounts for 31-percent of the sample set, flake fragments (*n*=578) account for 41-precent, broken flakes (*n*=111), eight-percent, and complete flakes (*n*= 282), 20-percent. Thirty-two percent (*n*=35) of the specimens assigned to the broken flake category were noted as having a lipped platform, as were 36-percent (*n*=102) of the complete flakes.

Table 11. Late Archaic I flakes, all sizes combined.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	>25	37	80	24	73	5	21
	12.5-25	273	372	68	165	22	63
	6.3-12.5	128	126	19	44	8	18
	3.37-6.3	0	0	0	0	0	0
Totals:		438	578	111	282	35	102

Late Archaic II

For the Late Archaic II sub-period, 1362 flakes were analyzed (**Table 12**). Combining all size grades in order to compare the percentages of flake types it is noted that flake fragments (*n*=611) account for 45-precent of the Late Archaic II sample set. Debris (*n*=377) accounts for 28-percent, complete flakes (*n*=290) 21-percent of the assemblage, with broken flakes (*n*=111) comprising the remaining six-percent**.** Within the broken flake category, 26-percent (*n*=22) of the 84 specimens were noted as having lipped platforms. Within the complete flake category, 37-percent (*n*=107) of specimens have lipped platforms.

Table 12. Late Archaic II flakes all sizes combined.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	>25	22	83	26	81	7	34
	12.5-25	203	344	44	157	11	55
	6.3-12.5	147	183	14	52	4	18
	3.37-6.3	5	1	0	0	0	0
Totals:		377	611	84	290	22	107

Late Prehistoric I

The representative sample for the Late Prehistoric I debitage assemblage totals 1148 specimens. Of these, debris accounts for 26-percent (*n*=293) of the total amount, flake fragments, 42-percent (*n*=482), broken flakes, eight-percent (*n*=93), and complete flakes (*n*=213), 24-percent. Twenty-two percent (*n*=20) of the specimens organized into the broken flake category were noted as having a lipped platform, while 24-percent (*n*=68) of the complete flakes were noted as being lipped. **Table 13**, below, presents these data when further organized by size-category.

Table 13. Late Prehistoric I flakes all sizes combined.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	>25	24	60	25	42	6	9
	12.5-25	158	264	55	183	12	40
	6.3-12.5	110	158	13	55	2	19
	3.37-6.3	1	0	0	0	0	0
Totals:		293	482	93	280	20	68

Late Prehistoric II-Historic

For the Late Prehistoric II-Historic period, 1929 specimens of debitage were randomly selected for analysis**.** Following flake-type classification it is noted that debris (*n*=695) accounts for 36-percent of the sample set, flake fragments (*n*=727) account for 38-precent, broken flakes (*n*=159), eight-percent, and complete flakes (*n*= 348), 18-percent. Thirty-one percent (*n*=49) of the specimens assigned to the broken flake category were noted as having a lipped platform, as were 33-percent (*n*= 102) of the complete flakes. Below, **Table 14** presents this data by size-category.

Table 14. Late Prehistoric II-Historic flakes all sizes combined.

	Size (mm)	Debris	Fragment	Broken	Complete	Lipped, Broken	Lipped, Complete
	25	127	164	46	104	9	35
	12.5-25	191	270	63	138	23	38
	6.3-12.5	371	291	50	106	17	42
	3.37-6.3	6	2	0	0	0	0
Totals:		695	727	159	348	49	115

Debitage Statistical Analysis

In order to compare variation in technological organization between temporal periods, as evidenced through debitage assemblages, two statistical methods were utilized: the Chi-Square Test-for-Independence of variables and adjusted residuals. Initially, Chi-Square analysis was chosen to ascertain if significant differences existed between the debitage assemblages associated with the Early Archaic, Middle Archaic, Late Archaic I, Late Archaic II, Late Prehistoric I and Late Prehistoric II-Historic temporal periods utilizing totals for the four flake type categories of debris, fragment, broken, and complete as presented in **Tables 9-14**, above. The Chi-Square Test-for-Independence was calculated in Excel, with critical values determined at the five-percent (0.05) confidence level. The result of the Chi-Square Test-for-Independence was: X^2= 193.83, with α=.05, df=23, and cv=35.172. This result indicates that there is significant variation in the debitage assemblages when partitioned and analyzed by time period.

While successful in illuminating variation, the Chi-Square Test-for-Independence is unable to identify within which flake category the noted significant differences occur. To do so, an adjusted residual table was generated in Excel for the entire flake type data set. At a five-percent confidence level, calculated adjusted residuals above 1.96 and below -

1.96 are considered as varying significantly from expected values. The results of this analysis are presented below in **Table 15** and in **Figure 34**.

Table 15: Adjusted residuals by flake type, all time periods**.**

	Debris	Fragment	Broken	Complete
EA	-0.11	-1.24	2.69	-0.16
MA	4.08	0.26	0.09	-5.21
LAI	-0.76	0.08	0.07	0.76
LAII	-3.72	3.26	-2.53	2.06
LPI	-5.06	0.79	0.36	4.75
LPII-H	4.47	-3.36	0.77	-1.62

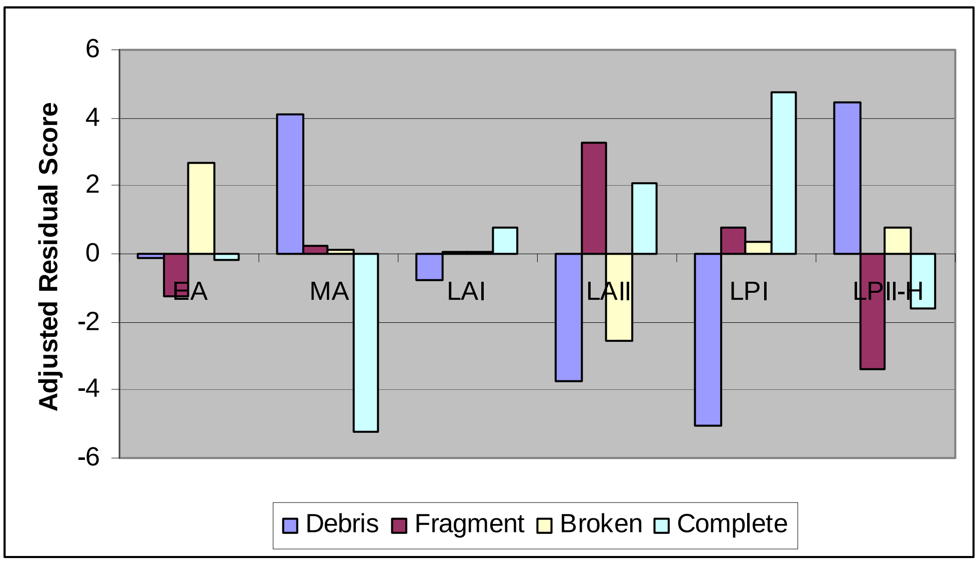

Figure 34. Adjusted residual distribution of flake type by temporal period**.**

With an adjusted residual of 2.69, the Early Archaic flake type assemblage has a significant high percentage of broken flakes and a near-significant low percentage of flake fragments. The Middle Archaic assemblage has a significantly higher than expected percentage of debris (z score= 4.08) and a lower than expected percentage of complete flakes (z score= -5.21). In comparison, the Late Archaic II assemblage exhibits significantly low representative numbers of debris and broken flakes (z scores= -3.72 and -2.53, respectively) and significant high numbers of flake fragments and complete flakes (z scores= 3.26 and 2.06 respectively). For the Late Prehistoric I there is a significant low representation of debris (-5.06) and a high represented amount of complete flakes (4.75). With a z score =4.47, the Late Prehistoric II-Historic assemblage displays high numbers of debris but a significant low amount of flake fragments (z score= -3.36).

When the debitage assemblages are further partitioned by size grade (**Table 16,** below), it becomes evident that the significant variation within the Early Archaic broken flake category occurs within the ≤25mm size category. Variation for the Middle Archaic is noted as occurring in the ≤25mm debris size category, the >25mm flake fragment category, the >25mm broken flake category, and within both complete flake categories. While no significant variation was highlighted for the Late Archaic I debitage assemblage when adjusted residuals were calculated without the compliment of sizing, **Table 16** illustrates that significant variation does indeed occur within the >25mm debris category. Significant variation is noted in both size grades for the debris category, the ≤25mm flake fragment category, the ≤25mm broken flake category, and the ≤25mm complete flake category. For the Early Archaic, variation is noted within both debris categories, and within both complete flake categories. Of interest, a high significant number was noted within the ≤25mm complete flake category and a low significant number was noted for the >25mm complete flake category. A very high level of variation is observed for the >25mm debris category for the Late Prehistoric II-Historic assemblage. Further, for the same assemblage, there are significant variation noted for the ≤25mm flake fragment category, the >25mm flake fragment category, and the ≤25mm complete flake category.

Table 16: Adjusted residuals by flake type and size grade, all time periods.

	≤25mm Debris	>25mm Debris	≤25mm Fragment	>25mm Fragment	≤25mm Broken	>25mm Broken	≤25mm Complete	>25mm Complete
EA	-0.81	1.72	-0.71	-1.14	2.8	0.47	-0.53	0.58
MA	4.79	-1.38	1.89	-3.23	1.25	-1.97	-4.2	-2.7
LA I	0.04	-2.02	0.45	-0.73	0.47	-0.67	0.42	0.7
LA II	-2.13	-4.21	3.37	0	-2.86	-0.05	1.01	2.14
LP I	-4.07	-2.85	1.49	-1.34	0.02	0.68	6.54	-2
LP II-Hist.	1.16	8.45	-6.04	5.12	-0.11	1.7	-2.64	1.36

Table 17: Adjusted residuals by platform type and size grade, broken and complete flakes combined.

	≤25mm Cortical	>25mm Cortical	≤25mm Flat	>25mm Flat	≤25mm Complex	>25mm Complex	≤25mm Abraded	>25mm Abraded
EA	-1.2	2.65	0.87	0.76	0.64	-0.49	-0.79	-1.94
MA	0.35	-0.6	-0.21	-0.5	2.65	-0.08	-0.75	-1.68
LA I	2.22	0.67	1.8	-0.28	-0.71	0.22	0.3	-0.5
LA II	2.88	0.88	-0.83	-1.02	-1.49	2.44	-1.31	1.3
LP I	5.68	-1.36	-0.24	-0.79	-1.61	-1.68	1.79	-2.33
LP II-Hist.	-5.43	-0.76	-0.87	1.99	0.9	-0.61	0.26	3.6

In addition to sorting flakes by size and type, complete and broken flakes were further organized by platform type (cortical, flat, complex, and abraded). A contingency table with calculated adjusted residuals was created from this data in order to highlight significant variation (**Table 17**). Again, at a five-percent confidence level, calculated adjusted residuals above and below 1.96 are considered as varying significantly from expected values. For platform type, significant variation is noted in ten instances: cortical platforms >25mm in size from the Early Archaic, complex platforms ≤25mm in size from the Middle Archaic, cortical platforms <25mm in size dated to the Late Archaic I, cortical platforms <25mm in size and complex platforms >25mm in size from the Late Archaic II, cortical platforms <25mm in size and abraded platforms >25mm in size from the Late Prehistoric I, and, dating to the Late Prehistoric II-Historic, cortical platforms <25mm in size, flat platforms >25mm in size and abraded platforms >25mm in size.

During sorting, both broken and complete flakes were examined for the presence of platform lipping, an oft used indicator of soft-hammer percussion. The results are presented below in **Table 18** by time period and flake type and in **Figure 35** by time period and flake type, as well as by flake type combined (which, ultimately maybe of more utility). As depicted in **Figure 35**, the presence of lipped platforms, as a percentage of each time period's debitage assemblage, increases from the Early Archaic to the Late Archaic I while the represented amounts from the Late Archaic I (35%) and the Late Archaic II (34%) are nearly identical. During the Late Prehistoric I, the combined percentage lipped platforms declines to 27-percent, increasing to 34-percent during the Late Prehistoric II-Historic.

Table 18: Lip presence by amount and percentage on broken and complete flakes.

	Broken Flake Total	Lipped Amount	Percentage	Complete Flake Total	Lipped Amount	Percentage
EA	27	3	11%	40	12	30%
MA	116	38	33%	213	65	30%
LA I	111	35	32%	282	102	36%
LA II	84	22	26%	290	107	37%
LP I	44	20	45%	280	68	24%
LP II-Hist.	159	49	31%	348	115	33%

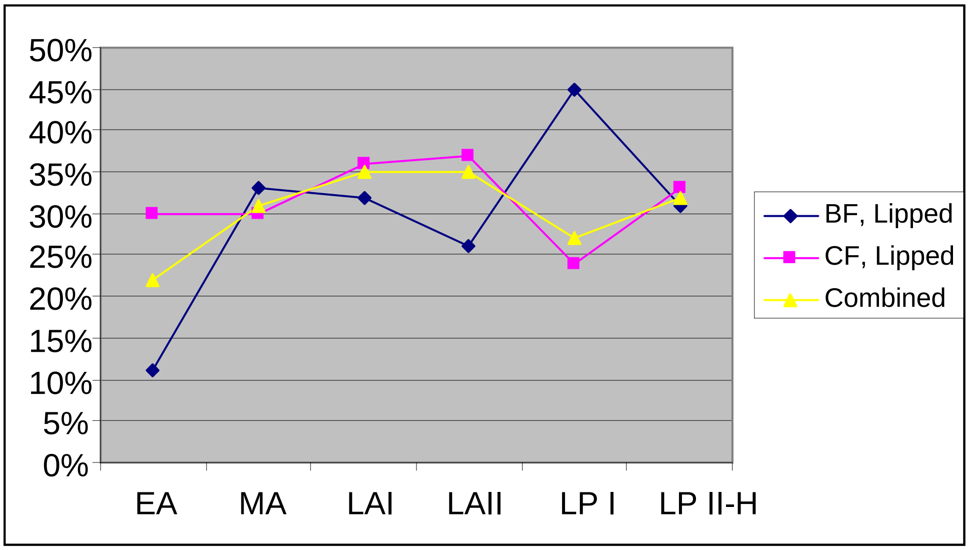

Figure 35. Lip presence by amount and percentage on broken and complete flakes.

Interpretations

As reported above, technological organization shows significant variation between different temporal periods with differing reduction strategies characterizing the Early, Middle, and Late Archaic periods as well as the Late Prehistoric I and the Late Prehistoric II periods. The higher than expected value for cortical platforms for flakes within the >25 mm may indicate that during the Early Archaic occupation of 41HY160, comparatively more initial core reduction and cobble testing was done on site than in subsequent time periods. The significantly high number of small broken flakes may be due to natural-transform compaction or could be a proxy indicator of flake selection, with the larger and complete detachments selected for transport, to be reduced as needed, elsewhere. When these observations are coupled with the very low percentage of lipped platforms, an indicator of soft-hammer application, no noted significance in the counts of complete flakes, or complex and abraded platforms, this summation seems probable.

The debitage assemblage associated with the Middle Archaic, with significant low amounts of complete flakes of both size categories, a significant high amount of debitage, and a comparatively low frequency of lipping, suggests that at 41HY160, there was little emphasis on intensive biface production. However, there are a significantly high number of small-sized complete flakes, an indication that either some degree of tool production occurred at this locale, with, perhaps initial reduction occurring elsewhere, or that bifacial and/or unifacial tools were rejuvenated at this location. In terms of mobility, these signatures are indicative of an expedient assemblage and short term occupation characteristic of a foraging subsistence strategy.

As an indicator of tool production, the calculated adjusted residuals for complete flakes indicate that comparatively high amounts of tool production occurred at 41HY160 during the Late Archaic II and Late Prehistoric I period, a trend which appears to originate during the Late Archaic I. The Middle Archaic debitage assemblage is characterized by high amounts of debris, particularly in the ≤25mm size-class, and is taken as indicative of high amounts of core reduction and expedient flake tool production. The limited amounts of complete flakes, particularly in the ≤25mm size class is further evidence of this observation (Baumler and Downum 1989). The higher than expected numbers of small-sized complex platforms suggests that, in addition to core reduction and expedient tool production, tools (likely bifaces) were retouched/refurbished at 41HY160 during the Middle Archaic, although not necessarily produced at this exact locale.

The sampled debitage assemblage dated to the Late Archaic I exhibits the most homogeneity of all the represented time periods, with the only noted significant variation occurring when flake type is further partitioned by size. Here, the variation occurs in the >25mm debris category and may signal reduced initial core reduction during this time period.

The trend towards lower than expected numbers of debris continues for the Late Archaic II, where both size categories evidence less general core reduction while the higher than expected values for large-sized complete flakes may be linked with increased tool production. The higher than expected values for large-sized complex-platform complete flakes supports the notion that during the Late Archaic II, initial biface manufacture and/or shaping occurred at 41HY160, with the possibility that flake tools were both produced from bifacial cores and utilized locally.

Overall, numbers for debris continues to trend lower than expected values for the Late Prehistoric I while complete flakes are represented in higher than expected values. For complete flakes, this trend is evident in the ≤25mm size class but not within the >25mm category. While this attests a technological organization oriented towards non-expedient tool production, lower than expected values for complex and abraded platforms and higher than expected values for cortical flakes in the ≤25mm size class suggests a general lack of biface manufacture and refurbishment.

For the Late Prehistoric II-Historic period, the analysis of flake type, with observed higher than expected values of debitage and lower than expected values of complete flakes indicates an orientation towards a generalized core technology. An examination of platform types indicates that the observed values for cortical platforms were lower than the expected values while both the >25mm flat platform category and the >25mm abraded platform category had values that exceeded expected values. The higher than expected values observed for the flat platformed flake category correlates with expedient tool manufacture. However, the high observed values for >25mm abraded platforms is anomalous and, as an indicator of platform preparation, suggests that some amount of tool manufacture and/or refurbishment occurred at 41HY160 for the Late Prehistoric II-Historic period. Further, when expressed as a percentage of the total counts of platformed flakes by time period, the presence of lipping is comparatively high for both the Late Archaic I and Late Archaic II, an indication that during these time periods, soft hammer percussion was utilized more extensively than during the preceding Middle and Early Archaic periods.

Cores

During the 1982 and 1983 field school excavations, no cores were recovered within contexts that date to the Early Archaic period. According to the original laboratory analysis sheets from the excavations, three cores were recovered in Middle Archaic contexts: XU1, level 10 and XU13, level 10, East Quad, XU14, level 15, south quad. Unfortunately, these specimens were not relocated within the artifact collection during this analysis. Four cores dating to the Late Archaic I sub-period were available for analysis. Missing from the collection are cores documented for XU13, level 7 (n=2) and XU 18, level 7 (n=2). Of the cores available for analysis four where identified as multi-directional with one of these specimens further identified as discoid in appearance. With specimens missing from XU 2, level 5 (n=1), XU 6, level 5, south quad (n=1), XU10, level 5 (n=1), XU13, level 4, north quad (n=1), XU18, level 4, west quad (n=1), XU 18, level 5, south quad (n=1), and XU 18, level 6, south quad (n=1), 18 cores dating to the Late Archaic II sub-period were available for analysis. Two of these specimens were identified as being unidirectional and 16 as multidirectional. Of the multidirectional cores, a single specimen was noted as being discoidal.

The Late Prehistoric I data assemblage provides four cores for analysis. Absent from the collection are cores documented for XU 2, level 3, south quad, (*n*=1), XU 3, level 3, north quad (*n*=1), XU 3, level 3, east quad (*n*=1), XU 6, level 3, west quad (*n*=1), and XU 18, level 3 (*n*=1). Three of these were classified as multidirectional cores and one as unidirectional. None of the multidirectional cores were noted as being multidirectional. With specimens missing from XU 3, level 2, east quad (*n*=2), XU 6, level 1, south quad (*n*=1), XU 9, level 1, south quad (*n*=3), XU 9, level 2, north quad (*n*=2), and XU 11, level 1(*n*=3), a total of fifteen cores were identified within the Late Prehistoric II-Historic artifact assemblage. Of these, following the recording methods outlined in Chapter Six, two specimens were recorded as unidirectional cores, nine as multidirectional cores, and four as discoid cores. Data concerning analyzed cores are presented below in **Table 19**.

Table 19. Core data for analyzed cores.

	Uni-directional	Multi-directional	Avg Size Value	Avg # of Detachments	% Discoidal
LA I	0	4	1183.33	6.5	25
LA II	2	16	1190.22	7.5	6
LP I	1	3	1431.04	7	0
LP II-Hist.	2	13	864.29	8	31

Interpretations

Although there appears to be little variation in the average size value between the Late Archaic I and the Late Archaic II core assemblages, size values increase during the Late Prehistoric I and decreases sharply during the Late Prehistoric II-Historic (size values for each core were calculated by multiplying weight by maximum linear dimension; average size values for each assemblage were the total of these values divided by number of cores). Raw material selection biases aside, these measurements suggest that core reduction during the represented temporal periods was relatively homogenous during the Late Archaic, less intensive during the Late Prehistoric I and more intensive during the Late Prehistoric II-Historic. Also, while the available data sets for analysis were limited, both the Late Archaic I and Late Prehistoric II-Historic assemblages had comparatively higher percentages of multidirectional cores that were noted as being discoid (bifacial-like) in shape, with nearly a third of the Late Prehistoric II-Historic assemblage identified as such, and may well be an indicator that reduction trajectory may have been anticipatory of mobility. The increased number of detachments and reduced size observed for the cores of the Late Prehistoric II-Historic assemblage correlates with Johnson’s (1994) assertion that the majority of the stone tools, including arrowheads, with Toyah affiliations were fabricated from flake and blade detachments, with a number of these preforms noticeably small in size.

Bifaces

A total of 69 bifaces were available for analysis. No bifaces were noted for excavation units (XUs) dated to the Early Archaic on the original lab artifact sheets and none were noted during this study. For the Middle Archaic, 10 total bifaces and unfitted biface fragments were analyzed (**Appendix B: Lithic Data)**. While a total of 10 bifaces were noted on the lab artifact sheets, during the current study, biface fragments were occasionally found mixed in with the debitage. Hence, by best calculation, it appears that there are unaccounted for bifaces ascribed for XU 13, level 10, east quad (*n*=1), XU 13, level 16 (*n*=3), XU14 level 10, north quad (*n*=1), XU 14, level 11, south quad (*n*=1), XU 14, level 15, north quad (*n*=1). A total of six bifaces comprises the analyzed assemblage dated to the Late Archaic I subperiod. Eighteen biface specimens are missing from the Late Archaic I assemblage: XU 5, level 7, south quad (*n*=3), XU 5, level 7, north quad(*n*=1), XU 10, level 9 (*n*=1), XU 13, level 7 (*n*=5), XU 13, level 8 (*n*=2), XU 13, level 9 (*n*=2), XU 14, level 8 (*n*=3), and XU 14, level 8 (*n*=1). A total of fourteen bifaces dating to the Late Archaic II subperiod were available for this present study. Noted on the original lab artifact sheets but missing from the collection are specimens from the following excavation units: XU 1, level 4, south quad (*n*=1), XU 6, level 6 (*n*=1), XU 7, level 5 (*n*=1), XU 9, level 6, south quad (*n*=1), XU 13, level 4, north quad (*n*=1), XU 14, level 5, south quad (*n*=1), XU 15, level 5, (*n*=1), XU 18, level 5, south quad (*n*=1), XU 19, level 4 (*n*=1), XU 19, level 5 (*n*=2), and XU 19, level 6 (*n*=1). Eight biface specimens from the Late Prehistoric I assemblage were available for analysis. Missing are specimens noted for: XU 2, level 3, west quad (*n*=1), XU 6, level 3, west quad (*n*=2), and XU 13, level 3, east quad (*n*=1). Thirty-one bifaces from the Late Prehistoric II-Historic assemblage were available for use in the current study. Eighteen specimens were noted as missing: XU 7, level 1, east quad (*n*=2), XU 9, level 1, north quad (*n*=1), XU 12, level 2, (*n*=1), XU 13, level 2, west quad (*n*=4), XU 13, level 2, east quad (*n*=1), XU 13, level 2, north quad (*n*=1), XU 14, level 1, north quad (*n*=1), XU 17, level 1, west quad (*n*=1), XU

18, level 2, south quad (*n*=2), XU 18, level 2, north quad (*n*=3), a and XU 19, level 1 (*n*=1). **Table 20** below, presents data only for those biface specimens that were available for verification and analysis. The below table organizes these elements into stages proposed by Callahan (1974) as discussed in Chapter 6. In some case, only a small fragment of a biface specimen was available for inspection, resulting in an indeterminate stage assignment.

Table 20. Bifaces, categorized by stage (from Callahan 1974) and time period.

	Total Quantity	Early Stage (I&II)	Mid-Stage (III&IV)	Late Stage (V)	Indeterminate
EA	0	0	0	0	0
MA	10	0	6	4	0
LA I	14	0	6	7	1
LA II	6	1	0	1	4
LP I	8	0	5	2	1
LP II-H	31	1	12	13	5
Totals	69	2	29	27	11

An examination of these data notes that, for all represented time periods, early stage bifaces (Stages 1 and 2) are either absent or largely absent from the lithic assemblages (**Figure 36**). With the exception of the Late Archaic II (an anomaly that may likely be a function of an underrepresented data set), stage four bifaces are equally represented in numbers until a small spike that occurs during the Late Prehistoric II-Historic. Accompanying this increase is a comparatively higher count for Stage V bifaces among the Late Prehistoric II-Historic assemblage. In general, all time periods save for the Late Archaic I have assemblages where biface representation is oriented to Callahan’s late stage (V) biface manufacture, a pattern that is most noticeable in the Late Prehistoric II-Historic period and, to a lesser degree, the Late Archaic I. Early and mid-stage (I-IV) bifaces are represented in greater numbers in the Middle Archaic and Late Prehistoric I assemblages.

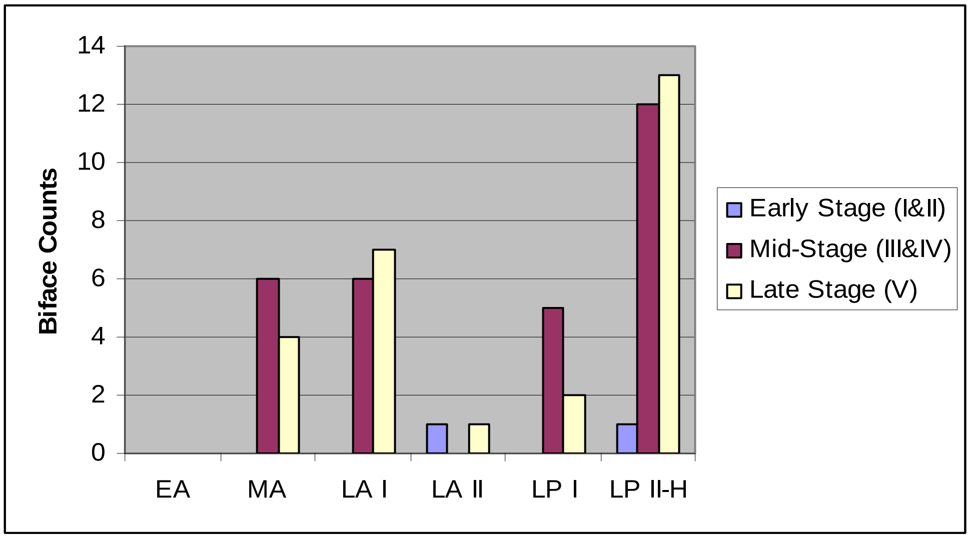

Figure 36. Biface count by stage and time period.

This pattern is further highlighted when numbers are converted to percentages for intra-assemblage comparison (**Figure 37**). By percent, in descending order, late stage bifaces (stage IV and V) are represented in: Middle Archaic (80%), Late Archaic I (78%), the Late Prehistoric I (75%), the Late Prehistoric II-Historic (68%), and the Late Archaic II (12%). With the exception of the Late Archaic II, with a noted absence, Stage III biface representation is fairly constant with the Middle Archaic at 20-percent, Late Archaic I at 14-percent, the Late Prehistoric I at 12-percent, and the Late Prehistoric II-Historic at 13-percent. Although there are noted differences within the assemblage when compared by temporal period, results of a Chi-Square Test-for-Independence of variables utilizing Yates' Correction for continuity (X_c^2= 2.3, with α=.05, df=4, and cv=9.488) indicates that significant difference does not exist between the assemblages. Further, a contingency table of adjusted residuals computed for stage I-IV and stageV bifaces indicates no significant variation between the Middle Archaic, Late Archaic I, Late Prehistoric I and the Late Prehistoric II-Historic biface assemblages (**Table 21**).

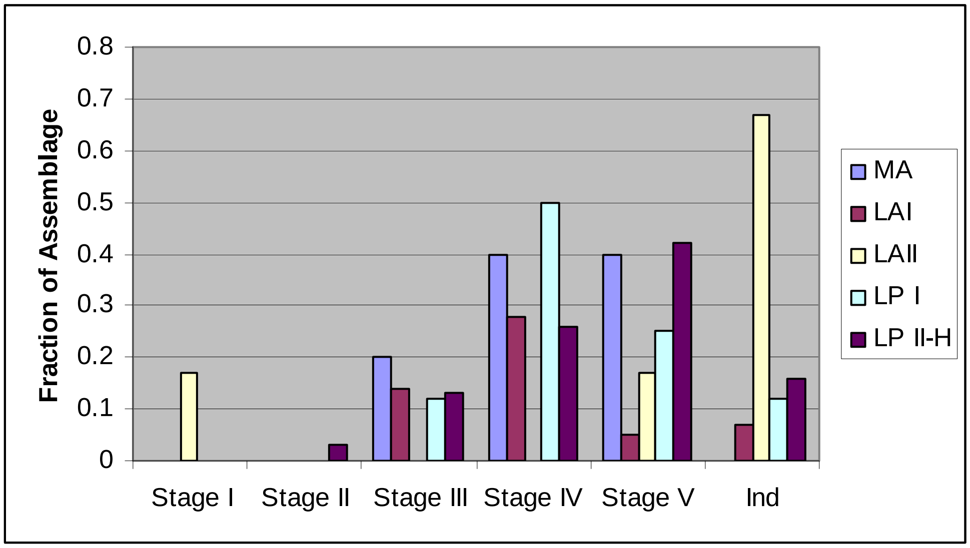

Figure 37. Biface stage (I-V, Ind=indeterminate) count by percentage of temporal period.

Table 21. Adjusted residuals, biface stage.

Bifaces:	Early & Med. Stage (I-IV)	Late Stage (V)
MA	0.46	-0.46
LA I	-0.6	0.6
LA II	-0.1	0.1
LP I	1.02	-1.02
LP II-Hist.	-0.47	0.47

Interpretations

The initial sorting of bifaces by stage illustrates that, with the exception of the Late Archaic II and the Late Prehistoric II-Historic time period, bifaces did not enter into the archaeological record at 41HY160 during initial reduction, suggesting that cobble testing, blank selection and initial edging were done either at a quarrying locale, such as nearby site 41HY37, with biface finishing occurring at 41HY160 or that, as a consequence of function, activities requiring stone tools benefitted from the overall morphology of later stage bifaces. While late stage bifaces are represented in greater numbers in the Late Prehistoric II assemblage, the computation of adjusted residuals indicates that, beyond sheer numbers, there is no significant variation in later stage biface representation when compared by time period.

Utilizing counts provided by the original laboratory tally sheets, an examination of the ratio of bifaces to cores from the Middle Archaic to the Late Prehistoric II-Historic indicates a decrease from the Middle Archaic up to the Late Archaic II and than an increase up to and during the Late Prehistoric II-Historic period (**Table 22**). Noting that there is no comparable assemblage for cores or bifaces for the Early Archaic, as measures of mobility versus sedentism, this data indicates that the peoples who occupied site 41HY160 during the Middle Archaic and Late Archaic I were highly mobile, with a noted low significant value for cores during the former period and a near low significant value for the latter (**Table 23**). When counts for core total are compared with totals for combined early and mid-stage (Callahan's stages I-IV) and late stage bifaces (stage V) utilizing adjusted residuals (**Figure 38**), it is noted that low significant values for core totals for the Middle Archaic is associated with a high significance in the numbers of early and mid-stage bifaces and near high significance in late stage bifaces. Conversely, there is very high significant variation noted for core totals for the Late Archaic II and low significant values reported for both biface categories. Utilizing a comparison of cores to bifaces as proxy measures of mobility, high mobility is posited for the Middle Archaic and is slightly reduced for the Late Archaic I period. During the Late Archaic II there is a shift toward increased sedentism. For the Late Prehistoric I, or Austin Interval, there appears to be slight shift back towards increased mobility, a trend that continues towards increased mobility for the Late Prehistoric II-Historic period.

Table 22. Biface/core ratio.

	Bifaces	Cores	Biface/ Core Ratio
EA	0	0	na
MA	10	3	3.33
LA I	19	8	2.38
LA II	21	25	0.84
LP I	8	9	0.89
LP II-Hist.	31	26	1.19

Table 23. Adjusted residuals for cores, bifaces stages I-IV, and bifaces, stage V.

	Cores	BF (I-IV)	BF (V)
MA	-2.44	1.97	0.92
LA I	-1.71	0.53	1.53
LA II	4.41	-2.78	-2.47
LP I	0.1	0.72	-0.89
LP II-H	-0.95	0.21	0.93

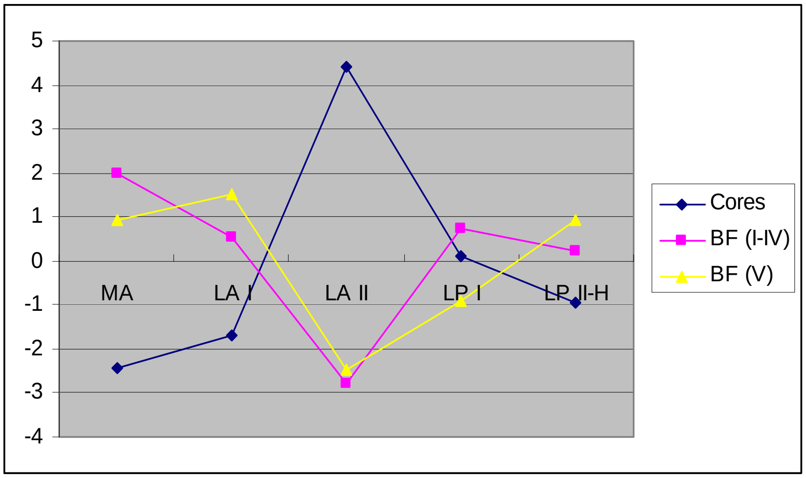

Figure 38. Plotted residuals for cores, biface stages I-IV, and biface stage V by time period. Vertical scale-move horizontal scale to bottom.

Flake Tools

With the exception of the Early Archaic, flake tools are represented in good numbers among all time period assemblages. In contexts dated to the Early Archaic, only three flake tools were identified for analysis. Increasing to 44 specimens, there are considerably more flake tools dated to the Middle Archaic. Nearly doubling in count, 81 flake tools were identified from the Late Archaic I lithic assemblage. The Late Archaic II assemblage contains 83 flake tools. Thirty-four flake tool specimens are dated to the Late Prehistoric I, while 79 flake tools were identified in contexts dated to the Late Prehistoric II. Total counts by time period are provided below in **Appendix B.**

Early Archaic

Following the methodology outlined in Chapter 6, each flake tool was assessed for a quadrant point values (QPV) (**Figure 39**). Following a technique described by Baumler (1988), each flake tool's dorsal surface was divided into 4 quadrants and positive or negative values were assigned to each quadrant by the orientation of flake scars within each quadrant and each flake tool was assigned a QPV from 1 to 4. Because they likely originated after detachment, flake scars resulting from retouch were not included in the QPV count. Of the three flake tool specimens comprising the Early Archaic assemblage, two were assigned a QPV of 1 and the remainder was noted as having an indeterminate QPV. Further, of the three specimens assigned to the Early Archaic, one was noted as having a cortical platform, while two flake tools were incomplete with non-discernable platforms.

Middle Archaic

Of the 44 flake tools from the Middle Archaic, 13 of these were assigned a QPV of 1. Twelve of flake tool specimens were assigned a QPV of 2. Two specimens were assigned a QPV of 3 and a single specimen was given a QPV of 4. Sixteen flake tools from the Middle Archaic assemblage were had an indeterminate QPV, largely due to tool incompleteness/fragmentation. Among these flake tools, eight specimens were recorded as having abraded platforms, while six were noted as having complex platforms. Three flake tools were noted as having cortical platforms and 19 as having a flat platform. Eight platforms were non-discernable due to flake tool incompleteness.

Late Archaic I

From the lithic assemblage assigned to the Late Archaic I, 37 flake tools were assigned a QPV of 1. Seventeen flake tools were assigned a QPV of 2, while six were assigned a QPV of 3. No flake tools from the Late Archaic I assemblage were assigned a QPV of 4. Twenty one flake tools, mostly due to incompleteness have indeterminate QPVs. Twenty-one flake tools were identified as having an abraded platform while eight specimens were observed as having complex platforms. Additionally, four cortical platforms were noted as were 33 flat platforms.

Late Archaic II

Twenty-seven flake tools from the Late Archaic II assemblage were assigned a QPV of 1. Twenty-three flakes were assigned a QPV of 2, while five flakes were assigned a value of 3. No flake tools within the Late Archaic II assemblage were assigned a QPV of 4. At a count of 27, a high number of flake tools from the Late Archaic II had an indeterminate QPV. Twenty-four of these specimens were noted as having abraded platforms, five were noted as being complex, three were cortical platforms, and twenty-six were noted as being flat platforms.

Late Prehistoric I

Of the 34 flake tools organized into the Late Prehistoric I, 12 were assigned a QPV of 1, six, a QPV of 2, four, a QPV of 3, and one, a QPV of 4. The remaining were indeterminate as to a QPV value due to incompleteness. Where platform identification was possible, there were 11 occurrences of abraded platforms, five complex platforms, two cortical platforms, nine flat platforms, and seven with non-discernable platforms.

Late Prehistoric II-Historic

As discussed in Chapter 6, quadrant point values (QPV) (Baumler 1988) of one were assigned to 29 specimens, a QPV value of 2 to 21 specimens, and a QPV value of 3 to nine specimens. Generally due to flake incompleteness, 18 specimens had an indeterminate QPV. No flake tools from the Late Prehistoric II-Historic assemblage were noted as having a QPV of 4. In certain cases, flake tools were observed to retain evidence of a striking platform. In cases where platform type identification was possible, the results are that there are 14 flake tools with abraded platforms, 16 with complex platforms, two with cortex bearing platforms, and 33 with flat platforms. Thirteen of the specimens were devoid of an identifiable platform type.

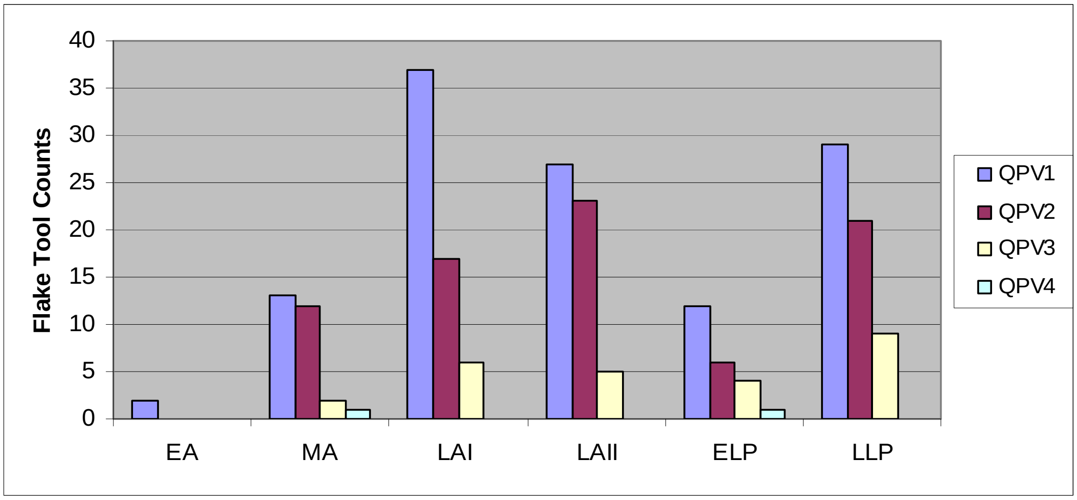

Figure 39. QPV count by time period.

Analysis

When total numbers of assigned QPV are considered in terms of percentage of composition by temporally assigned assemblages some notable differences are highlighted (**Figure 40** and **Table 24,** below). Noting that the Early Archaic assemblage only has a single represented flake tool, it is evident that there is some patterning in the assemblages. Combined numbers for QPV1 and QPV2 counts hover at approximately 90% for the Middle Archaic, Late Archaic I and the Late Archaic II with the combined QPV3 and QPV4 percentages at between 9 and 11-percent. During the Late Prehistoric I, the QPV1 and 2 percentages drop to 78-percent while QPV3 and 4 increases to 21-

percent. During the Late Prehistoric II-Historic, these values are similar with the former rising to 85-percent and the latter decreasing to 15-percent.

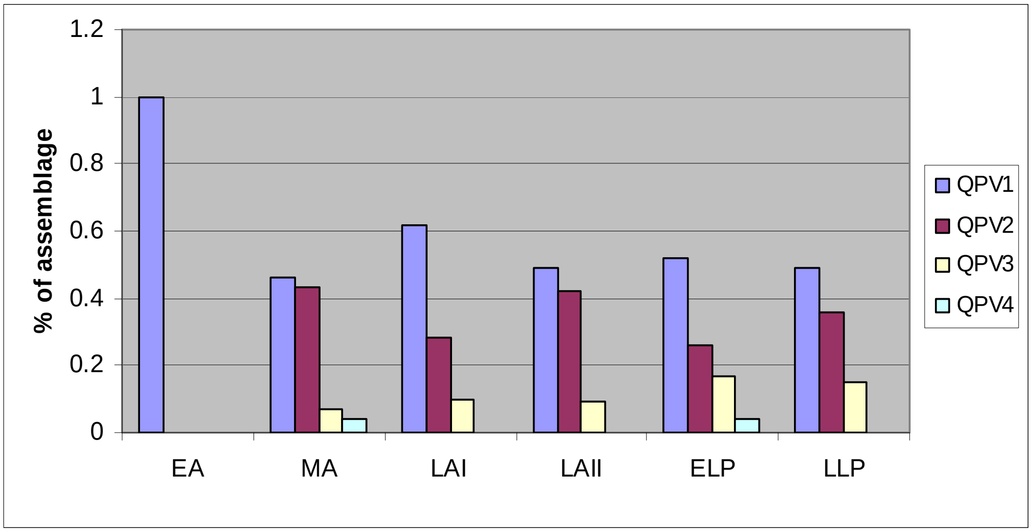

Figure 40. QPV percentage of flake tools by time period.

Table 24. Totals for QPV for flake tools by temporal assemblage.

QPV:	1	2	3	4
EA	1	0	0	0
MA	46	43	7	4
LAI	62	28	10	0
LAII	49	42	9	0
LP I	52	26	17	4
LP II-H	49	36	15	0

Utilizing QPV counts, comparing QPV1, QPV2, and QPV3 and 4 combined, a Chi-Square Test-for-Independence was calculated in Excel, with critical values determined at the 5-percent (0.05) confidence level. Under the working hypothesis that there is no difference in the observed frequencies between time periods, expected frequencies were generated for the Middle Archaic, Late Archaic I, Late Archaic II, and Late Prehistoric II-Historic NISP counts presented above for the extra-large, large, and large/medium mammal size categories. With only a single represented flake tool, the data set for the Early Archaic was not used. Result of the Chi-Square Test-for- Independence is: X^2= 17.31, with α=.05, df=8, and cv=15.507 and significant difference is noted as exiting between assemblages.

To further assess the difference between assemblages noted by the above described Chi-Square analysis, an examination of adjusted residuals was plotted as a contingency table (**Table 25, below**), wherein QPVs of 3 and 4 are combined. Results indicate significant high variation at the 5-percent confidence level in the QPV1 category for the Late Archaic I period and in the QPV3&4 category for the Late Prehistoric I category. Significant low variation was noted for the QPV2 category for the Late Prehistoric I category. This pattern is also similarly noted above, in **Figure 40** and **Table 25**.

Table 25. Adjusted residuals for QPV.

QPV:	1	2	3&4
MA	-1.28	1.86	-0.73
LAI	2.30	-1.66	-1.07
LAII	-0.61	1.62	-1.40
LP I	0.18	-2.05	2.62
LP II-H	-0.61	0.22	0.59

Although it should be cautioned that abrading can occur post flake blank detachment, when present, flake-tool platform can be analyzed to determine how flake blanks were produced (**Table 26**). **Table 27**, below, presents a contingency table of calculated adjusted residuals for discernable platforms for the flake tool assemblages of the Middle Archaic, Late Archaic I, Late Archaic II, Late Prehistoric I, and the Late Prehistoric II-Historic. Since only a single cortical platform was noted among the sparse Early Archaic assemblage it was not used in this particular statistical analysis. Variation on the significant level is noted for abraded platforms of the Late Archaic II assemblage and for complex platforms of the Late Prehistoric II–Historic assemblage.

Table 26. Platform type for flake tools by time period.

	Cortical	Flat	Abraded	Complex
EA	1	0	0	0
MA	3	19	8	6
LA I	4	33	21	8
LA II	3	26	24	5
LP I	2	9	11	5
LP II-H	2	33	14	16
Totals:	15	120	78	40

Table 27. Adjusted residuals for platform type of flake tools by time period.

	Cortical	Flat	Abraded	Complex
MA	0.79	0.67	-1.22	0.14
LA I	0.21	0.45	0.18	-0.97
LA II	-0.15	-0.49	1.96	-1.72
LP I	0.44	-1.57	1.16	0.4
LP II-Hist.	-1.01	0.59	-1.91	2.24

Interpretation

Used as an indicator of source for flake tools, the percentage of flake-tools detached from bifacial cores (QPV3&4) as opposed to expedient core detachments (QPV1, QPV2) is relatively equal for the Middle Archaic. During the Late Archaic I, there is a noticeable increase in QPV1 flake tools, an indication of increased expedient flake tools usage with platform type noting little variation save for a moderately low number of recorded complex platforms. For the Late Archaic II, this trend is somewhat reversed with low QPV1 values noted and an increase in QPV2 values. For the same time period, a near high significant value is noted for the abraded flake category and a near low significant value for complex platforms, an indication of possible platform preparation no matter if the flake tools were detached from expedient cores or biface or possibly of post detachment preparation associated with hafting. Considering the low OPV values for this time period, the latter is extremely likely. Although there is little variation in platform type for Late Prehistoric I flake tools, adjusted residual scores for QPV 3&4 values are significantly high, and indication that bifacial flake detachments were increasingly utilized as flake tools at 41HY160 during this time period. During the Late Prehistoric II-Historic temporal period, there is a return to below significant value for QPV 3&4 with a noted high significant value for complex platforms and a low significant value for abraded platformed flake tools.

CHAPTER 10

FAUNAL ANALYSIS

Introduction

The faunal remains utilized for this thesis is comprised of 7286 specimens (elements identified as gastropod were not utilized), totaling 2836.56 grams in weight, collected from 19 separate excavation units opened during the 1982 and 1983 field school investigations (**Appendix C**). Specimens were removed from their original bags, quantified, tabulated into an excel spreadsheet, and sent to the Zooarchaeology Laboratory at the University of Tennessee at Knoxville (UTK). At UTK, faunal remains were classified to the most specific taxonomic level possible using nomenclature for vertebrates following the Peterson Field Guides (personal communication, Hollenbach 2010; e.g. Burt and Grossenheider 1980; Conant and Collins 1991; Page and Burr 1991; Peterson 1980). Recorded information includes element, side, portion, fusion, and whether any modification was noted on the bone (burning, gnawing, etc.).

In cases where this identification was not possible to the species level, mammal specimens were assigned to one of seven size categories: Extra large-sized mammal, large-sized mammal, large/medium-sized mammal, medium-sized mammal, medium/small-sized mammal, small-sized mammal, and very-small-sized mammal. Represented animals of the extra large-sized class are limited to bison (*Bison bison*).

Deer (*Odocoileus* sp.), pronghorn antelope (*Antilocapra americana*), and bear (*Ursus americanus*) constitute animals organized into the large-sized mammal category. Generally, animals belonging to this category, full-grown, would weigh over 75 pounds. Mammals whose adult weight ranges between 50-75 pounds comprise the large/medium-sized mammal category. Typically, canids (*Canis* spp.), specifically coyote, wolf, and dog comprise the large/medium sized mammal category. The medium-sized mammal category includes taxa that weigh between 20-50 pounds, such as foxes [gray fox (*Urocyon cinereoargenteus*) and red fox (*Vulpes fulva*)], beaver, and raccoon (*Procyon lotor*). The medium/small-sized mammal category by design, includes opossum (*Didelphis virginiana*), skunk (*Mephitis mephitis*), cottontail rabbit (*Sylvilagus floridanus*), animals that generally weigh 5-20 pounds. Small-sized mammals, weighing 0.5-5 pounds, include squirrels (*Sciurus* sp.), muskrat (*Ondatra zibethicus*), pocket gophers, and the Old World rats (*Rattus* sp.), intrusive post-contact elements. The very-small-sized mammal category includes the mice, voles, and bat taxa, animals weighing less than 0.5 pounds.

With fragmented bone, assignment to specific taxon was often impossible. In these cases specimens were ordered by range, into categories of large/medium-sized, medium/small-sized, and small/very small-sized. For example, fragmented bone specimens which could just as likely be either deer or coyote were given the large/medium-sized mammal designate. As discussed below, it is likely that the bulk of these fragments are deer and/or pronghorn. Further, many fragments that were identified as non-beaver rodent were assigned to the small/very small-sized mammal category.

Concerning Aves (birds), large-sized birds are represented by turkey (*Meleagris gallopavo*), raptors of large size such as eagle and hawk, and geese. The various ducks and owls are organized into the medium-sized bird category. Passerines, or song-birds, such as the jays, warblers, and buntings are, collectively, arranged into the small-sized bird category. Other identified elements included snakes, frogs, turtle, and bivalves. In all cases, identification of faunal specimens was aided through the use of comparative collections housed at the Archaeological Research Laboratory and the Zooarchaeology Laboratory at UTK.

In addition to classification, attempts were made in the identification of each skeletal element, the part of said element, and, when possible, from which side of the skeletal frame the body part originated. Further, modifications to the bone were noted. Most were post-death, likely culture-created, modifications such as indications of burning, chop and cut markings, and the occasional evidence of worked bone (for instance one large-sized mammal bone fragment was identified as having been worked into a fish hook.)

Two distinct forms of burning were recognized within the assemblage: charring and calcination. Charred elements were identified as being burned to a black or near-black color, representing bone that has only been partially combusted. Calcination, on the other hand, represents bone that is more completely combusted and is recognized as being discolored white, light-grey or blue, often with a porcelain-like texture (Nicholson 1993; Stiner et al. 1995). Other modifications which were identified on specimens were carnivore and rodent gnawing (**Appendix C**).

Results

Regarding the organization of the faunal remains, 67 specimens (NISCV=67) were identified as bison (*Bison bison*) and ordered into the extra large-sized mammal category. These specimens represent approximately 1-percent of the entire assemblage. Accounting for approximately 8-percent of the collection, 682 separate specimens (NISCV=682) were identified as belonging to the large-sized mammal class. Of these specimens, 177 (NISCV=177) were identified as pronghorn antelope (*Antilocapra americana*), 14 (NISCV=14) were identified as white-tailed deer (*Odocoileus virginiana*), and 3 (NISCV=3) simply as deer (Cervidae).

By far the largest amount of faunal remains were organized into the large/medium-sized mammal class with 5946 (NISCV=5946) specimens, accounting for approximately 81-percent of the collection. Two (NISCV=2) were identified as canidae, the family of wolves, foxes, dogs, and coyotes while 3 (NISCV=3) specimens were more specifically identified to be Coyote (*Canis latrans*). A single incisor (NISCV=1) represents the lone identifiable element representing either a hog or pig (*Suidae*). Being from an Old World swine, this element, located in level 2 of Excavation Unit 3 at a depth between 10 and 20 centimeters below ground surface, is intrusive and an indication of disturbance. One hundred and seventeen (NISCV=117) faunal specimens were organized into the medium-sized mammal category. Of these 16 were identified as being beaver and a single proximal radius specimen was identified as belonging to the raccoon (*Procyon lotor*) family.

Because the crux of this thesis involves the identification of culture change over time the, further description and analysis of the faunal assemblage is organized by temporal period: Middle Archaic, Late Archaic I, Late Archaic II, Early Late Prehistoric, and the Late Prehistoric II-Historic. In similar fashion to the temporal assignment of lithics, recovered bone was organized into time periods for analysis based on the depositional model presented in Chapter 8 **(Table 28**, below).

Table 28. Depth by Archaeological Period.

Archaeological Period	Depth (cmbgs)
Late Prehistoric II-Historic	0-20
Late Prehistoric I	20-30
Late Archaic II	30-60
Late Archaic I	60-90
Middle Archaic	90-245
Early Archaic	245-660

Early Archaic

Only a single specimen, recovered during explorations of XU1 at a depth between 245-265 centimeters below ground surface (cmbgs), can be attributed to the Early Archaic. This specimen was identified as a shaft fragment of a long bone belonging to a large-sized mammal. No burning or calcinations was noted.

Middle Archaic

Weighing a total of 125.38 grams, 320 specimens were recovered from deposits dated to the Middle Archaic (**Table 29**)**.** Three of these were identified as bison and these comprise the extra large-sized mammal class. The bison were identified from two tooth enamel specimens and one long bone shaft element. Thirty-eight (NISCV=38) specimens were classified as large-sized mammal, with eight faunal specimens further identified to the species level: five as pronghorn antelope (*Antilocapra americana*,) and three as white-tailed deer (*Odocoileus virginiana*). Pronghorn were identified from a lower third molar, a metatarsal, and three phalanxes, one of which showed evidence of carnivore gnawing. White tailed deer were identified from teeth (2) and a single phalanx. Two hundred and fifty-three faunal specimens were identified as belonging to the large/middle-sized category. Of these elements, a single left distal humerus was further identified as belonging to the species coyote (*Canis latrans*). Of the remaining elements, three were noted as long bone shafts, one as a vertebral cap, and the rest as bone fragments. Regarding medium-sized mammals, 14 specimens were identified as such, weighing 1.7 grams. Being comprised of thirteen unidentifiable bone fragments and a right-side innominate (hip bone), an ordering to the species of these elements was not possible. Only five specimens were noted as belonging to the small-sized mammal category including two long bone shafts, a right side proximal end of an ulna, and a complete vertebra. A single right-side incisor fragment was determined to originate from a rodent. In addition to these mammal specimens, four turtle carapace fragments and a vertebra belonging to a viper were identified. A single large-sized bird femur was noted in the Middle Archaic assemblage. Further, a single fragment of shell was identified as being mussel shell.

Noted modifications on bone from the Middle Archaic include burning and calcinations with four long bone shaft fragments from a large-sized mammal identified as being burned black. Further, a rib element from a large-sized mammal was noted as being calcined as were six medium-sized mammal bone specimens, 11 large/medium sized bone fragments, and the lone recorded bird element. Other modification noted on Middle Archaic bone elements is limited to carnivore gnawing noted on a single phalanx element of a pronghorn antelope, five long bone shaft elements from an unidentified large-sized mammal, and a single long bone shaft fragment belonging to a medium-sized mammal. Considering the limited evidence of carnivore gnawing within the Middle Archaic assemblage, it is more than likely that a large percentage of elements attributed to the large-sized mammal class are highly fragmented and unidentifiable deer and/or pronghorn.

Table 29. Middle Archaic faunal assemblage with NISP and weight in grams.

Category	Common Names	NISP	Weight	Category	Common Name	NISP	Weight (grams)
Mammals, Extra Large-Sized	Bison	3	13.14	Mammals, Very Small-Sized	Mice, Voles, Bats	0	0
Mammals, Large-Sized	Deer, Pronghorn	38	35.67	Amphibians	Turtles	4	0.94
Mammals, Large/Medium-Sized	Coyote, Wolf, Dog*	253	72.23	Reptiles	Snakes	1	0.15
Mammals, Medium-Sized	Fox, Beaver, Raccoon	14	1.7	Bivalves	Mussel	1	0.11
Mammals, Medium/Small Sized	Rabbit, Skunk, Opossum	0	0	Mammals, Small-Sized	Squirrel, Muskrat, Pocket Gopher	5	0.61

*Or highly fragmented deer or pronghorn (see above and below).

Late Archaic I

From deposits dated to the Late Archaic I (4000-2500 B.P.), 485 faunal specimens were recovered, weighing 193.82 grams (**Table 30**). None of these specimens were identified as belonging to the extra large-sized mammal category. Eighty four (NISCV=92) specimens were identified as being large-sized mammal with eight of these specimens identified as pronghorn antelope (*Antilocapra a,*) and four identified as white-tailed deer (*Odocoileus v.*). Elements identified as pronghorn include enamel components of two teeth, an upper first molar, a right tarsal, a metatarsal, and three phalanxes. Elements attributed to white-tailed deer include two metatarsal shaft elements. Six of the bone collection collected within Late Archaic II deposits were identified as middle-sized mammals. Only one, an upper canine belonging to a coyote (*Canis l.*) was identified to the species level. Four others were unidentifiable beyond being fragmented medium-sized mammal bone and one element was determined to the ball portion of a femur bone. Numbering 371, the majority of the Late Archaic I specimens could only be organized into the large/medium-sized mammal class as unidentified bone fragments.

Table 30. Late Archaic I faunal Assemblage with NISP and weights in grams.

Category	Common Name	NISP	Weight (grams)	Category	Common Name	NISP	Weight (grams)
Mammals, Large-Sized	Deer, Pronghorn,	92	87.13	Large Birds		1	0.06
Mammals, Large/Medium -Sized	Coyote, Wolf, Dog*	371	103.25	Amphibian	Turtles	6	1.18
Mammals, Small-Sized	Hares, Rodents	5	0.86	Reptiles	Snakes	2	0.2
Mammals, Medium-Sized	Fox, Beaver, Raccoon	6	0.99	Fish	Gar	2	0.15

*Or highly fragmented deer or pronghorn.

Belonging to the small/very small-sized mammal class, 2 complete molars and a left proximal fragment of a femur were identified as Rodent (*Rodentia* sp.). In addition to the mammal bone, a calcined long bone fragment was identified as belonging to a large bird. Additionally, five turtle carapace fragments were identified, with one evidencing cut-marks. Two complete vertebra, quite possibly from the same animal, belonging to a non-venomous snake. Also noted amongst the Late Archaic I assemblage, were a pair of bone elements belonging identified as being Gar fish.

Modifications noted on faunal elements for the Late Archaic I assemblage include burning where a large-sized mammal long bone, two unidentifiable large/medium-sized mammal elements and a single unidentifiable Medium-sized element were observed as being burned black while six unidentified elements and a single long bone fragment identified as belonging to the large-sized mammal class, 13 unidentified large/medium-sized mammal elements, five unidentified medium-sized mammal bone, and a single long bone from a large-sized bird were noted as being calcined. Six large-sized mammal elements were noted as evidencing rodent gnawing. Four of these are long bone elements from a large-sized mammal. The remaining two elements, a tibia and metatarsal are further identified as pronghorn.

Late Archaic II

Comprising 2058 specimens and weighing 863.54 grams, faunal remains dating to the Late Archaic II accounts for approximately 8-percent of the collection recovered at site 41HY160 during the 1982 and 1983 field school years (**Table 31**). Identified as bison, twenty (NISCV=20) specimens were categorized as extra large-sized mammal. Identified bison elements include 12 long bone shaft fragments, a left distal metatarsal, six tooth components, and a skull fragment. Also, there are 252 elements, at 275.01 grams, categorized as large-sized mammal. Of these, 68 elements were identified as pronghorn antelope, two as white-tailed deer and one, simply, as deer (*Cervidae*). Fifty-five (NISCV=55) elements were categorized as medium-sized mammal with a single tooth identified as beaver, and a right proximal radius as raccoon. The small-sized animal category is comprised of six specimens: three elements identified as lagomorph, and two only identified as small animal. Within the Aves class, eight elements were identified as belonging to the species *Meleagris gallopavo* (wild turkey) and were categorized as large-sized bird. Two elements were categorized as medium-sized bird, two as small-sized, and two as medium/small-sized bird. A large number of turtle elements were identified with 62 carapace fragments and a single long bone belonging to *Testudine* and five carapace remains belonging to *Trionychidae* (soft shell turtle). Thirty-five vertebra elements were recognized as being *Colubridea* sp. and four as *Nerodia* sp.

Table 31. Late Archaic II faunal assemblage with NIPS and weights in grams.

Category	Common Names	NISP	Weight (grams)	Category	Common Name	NISP	Weight (grams)
Mammals, Extra Large-Sized	Bison	20	115.02	Large Bird	Turkey	8	2.98
Mammals, Large-Sized	Pronghorn, Deer	252	275.01	Medium Bird	Indeterminate	1	0.04
Mammals, Large/Medium-Sized	Coyote, Wolf, Dog*	1558	437.53	Medium/ Small Bird	Indeterminate	2	0.31
Mammals, Medium-Sized	Coyote	54	10.25	Small Bird	Indeterminate	2	0.15
Mammals, Medium/Small-Sized	Indeterminate	2	0.45	Reptile	Snakes	39	5.5
Mammals, Small-Sized	Hares	54	9.68	Amphibian	Turtles	68	14.33
Mammals, Very Small-Size	Mouse	3	0.33	Fish	Gar, Catfish	15	3.68
Mammals, Small/Very Small-Sized	Indeterminate	1	0.02	Bivalve	Mussel	2	0.22
Mammal/Bird	Indeterminate	4	0.56	UID	Indeterminate	1	0.06

*Or highly fragmented deer or pronghorn.

A number of faunal elements were noted as being modified. Two long bones from the large-sized mammal category and eight unidentified elements form the large/medium-sized mammal category were noted as being burned black. Observed calcined elements from the large-sized mammal category include three long bones and 10 unidentified elements. Forty-two unidentified elements organized into the large/medium-sized mammal category had noted calcinations as did five turtle carapaces. Carnivore gnawing was evident on two of the bison bone (long bone and metatarsal), two long bone elements attributed to a large-sized mammal, and a single long bone from a medium-sized mammal. Rodent gnawing was identified on five large-sized mammal elements: two long bones, two unidentified bones, and a phalanx from a pronghorn antelope. A single bison long bone was noted as having both rodent and cut-marks.

Late Prehistoric I

Deposits here associated with the Late Prehistoric I (1200-800 B.P) were estimated to occur from approximately 20 cmbgs to 30 cmbgs. Here too, although slight temporal overlap with preceding and subsequent temporal periods is expected, faunal remains from level 2 in Excavation Block 1 (15-25cmbgs) are also included with this discussion as cross referencing these deposits with projectile points and dates taken from this block suggest that deposits here date comparatively older (see discussion in **Chapter 6**). A total of 1775 specimens, weighing 690.42 grams comprise this portion of the collection (**Table 32**). Nine elements were identified as bison (extra large-sized mammal). One hundred and twenty- three elements were identified as originating from large-sized mammals, with 59 of these specimens identified as pronghorn antelope, four as white-tailed deer, and 1 as bear (*Ursus americanus*). Bone identified only to the large-sized mammal category include four long bone shaft fragments, nine tooth elements, four rib parts, and 14 other unidentifiable fragments. Identified pronghorn elements are six vertebrae, nine phalanxes, two metatarsals, two tooth elements, a complete navicular cuboid, a complete left fibula, part of a right distal femur, a complete sesamoid, the distal portion of a left humerus, and the distal part of a right-side humerus. Three elements were organized into the medium-sized mammal category: two long bones shaft elements, a phalanx, a femur, and an Ulna identified as beaver. Twenty-three elements of the submitted faunal remains were identified as small mammal with three of these further identified as pocket gopher (*Geomyidae*). Further identification to specific species was impossible for the remaining elements identified as small-sized animal. Eighteen elements were identified as rodent.

One-thousand four hundred and sixty-six elements were identified as belonging to the large/medium-size mammal category. The vast majority of these (1359) were unidentified bone fragment while the remaining elements were identified as long bone fragments. Also identified as large/medium sized were a single right side proximal portion of a radius and a single complete sesamoid. Four elements were categorized as medium/small-sized including two mandible fragments of an opossum and a complete right calcaneus belonging to a lagomorph. Numbering 18 specimens, the majority of the 20 elements organized into the small/very small-sized mammal category were further identified as rodent. One of the faunal specimens was identified as belonging to either bird or mammal while a single metatarsus was noted as belonging to the skeleton of a wild turkey (large-sized bird). Five turtle carapace fragments were identified as belonging to soft-shell turtle (Trionychidae) and fourteen as hard-shell (Testudinidae).

Twenty-one elements, all vertebras were identified as non-venomous snake (*Colubridae*). A single fish element was also identified as a nearly complete quadrate.

Thirteen unidentified elements arranged into the medium/large-sized mammal category were noted as being burned black. Seven large-sized mammal bones, a long bone, a phalanx belonging to a pronghorn antelope, and five unidentified, were noted as being calcined. Eighty-seven elements belonging to the large/medium-sized mammal class were noted as calcined as were two elements from the small-sized mammal category. Additionally, four large-sized mammal elements bear evidence of cutting or chopping. Further cultural modification was noted in the form of a single worked large mammal bone that displayed polish and etched lines. Carnivore gnawing was noted on three large/medium-sized and one large-sized long bone. Rodent gnawing was noted on two elements: on an unidentified small animal bone and on a long bone belonging to a large mammal.

Late Prehistoric II-Historic

Discounting a single *Suidea* incisor and a nearly complete innominate from an Old World Rat as intrusive elements, 2613 faunal specimens weighing 946.48 grams, were organized into the Late Prehistoric II-Historic assemblage (**Table 33**). Comprising the extra large-sized mammal class, 35 of these specimens were identified. The bison were identified from two tooth enamel specimens and one long bone shaft element. One-hundred and eight (NISCV=108) specimens were classified as large-sized mammal, with a number further identified to the species level: two tooth elements as white-tailed deer (*Odocoileus virginiana*), 1 tooth element as deer (*Cervidae*), thirty-three as pronghorn antelope (*Antilocapra americana*,).

Table 32. Late Prehistoric I faunal assemblage with NISP and weight in grams.

Category	Common Names	NISP	Weight (grams)	Category	Common Name	NISP	Weight (grams
Mammals, Extra Large-Sized	Bison	9	40.65	Mammal/Bird	Indeterminate	1	0.15
Mammals, Large-Sized	Deer, pronghorn	123	190.22	Large Bird	Turkey	5	0.79
Mammals, Large/Medium-Sized	Coyote, Wolf, Dog*	1465	428.26	Small Bird	Indeterminate	5	0.33
Mammals, Medium-Sized	Coyote	3	0.62	Reptile	Snake	21	2.75
Mammals, Medium/Small-Sized	Indeterminate	1	0.16	Amphibian	Turtle	65	15.53
Mammals, Small-Sized	Hares	45	8.15	Amphibian	Frog	1	0.01
Mammals, Very Small-Size	Mice, voles, bats	2	0.05	Fish	Gar, Catfish, Perch	23	2.36
Mammals, Small/Very Small-Sized	Indeterminate	2	0.03	Bivalve	Mussel	4	0.36

*Or highly fragmented deer or pronghorn.

Pronghorn elements from the Late Prehistoric II-Historic assemblage include a single sesamoid, 13 tooth elements, 12 phalanges, a single metatarsal, four metapodial elements, one carpal element, and a single metacarpal element. Weighing 699.44 grams, 2293 specimens were organized into the large/ middle-sized mammal category. Three of these specimens, all dental elements, where further identified as belonging to family *Canidae*. Of the remaining elements, five were noted as being long bone elements, with the rest as noted as unidentified fragments. Twenty-seven specimens, weighing 10.82 grams, were identified as medium-sized mammal. Fifty-eight specimens were noted as belonging to the small-sized mammal category and a single skull fragment was organized into the small/medium-size category. Two medium-sized bird and a small-sized bird element were identified within the Late Prehistoric II-Historic assemblage. Additionally, 19 vertebrae were identified as snake, 48 elements as turtle (two as softshell). Ten elements were identified as being shell from bivalves.

Table 33. Late Prehistoric II-Historic faunal assemblage with NISP and weight in grams.

Category	Common Names	NISP	Weight (grams)	Category	Common Name	NISP	Weight (grams)
Mammals, Extra Large-Sized	Bison	35	100.02	Small Birds	Indeterminate	2	0.14
Mammals, Large-Sized	Pronghorn,	108	95.62	Reptiles	Snakes	19	2.58
Mammals, Large/Medium-Sized	Coyote, Wolf, Dog*	2291	699.15	Reptile	Indeterminate	1	0.04
Mammals, Medium-Sized	Fox, Beaver, Raccoon	27	10.82	Amphibians	Turtles	48	15.27
Mammals, Medium/Small-Sized	Indeterminate	1	0.36	Amphibians	Frog/Toad	1	0.1
Mammals, Small-Sized	Squirrel, muskrat, pocket gopher	58	18.65	Fish	Gar	10	1.07
Medium Bird	Indeterminate	2	0.71	Bivalves	Mussel	10	1.95

*Or highly fragmented deer or pronghorn.

A large number of bones from the Late Prehistoric II-Historic assemblage were observed to be modified. Elements burned black include a single mussel shell, a sesamoid identified as pronghorn antelope and three unidentified bone belonging to the large/medium-sized mammal class. Calcination was noted on a bison long bone, sixteen large mammal elements including a carpal and metapod identified as pronghorn antelope (other elements not indentified to species consist of six long bones, a vertebra, and six unidentifiable bone fragments), 107 unidentified large/medium-sized mammal elements. A single large/medium-sized mammal element was noted as being both burned and cut while another, a long bone, also was noted as having cut-marks. Two unidentified large mammal bone was noted as being worked, with one fashioned into a fish hook. Carnivore gnawing was noted on four large-sized mammal long bones, while rodent gnawing was noted on a bison tibia, two incisors identified as pocket gopher, and two unidentified large-sized mammal bone fragments.

Analysis

An examination by total weight for faunal remains by time period indicates that the bulk of meat procurement was likely oriented towards the procurement of large and extra large-sized game (**Table 34**). A plot of the extra-large, large, and large/medium mammal size classes illustrates that there is a slight increase in total weight from the Middle to the Late Archaic I subperiod (**Figure 41**). As there are no extra-large (bison) faunal remains associated for Late Archaic I, it is noted that this increase occurs within the large and large/medium mammal size classes. From the Late Archaic I to the Late Archaic II, there is a large spike in the total combined weight total for the three plotted size classes, with both the extra-large and large size classes reaching its highest contributing weight at 115.02 grams and 275.01, respectively. From the Late Archaic II to the Late Prehistoric I there is a decline in total weight with this decrease largely occurring within the extra-large and large size classes. While the total weight for the extra-large class increases again during the Late Prehistoric II-Historic (as does the weight of the large/medium size class), there is a decline in total weight for the large-size class.

Table 34. Faunal remains in grams by size class and time period.

	X-large	Large	Large/med	Medium	Med/small	Small	Small/very small	V. small	Totals
MA	13.14	36.5	69.01	4.92	0	0.61	0	0	124.18
LAI	0	87.13	101.21	3.03	0	0.86	0	0	192.23
LAII	115.02	275.01	437.53	10.25	0.45	9.68	0.02	0.33	848.29
LP I	40.65	190.22	428.26	0.62	0.16	8.15	0.03	0.05	668.14
LP II-Hist.	100.02	95.62	699.15	10.82	0.36	18.77	0	0	924.74
Totals	268.83	684.48	1735.16	29.64	0.97	38.07	0.05	0.38	2757.58

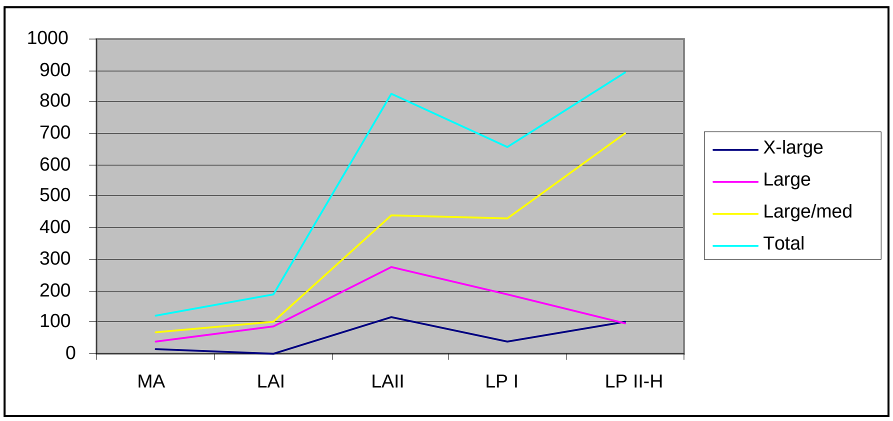

Figure 41. Total weights in grams by time period for extra-large, large, and large/medium mammal size classes by time period.

While the above presented weight totals highlight trends over time, to compare diet breadth between time periods, weight by size-class expressed as a percentage of total weight by period is utilized for inter-assemblage comparison (**Table 35**). In doing, it is observed that, with the exception of the Late Archaic I, the extra-large size class generally comprises 10% of the total weight of the faunal assemblages for each time period. The greatest fluctuation in percentage occurs in the large/medium sized class with a high percentage of 82-percent occurring during the Late Archaic I, and a low percentage of 52-percent noted for the Late Archaic II (**Figure 42**). Following the Late Archaic II, the percentage of assemblage content increases for the large/medium mammal size category during the Late Prehistoric I and, again, during the Late Prehistoric II-Historic. At approximately half the calculated percentage, mammal class, the distribution of the large-sized class mirrors the large/medium sized class from the Middle Archaic to the Late Archaic II, where it declines noticeably from 32-percent to 28-percent during the Late Prehistoric I to 10-percent for the Late Prehistoric II-Historic.

Table 35. Percent of faunal assemblage content by size category and temporal period.

	X-large	Large	Large/med	Medium	Med/small	Small	Small/very small	V. small
MA	11	29	56	4	0	<1	0	0
LAI	0	45	82	2	0	<1	0	0
LAII	14	32	52	<1	<1	1	<1	<1
LP I	6	28	64	<1	<1	1	<1	<1
LP II-Hist.	11	10	76	1	<1	2	0	0

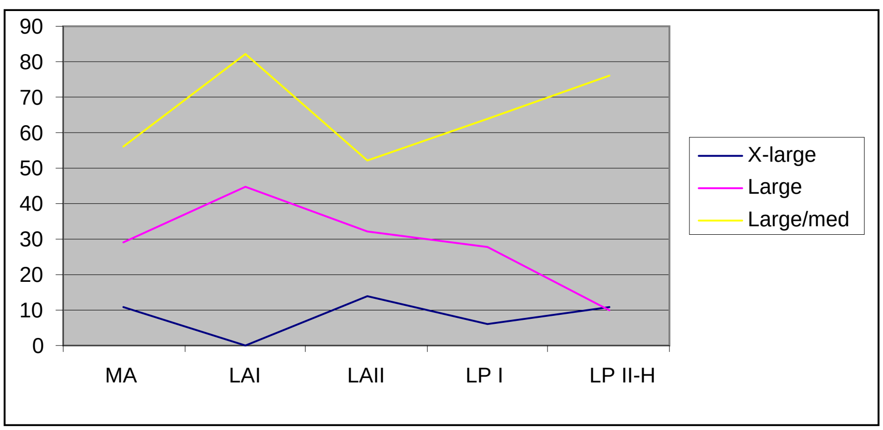

Figure 42. Percent of faunal assemblage content by size category (Extra - large, Large, and Large/Medium) and temporal period.

Utilizing NISP counts (**Tables 29-32**), a Chi-Square-Test for-Independence was calculated in Excel, with critical values determined at the 5-percent (0.05) confidence level and adjusted with Yates' correction for continuity because a few of the expected frequencies were lower than five. Under the working hypothesis that there is no difference in the observed frequencies between time periods, expected frequencies were generated for the Middle Archaic, Late Archaic I, Late Archaic II, and Late Prehistoric II-Historic NISP counts presented above for the extra-large, large, and large/medium mammal size categories. Results of the Chi-Square independence test is: X_c^2= 189.07, with α=.05, df=14, and cv=23.658. This result indicates that there is significant variation in the faunal assemblages for the three size classes of extra-large, large, and large/medium-sized mammal when partitioned by NISP.

While successful in illuminating variation, the Chi-Square-Test for-Independence is unable to identify within which size category the noted significant differences occur. To do so, an adjusted residual table was generated in Excel for the Middle Archaic, Late Archaic I, Late Archaic II, and Late Prehistoric II-Historic faunal assemblages utilizing the extra-large, large, and large/medium mammal size classes. At a 5-percent confidence level, calculated adjusted residuals above 1.96 and below -1.96 are considered as varying significantly from expected values. The results of this analysis are presented below in **Table 36**.

Table 36. Adjusted residuals for the extra-large, large and large/medium mammal size classes by time period.

	X-Large	Large	Large/Med.
MA	0.01	2.22	-2.12
LA I	-2.26	8.16	-7.05
LA II	0.4	7.82	-7.6
LP I	-2.06	-2.47	3.04
LP II-Hist.	2.64	-10.33	8.99

The calculation of adjusted residuals identified 13 instances of significant variation. For the Middle Archaic period, there is a higher than expected NISP value for large-sized mammalian fauna and a lower than expected value of large/medium sized faunal remains on a significant level. Calculated adjusted residuals for the Late Archaic I faunal assemblage notes a significantly low NISP value for both the extra-large and large/medium size classes and a very high significant value for the large size class. The Late Archaic II time period is characterized by a significantly high number for the large sized class and a significantly low number for the large/medium category. For the Late Prehistoric I period, there is a significantly low variation for the both the extra-large class and the large-sized mammal class and a high significant value for the large/medium mammal category. Finally, high significant variation is noted for the extra-large mammal and large/medium mammal categories. During this same time period, there is a significantly low represented NISP number for the large sized class.

Interpretation

The above calculated adjusted residuals highlight the shifts in subsistence strategy first suggested in **Figure 41,** and identified through the Chi-Square-Test for-Independence. The data suggest that there is a pattern in the significant variations noted in the large-sized and the large/medium sized mammal categories wherein a high significant value for the large class appears to correlate with a low significant value for the large/medium class and vice versa (**Table 36**). Further, the NISP value for the large/medium size mammal category increases continuously from a significantly low value during the Middle Archaic to a significantly high value during the Late Prehistoric II-Historic period. This is contrary to what one would expect if sediment compaction was responsible for the high numbers of fractured bone present in this size class. This is taken as evidence that the transforms that reduced much of the bone to unidentifiable as to specific taxon was a cultural process and not a natural phenomenon.

As evidence of a cultural transform, Klein and Cruz-Uribe (1984) offer that, at times, bone fragmentation can be accounted for entirely by human behavior while Madrigal and Holt (2002) suggest that bones with high marrow yields are more than likely to appear as fractured within a faunal assemblage. Brain (1981) offers that a high degree of fragmentation is indicative of the highly destructive nature of human food preparation rather than that of other carnivores. In the case of long-bones the process of marrow extraction and grease processing often obliterates epiphyseal elements, making them unrecognizable (Madrigal and Holt 2002:756). Also, because they retain a modicum of nutritional value, these elements may be destroyed or removed from a site by dogs or other scavenging carnivores. In contrast, fragments of long bone retain little nutritional value and are less likely to be destroyed by the same opportunistic scavengers. Hence, in faunal assemblages represented of a large amount of marrow and grease extraction, there should be noticeable amounts of non-episphyseal long boned fragments, and/or fragments that are largely unidentifiable. A comparison of calculated MNIs by temporal period (**Tables 37, 38, 39, 40,** and **41** below) with the above presented NISP values illustrates that, with low MNIs for all faunal categories for temporal periods, all the represented assemblages have a high degree of fragmentation, including those which make up the largest percent of the temporal assemblages, the large and large/medium-sized mammal classes. Further, in an examination of *in situ* transformations affects on the preservation of long bone elements, Stiner (2002:986) noted that “there is considerable fallacy to the assumption that shafts are more persistent…than *every* end" (epiphyses) and that the differential is, at its most extreme, 2/1 or 3/1.

Table 37. Identified faunal elements and calculated MNI for the Middle Archaic.

MA	Bison	Large Mam.	Prong-horn	White Tailed Deer	Large/ med. Mam.	Coyote	Medium Mam.	Rodent	Small Mam.	Lrg. Bird	Snake	Turtle
Long Bone Fragment	1	11	0	0	3	0	0	0	2	0	0	0
Tooth	2	1	1	0	0	0	0	1	0	0	0	0
Phalanx	0	0	3	1	0	0	0	0	0	0	0	0
Metatarsal	0	0	1	2	0	0	0	0	0	0	0	0
Rib	0	1	0	0	0	0	0	0	0	0	0	0
Humerus	0	0	0	0	0	1	0	0	0	0	0	0
Innominate	0	0	0	0	0	0	1	0	0	0	0	0
Femur	0	0	0	0	0	0	0	0	0	1	0	0
Vertebrae	0	0	0	0	1	0	0	0	1	0	1	0
Ulna	0	0	0	0	0	0	0	0	1	0	0	0
Carapace	0	0	0	0	0	0	0	0	0	0	0	2
MNI	1	1	1	1	1	1	1	1	1	1	1	1

Table 38. Identified faunal elements and calculated MNI for the Late Archaic I.

LA I	Larg. Mam	Prong-horn	White Tailed Deer	Large/med .Mam.	Coyote	Med. Mam.	Hares	Rodent	Large Bird	Snakes	Gar
Long Bone	12	0	0	0	0	0	0	0	1	0	0
Tooth	2	2	0	0	1	0	0	2	0	0	0
Phalanx	0	3	0	0	0	1	0	0	0	0	0
Metatarsal	0	1	4	0	0	0	0	0	0	0	0
Femur	0	0	0	0	0	1	1	1	0	0	0
Vertebrae	0	0	0	0	0	0	0	0	0	2	0
Carapace	0	0	0	0	0	0	0	0	0	0	0
Tibia	0	1	0	0	0	0	0	0	0	0	0
Carpal	0	1	0	0	0	0	0	0	0	0	0
Metapoidal	0	1	0	0	0	0	0	0	0	0	0
Tarsal	0	1	0	0	0	0	0	0	0	0	0
Radius	1	0	0	0	0	0	0	0	0	0	0
Sesamoid	1	0	0	0	0	0	0	0	0	0	0
Scapula	0	0	0	0	0	0	1	0	0	0	0
Scale	0	0	0	0	0	0	0	0	0	0	1
MNI	1	1	4	1	1	1	1	1	1	1	1

Table 39. Identified faunal elements and calculated MNI for the Late Archaic II.

LAII	Bison	Lrge Mam.	Prong-horn	W.tailed deer	Deer	Lrge/ med Mam	Coyote	Med. Mam	Beaver	Racn.	Hare	Ctn tail	Small Mam.
Long Bone	10	29	26	0	0	0	0	2	0	0	0	0	1
Tooth	6	38	0	0	0	1	1	2	1	0	0	0	0
Phalanx	0	0	15	0	0	0	0	2	0	0	0	0	1
Metatarsal	1	0	3	0	0	0	0	0	0	0	0	0	0
Rib	0	4	0	0	0	0	0	0	0	0	0	0	0
Humerus	0	0	1	0	0	0	0	0	0	0	0	0	1
Innom.	0	0	0	0	0	0	0	0	0	0	0	0	1
Femur	0	0	2	0	0	0	0	0	0	0	0	0	2
Vertebra	0	0	2	0	0	0	0	0	0	0	0	0	2
Ulna	0	0	0	0	0	0	0	1	0	0	0	0	0
Tibia	0	0	0	0	0	0	0	0	0	0	0	0	3
Carpal	0	0	1	2	0	0	0	1	0	0	0	0	0
Metapoid	0	0	2	0	1	0	0	1	0	0	0	0	0
Tarsal	0	0	2	0	0	0	0	0	0	0	0	0	0
Radius	0	0	2	0	0	1	0	0	0	1	0	0	0
Sesamoid	0	1	5	0	0	1	0	0	0	0	0	0	0
Scapula	0	0	0	0	0	0	0	0	0	0	0	0	1
scale/shell	0	0	0	0	0	0	0	0	0	0	0	0	0
Skull	1	0	0	0	0	4	0	0	0	0	0	0	0
Calcaneus	0	0	2	0	0	0	0	0	0	0	2	0	1
Nav. cuboid	0	0	1	0	0	0	0	0	0	0	0	0	0
Fibula	0	0	2	0	0	0	0	0	0	0	0	0	0
Mandible	0	0	0	0	0	0	0	0	0	0	0	1	3
Maxila	0	0	0	0	0	0	0	0	0	0	0	0	1
MNI	1	1	2	1	1	1	1	1	1	1	1	1	1
LAII	Squirrel	Goph.	Rodent	Small/V. Small Mam.	Very Small Mam.	Mouse	Wild turkey	Med. bird	Med. /small bird	Sm. bird	Snakes (Non-Viper)	Water snake	
Tooth	0	0	6	0	0	0	0	0	0	0	0	0	
Metatarsal	0	0	0	0	0	0	1	0	0	0	0	0	
Humerus	0	0	0	0	0	0	0	0	1	1	0	0	
Innom.	0	0	1	0	0	0	0	0	0	0	0	0	
Femur	0	0	0	1	0	0	0	0	0	0	0	0	
Vertebrae	0	0	0	0	0	0	0	0	0	0	35	4	
Ulna	0	0	1	0	0	0	1	0	1	0	0	0	
Tibia	0	0	1	0	0	0	0	1	0	1	0	0	
Skull	0	1	1	0	0	0	0	0	0	0	0	0	
Fibula	0	0	0	0	0	0	0	0	0	0	0	0	
Mandible	1	2	9	0	2	1	0	0	0	0	0	0	
MNI	1	1	1	1	2	1	1	1	1	1	1	1	

Table 40. Identified faunal elements and calculated MNI for the Late Prehistoric I.

LP I	Bison	Large Mam.	Prong-horn	White-tailed	Black Bear	Large/med Mam.	Coyote	Med. Mam	Beaver	Opposs	Hare	Goph
Long Bone	1	11	13	0	0	7	0	0	0	0	0	0
Tooth	2	32	13	2	0	0	1	0	0	0	0	0
Phalanx	0	0	7	0	0	0	0	1	0	0	0	0
Metatarsal	0	0	4	0	0	0	0	0	0	0	0	0
Rib	0	1	0	0	0	0	0	0	0	0	0	0
Humerus	0	0	1	0	0	0	0	0	0	0	0	1
Femur	0	0	0	0	0	0	0	1	0	0	0	1
Vertebrae	0	5	2	0	0	0	0	0	0	0	0	0
Ulna	0	0	2	0	0	0	0	0	1	0	0	0
Tibia	0	0	0	0	0	0	0	0	0	0	0	0
Carpal	0	1	2	0	0	0	0	0	0	0	0	0
Metapoid	0	0	2	0	0	0	0	0	0	0	0	0
Tarsal	0	0	0	1	0	0	0	0	0	0	0	0
Radius	0	0	0	0	1	0	0	0	0	0	0	0
Sesamoid	0	0	0	1	0	0	0	0	0	0	0	0
Skull	0	1	3	0	0	0	0	0	0	0	0	0
Calcaneus	0	0	0	0	0	0	0	0	0	0	1	0
Mandible	0	0	3	0	0	0	0	0	0	1	0	1
Premaxilla	0	1	0	0	0	0	0	0	0	0	0	0
MNI	1	1	2	1	1	1	1	1	1	1	1	1

LP I	Rodent	Small/ V. Sm Mam.	Very Small Mam.	Large bird	Wild turkey	Small bird	Snakes (Non-Viper)	Frog	Ind. Reptile	Gar	Perch	Ind. Fish
Long Bone	1	0	0	1	0	1	0	0	0	0	0	0
Humerus	2	0	0	0	0	4	0	0	0	0	0	0
Innominate	1	0	0	0	0	0	0	1	0	0	0	0
Femur	3	0	0	0	0	0	0	0	0	0	0	0
Vertebrae	0	0	0	0	0	0	21	0	2	1	0	3
Ulna	1	0	0	0	0	0	0	0	0	0	0	0
Tibia	0	1	1	0	0	0	0	0	0	0	0	0
Tarsal	0	0	0	1	0	0	0	0	0	0	0	0
Skull	1	0	0	0	0	0	0	0	0	0	0	0
Calcaneus	0	1	0	0	0	0	0	0	0	0	0	0
Mandible	7	0	1	0	0	0	0	0	0	0	0	0
Maxila	1	0	0	0	0	0	0	0	0	0	0	0
Pharyngeal	0	0	0	1	1	0	0	0	0	0	0	0
MNI	2	1	1	1	1	1	1	1	1	1	1	1

Table 41. Identified faunal elements and calculated MNI for the Late Prehistoric II-Historic.

LP II-H	Bison	Large mamm.	Prong horn	White tailed deer	Deer	Large/ Med. Mam.	Canidae	Med. mam.	Beaver	Hare	Small mam.	Gopher
Long Bone	10	20	0	0	0	5	0	2	0	0	1	0
Tooth	9	31	12	1	2	1	3	3	1	0	0	1
Phalanx	0	1	12	0	0	0	0	1	1	0	2	0
Metatarsal	0	0	1	0	0	0	0	0	0	0	0	0
Humerus	0	0	0	0	0	0	0	0	0	1	2	0
Innom.	0	0	0	0	0	0	0	0	0	0	1	0
Femur	0	0	0	0	0	0	0	1	0	0	0	0
Vertebrate	0	3	0	0	0	0	0	1	0	0	2	0
Ulna	0	1	0	0	0	0	0	0	0	0	1	0
Tibia	1	0	0	0	0	0	0	0	0	0	2	0
Carpal	0	0	2	0	0	0	0	0	0	0	0	0
Metapoidal	0	1	4	0	0	0	0	0	0	0	0	0
Radius	1	0	0	0	0	0	0	0	0	0	0	0
Sesamoid	0	0	1	0	0	0	0	0	0	0	0	0
Scapula	0	1	0	0	0	0	0	0	0	0	0	0
Scale	0	0	0	0	0	0	0	0	0	0	0	0
Calcaneus	0	0	0	0	0	0	0	0	0	2	0	0
Mandible	0	0	0	0	0	0	0	0	0	0	3	1
Maxila	0	0	0	0	0	0	0	0	1	1	0	0
MNI	1	1	1	1	1	1	1	1	1	1	1	1

LP II-H	Rodent	Med. bird	Small bird	Med./ small mam.	Turtle (soft shell)	Snakes	Snakes	Turtle	Gar	Frog	Ind. Fish	Ind. Reptile
Rib	0	1	0	0	0	0	0	0	0	0	0	0
Humerus	0	1	1	0	0	0	0	0	0	0	0	0
Iinnominat e	0	0	0	0	0	0	0	2	0	0	0	0
Femur	0	0	1	0	0	0	0	1	0	1	0	0
Vertebrate	0	0	0	0	0	18	1	0	1	0	1	1
Ulna	0	0	0	0	0	0	0	0	0	0	0	0
Carapace	0	0	0	0	2	0	0	40	0	0	0	0
Tibia	3	0	0	0	0	0	0	0	0	0	0	0
Radius	1	0	0	0	0	0	0	0	0	0	0	0
Scale	0	0	0	0	0	0	0	0	2	0	0	0
Skull	1	0	0	1	0	0	0	0	0	0	0	0
Calcaneus	0	0	0	0	0	0	0	0	0	0	0	0
Mandible	8	0	0	0	0	0	0	0	0	0	0	0
Plastron	0	0	0	0	0	0	0	3	0	0	0	0
MNI	1	1	1	1	1	1	1	1	1	1	1	1

Taphonomy aside, and considering both Madrigal and Holts' (2002) and Stiner's (2002) postulates the high degree of fragmentation observed within all temporal assemblages is attributed to bone extraction and marrow processing. Further, at first glance, numbers for the large/medium-sized mammal class for all time periods appears high for a category largely assigned to predators (generally, counts for prey species' would be expected to far outnumber those of predators in most assemblages). However, considering that many of the elements organized into the large/medium-sized category were noted as fragmented elements likely originating from larger animals, it is quite possible that a majority of these elements are the remains of deer and/or pronghorn antelope fragmented by cultural processes (butchering and processing). Following, when the calculated adjusted residuals (**Table 36,** above) for the large/medium-sized mammal classes is utilized as an indication of fragmentation due to bone processing for marrow and grease extraction, there appears to be less of this activity during the Late Archaic II than any other represented time period, when bison remains again appear within the assemblage in moderate (although not significantly so) numbers. Although numbers for the large sized class indicate that deer and pronghorn were extensively hunted during this time period, intensive processing of the bone for marrow and grease did not occur. In fact, the evidence suggests this to be the case for the preceding Middle Archaic and the Late Archaic I as well. NISP counts reach their significant lowest during the Late Archaic I with a significantly high number represented in the large size mammal class suggesting that as bison procurement waned there was an increased emphasis on the acquisition of deer and pronghorn antelope.

During the Late Prehistoric I, when NISP counts for bison again return to a significant low value, there is a significant high value reported for the large/medium sized category, suggesting an increase in bone fragmentation as a result of increased processing, the earliest this is evidenced in this collection. This indicator for increased bone processing, evidence by high significance in the large/medium class, increases again during the Late Prehistoric II-Historic although, in contrast to the Late Prehistoric I assemblage, there is also a high significant value indicated for bison, or extra-large mammal category for this time period as well.

Two cultural trends are herein evidenced by the presented data. First, from the Middle Archaic up through the Late Archaic I, deer and/or pronghorn were the primary hunted resource for the occupants of 41HY160. While bison was procured during the Middle and Late Archaic II, there is no evidence of this occurring for the Late Archaic I time period. During this time, there is an increase in the exploitation of deer and/or pronghorn, which somewhat subsides when bison again appear in the faunal assemblages during the Late Archaic II. During these times, fragmentation of animal bone as a result of increased processing did not occur. It is during the Late Prehistoric I that the second trend occurs. During this time period, bison numbers again wane. However, instead of an expected significant high value noted in the large mammal class in the calculated residuals, the correlated increase is witnessed in the large/medium mammal class. It would appear that in order to offset the decrease in bison exploitation or availability, increased processing of deer/ and or pronghorn bone occurred during this time. While the adjusted residuals presented above in **Table 36** show a low significant value for the large mammal category for the Late Prehistoric I, when this class is combined with that of the large/medium class (with identifiable *canidae* taxon removed from the NISP count) there *is* a suggested correlated increase in deer/pronghorn exploitation (**Table 42**) that does not manifest itself in the large size mammal category due to extensive fragmentation as a result of intensive grease and marrow extraction.

Table 42. Adjusted residuals for the extra -large and combined large and large/medium mammal size classes by temporal period.

	X-Large	Large & Large/med.
MA	0.02	-0.02
LA I	-2.26	2.26
LA II	0.4	-0.4
LP I	-2.06	2.06
LP II-Hist	2.64	-2.64

The trend of intensive bone processing observed during the Late Prehistoric I period continues is also observed for the Late Prehistoric II-Historic with a very significant high variation noted within the large/medium category at this time. While increased bone processing continued from the Late Prehistoric I to the Late Prehistoric II-Historic, there is a decline in the overall exploitation of deer and pronghorn, offset by the intensive use of bison as evidenced by the significant high variation noted within the extra large mammal class for this time period.

CHAPTER 11

CONCLUSION

Dated through the creation of a chronostratigraphical model in OxCal (v4.0), radiocarbon dates, and projectile point chronology, the artifacts utilized in this work from the 1982 and 1983 field school collections represent temporal periods dating from the Early Archaic up through the Late Prehistoric II-Historic period, or approximately 5,000 years of Texas prehistory. Under the governing theoretical principle that changes in technological organization can illuminate changes in the behavior of prehistoric peoples, a lithic analysis was conducted on samples of debitage, bifaces, cores, and flake tools from all represented temporal periods: Early Archaic, Middle Archaic, Late Archaic I, Late Archaic II, Late Prehistoric I, and Late Prehistoric II-Historic (**Chapter 9**). In total, following the methods outlined in **Chapter 8,** 7350 individual specimens of debitage, 41 cores, 69 bifaces, and 324 flake tools were quantified with 253 analyzed for platform type and 227 for quadrant point value (QPV), with the disparities in the numbers due to differing levels of flake tool completeness. From these analyses, general interpretations were presented concerning changes in site use and mobility strategies by the inhabitants of 41HY160 over time. Additionally, the entire faunal assemblage from the 1982 and 1983 field school years was outsourced to the University of Tennessee, Knoxville's zooarchaeological laboratory for the identification of taxon and modification for each individual specimen of bone. These data, provided to the author in a tabulated Excel file, were then separated into temporal periods in a similar manner as the lithic assemblage and analyzed. Results and initial interpretations are presented in **Chapter 10**. What follows are conclusions regarding the lithic and faunal analyses presented by time period.

Early Archaic

The complete absence of cores and near-absence of bifaces and flake tools from the Early Archaic lithic assemblage is indicative of short-term, ephemeral logistical site use by hunters and gatherers. While cores would have been available in the form of river cobbles or outcropping stone at nearby 41HY37, adjusted residual scores for flake category seem to indicate that the majority of cobble reduction was done elsewhere, although the near significant amount of large-sized debris indicates a moderate amount of early stage reduction was done at 41HY160 during the Early Archaic (**Figure 43**). With the absence of high amounts of identified flake tools, cores, and bifaces, and the high adjusted residual score for the large-sized cortical platform category suggests that these flakes are the byproduct of bifaces that were intended for use elsewhere-an indicator of high mobility, perhaps into regions where resource availability was variable or not well defined (**Figure 44**). While not significant, positive values for small and large flat platformed and small complex platformed flakes may indicate instances of late-stage biface and/or tool production/rejuvenation. While lack of bone preservation is likely, if the complete absence of faunal remains from the Early Archaic assemblage is indicative of exploitation strategy, then the hypothesized short-term logistical site use by a highly mobile hunter and gatherer people correlates with the faunal evidence (or lack thereof). Further, this also suggests that the overall numbers of people inhabiting 41HY160 were low compared to succeeding time periods. If the Early Archaic was indeed a period wherein the intensification of the exploitation of more local resources began, the evidence is scant that this was occurring at 41HY160.

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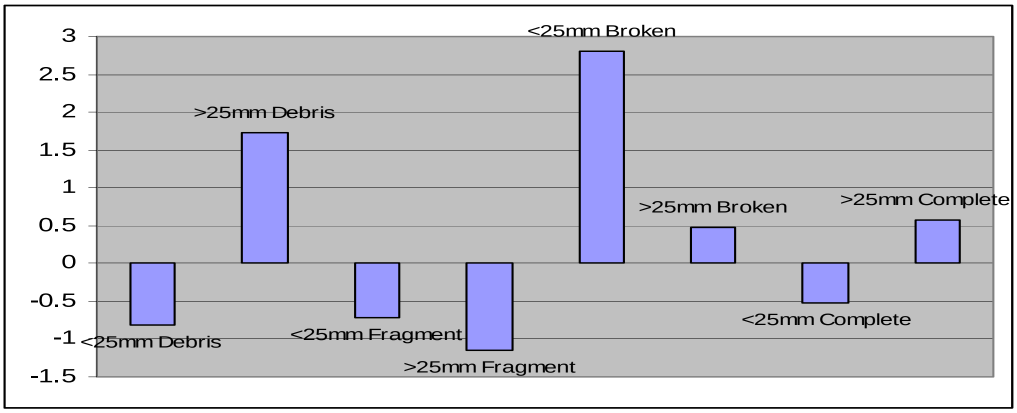

Figure 43. Adjusted residuals for Early Archaic flake type and size category.

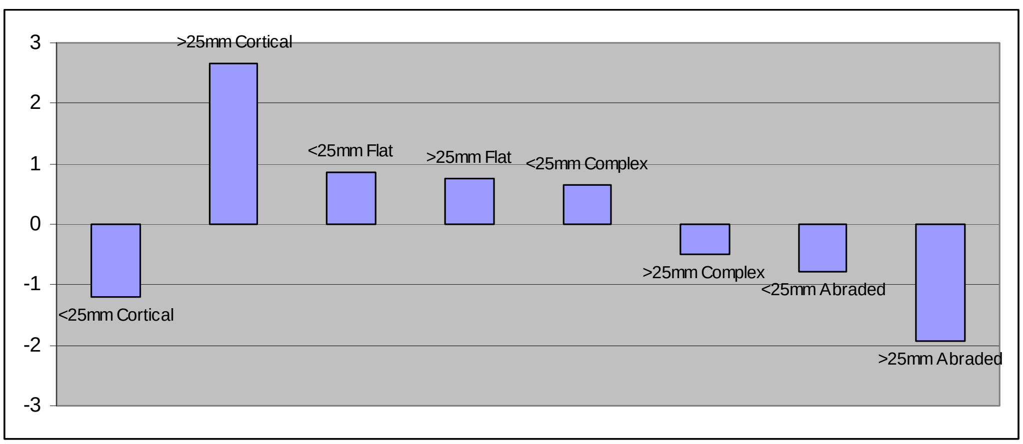

Figure 44. Adjusted residuals for Early Archaic flake platform type and size category.

Middle Archaic

While three cores were recorded on the original lab sheets for the 1982 and 1983 field schools, these items were not available in the current collection for confirmation or further analysis. When this quantity is compared to bifaces as a measure of mobility utilizing adjusted residuals (**Figure 45**), the Middle Archaic hunter and gatherers that inhabited the 41HY160 locale were comparatively highly mobile in relation to the following time periods as evidenced by very low significant values reported for cores, and the very high significant and the near significant high value of early to mid-and late-stage bifaces, respectively. Still, for this time period, there is a near equal amount of simple flake tools when compared to the Late Archaic I, Late Archaic II, Late Prehistoric I, and Late Prehistoric II-Historic time periods. Further, calculated high variation in the amounts of small-sized debris and low amounts of complete flakes noted for this period indicates either increased late-stage reduction or decreased residential mobility (**Figure 46**). The absence of flake tools detached from formalized bifacial cores, as evidenced by low values for QPV3&4 and flake tools with abraded or complex platforms (**Figure 47**) coupled with the presence of a high significant amount of small-sized complex flakes, indicates that, while bifaces were occasionally manufactured, thinned, and/or refurbished during this time period, their use as tools and cores likely occurred away from 41HY160 at other, perhaps, logistical sites.

With significant high numbers of large-sized mammal bone represented in the faunal assemblage (**Figure 45**), it is likely that deer/pronghorn were exploited during the Middle Archaic, acquired in short forays and brought back to 41HY160 where they may have been butchered and processed utilizing expedient flake tools. Bison (represented as extra-large sized mammal) appear in the faunal assemblage for this time period in minute amounts. With evidence of biface manufacture and preparation and little evidence of bifacial flake tool detachments used locally, it is posited that this resource was available, although at a greater distance or in lesser numbers than deer and pronghorn, and were pursued at locales far enough away from 41HY160 where their butchering, processing, and consumption left little record at 41HY160.

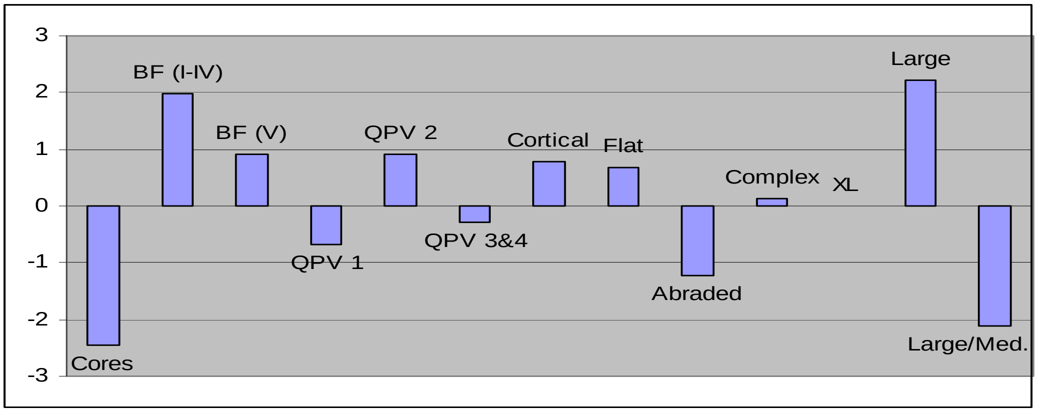

Figure 45. Adjusted residuals for Middle Archaic cores, bifaces, and QPV and platform types for flake tools, Extra-large, Large, and Large/medium fauna size classes. Note value for the extra large fauna class is extremely low at .01.

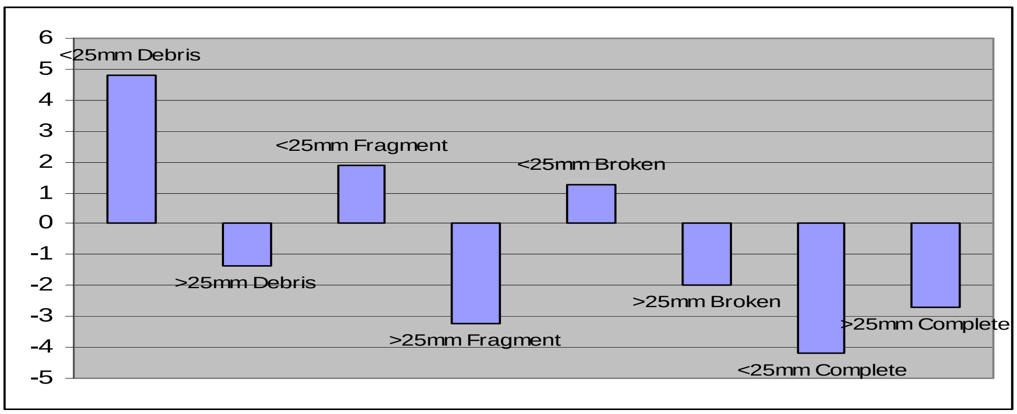

Figure 46. Adjusted residuals for Middle Archaic flake type and size category.

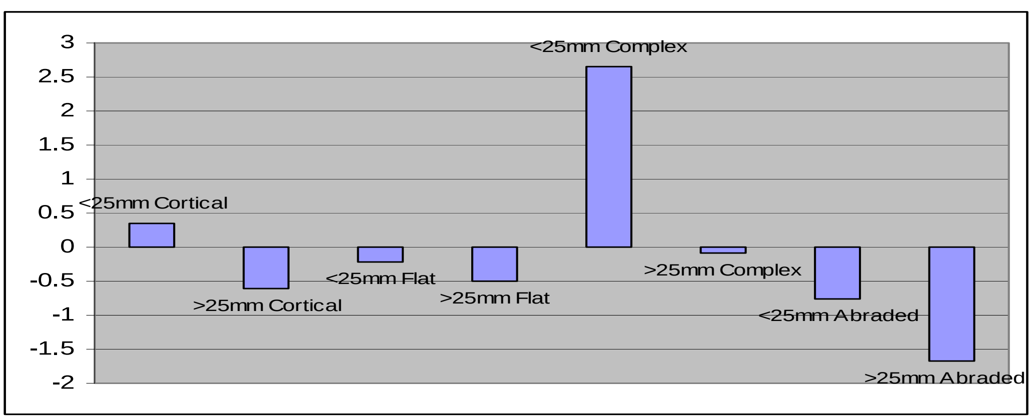

Figure 47. Adjusted residuals for Middle Archaic flake platform type and size category.

Faunal analyses indicate that while the remains of deer and/or pronghorn are statistically represented more significantly than bison in the Middle Archaic assemblage, both were consumed. Correlating with the lithic analysis, it is hypothesized that there was an increased intensification in the occupation of 41HY160 during this time period. Deer were exploited along with other local resources during periods of reduced residential mobility, while, as evidenced by lithic analysis, moderate to frequent planned logistical forays occurred or seasonal residential movements, that may have been tied to the exploitation of other resources at far away locales.

Late Archaic I

With little significant variation noted within debitage categories outside of a low amount of large-sized debris (**Figure 49**) and a high amount of small-sized cortical platformed flakes (**Figure 50**), the Late Archaic I period displays the least distinctive debitage assemblage. A decrease in the ratios of bifaces to cores when compared to the Middle Archaic suggests a move closer towards a more expedient technology and increased long term occupation of 41HY160; although, an intra-assemblage comparison of bifaces and cores utilizing adjusted residuals suggests that high residential mobility was still practiced (**Figure 48**). The low significant value for large-sized debris (**Figure 49**) indicates less intensive initial core reduction was done at this location while the significant high numbers of small-sized cortical and flat platforms indicate intensive mid-and-late stage non-bifacial core reduction occurred. Also, the flake tool assemblage utilized at 41HY160 appears oriented towards expedient detachments from non-prepared cores. During the Late Archaic I, there is no evidence in the faunal assemblage that bison were exploited or consumed at this locale. With a posited local absence of buffalo, Late Archaic I peoples increased their exploitation of deer and/or pronghorn. Co-varying with the significant low amounts of these extra-large sized mammals in the faunal assemblage is evidence for increased sedentism and expedient core reduction and simple flake tool use. As noted as a hallmark for the Late Archaic I in Chapter 3, as measured by the numbers of lipped platforms, soft hammer reduction increases noticeably from the Middle Archaic to the Late Archaic I (**Chapter 9**).

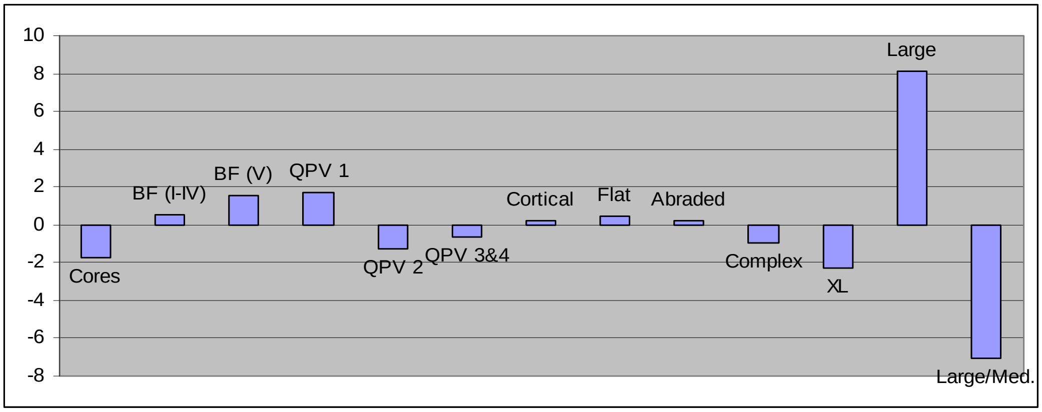

Figure 48. Adjusted residuals for Late Archaic I cores, bifaces, and QPV and platform types for flake tools, Extra-large, Large, and Large/medium fauna size classes.

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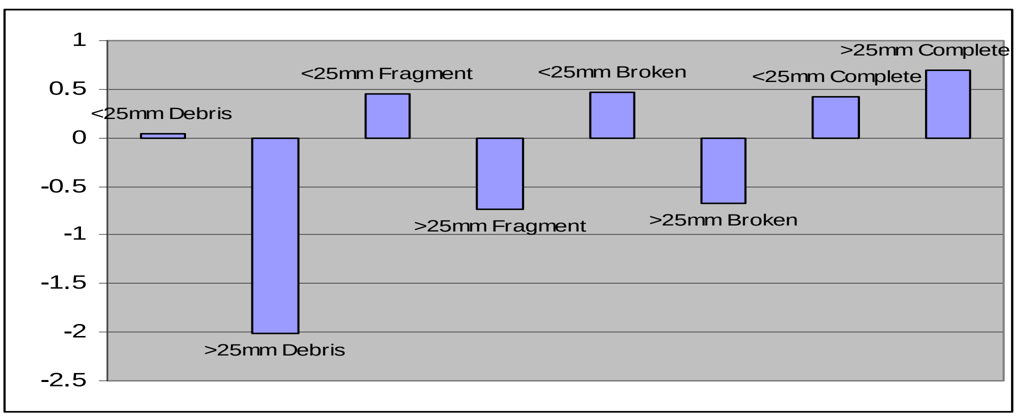


Figure 49. Adjusted residuals for Late Archaic I flake type and size category.

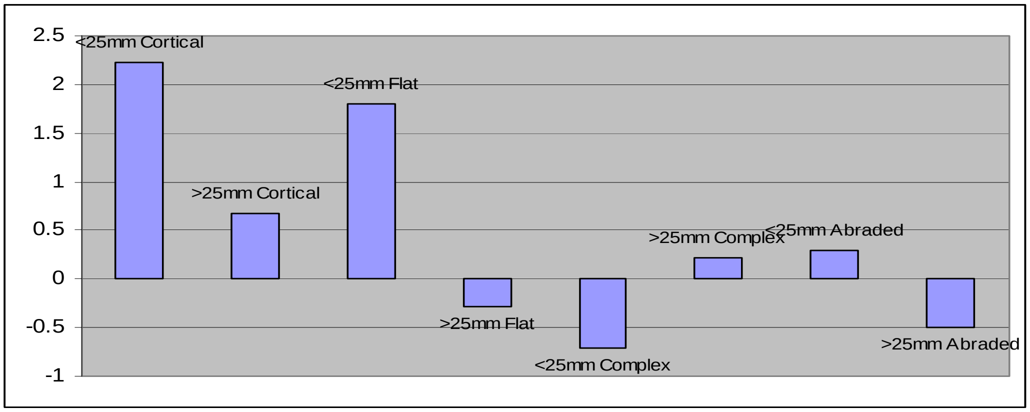


Figure 50. Adjusted residuals for Late Archaic I flake platform type and size category.

Late Archaic II

During the Late Archaic II bison returns in greater numbers to the faunal assemblage, (**Figure 51**) and their logistical exploitation is witnessed within the corresponding lithic assemblage that evidences increased biface manufacture through high significant values for large complete flakes (**Figure 52**) and large-sized complex platforms (**Figure 53**) used away from 41HY160. At the same time, expedient flake tool numbers remain similar to previous periods as represented by the numbers of deer and/or pronghorn remains, suggesting that while increased logistical forays occurred, intensive site use of 41HY160 continued during the Late Archaic II. High significant numbers of cores and low significant values for bifaces indicates residential and sedentary site use, with bifaces, when manufactured at 41HY160, likely discarded elsewhere. Since, we have yet to witness evidence of intensive marrow and grease extraction it is posited that the groups of hunter and gatherers that utilized site 41HY160 during the Late Archaic II were similar in size to the groups that inhabited 41HY160 during the Late Archaic I.

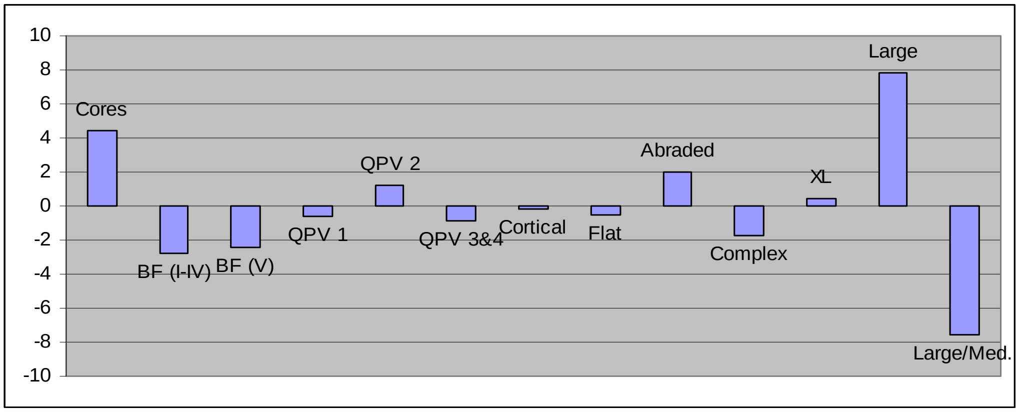


Figure 51. Adjusted residuals for Late Archaic II cores, bifaces, and QPV and platform types for flake tools, Extra-large, Large, and Large/medium fauna size classes.

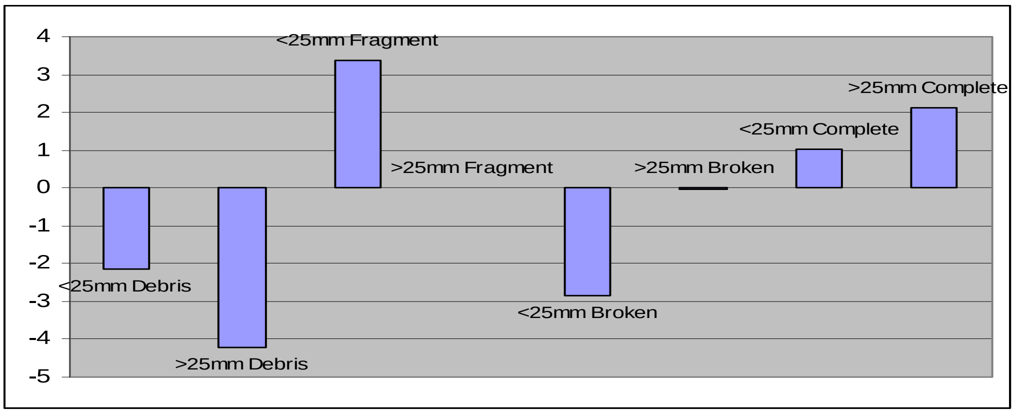


Figure 52. Adjusted residuals for Late Archaic II flake type and size category.

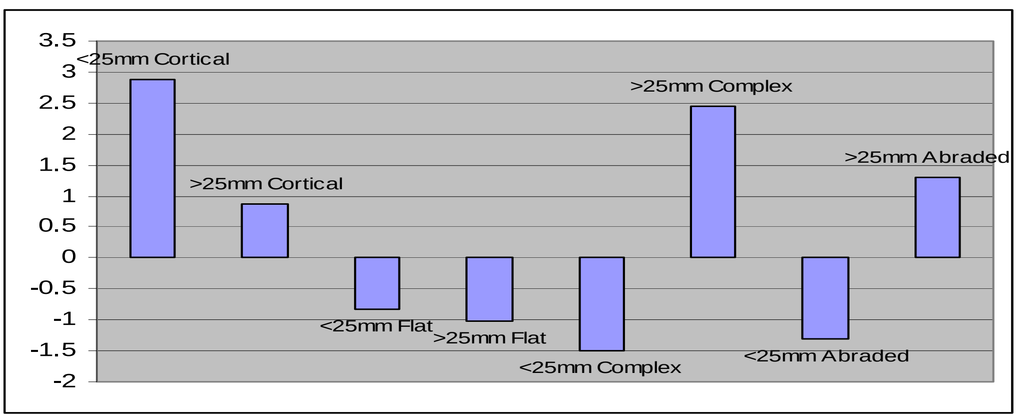


Figure 53. Adjusted residuals for Late Archaic II flake platform type and size category.

Late Prehistoric I

Using the statistically high significant increase in the fragmentation of animal bone at 41HY160 as a proxy indicator of intensive bone processing/grease extraction, it is posited that during the Late Prehistoric I, site 41HY160 witnesses either an increase in the duration of occupation, an increase in the numbers of inhabitants, or both (**see Chapter 10**). At the same time, buffalo exploitation wanes, and there was decreased use of late-stage bifacial cores at 41HY160 (**Figure 54**). With near high significant numbers of QPV3&4 and abraded platformed flakes, the Late Prehistoric I time period bears first witness to noted bifacial flake tool use (**Figure 54**). With a noted high significant value for abraded platformed large-sized flakes (non tool), there is indication that abrasion may have occurred post-detachment, or abraded platformed flakes were more actively selected for use as flake tools, in which case there may be a correlation between these tools and increased bone processing. Significant low amounts of debris indicates less early stage reduction at 41HY160 during the Late Prehistoric I, and the very high significant values for small-sized complete (**Figure 55**) and cortical platformed flakes (**Figure 56**) indicate mid-stage and late-stage production of bifaces, (if so the low numbers of represented late stage bifaces indicates they were used and discarded elsewhere) perhaps in anticipation of logistical forays. Otherwise these signatures may represent the debitage from bifacial tool production that is evidence for this time period at 41HY160.

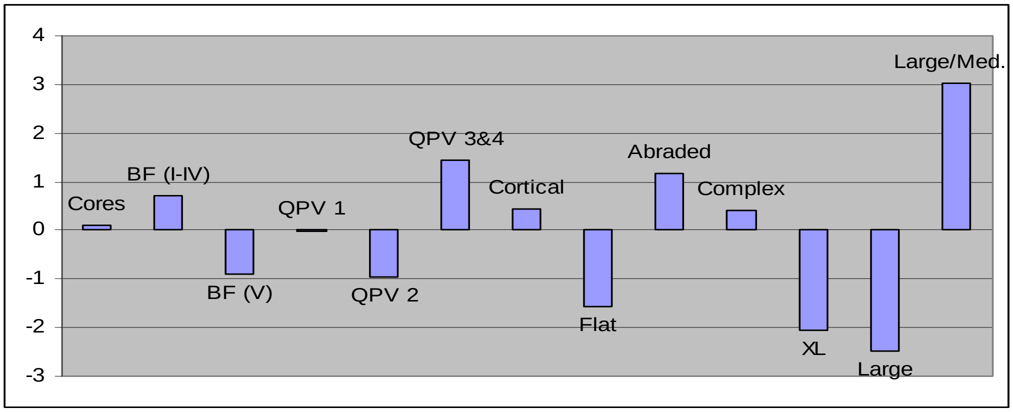


Figure 54. Adjusted residuals for Late Prehistoric I cores, bifaces, and QPV and platform types for flake tools, Extra-large, Large, and Large/medium fauna size classes.

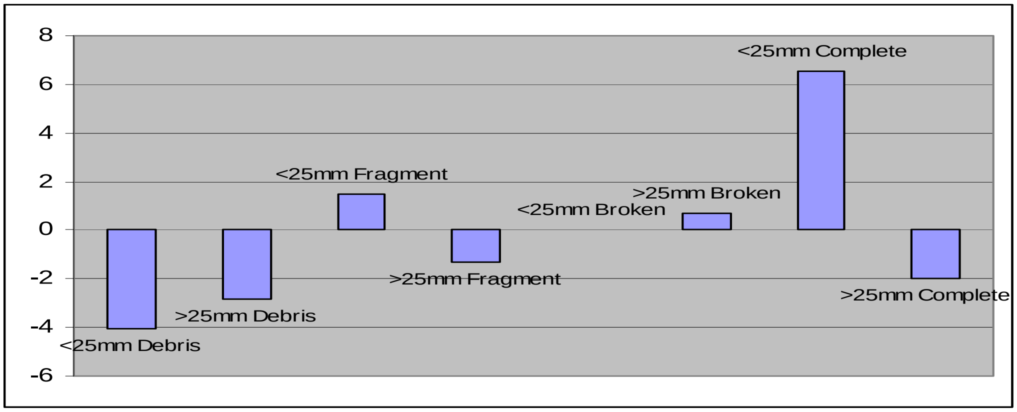


Figure 55. Adjusted residuals for Late Prehistoric I flake type and size category.

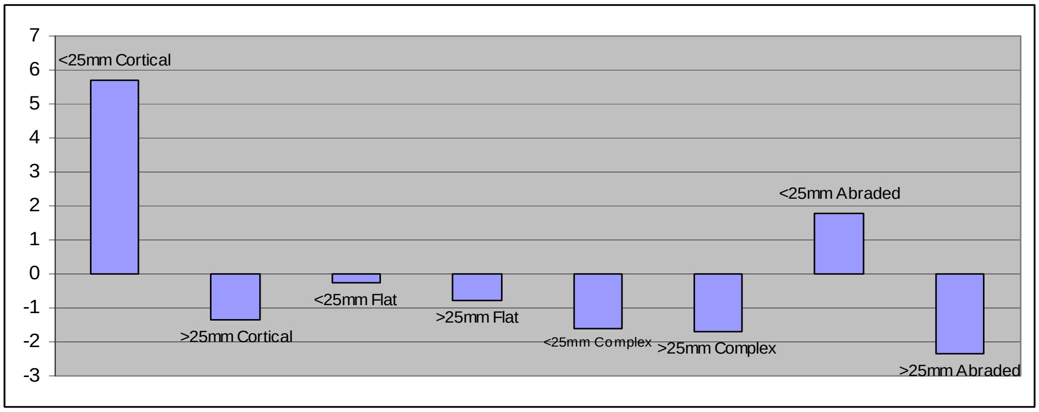


Figure 56. Adjusted residuals for Late Prehistoric I flake platform type and size category.

Late Prehistoric II-Historic

During the Late Prehistoric II-Historic, we see the exploitation of the buffalo in its highest numbers (**Figure 57**). Still, the evidence suggests that bone processing/marrow extraction intensified further. Together this is taken as evidence for increased site use or as an indicator of population growth. While expedient tool use continued at 41HY160, the lithic assemblage indicates that bifaces were both manufactured and used locally as well as away at logistical sites with very high significant numbers of complex platformed flake tools (**Figure 57**) and large size abraded platforms (**Figure 59**) dominating the assemblage. Still, significant amounts of large-sized debris (**Figure 58**) and large flat platformed flakes (**Figure 59**) may be indicative of intensive core reduction, although the lack of cortical platformed flakes suggests initial decortication was done off-site.

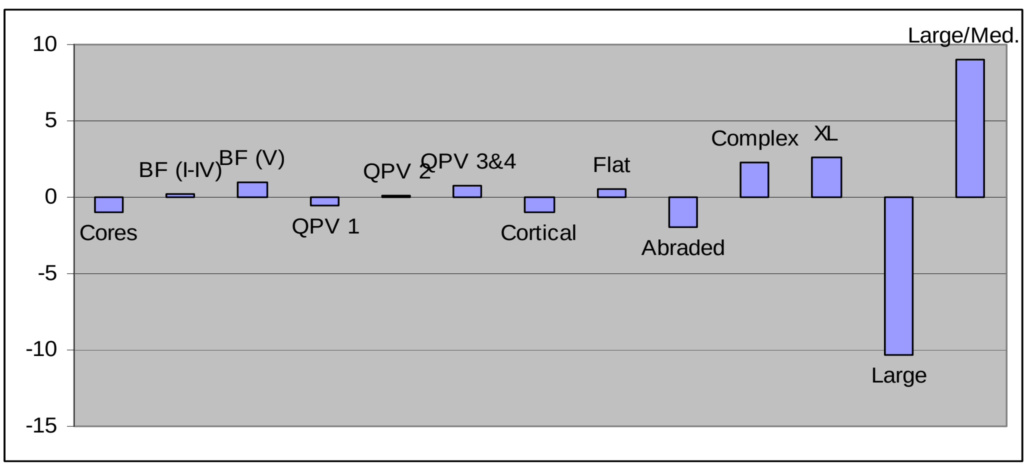


Figure 57. Adjusted residuals for Late Prehistoric II-Historic cores, bifaces, and QPV and platform types for flake tools, Extra-large, Large, and Large/medium fauna size classes.

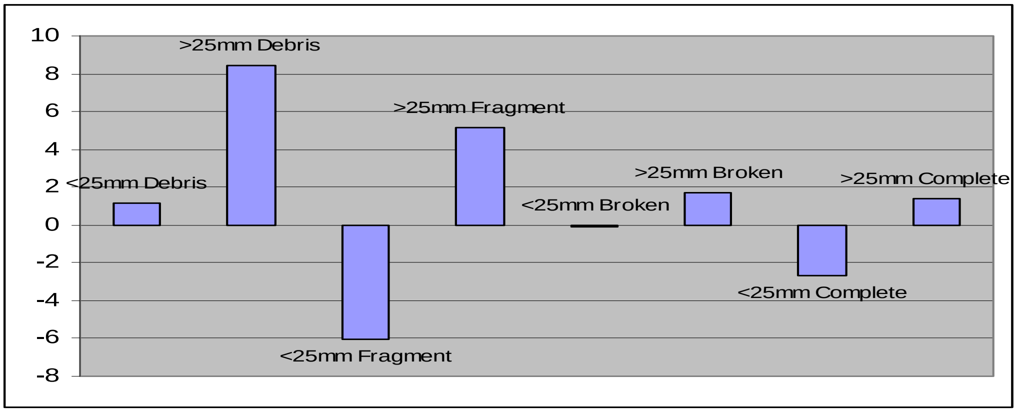


Figure 58. Adjusted residuals for Late Prehistoric II-Historic flake type and size category.

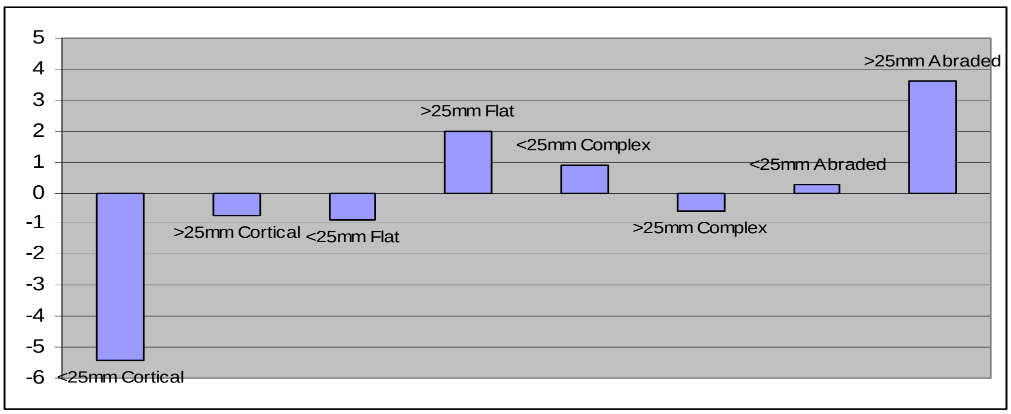


Figure 59. Adjusted residuals for Late Prehistoric II-Historic flake platform type and size category.

Future Research

While the temporal trends presented in this study are both well presented and bolstered by a statistically valid lithic analysis sample, a few potential problems are recognized. First, because of the excavation methodology, wherein the ¼-screen was utilized, there may be a bias in the size categories of the debitage sample sets. For instance, late-stage reduction evidence, such as pressure flaking, may be underestimated in the assemblages. Further, because the assemblages were undoubtedly mixed and documentation in the form of detailed field or lab notes beyond unit summary forms and artifact tally sheets no longer exists with the 1982 and 1983 artifact assemblages, the aggregate component of the debitage analysis is likewise a conglomeration of many reduction events by many individuals. In such circumstances, it has been noted that the use of weight with size distribution without representative samples of debitage from grades smaller than ¼ inch, is not recommended (Baumler and Davis 2004). Also, flake size (aggregate) analysis alone is fraught with misinterpretation possibilities because there is overlap in size distribution in different reduction trajectories, and these assemblages are likely representative mixtures of debris from different reduction events (Root 2004). Because of this, the debitage analysis methodology utilized was an attempt to somewhat mitigate these complications. Still, in examining technology diachronically, in large blocks of time, effects produced by mixed lithic assemblages may result in distorted articulations of past human behavior. Further, as discussed previously in this thesis, the assemblages of the Late Prehistoric and Historic periods are mixed. Whether a more meticulous excavation methodology employed in future excavations could help solve this issue is unclear. However, as general trends compared through large temporal time frames, it is suggested that what is presented herein is a more than adequate initiation point and framework for future studies that will partition the Early, Middle, and Late Archaic, and, possibly, the Late Prehistoric, into increasingly more refined temporal sets in order to answer increasingly more refined questions.

APPENDIX A: PROJECTILE POINT DESCRIPTIONS

Arrow Points

Perdiz

The Perdiz is a triangular shaped arrow point with edges that are most often straight, but, on occasion, have been reported as slightly concave or convex (Suhm and Jelks 1962). Some edges are finely serrated. Shoulders usually are well barbed, although they have been also been noted as being right-angled to the stem, perhaps a result of reworking following a snap fracture. The stem is proportionately long and contracting, sometimes to a fine-point (Turner and Hester 1985). Distribution is widespread, encompassing most all of Texas, the Red River Valley of Oklahoma as well as parts of Lousiana (Suhm and Jelks 1962; Turner and Hester 1985). In Central Texas, Perdiz points are associated with the Toyah phase of the Late Prehistoric Period. Collins (1995) dates the Pediz point to approximately 250-700 B.P.

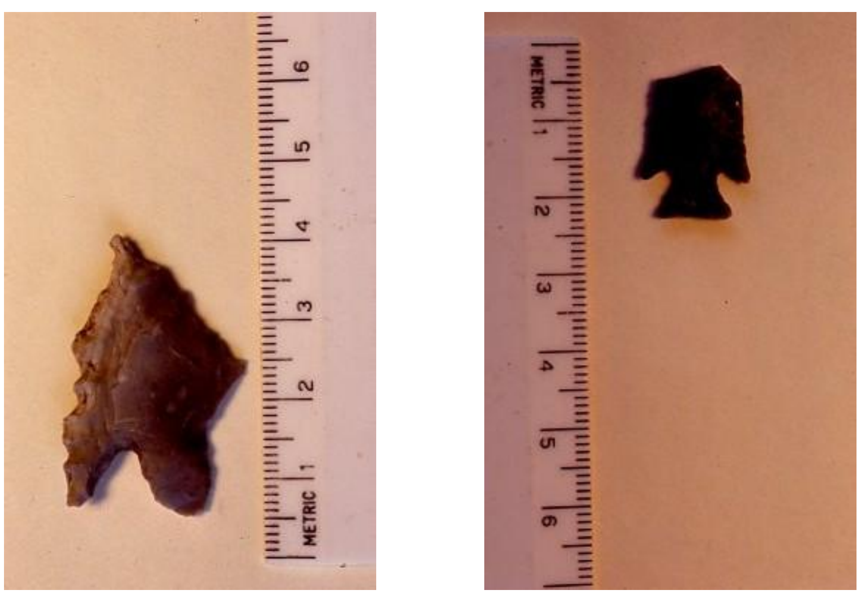


Figure 60. Perdiz from XU9, Level 2 (south quad) and Scallorn point from XU5, Level 4 (east quad).

Scallorn

Suhm and Jelks (1962) describe the Scallorn arrow point as being broad to slender in shape with edges that vary from straight to convex, and, on occasion, to concave. Shoulders typically have prominent barbs, but may be squared. Corner notching is deep, forming an expanding stem that is a broad wedge shape with a base that often is as wide as the shoulders (Turner and Hester 1985). Bases have been recorded as straight, concave, and convex. For Texas, there is a wide distribution of this point that stretches from the northern reaches of the panhandle to the gulf, east into Lousiana and west to the Rio Grande. Within Central Texas, Collins orders the Scallorn point into the Late Prehistoric from 700 B.P. to 1100 B.P.

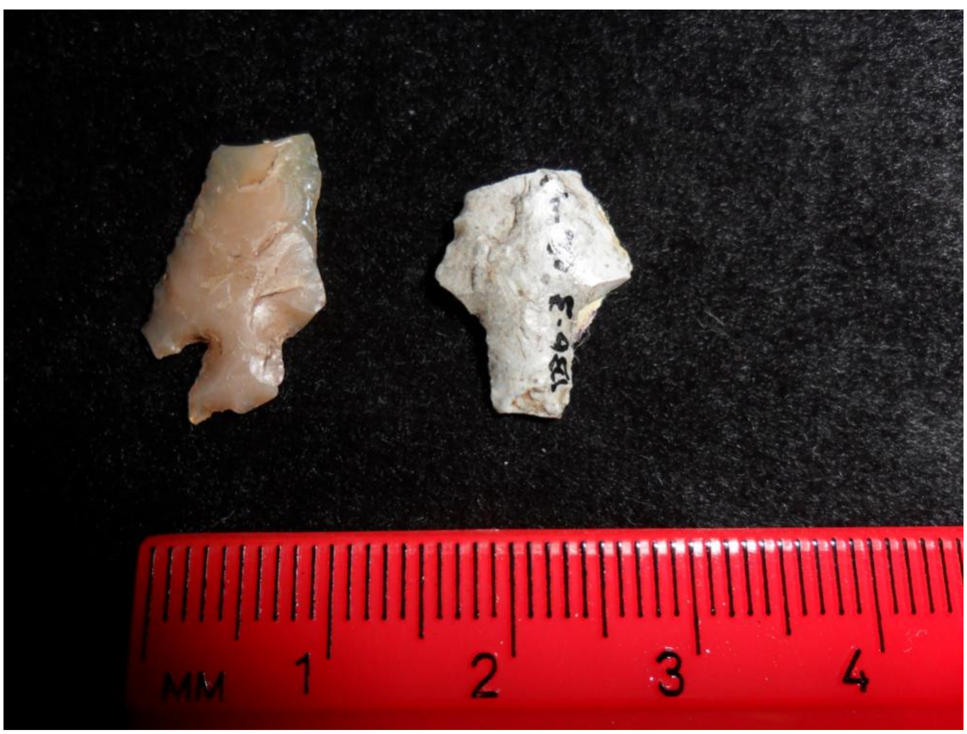


Figure 61. Scallorn/Cuney variant recovered from XU4, level 1, west quad (on left) and a Perdiz base (tangs broken) recovered from XU3, level 2, west quad.

Young

Suhm and Jelks (1962) describe the Young arrow point as being crudely triangular to leaf shaped in morhology. Turner and Hester (1985) note that generally the edges are crudely knapped and convex and this point often has faces show little signs of intensive work. Regarding its range within Texas, Turner and Hester (1985) place this type across North central Texas, down across Central Texas into the Gulf Coast region. This point is dated to the Late Prehistoric with Suhm and Jelks (1962) estimating it's age as 450 B.P.-750 B.P.

Figure 62.: Perdiz stem recovered from XU6, level 1, north quad (on left) and a Young point (cf.) recovered from XU3, level 2, north quad

Dart Points

Darl

Darl points are morphologically long and slender , sometimes bevelled projectile points (Turner and Hester 1985). Edges on Darl points range from straight to slightly convex in design and are occasionally finely serrated. Shoulders when present are slight (Suhm and Jelks 1962). Stems range from parallel to slightly expanding and often are grinded to smoothness. Rarely, these stems are beveled. Typically, bases vary from straight to deeply concave. The range for the dsitribution of Darl points is primarily throughout Central Texas, reaching westward to the lower Pecos and eastward towards the coastal plain (Turner and Hester 1985). Collins (1995) orders the Darl point into the last millenium of the Late Archaic spanning 1100 B.P. to approximately 1200 B.P.

Figure 63. Darl Point from XU3, Level 2.

Figure 64. Darl points recovered from XU 5, level 4, North Quad (on left) and from XU 2, level 2.

Ensor

Suhm and Jelks (1962) describe the Ensor point as a triangular blade that exhibits high variation in both its length and width. Ensor edges are most often straight and, less often, convex. On occasion, these edges are finely serrated. Shoulders range in shape from slight to pronounced and barbs are short to non-existent. Shallow notching keeps stems broad and bases are wide, sometimes in line with the blade edges. Turner and Hester (1985:114) caution that typology of this point is difficult due to apparent gradation between the bases of Ensor and its contemporary, the Frio point. The Ensor is a frequent find in central Texas, with a range that extends to the lower Pecos and throughout South

Texas to the Rio Grande. Collins (1995) dates the Ensor point style from approximately 1250 B.P. to 1600 B.P.

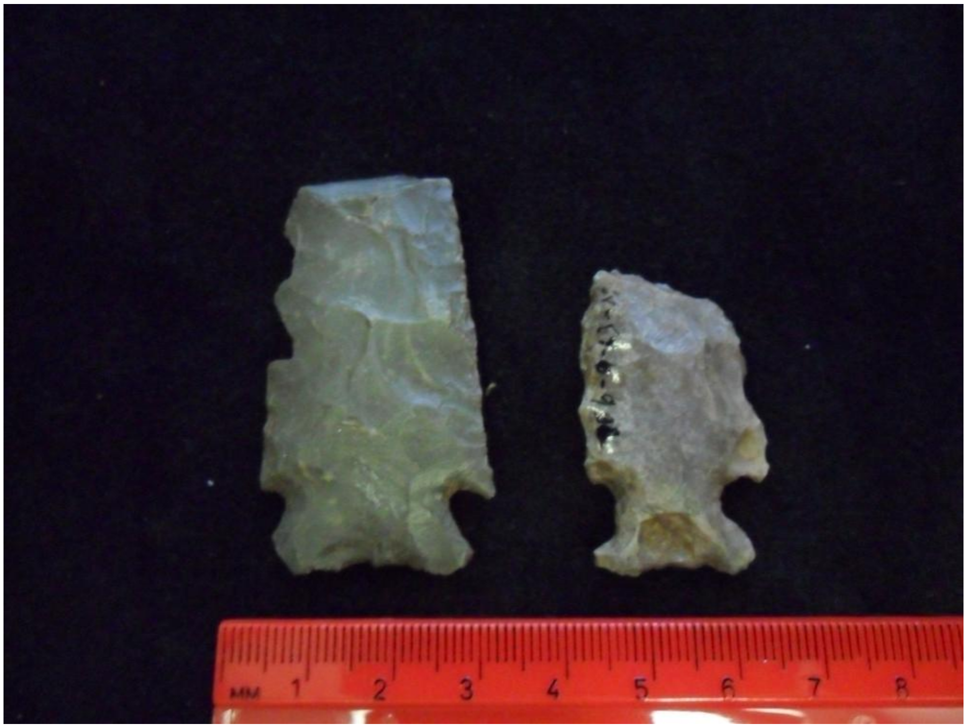


Figure 65. Ensor point recovered from XU7, level 3 (left side) and an Ensor/Frio variant (*cf*) recovered from XU9, level 3.

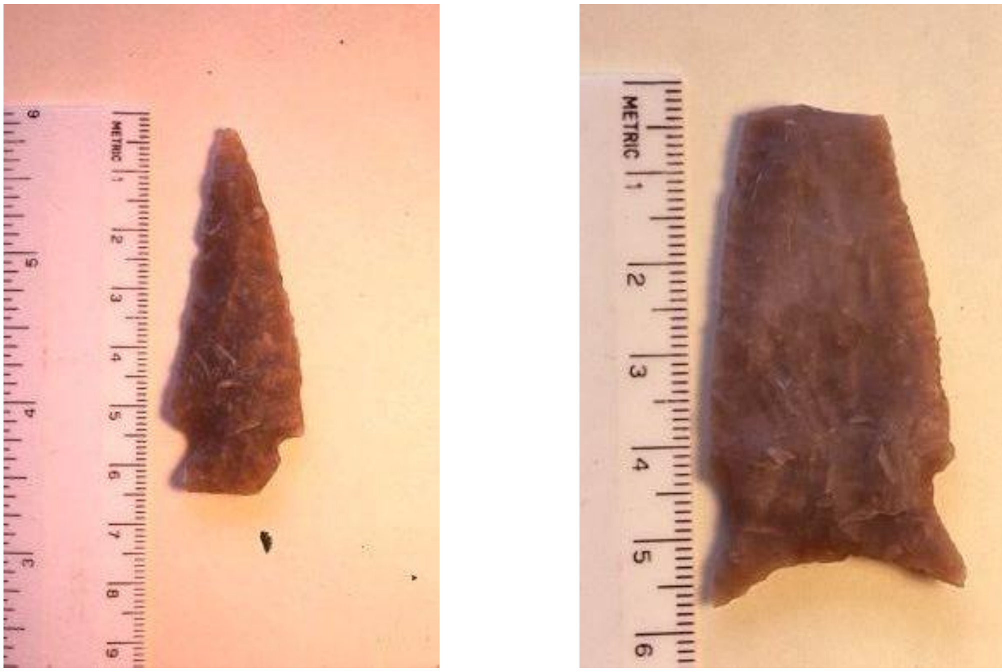


Figure 66. Ensor Point from XU2, Level 4 south quad (to left) and Fairland Point from XU5, Level 2 (west quad).

Fairland

The Fairland projectile point is a triangular blade with convex or straight edges (Suhm and Jelks (1962). Shoulders are narrow and the stem is expanding, formed by lengthy but shallow notches (Turner and Hester 1985). The base is distinctive and is long and flaring with a length that is usually as wide or wider than the shoulder. Often, the base has a wide and deep concavity with sharp corners and has been finely flaked to produce a thin and sharp edge (Suhm and Jelks 1962). These point types are found throughout central Texas, south Texas, and the lower Pecos (Turner and Hester 1985). Along with the Ensor and Frio projectile points, Collins (1995) places the Fairland point into the latter third of the Late Archaic, at approximately 1200 B.C. to 1500 B.C.

Figure 67. Fairland bases, both recovered from XU11, level 1, North Quad.

Figure 68. Fairland points recovered from XU3, level 2, west quad (on left) and XU8, level 3.

Pedernales

Described by Suhm and Jelks (1962) as variably a triangular or leaf-shaped specimen, this point type varies greatly in dimensions and proportions. Even though there is great variation in body measurements the Pedernales is recognizable by a more or less rectangular, bifurcated stem (Turner and Hester 1985: 171). Most often, edges are straight or convex, although, infrequently, concave. There is high variation in shoulder morphology with Suhm and Jelks (1962:235) describing them as “weak to narrow and right-angular and through various degrees of barbs from very small to very large, reaching almost to the base of the stem.” The base is often thinned, typically through the removal of two or three small-sized longitudinal flakes on either or both sides. Almost never have these stems been recorded as having been “smoothed” (Suhm and Jelks 1962). The Pedernales point is very common, almost ubiquitous, to the central Texas area, extending into coastal, north-central, and Trans-Pecos Texas. Collins (1995), along with the Kinney type, dates the Pedernales point type to approximately 2300 B.P. to 3200 B.P. within the Late Archaic period.

Figure 69. Pedernales Point recovered from XU2, level 5 (north quad).

Figure 70. Pedernales point recovered from XU19, level 6.

Marcos

The Marcos is a broad triangular point with edges that are generally straight, slightly convex or lightly recurved (Suhm and Jelks 1962). Deep corner notching creates prominent barbs that occasionally are long enough to be in line with the point's base.

The stem expands sharply and the bases typically range from straight to convex. Turner and Hester (1985) report that the distribution of this point is mainly throughout central Texas, with specimens found also in south Texas and the central coastal plain. Suhm and Jelks (1962) posit that this point type ranges farther north, into the upper Brazos region around the Possum Kingdom Reservoir. Within central Texas Collins (1995) places the Marcos point into the latter half of the Late Archaic, from approximately 1400 B.P. to 2100 B.P.

Figure 71. Marcos Point (on left) from XU2, Level 4, west Quad and Travis Point from XU1, Level 19.

Travis

The Travis point is a slender leaf-shaped to triangular point. Edges are usually straight to convex and tips are often knapped into needle-like points (Suhm and Jelks 1962). Shoulders on this point are slight and rounded towards the stem that, in most cases, is parallel-edged although, occasionally, slightly expanding or contracting. In outline, these points are similar to the Nolan projectile point but lack the distinctive beveled stem. Largely, this is a central Texas point with a distribution that ranges into the surrounding areas (Turner and Hester 1985). Along with the Nolan point, Collins (1995) places the Travis into the latter third of the Middle Archaic period, ca. 4000 B.C. to 4500 B.C.

Figure 72. Marcos point recovered in XU4, level 6, west quad.

Castroville

Turner and Hester (1985) describe this projectile point as having a large, triangular body with long and narrow barbs. The stem is broad and generally straight in shape and this point type often has straight lateral edges. This projectile point is noted as being very similar to the Marcos type and has a similar range both temporally (Late Archaic) and geographically.

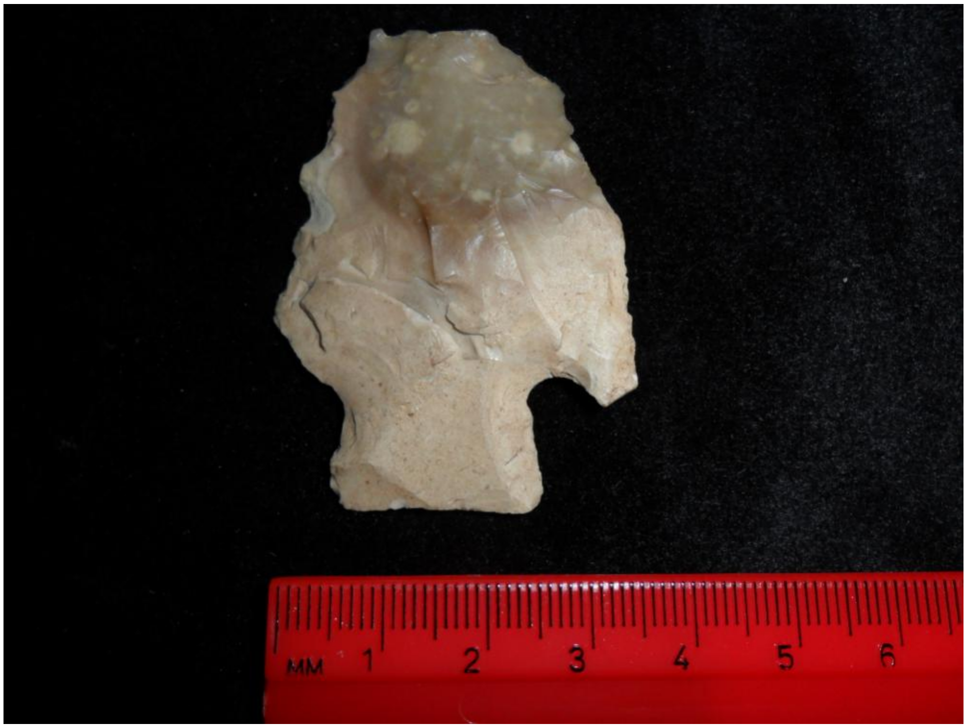


Figure 73. Castroville/Marcos variant recovered from XU1, level 3.

Frio

Hester (1985) describes this projectile point as a triangular shaped point that is often short and broad. The dominate indentifying feature of this projectile point is the concave basal indentation that can be shallow and slightly broad to deep U-shaped in form (Suhm and Jelks 1962; Hester 1985). The Frio projectile point is widespread in Central Texas, particularly along its southwest margins with a range extending westward towards the Pecos River (Suhm and Jelks 1962). Collins (1995) arranges this point style, along with Ensor and Fairland, into the latter quarter of the Late Archaic from approximately 1250 B.P. to 1600 B.P.

Figure 74. Frio point recovered from XU13, level 4.

Marshall

Turner and Hester (1993) describe the Marshal projectile point type as being broad and triangular in shape with moderate to convex lateral edges and strong shoulders that often is deeply barbed. Stems on Martindale points are generally short and expanding with concave bases being the norm. Along with Lange, and Williams points, Collins

(2004) chronologically arranges the Marshall style into the middle of the Late Archaic, approximately 2100-2400 B.P.

Figure 75. Marshall (*cf*) recovered from XU13, level 7, west quad.

Bulverde

These projectile points are described as triangular blades with slightly convex edges that rarely can be strongly convex to leaf-shaped (Suhm and Jelks 1962). Bulverde stems are typically rectangular and wedged-shaped and thinned to form a sharp edge at the base. Hester (1985:82) notes that this point is "principally a Central Texas point" although it occasionally is found in south and east Texas. Collins (1995) orders this projectile point style into the beginning of Late Archaic or ~3200-4000 B.P.

Figure 76. Bulverde base recovered in XU10, level 9.

Nolan

Nolan projectile points are described as triangular blades of “greatly variable length and width, edges convex or recurved, seldom straight” by Suhm and Jelks (1962). Shoulders of this projectile type can range from nearly absent to strong-barbless-shoulders that slant towards a slender tip. Stem shapes range from parallel-edged broad types to expanding or slightly contracting in shape. The distinctive trait of the Nolan point is the presence of steep, alternate beveling along the edges of the stem (Suhm and Jelks 1962; Turner and Hester 1985). On occasion, this beveling continues onto the blade surface (Suhm and Jelks 1962). It has been suggested that the Pandale point type from the lower Pecos area of Texas could be a regional variant of the Nolan. The distribution of Nolan points is noted as being throughout central Texas extending from the upper Brazos River drainage to the lower Pecos and the central coastal region. Collins (1995) dates the Nolan point to the end of the Middle Archaic, ca. 4000 B.P. to 4500 B.P.

Figure 77. Nolan point recovered from XU1, level 10.

Golondrina

This lanceolate point is readily identified by its deep V-shaped basal concavity, usually exceeding 4mm and the ear-shaped basal corners (Turner and Hester 1993:126-127). Generally, the basal edges and concavity are heavily ground and the flaking pattern is most typically undefined. Collins (2004) orders the Golondrina type into the Late Paleoindian period dating it to approximately 9600 B.P. to 9300 B.P.

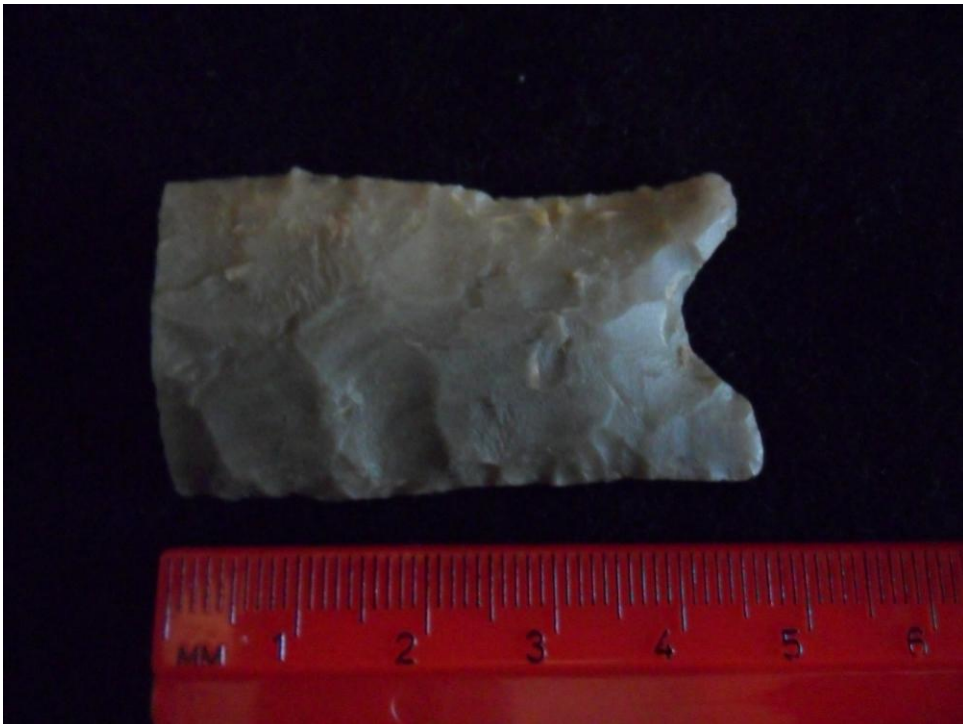


Figure 78. Golondrina point recovered from XU3, level 4, north quad.

APPENDIX B: LITHIC DATA

Debitage:

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
1	18	n/a	25 mm	4	0	0	1	0	0	0	0	1	0	0	0
1	18	n/a	12.5 -25 mm	4	5	0	2	0	1	0	0	1	0	1	1
1	18	n/a	6.3- 12.5 mm	14	12	0	1	0	0	0	0	1	1	1	1
1	19	n/a	25 mm	2	2	1	0	0	0	0	1	2	1	0	0
1	19	n/a	12.5 - 25mm	8	13	1	1	1	1	1	1	1	3	4	6
1	19	n/a	6.3- 12.5 mm	6	9	0	1	3	1	1	0	1	0	0	0
1	20	n/a	25 mm	6	5	1	1	1	0	0	3	0	0	0	0
1	20	n/a	12.3 - 25mm	9	18	0	3	0	1	0	0	1	6	2	3
1	21	n/a	25 mm	0	1	0	0	0	0	0	0	2	1	1	1
1	21	n/a	12.5 -25 mm	3	3	0	1	0	0	0	0	0	0	0	0
1	21	n/a	6.3- 12.5 mm	3	3	0	1	0	1	1	0	0	0	2	0
1	21	n/a	6.3 mm	2	1	0	0	0	0	0	0	0	0	0	0
13	18	East	12.5 -25 mm	1	2	0	0	0	1	0	0	1	0	0	0
13	19	East	12.5 -25 mm	3	1	0	1	0	0	0	0	0	0	0	0
13	19	East	6.3- 12.5 mm	1	0	0	0	0	0	0	0	0	0	0	0
13	20	n/a	12.5 -25 mm	0	1	0	0	0	0	0	0	0	1	0	0
13	20	n/a	6.3- 12.5 mm	1	2	0	0	0	0	0	0	0	0	0	0
Early Archaic Debitage Sample			**Tot**	67	78	3	13	5	6	3	5	11	13	11	12

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
1	10	n/a	25 mm	2	8	1	1	0	0	0	1	1	1	0	0
1	10	n/a	12.5-25 mm	20	37	3	2	2	4	2	4	0	2	1	0
1	10	n/a	6.3-12.5 mm	100	79	1	3	7	6	7	2	2	3	7	3
1	10	n/a	6.3mm	28	10	0	0	0	0	1	0	0	0	0	0
1	12	n/a	25 mm	1	1	0	0	0	0	0	1	0	1	0	1
1	12	n/a	6.3-12.5 mm	10	8	1	2	2	0	3	0	0	1	1	1
1	12	n/a	12.5-25 mm	3	6	0	0	1	1	1	0	0	0	0	0
1	12	n/a	6.3 mm	1	0	0	0	0	0	0	0	0	0	0	0
1	15	n/a	12.5-25 mm	0	1	0	0	0	0	0	0	0	0	0	0
1	15	n/a	6.3-12.5 mm	0	1	0	0	0	0	0	0	0	0	1	0
1	16	n/a	25 mm	0	1	0	1	0	0	1	1	1	0	0	1
1	16	n/a	6.3-12.5 mm	5	5	0	0	0	0	0	1	1	0	0	1
1	16	n/a	12.5-25mm	2	3	1	0	0	0	0	1	0	1	1	1
1	16	n/a	6.3 mm	0	1	0	0	0	0	0	0	0	0	0	0
13	10	West	12.5-25 mm	10	14	0	0	1	1	1	4	0	2	2	0
13	10	West	6.3-12.5 mm	4	12	0	0	0	0	0	0	0	1	1	2
13	10	West	25 mm	1	6	0	0	2	1	1	0	0	1	0	1
13	10	South	25 mm	6	2	0	1	0	0	0	0	1	4	1	2
13	10	South	12.5-25 mm	28	23	0	5	0	0	2	0	3	2	3	4
13	10	South	6.3-12.5 mm	4	2	0	0	0	0	0	0	0	0	0	0
13	10	East	25 mm	2	4	0	1	0	0	0	1	0	1	2	0
13	10	East	12.5-25 mm	9	7	0	0	0	0	0	0	2	2	2	5
13	10	East	6.3-12.5 mm	1	0	0	0	0	0	0	0	0	0	0	0
13	10	North	25 mm	0	2	0	0	0	0	0	0	0	1	1	1
13	10	North	12.5-25 mm	0	1	0	0	0	0	0	0	1	2	1	3

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
13	10	North	6.3-12.5 mm	0	0	0	0	0	0	0	0	0	0	0	0
13	11	East	12.5-25 mm	0	1	0	1	0	0	0	0	0	0	0	0
13	12	n/a	12.5-25 mm	1	0	0	0	1	0	0	0	0	0	0	0
13	12	n/a	6.3-12.5 mm	0	1	0	1	0	0	0	0	0	0	0	0
13	14	East	25 mm	2	1	0	0	0	1	0	0	0	0	1	0
13	14	East	12.5- 25 mm	6	9	0	0	1	0	1	0	0	0	0	0
13	14	East	6.3-12.5 mm	5	1	0	0	0	0	0	0	0	0	0	0
13	15	East	12.5-25 mm	1	2	0	0	0	0	0	0	0	0	0	0
13	16	n/a	25 mm	2	4	0	0	0	1	0	0	1	1	0	0
13	16	n/a	12.5-25 mm	3	10	0	3	0	0	0	0	0	0	2	1
13	17	East	12.5-25 mm	11	15	0	3	0	1	0	0	2	2	2	1
13	17	East	25 mm	2	4	1	0	0	0	0	0	0	0	1	0
13	17	East	6.3-12.5 mm	2	4	0	0	0	0	0	0	1	0	1	2
13	13	East	25 mm	0	1	0	2	0	0	0	0	0	0	1	0
13	13	East	12.5-25 mm	1	4	0	0	0	0	0	0	0	0	2	0
14	10	South	25 mm	7	3	0	0	1	1	0	0	1	3	2	2
14	10	South	12.5-25 mm	46	46	2	5	2	0	4	1	4	1	6	5
14	10	South	6.3-12.5 mm	63	30	0	1	2	0	1	0	0	1	2	0
14	10	South	3.17-6.3 mm	1	2	0	0	0	0	0	0	0	0	0	0
14	10	North	25 mm	4	9	0	2	0	0	1	1	2	1	0	2
14	10	North	12.5-25 mm	25	36	0	3	2	5	6	1	1	5	6	2
14	10	North	6.3-12.5 mm	13	8	0	0	2	1	1	0	0	2	1	1
14	11	North	12.5-25 mm	3	8	0	0	0	0	0	0	0	0	2	1
14	11	North	6.3-12.5 mm	0	1	0	0	0	0	0	0	0	0	0	0

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
14	11	n/a	25mm	4	2	0	0	1	0	1	0	1	0	1	0
14	11	n/a	12.5-25 mm	8	15	0	0	1	0	0	0	1	0	3	1
14	11	n/a	6.3-12.5 mm	2	7	0	0	0	0	0	0	1	0	0	0
14	12	n/a	25mm	0	4	0	0	0	0	0	0	1	0	0	1
14	12	n/a	12.5-25 mm	0	2	0	0	0	0	0	0	0	0	0	0
14	12	n/a	6.3-12.5 mm	1	3	0	0	0	0	0	0	0	1	1	1
14	12	North	12.5-25 mm	1	1	0	0	0	0	0	0	0	0	2	0
14	12	North	6.3-12.5 mm	0	1	0	0	0	0	0	0	0	0	0	0
14	14	North	12.5- 25 mm	2	5	0	0	0	0	0	0	1	1	1	2
14	14	North	6.3-12.5 mm	1	2	0	0	0	0	0	0	0	0	0	0
14	15	South	25 mm	2	1	0	0	0	0	0	0	0	0	0	0
14	15	South	12.5-25 mm	4	12	0	0	1	0	0	0	1	1	3	0
14	15	South	6.3-12.5 mm	12	10	0	1	1	0	0	0	0	0	1	0
14	15	South	6.3 mm	1	0	0	0	0	0	0	0	0	0	0	0
14	15	North	25 mm	0	1	0	0	0	0	0	1	4	1	1	0
14	15	North	12.5-25 mm	13	25	1	2	1	0	2	0	5	5	1	5
14	15	North	6.3-12.5 mm	9	14	0	0	1	1	1	0	1	2	2	2
14	16	East	25 mm	0	3	0	0	0	1	0	0	0	0	0	0
14	16	East	12.5-25mm	11	17	0	0	3	2	0	0	4	5	1	5
14	16	East	6.3-12.5 mm	3	10	0	1	0	0	1	0	0	0	0	0
14	17	South	25 mm	6	2	0	0	0	0	0	0	0	0	2	1
14	17	South	12.5-25 mm	7	6	0	2	0	0	0	0	1	4	2	2
14	17	South	6.3-12.5 mm	3	3	0	0	0	0	0	0	0	0	0	0
14	13	North	25 mm	1	0	0	0	0	0	0	0	0	0	0	0

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
14	13	North	12.5-25 mm	0	0	0	0	0	0	0	0	1	1	1	1
14	13	North	6.3-12.5	0	2	0	0	0	0	0	0	0	0	0	0
14	14	South	25 mm	1	0	0	0	0	0	0	0	1	0	0	1
14	14	South	12.5-25 mm	3	16	0	0	0	0	0	0	0	3	3	0
14	14	South	6.3-12.5 mm	5	4	0	0	0	0	0	0	0	0	0	0
14	14	North	25 mm	0	4	0	0	0	0	0	1	2	0	0	0
Middle Archaic Debitage Sample			**Tol**	535	606	11	43	35	27	38	21	49	65	78	65

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
1	9	n/a	25 mm	10	16	0	2	0	3	0	1	2	4	6	4
1	9	n/a	12.5-25mm	46	66	8	0	4	2	2	0	8	5	9	6
1	9	n/a	6.3-25 mm	29	29	0	0	1	2	0	0	4	3	2	4
6	8	North	25 mm	3	4	0	0	2	0	0	1	0	1	0	0
6	8	North	12.5-25 mm	19	25	0	0	0	0	0	0	4	3	5	1
6	8	North	6.3-25 mm	3	4	0	0	0	0	0	0	0	1	1	1
6	8	South	12.5-25 mm	7	11	0	2	0	0	1	0	2	3	6	2
6	8	South	25 mm	2	3	0	0	2	0	1	1	2	1	2	2
6	8	South	6.3-25 mm	6	4	0	1	0	0	0	0	1	0	1	1
10	9	n/a	12.5-25 mm	100	129	0	15	4	13	11	8	18	20	25	33
10	9	n/a	25 mm	7	17	1	2	1	1	3	2	7	7	9	9
10	9	n/a	6.3-25 mm	66	73	0	3	2	7	6	0	12	4	12	10
13	9	West	6.3-25	2	1	0	0	0	0	0	0	0	0	0	0

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
			mm												
13	9	West	12.5-25 mm	7	19	0	3	0	1	1	0	2	1	7	3
13	9	West	25 mm	3	5	1	2	0	0	0	2	3	0	3	1
13	7	East	25 mm	1	9	0	1	2	0	0	3	2	1	0	1
13	7	East	12.5-25 mm	13	15	0	0	3	0	1	0	3	0	3	4
13	7	East	6.3-12.5 mm	0	2	0	0	1	0	1	0	0	0	0	0
14	7	North	25 mm	4	10	1	0	0	0	0	0	4	0	0	2
14	7	North	12.5-25 mm	35	41	0	1	0	0	1	0	5	4	4	7
14	7	North	6.3-12.5 mm	19	8	0	0	1	0	1	0	1	0	0	1
14	9	South	25 mm	7	16	0	1	2	0	1	2	2	1	4	2
14	9	South	12.5-25 mm	46	66	0	5	5	2	5	0	5	5	10	7
14	9	South	6.3-12.5 mm	3	5	0	1	0	0	0	0	0	1	1	1
Late Archaic I Debitage Sample			**Tot**	438	578	11	39	30	31	35	20	87	65	110	102

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
3	5	north	25 mm	1	4	0	0	0	0	0	0	0	2	0	2
3	5	north	12.5-25 mm	5	4	0	2	0	0	1	3	0	1	1	1
3	5	north	6.3-12.5 mm	9	5	0	0	0	0	0	0	0	0	0	0
3	5	north	3.17-6.3 mm	1	1	0	0	0	0	0	0	0	0	0	0
3	5	east	25 mm	1	3	0	0	1	0	1	0	1	0	1	0
3	5	east	12.5-25 mm	13	13	2	0	0	1	0	4	0	2	3	2
3	5	east	6.3-12.5 mm	10	13	0	0	1	1	1	0	0	0	0	0
3	5	west	25	1	4	0	0	0	0	0	0	1	1	0	1

XU	Lv	Qd	Size mm	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
3	5	West	12.5-25 mm	14	14	0	0	0	0	0	1	2	2	0	2
3	5	West	6.3-12.5 mm	8	11	0	0	0	0	0	0	0	0	0	0
3	5	south	25 mm	0	0	0	1	0	0	0	0	0	1	0	0
3	5	south	12.5-25 mm	9	8	0	0	0	0	0	0	1	2	2	3
3	5	south	6.3-12.5 mm	4	1	0	0	0	0	0	0	0	0	0	0
4	4	east	25 mm	1	6	1	1	0	1	2	0	1	5	2	5
4	4	east	12.5-25 mm	20	62	0	4	2	3	3	0	10	8	12	13
4	4	east	6.3-12.5 mm	26	26	0	0	0	1	0	0	4	2	6	6
4	6	east	25 mm	3	2	0	0	0	0	0	0	0	1	0	0
4	6	east	12.5-25 mm	2	9	0	0	1	0	0	0	1	1	0	0
4	6	east	6.3-12.5 mm	1	1	0	0	0	0	0	0	0	0	0	0
4	6	north	25 mm	2	2	1	0	1	0	0	9	0	3	3	3
4	6	north	12.5-25 mm	13	13	0	2	0	0	1	0	1	0	0	0
4	6	north	6.3-12.5 mm	19	27	1	1	2	0	1	8	2	1	3	4
4	6	north	25 mm	2	10	0	1	0	1	0	0	2	1	4	4
4	6	north	12.5-25 mm	26	30	0	1	0	0	0	0	3	0	5	2
4	6	north	6.3-12.5 mm	8	5	0	0	0	0	0	0	0	0	1	0
4	5	south	25 mm	0	1	0	0	0	0	0	0	2	0	0	0
4	5	south	12.5-25mm	0	2	0	0	0	0	0	0	0	0	0	0
4	5	south	6.7 - 12.5 mm	1	1	0	0	0	0	0	0	0	0	1	0
4	5	east	25 mm	1	0	0	0	0	0	0	0	0	0	0	0
4	5	east	12.5-25 mm	0	0	0	0	0	0	0	1	1	0	0	0
4	5	east	6.7 - 12.5 mm	2	5	0	1	0	0	0	0	1	1	0	1
4	5	nort	25	2	10	0	1	0	0	0	0	0	4	4	4

XU	Lv	Qdh	Size mm	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
4	5	north	12.5-25mm	19	25	0	1	0	0	0	14	2	7	3	8
4	5	North	6.3-12.5 mm	10	28	0	1	0	2	2	0	0	3	4	4
4	5	North	3.17-6.3 mm	4	0	0	0	0	0	0	0	0	0	0	0
4	5	South	25 mm	2	15	2	0	1	1	1	0	5	0	4	5
4	5	South	12.5-25 mm	35	64	0	6	6	3	5	0	9	3	10	6
4	5	South	6.3-12.5 mm	25	31	0	0	1	2	0	0	2	2	5	1
4	5	east	25 mm	3	2	1	0	0	0	0	0	3	1	1	3
4	5	east	12.5-25 mm	7	18	0	1	0	1	0	1	0	5	2	2
4	5	east	6.7-12.5 mm	1	3	0	0	0	0	0	0	0	0	1	0
4	5	west	25 mm	3	19	0	1	3	3	1	1	4	3	9	7
4	5	west	12.5-25mm	27	63	0	0	3	3	0	2	7	3	11	7
4	5	west	6.3-12.5 mm	14	21	0	0	0	0	0	0	2	1	2	2
11	5	west	25 mm	0	2	0	0	1	0	0	0	0	0	0	0
11	5	west	12.5-25 mm	4	5	0	1	0	1	1	0	1	1	3	5
11	5	west	6.3-12.5	5	0	0	0	0	0	0	0	0	0	0	0
11	5	South	25 mm	0	1	0	0	0	1	0	0	1	1	0	0
11	5	South	12.5-25 mm	6	8	0	0	0	0	0	0	2	1	2	3
11	5	South	6.3-12.5 mm	4	5	0	0	0	0	0	0	0	0	0	0
11	5	F1, area B	25 mm	0	2	0	0	2	0	2	0	0	0	0	0
11	5	F1, area B	12.5-25 mm	3	6	0	0	0	0	0	0	1	0	0	1
Late Archaic II Debitage Sample			**Tot**	377	611	8	26	25	25	22	44	72	69	105	107

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
1	3	n/a	25 mm	6	9	3	2	2	0	2	1	2	0	1	1
1	3	n/a	12.5-25 mm	27	37	5	5	6	4	3	6	1	2	1	4
1	3	n/a	6.3-12.5 mm	32	34	0	0	0	1	1	0	0	3	4	5
5	3	West	25 mm	2	5	1	5	1	0	2	0	1	3	2	2
5	3	West	12.5-25 mm	21	47	1	2	3	4	7	0	12	6	20	11
5	3	West	6.7-12.5 mm	20	32	1	0	1	2	1	0	4	1	9	2
5	3	South	25 mm	3	12	0	1	0	0	0	1	2	3	6	3
5	3	South	12.5-25 mm	27	40	1	2	1	1	1	2	6	7	7	8
5	3	South	6.7-12.5 mm	22	24	0	1	0	1	0	0	3	2	6	5
5	3	East	25 mm	3	13	0	1	1	0	2	1	2	1	2	2
5	3	East	6.7-12.5 MM	14	23	0	0	0	1	0	0	1	3	9	3
5	3	East	12.5-25 MM	40	62	0	3	3	1	0	32	11	7	14	7
5	3	North	6.7-12.5 mm	15	31	0	1	0	3	0	0	3	1	5	4
5	3	North	3.37-6.7 mm	1	0	0	0	0	0	0	0	0	0	0	0
5	3	North	12.5-25 mm	25	45	0	4	1	1	0	0	8	5	18	9
5	3	North	25 mm	6	8	0	2	2	1	0	0	3	0	3	0
13	3	South	6.3-12.5 mm	3	2	0	0	0	0	0	0	0	0	0	0
13	3	South	25 mm	2	10	0	0	0	0	0	0	0	2	2	1
13	3	South	12.5-25 mm	9	12	0	1	1	0	1	0	2	2	2	0
14	3	n/a	25 mm	2	2	1	2	0	0	0	0	1	0	1	0
14	3	n/a	12.5-25 mm	5	7	0	2	1	0	0	0	2	3	2	0
14	3	n/a	6.3-12.5 mm	2	2	0	0	0	0	0	0	0	0	1	0
14	3	n/a	25 mm	0	1	0	0	0	0	0	0	2	0	0	0
14	3	n/a	12.5-25 mm	4	14	0	2	0	0	0	1	1	1	2	1
14	3	n/a	6.3-12.5	2	10	0	0	1	0	0	0	0	0	0	0

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
			mm												
L. Prehistoric I Debitage Sample			**Tot**	293	482	13	36	24	20	20	44	67	52	117	68

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
1	1	n/a	12.5-25 mm	4	5	0	0	0	1	0	0	0	0	0	0
1	1	n/a	6.3-12.5 mm	26	15	0	1	0	1	0	0	1	1	0	0
1	1	n/a	6.3 mm	8	3	0	0	0	0	0	0	0	0	0	0
2	2	East	25 mm	104	102	1	10	0	11	6	1	20	9	27	17
2	2	East	3.17-6.3 mm	2	1	0	0	0	0	0	0	0	0	0	0
2	2	East	6.3-12.5 mm	80	62	0	3	1	2	3	2	6	11	11	15
2	2	North	25 mm	8	16	0	4	0	2	1	1	3	5	4	6
2	2	North	12.5-25 mm	70	118	0	6	10	14	14	1	18	15	22	16
2	2	North	6.3-12.5 mm	108	83	0	5	2	7	3	0	9	6	15	17
2	2	North	3.17-6.3mm	1	1	0	0	0	0	0	0	0	0	0	0
2	2	East	25 mm	3	17	2	4	0	3	1	0	3	2	2	2
2	2	West	25 mm	5	18	1	3	3	1	1	8	2	4	7	7
2	2	West	12.5-25 mm	85	100	0	3	9	10	5	3	19	17	27	15
2	2	West	6.3-12.5 mm	137	110	0	10	7	6	8	1	12	13	16	10
2	2	West	3.17-6.3 mm	3	0	0	0	0	0	0	0	0	0	0	0
14	2	South	25 mm	4	4	0	1	0	0	0	0	1	2	0	1
14	2	South	12.5-25 mm	18	23	0	3	1	1	1	0	1	3	3	4
14	2	South	6.3-12.5 mm	10	10	0	1	0	2	1	0	0	0	2	0

XU	Lv	Qd	Size	Db	Fra	BF Cor	BF Flt	BF Cpx	BF Abr	BF Lip	CO Cor	CO Flt	CO Cpx	CO Abr	CO Lip
14	2	North	25 mm	3	7	0	0	0	0	0	0	0	2	1	2
14	2	North	12.5-25 mm	14	24	0	0	3	2	3	0	2	6	1	3
14	2	North	6.3-12.5 mm	1	4	0	0	0	1	1	0	0	0	0	0
14	2	North	6.3-12.5 mm	1	4	0	0	0	1	1	0	0	0	0	0
L. Prehistoric II Debitage Sample			**Tot**	691	722	4	54	36	64	49	17	97	96	138	115

Bifaces:

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
1	10	n/a	18.1	45.11	36.05	12.7	ind	2.8	3	n
1	10	n/a	11.1	ind	ind	ind	ind	ind	4	y
6	10	east	36	ind	37.53	17.25	ind	2.2	3	y
6	10	east	38.9	80.88	43.34	14.59	ind	0.3	5	n
10	10	n/a	15.8	ind	ind	ind	ind	ind	4	y
4	11	west	54.6	ind	54.57	17.33	ind	3.2	4	y
10	12	n/a	11.4	ind	ind	ind	ind	ind	5	y
15	14	south	25.1	ind	ind	ind	ind	ind	5	y
1	10	n/a	12.4	ind	ind	ind	ind	ind	5	y
6	10	1	9.8	ind	ind	ind	ind	ind	4	y

Source: Cobble or flake blank.

Middle Archaic Bifaces

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
6	7	north	18.7	ind	ind	Ind	ind	ind	ind	y
6	8	west	2.7	ind	ind	Ind	ind	ind	ind	y
5	7	south	4.7	ind	ind	Ind	ind	ind	ind	y
5	7	south	2.3	ind	ind	Ind	ind	ind	ind	y
1	8	n/a	6.7	ind	ind	5.3	ind	ind	5	y
2	9	North	107.4	ind	ind	Ind	Cobble	ind	1	Y

Source: Cobble or flake blank.

Late Archaic I Bifaces

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
4	4	east	6	ind	24.88	6.4	ind	3.9	5	y
4	4	south	4.8	ind	ind	ind	ind	ind	4	y
8	4	unk	6.7	ind	ind	ind	ind	ind	5	y
12	4	n/a	1	ind	ind	ind	ind	ind	5	y
5	4	east	27.8	ind	ind	ind	ind	ind	5	y
7	5	south	23.9	ind	46.64	9.87	ind	4.7	5	y
13	5	west	10.1	ind	ind	ind	ind	ind	3	y
4	5	east	5.5	ind	ind	ind	flake	ind	3	y
4	5	ped	1.5	ind	ind	ind	ind	ind	5	y
4	5	west	2	ind	ind	ind	ind	ind	ind	y
4	6	North	15.7	ind	25.96	8.62	ind	3	4	y
4	6	North	19.5	ind	33.43	8.61	ind	3.9	4	y
4	6	East	26.6	ind	ind	ind	ind	ind	4	y
4	6	West	7.5	ind	37.67	ind	ind	ind	5	y

Source: Cobble or flake blank.

Late Archaic II Bifaces

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
7	3	East	13.9	ind	40.83	8.27	ind	4.9	4	y
7	3	South	5.3	ind	ind	Ind	ind	ind	5	y
14	3	South	6	ind	ind	Ind	ind	ind	3	y
2	3	West	7.7	ind	28.04	7.06	flake	4	4	y
6	3	West	6.7	ind	ind	Ind	flake	ind	ind	y
4	3	East	9.4	ind	ind	Ind	ind	ind	4	y
4	3	East	19.1	ind	ind	Ind	ind	ind	4	y
5	3	North	56.9	60.86	48.97	19.21	ind	2.5	5	no

Source: Cobble or flake blank.

Late Prehistoric I Bifaces

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
7	1	West	7.2	38.71	22.32	6.03	ind	3.7	4	Y
4	1	South	1.6	ind	ind	ind	ind	ind	5	Y
4	1	North	7.3	ind	28.42	9.14	ind	3.1	4	Y
4	1	South	8.3	ind	ind	ind	ind	ind	ind	Yes
1	1	n/a	17.4	ind	37.29	ind	flake	ind	3	Y
6	1	North	13	ind	ind	ind	ind	ind	4	Y
6	1	North	5.2	ind	ind	ind	ind	ind	4	Yes
6	1	West	3.4	ind	ind	4.76	ind	ind	5	Y
10	1	n/a	51.6	ind	ind	ind	ind	ind	3	Y
11	1	North	27.4	ind	ind	ind	ind	ind	4	Y
11	1	West	13.6	ind	ind	7.07	ind	ind	5	Y
11	1	East	9.5	39.56	34.07	8.07	flake	4.2	5	No
11	1	East	1.2	ind	ind	ind	ind	ind	5	Y
11	1	North	1.6	ind	ind	ind	ind	ind	5	Y
11	1	North	1.6	ind	ind	ind	ind	ind	5	Y

XU	Level	Quad	Weight	Max. length	Max. width	Max. thick	Source	MWMT Ratio	Stage	Break
11	1	North	19.9	41.31	29.08	16.03	cobble	1.8	2	No
5	1	East	2	ind	ind	ind	ind	ind	5	Yes
7	2	North	11.8	47.52	27.22	8.42	flake	ind	4	No
7	2	East	4.7	ind	ind	5.07	ind	ind	5	Y
7	2	West	3.5	ind	ind	4.17	ind	ind	5	Y
7	2	South	3.3	ind	ind	ind	ind	ind	ind	Y
7	2	East	1.2	ind	ind	ind	ind	ind	5	Y
4	2	East	6.8	ind	26.06	6.29	ind	4.1	5	Y
4	2	South	1.4	ind	ind	ind	ind	ind	4	Y
4	2	North	5.6	ind	ind	ind	ind	ind	3	Y
6	2	South	16	56.25	32.41	10.66	ind	3	3	Y
5	2	North	10.3	49.56	26.87	9.29	ind	2.9	4	No
5	2	East	ind	ind	ind	ind	ind	ind	ind	Yes
5	2	South	17	ind	ind	ind	ind	ind	5	Yes
5	2	North	3.7	ind	ind	ind	ind	ind	ind	Yes
5	2	North	2.9	ind	ind	ind	ind	ind	ind	Yes

Source: Cobble or flake blank.

Late Prehistoric II Bifaces

Cores:

XU	Level	Quad	Uni/Multi	Weight	Max. Lin. Dim.	Size value	Est. #of detachments	Discoid like
10	7	n/a	M	115	6.8	782	8	y
9	8	West	M	288.5	10	2885	4	n
10	8	n/a	M	54.9	5.6	307.44	7	n
2	9	East	M	122.4	6.2	758.88	7	n

Late Archaic I

XU	Level	Quad	Uni/Multi	Weight	Max. Lin. Dim.	Size value	Est. # of detachments	Discoid like
3	4	West	M	270.3	11.5	3108.45	11	y
2	4	West	M	183.8	9.3	1709.34	12	n
5	4	East	M	158.2	8	1265.6	7	n
3	4	East	M	unk	8.4	8.4	6	n
3	4	South	M	271.1	9.3	2521.23	5	n
13	4	North	M	74.4	6.9	513.36	8	n
10	4	n/a	M	41.9	5.5	230.45	7	n
6	4	South	M	98	5.9	578.2	7	n
10	5	N/A	U	151	7.9	1192.9	6	n
3	5	South	M	296.4	9.2	2726.88	9	n
5	5	East	M	153.9	8	1231.2	9	n
9	5	West	M	129.5	6.6	854.7	5	n
6	5	North	M	76.8	6.8	522.24	5	n
10	6	n/a	U	195	6.6	1287	10	n
10	6	n/a	M	170.6	8.1	1381.86	10	n
6	6	East	M	35.9	4.7	168.73	7	n
6	6	South	M	173.4	9.7	1681.98	4	n
5	6	South	M	76.1	5.8	441.38	6	n

Late Archaic II

XU	Level	Quad	Uni/Multi	Weight	Max. Lin. Dim.	Size value	Est. # of detachments	Discoid like
6	3	west	U	194.4	9.5	1846.8	6	n
9	3	south	M	200.4	7.6	1523.04	6	n
11	3	south	M	205.2	9.4	1928.88	6	n
10	3	n/a	M	63.5	6.7	425.45	10	n

Late Prehistoric I

XU	Level	Quad	Uni/Multi	Weight	Max. Lin. Dim.	Size value	Est. # of detachments	Discoid like
9	1	south	M	116.9	7.3	853.37	12	n
4	1	south	M	121.1	7.6	920.36	10	n
6	1	south	U	159.5	7.6	1212.2	6	n
8	1	south	M	74	5.2	384.8	6	n
11	1	west	M	94.7	6	568.2	6	n
3	1	Unk	M	55.3	5.6	309.68	5	n
3	2	south	M	124.3	7.4	919.82	3	n
6	1	south	M	264.4	9.8	2591.12	8	y
11	1	west	M	46.7	5.1	238.17	4	n
3	2	North	M	161.3	7.7	1242.01	8	n
10	2	Unk	M	174.9	9.2	1609.08	7	n
4	2	North	M	88.5	7.4	654.9	10	y
3	2	south	M	98.2	7	687.4	11	y
8	2	North	U	91.9	4.9	450.31	6	n
1	2	n/a	M	59.8	5.4	322.92	19	y
Late Prehistoric II								

Flake Tools:

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
3	5	south	51.58	24.86	25.96	25.23	3.71	3.64	3.75	3	flat/lipped	6.3
3	2	east	67.46	51.86	35.88	26.82	21.68	16.55	11	1	flat	43.1
3	2	west	60	45.39	48.86	42.06	12.55	13.17	6.87	1	flat	35.2
3	5	south	33.56	19.76	19.53	15.4	2.34	2.34	2.11	Ind	flat/lipped	1.7
3	2	south	37.49	17.75	23.82	25.78	4.82	3.98	5.2	3	complex/lipp.	5.6
3	2	west	27.71	15.22	21.94	25.55	3.67	3.38	2.64	1	complex/lipp.	3
3	3	south	51.41	25.07	23.5	17.68	3.49	4.09	4.07	3	complex	5.3
3	5	south	51.64	23.17	28.51	21.44	4.64	3.58	3.83	Ind	flat	6.9
3	2	south	28.69	16.46	24.51	24.83	4.6	3.99	3.43	2	abraded	3.3
3	2	west	28.71	25.34	25.85	25.2	4.18	3.54	3.55	2	abraded	3.6
3	2	south	31.71	13.52	16.7	21.87	2.82	3.02	3.26	2	flat/lipped	1.8
3	2	south	21.89	18.06	23.73	ind	3.31	2.79	ind	2	abraded/lipp.	1.8
3	4	south	Ind	Ind	Ind	Ind	Ind	Ind	Ind	2	not present	1.8
3	1	n/a	41.85	34.89	38.25	36.43	11.98	12.57	10.16	1	complex	26.3
3	2	south	62.22	20.9	23.39	27.89	5.93	7.88	9.08	1	abraded	14.2
3	3	east	93.52	43.72	44.56	34.98	16.58	20.17	22.48	2	flat	100
3	1	n/a	49.21	28.22	25.7	21.63	14.88	11.19	6.61	1	abraded	12.2
3	1	n/a	30.85	16.79	18.6	19.77	8.81	6.47	5.16	1	flat	5.5
3	4	south	36.32	17.67	17.81	11.69	10.26	10.33	6.47	2	flat	6.5
13	13	east	23.2	13.34	19.91	40.31	3.33	4.25	5.52	4	flat	3.7
4	1	south	42.32	24.63	45.69	52.51	6.68	8.61	5	3	flat/lipped	17.3
4	4	west	50.94	21.76	30.48	32.62	7.94	9.79	8.46	3	abraded	15.2
4	6	west	52.84	28.71	31	42.44	4.79	4.99	3.29	1	ind	10.8
4	6	east	45.99	21.04	32.11	26.25	8.03	9.28	8.19	ind	complex	11.7
4	5	west	45.68	16.65	29.24	32.36	3.92	4.49	5.55	2	abraded	9
4	2	south	31.71	22.81	22.51	19.15	5.43	6.3	3.35	1 or ind.	complex	4.5
4	4	west	26.66	15.58	16.66	18.2	2.27	2.35	2.33	1	ind	1.5
4	5	west	43.84	25.56	34.57	40.36	4.83	3.58	3.08	1	abraded/lipped	8.9
4	1	north	40.97	28.15	28.9	24.24	7.95	8.65	5.2	2	flat	12.2
4	5	south								1	abraded/lipped	10.5
4	2	west	32.24	24.9	22.78	19.96	4.86	4.83	3.58	3	flat	
4	1	west	27.8	11.5	17.51	18.41	3.39	3.02	2.48	3	ind	1.7
4	4	west	21.44								complex	
4	2	west	58.39	29.13	32.25	30.72	6.04	5.64	3.48	2	complex/lipped	12.3
4	4	west	40.76	20.98	24.93	28.58	5.09	5.06	6.58	1	flat/lipped	6.9
4	5	east	67.52	26.34	27.87	42.17	11.28	11.05	7.83	1	ind	19.9
4	4	west								ind	ind	

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
4	3	west	58.42	44.1	46.09	44.2	16	19.42	10.5	1	flat	54.2
4	4	south	50.11	14.53	13.3	14.89	3.55	3.81	4.17	1	abraded	3.5
4	2	north	39.67	13.11	26.27	20.18	5.48	4.26	3.81	3	abraded	5
4	2	north	64.79	28.12	24.12	16.81	19.79	18.53	11.5	1	flat	33.7
4	6	north	32.86	26.13	23.18	15.92	3.91	3.53	3.11	2	abraded	3.1
4	1	north	23.91	17.86	19.49	16.91	6.05	5.07	4.35	1	flat	2.9
4	1	south	43.84	26.65	29.3	24.92	8.25	8.39	5.11	2	complex	10
4	1	west	37.65	26.95	26.91	16.03	8.22	7.53	4.96		flat	8.4
4	3	south	31.37	15.72	18.69	18.49	4.02	3.76	2.34	1	abraded/lipped	2.1
1	1	n/a	90.58	33.15	34.72	32.26	11.86	7.3	4.43	2	flat	32.3
1	5	n/a	45	22.47	29.3	32.26	5.07	4.47	3.72	3	abraded	6.1
1	9	n/a	55.41	25.45	32.83	23.21	6.61	6.08	3.81	2	abraded/lipped	8.4
1	11	n/a	41.87	26.72	35.23	ind	7.52	6.71	4.95	3	complex	11.1
1	4	n/a	54.79	23.23	28.02	32.49	7.04	6.95	4.41	2	flat	10.4
1	9	n/a	46.04	18.08	19.67	17.94	3.31	2.66	2.75	3	abraded/lipped	3.2
1	3	n/a	46.93	ind	35.48	17.44	6.29	5.13	4.38	4	flat	7
1	4	n/a	49.87	32.32	36.71	35.56	5.31	5.53	4.61	1	complex	9.3
1	7	n/a	37.63	37.93	39.43	28.5	11.75	10.48	6.88	1	flat	12.7
1	2	n/a	66.78	30.15	31.71	33.99	9.89	11.99	13.22	2	complex	34.6
1	1	n/a	52.59	25.08	20.28	14.53	7.41	8.87	6.93	2	complex	10.6
1	4	n/a	41.85	18.23	23.06	14.51	4.51	4.53	3.81	2	complex	4.6
1	3	n/a	24.02	15.82	26.68	25.19	2.4	1.94	1.78	1	complex	1.5
1	11	n/a	ind	21.47	25.95	ind	3.99	3.35	ind	ind	flat/lipped	3.7
1	1	n/a	ind	ind	i	ind	i	i	ind	ind	non discernable	12.2
1	18	n/a	52.02	24.26	35.38	40.79	9.57	10.41	13	1	cortex	28.4
1	9	n/a	60.99	33.23	21.37	18.56	14.84	14.6	10.11	1	Flat	30.1
1	11	n/a	29.11	19.45	19.59	19.4	7.66	7.33	5.77	1	flat	3.9
1	5	n/a	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	2.7
1	11	n/a	23.77	17.73	14.97	13.12	3.6	2.95	1.87	2	flat	1.3
1	10	n/a	ind	26.94	30.84	ind	6.66	5.09	ind	ind	abraded/lipped	6.7
1	7	n/a	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	
1	19	n/a	ind	ind	ind	ind	ind	ind	ind	1	non discernable	0.9
1	11		ind	ind	ind	ind	ind	ind	ind	ind	non discernable	2.9
1	1	n/a	ind	ind	ind	ind	ind	ind	ind	ind	complex/lipped	1.5

XU	Lvl	Qd	Length (mm)	Width: at 1/4	at 1/2	at 3/4	Thickness: at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
7	3	south	43.06	21.42	21.4	23.65	4.03	3.84	3.24	1	abraded/lipped	5.6
7	1	east	35.9	24.47	22.8	21.03	7.73	6.96	6.12	1	flat	7.8
7	5	north	35.66	17.77	20.35	27.05	4.47	5.27	3.51	2	abraded	3.9
7	4	north	ind	ind	ind	ind	ind	ind	ind	3	non discernable	5.9
7	3	north	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	11.9
7	2	north	51.89	30.35	20.5	16.91	12.43	6.66	7.76	1	flat	13.5
7	6	west	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	14.8
7	3	west	55.44	25.54	44.68	50.26	11.1	10.8	5.44		cortical	26
7	4	east	49.13	21.63	25.28	22.64	5.35	6.11	5.34	1	flat	7.6
7	3	north	37.07	28.79	37.12	29.6	5.89	5.31	3.23	2	abraded/lipped	6.4
7	3	south	39.86	17.53	23.04	17.17	5.41	6.84	4.56	2	complex	5.8
7	5	east	50.19	20.1	26.74	24.46	4.38	3.9	3.36	2	abraded/lipped	5
7	4	west	34.24	16.08	24.83	28.12	5.92	6.85	5.48	1	flat/lipped	5.6
7	4	south	38.45	16.65	20.45	22.3	3.99	3.57	2.95	1	abraded/lipped	3.5
7	2	west	ind	ind	ind	ind	ind	ind	ind	ind	abraded/lipped	5.4
7	4	west	40.31	18.64	21.22	20.5	3.37	4.88	3.51	2	flat/lipped	3.7
7	2	west	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	8.7
7	3	east	ind	ind	ind	ind	ind	ind	ind			
7	4	east	54.5	18.29	24.42	21.19	6.23	6.58	5.91	1	flat	9
7	2	north	43.99	72.03	71.97	60.48	9.14	11.93	10.62	2	flat	40.7
7	5	north	ind	ind	ind	ind	ind	ind	ind	ind	cortex	5.2
7	6	west	32.69	13.19	19.7	19.19	5.12	5.74	4.21	2	abraded	3.5
7	3	east	ind	ind	ind	ind	ind	ind	ind	ind	abraded	1.5
7	3	south	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	1.1
7	1	south	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	1.2
7	2	south	36.91	30.78	30.04	26.03	14.06	10	6.34	1	flat	13.7
7	3	north	56.73	50.32	58.87	49.55	16.31	15.13	14.13		flat	59.4
7	2	south	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	4.5
7	4	east	33.16	18.02	17.59	15.98	10.95	8.57	5.17	1	flat	5.6
7	1	east	50.69	23.32	29.75	24.16	8.65	10.6	9.51	2	flat	16.2
7	6	east	73.62	38.9	31.02	18.75	23.36	21.2	13.63	1	cortex	64.5
7	5	west	55.68	44.42	53.94	66.68	13.16	14.48	17.21	0	abraded?	57.2

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
7	4	west	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	6.7
7	2	west	50.47	23.73	20.04	17.9	4.96	5.17	4.45	1	complex	6.8
7	4	east	51.37	16.44	13.75	12.11	4.4	5.74	6.45	1	abraded/lipped	4.6
7	5	south										2.5
7	3	north	ind	ind	ind	ind	ind	ind	ind	ind	abraded	7.6
7	5	east	43.85	15.28	18.01	20.17	3.99	4.5	3.81	1	flat/lipped	3.9
7	2	north	29.77	22.81	25.57	25.04	2.87	2.83	2.25	2	abraded	2.4
7	1	south	ind	ind	indf	ind	ind	ind	ind	ind	flake fragment	3
7	3	south	29.64	16.22	18.96	19.71	2.67	2.75	2.46	3	abraded/lipped	1.8
7	1	east	25.61	11.74	14.64	14.22	2.68	2.16	2.15	2	complex/abraded	1
7	3	north	35.01	19.77	21.92	24.31	1.66	1.74	1.95	1	abraded/lipped	1.8
7	3	east	30.37	30.79	27.84	25.48	5.83	5.5	4.06	3	abraded	5.2
7	5	north	ind	ind	ind	ind	ind	ind	ind	ind	flake fragment	4.6
7	5	east	50.16	20.11	26.72	23.84	4.33	3.9	3.21	2	abraded lipped	5
7	2	east	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	9.1
7	4	east	28.59	12.89	17.96	21.5	4.31	3.35	3.12	1	flat/lipped	2
7	1	south	23.06	13.98	16.47	14.87	2.32	2.11	1.39	1	abraded/lipped	1
7	1	west	27.98	16.5	30.16	23.07	4.79	4.57	4.97	1	flat	4.1
7	2	north	32.22	26.57	30.59	34.42	5.48	7.55	10.6	2	flat	10.2
7	5	north	ind	ind	ind	ind	ind	ind	ind	ind	non discernable	0.6
7	2	east	19.07	12.55	12.48	10.56	2.22	2.45	2.12	1	flat	0.5
7	4	south	41.46	42.38	53.83	44.28	16.94	19.18	10.18	ind	cortex	40.7
7	3	east	ind	ind	in	ind	ind	ind	ind	ind	non discernable	8.4
7	5	west	22.21	22.35	21.32	20.29	6.42	4.94	3.77	2	complex	2.6
7	5	east	ind	ind	in	ind	ind	ind	ind	ind	non discernable	115.5
8	6	n/a	71.45	19.73	19.15	20.1	5.15	3.76	3.22	1	abraded	7.3
8	2	n/a	27.64	13.87	14.92	13.8	3.95	4.77	4.64	1	abraded	2.2
3	5	west	13.25	13.75	16.31	17.53	2.24	1.96	2.65	2	flat	0.6
4	3	west	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2
4	3	west	31.72	16.42	24.4	20.82	6.27	6.18	3.36		flat/lipped	3.9
4	4	west	ind	ind	ind	ind	ind	ind	ind	0	non-discernable	1.8

XU	Lvl	Qd	Length (mm)	Width: at 1/4	at 1/2	at 3/4	Thickness: at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
4	2	south	27.37	21.87	15.39	12.11	4.75	3.33	2.23		cortex	1.6
4	1	west	ind	ind	ind	ind	ind	ind	ind	ind	flat	18.7
11	1	east	39.06	16.8	21.38	18.8	2.65	5.24	2.88	2	abraded	3.1
11	1	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	6.9
11	3	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	4.2
11	2	ind	38.82	27.14	28.13	24.49	6.45	5.84	4.08	1	complex	7.2
11	3	south	ind	ind	ind	ind	ind	ind	ind	ind	complex	4.3
11	1	north	44.84	21.41	31.11	35.86	12.12	12.6	9.3	1	flat	18.3
11	1	north	82.5	60.17	52.68	38.41	26.85	27.75	18.95	ind	flat	106.1
5	2	west	68.88	45.8	45.44	32.52	12.98	12.19	11.46	2	flat/lipped	49.9
5	2	north	32.41	24.88	24.14	19.02	3.74	4.19	2.78	3	complex	3.4
5	1	south	44.79	26.41	26.44	24.06	4.06	6.09	3.88	2	flat	6.3
5	1	south	42.48	22.37	28.75	30.22	6.22	7.38	7.05	3	flat	9.4
5	1	south/feature1or5	34.04	22.55	27.12	21.85	3.1	2.95	2.75	2	flat	3
5	7	west	20.27	10.7	10.97	10.73	2.68	2.43	2.1	1	flat	0.6
5	8	east	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	5.2
5	1	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.4
5	1	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	4.8
13	5	west	48.76	19.67	29.35	27.86	4.6	7.28	5.04		abraded	9.5
13	10	south	ind	ind	ind	ind	ind	ind	ind	1	flat	2.9
13	6	feature1	58.01	26.21	33.15	31.84	4.49	4.6	4.83	1	abraded	10.7
13	3	south	29.98	21.29	21.28	19.7	2.35	2.74	2.31	2	flat	1.9
13	10	east	75.99	41.13	48.02	25.54	13.1	11.95	8.91	ind	flat	42.8
13	7	south	50.2	28.41	27.29	20.35	4.43	4.1	3.96	2	flat	6.8
13	7	east	58.47	34.26	28.84	22.49	5.64	5.67	3.41	3	complex/abraded	10.7
13	5	west	45.64	47.14	41.03	23.1	13.33	9.35	7.48	2	flat	24.5
13	7	south	59.5	13.02	17.68	20.49	3.99	5.52	3.6	2	Flat/lipped	5.6
13	7	west	32.66	17.05	16.58	10.59	2.74	2.91	2.92	1	flat	1.9
13	1	south	37.57	37.88	34.99	39.32	6.01	7.97	7.02	2	flat	10.7
13	9	west	36	22.32	25.01	23.16	6.21	7.08	6.84	1	flat	6.1
13	8	east	32.84	18.45	17.15	13.77	4.91	4.26	2.58	1	flat	2.9
13	14	east	35.55	30.24	35.56	40.87	7.65	8.69	9.68	1	complex	14.5
13	8	north	40.47	28.58	31.78	35.01	6.77	6.45	6.36	1	complex	11.8
13	6	east	50.38	25.9	33.42	55.66	4.5	5.04	4.26	2	abraded	9.6
13	8	west	46.8	15.71	20.57	15.14	2.83	2.55	2.29	1	flat	2.8

XU	Lvl	Qd	Length (mm)	Width: at 1/4	at 1/2	at 3/4	Thickness: at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
13	17	south	32.07	41.79	38.91	30.57	9.81	10.12	9.53	1	flat	14.2
13	8	south	35.42	32.66	38.21	42.5	7.29	4.94	4.91	1	flat	10.9
13	6	north	31.56	16.58	22.32	21.03	3.13	3.36	3.58	3	flat/lipped	2.8
13	10	south	57.58	35.58	46.39	42.54	7.92	6.94	6.69	2	Flat/lipped	20.1
13	8	west	36.15	20.77	21.97	21.41	4.59	4.73	4.27	1	Flat/lipped	4.2
13	9	east	36.1	23.4	25.78	25.06	4.43	3.98	4.23	1	abraded/lipped	6.9
13	10	east	40.18	17.52	22.84	28.46	3.54	3.59	3.54	2	abraded	4.5
13	1	south	25.42	24.11	21.85	18.18	5.24	4.23	3.24	1	flat	3.3
13	4	south	64.79	58.82	60.58	42.46	16.45	18.5	14.11	ind	flat	61
13	14	east	38.04	23.59	28.08	33.32	11.54	11.07	10.06	1	complex	13.2
13	2	south	28.85	22.46	24.72	30.01	4.45	5.03	4.33	2	flat	4.3
13	2	north	47.5	11.76	13.81	16.22	4.58	5.41	6.47	1	abraded	4.4
13	10	south	66.77	22.81	23.15	21.08	4.6	4.99	5.36	3	complex/lipped	10
13	2	south	54.97	20.03	25.37	28.98	7.92	7.04	5.35	1	abraded	12.4
13	8	west	44.36	24.82	30.91	25.87	6.65	5.28	2.5	2	abraded	7.4
13	10	east	73.31	26.93	35.31	32.69	13.29	10.37	5.75	2	flat	29.4
13	10	west	48.73	33.09	44.55	41.56	8.23	13.02	9.66	2	cortical	23.1
13	10	south	28.85	22.46	24.72	30.01	4.45	5.03	4.33	2	abraded	9.5
13	8	east	43.46	26.02	29.68	32.53	5.8	7.26	5.74	1	abraded/lipped	5.4
13	9	west	39.51	25.38	28.37	26.59	5.42	3.7	2.85	2	abraded	8.5
13	8	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	20.8
13	9	west	88	31.54	31.06	32.69	13.48	12.09	7.82	1	cortex	43.6
13	9	north	40.36	32.16	28.15	14.7	6.32	6.24	3.62	1	abraded	6.7
13	10	east	35.08	28.85	46.13	34.72	7.76	6.44	5.27	ind	cortex	9.2
13	2	south	36.21	27.31	27.91	22.77	7.6	5.82	6.86	1	flat	7.9
13	8	west	46.23	24.66	27.66	18.18	7.13	7.78	6.74	2	abraded	8.9
13	8	north	41.5	19.23	16.05	13.7	2.82	3.38	3.55	1	flat	3
13	8	north	50.4	32.84	43.28	29.21	14.02	10.23	6.84	ind	cortex	25.4
13	4	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	5.8
13	4	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	3.4
13	6	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	4.3
13	14	east	34.2	21.44	19.66	14.5	3.33	5.1	1.93	2	flat	2.7
13	8	east	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	18.8
13	6	F1	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2.4
13	8	north	29.96	12.09	14.59	15.03	2.08	1.35	1.31	3	abraded	1

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
13	5	west	49.39	27.67	36.98	36.44	12.3	12.15	12.95	2	flat	32.8
13	14	east	ind	ind	ind	ind	ind	ind	ind	ind	flat	2.7
13	8	east	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2.3
13	10	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	5.1
13	8	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	11.6
13	9	west	24.16	20.63	24.45	19.58	2.07	3.54	4.2	3	flat	2.3
13	5	west	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.7
13	10	east	21.8	17.48	23	15.97	3.9	4.09	1.5	1	flat	1.6
13	2	south	34.39	26.26	24.98	25.87	8.17	7.31	7.76	1	flat	10
13	9	south	28.81	18.13	23.84	19.34	6.74	6.55	6.28	1	flat	5.1
13	3	west	27.52	14.83	10.9	5.98	3.56	2.54	2.54	1	flat	1.3
13	9	west	19.43	9.46	11.02	10.6	3	3.34	2.75	1	abraded/lipped	0.7
13	14	east	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.7
13	4	east	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.1
13	2	south	20.06	15.04	20.65	19.69	3.14	3.24	3	3	complex/lipped	1.6
13	14	east	18.85	15.84	18.75	16.65	2.69	2.41	2.38	1	abraded/lipped	1
13	10	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	0.9
13	4	south	24.26	14.78	15.08	10	3.87	2.81	2.13	2	flat	1.1
14	8	north	57.06	28.97	37.23	20.8	6.68	3.95	5.32	1	abraded	10.1
14	6	north	45.97	18.13	17.08	22.05	6.8	6.59	5.8	1	abraded	6.5
14	8	north	64.32	28.7	37.78	34.02	6.58	7.3	6.58	1	complex	17.1
14	7	south	52.61	24.72	25.46	23.61	3.99	3.49	3.7		complex	6.7
14	9	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	4.1
14	1	south	33.94	28.81	33.35	36.04	7.9	6.76	6.54	1	cortex	10
14	3	south	41.9	22.89	32.74	17.61	6.94	5.57	4.07	1	flat/lipped	6.1
14	7	north	50.93	41.58	35.85	33.47	12.36	10.29	17.04	1	flat	29.8
14	4	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	34.1
14	9	north	38.15	31.42	40.83	25.33	5	7.48	5.38	1	complex	11
14	8	north	63.76	26.68	37.93	37.94	10.36	11.78	7.97		abraded	23.6
14	7	south	83.58	37.19	36.73	29.29	17.17	18.22	12.13	1	flat	53.7
14	15	north	42.56	25.55	34.88	36.2	7.47	6.7	6.76	2	flat	14.4
14	7	north	45.44	24.84	33.83	21.27	6.46	4.4	1.93	2	abraded	7.5
14	3	north	46.14	22.92	25.87	27.22	5.21	5.58	5.02	1	abraded	7.6

XU	Lvl	Qd	Length (mm)	Width: at 1/4	at 1/2	at 3/4	Thickness: at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
14	8	north	35.39	36.18	33.16	28.21	15.94	12.04	6.99	2	flat	16
14	4	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	11.7
14	9	north	40.11	18.81	24.23	22.76	4.4	3.56	3.11		flat	3.9
14	7	north	46.09	21.57	18.62	17.98	4.47	4.29	3.43		abraded/lipped	4.8
14	11	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	20.5
14	8	south	61.67	47.96	59.49	42.09	20.22	16.45	9.74		flat	54.4
14	7	north	56.82	25.43	20.62	17.65	4.97	9.98	8.6		flat	11.2
14	9	north	50.01	44.41	31.56	38.95	8.01	9.84	8.99		complex/lipped	18.4
14	15	north	58.62	51.38	42.25	33.44	11.51	6.33	3.11	1	complex/lipped	26.5
14	6	north	75.96	44.24	33.93	36.55	7.2	10.46	7.12	2	abraded	29.8
14	4	south	40.34	28.19	28.04	30.89	5.76	7.07	3.27		abraded	8.6
14	9	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	4
14	7	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	18.5
14	14	south	37.47	24.74	26.33	21.06	5.42	4.93	4.25	2	complex	5.1
14	17	south	44.37	23.4	24.57	22.59	6.87	6.21	4.51	1	abraded	8.5
14	9	north	45.95	27.5	20.45	26.17	3.37	2.8	3.18		abraded	4.6
14	2	south	31.75	31.63	24.47	33.63	5.06	5.47	5.25	1	complex	7.3
14	10	south	73.84	29.64	34.67	33.68	6.08	6.59	8.46	1	flat	25.3
14	10	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	3.8
14	6	north	38.89	19.62	25.07	28.05	6.8	8.29	7.25	2	flat	7.9
14	8	south	40.55	32.31	22.12	26.59	9.85	8.61	6.5	2	flat	10.7
14	1	south	ind	ind	ind	ind	ind	ind	ind	1	non-discernable	7.9
14	5	north	37.43	24.29	21.14	30.3	11.75	11.11	9.2	1	complex	13.2
14	8	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	7.5
14	6	south	ind	ind	ind	ind	ind	ind	ind	ind	flat	3.2
14	1	south	84.55	35.44	34.98	32.45	23.06	22.89	22.57	ind	complex	86.7
14	8	south	ind	ind	ind	ind	ind	ind	ind	ind	flat/lipped	11.4
14	7	north	ind	ind	ind	ind	ind	ind	ind	1	flat	4.3
14	8	south	35	21.11	18.49	19.41	5.67	4.05	3.99	2	cortical	4.3
14	5	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	5.3
14	15	south	35.96	16.21	24.11	23.09	3.84	3.33	2.54	2	abraded	2.9
14	8	south	29.29	14.92	18.58	17.75	3.18	3.87	3.61	2	flat	2.5
14	6	north	28.99	30.62	28.02	19.57	6.79	6.49	5.58	2	flat	2.5

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
14	8	north	35.5	17.32	20.45	17.47	4.41	2.8	3.39	1	abraded	3
14	15	south	34.09	31.71	32.46	28.3	8.29	7.9	6.86	2	cortical	9
14	8	south	ind	ind	ind	ind	ind	ind	ind	ind	abraded	1.8
14	1	south	27.56	23.8	25.2	21.16	4.44	3.91	3.99	3	flat	4
14	9	south	ind	ind	ind	ind	ind	ind	ind	ind	complex	3.2
14	3	north	ind	ind	ind	ind	ind	ind	ind	ind	complex	3.1
14	9	north	ind	ind	ind	ind	ind	ind	ind	ind	flat/lipped	3.8
14	15	south	31.07	14.9	15.27	14.44	3.01	2.83	2.95	2	abraded/lipped	1.8
14	7	north	27.75	22.26	32.48	25.92	6.33	7.13	7.02	1	flat	6.1
14	9	south	40.75	26.08	17	17.23	4.9	4.14	3.29	1	flat	4.4
14	7	south	ind	ind	ind	ind	ind	ind	ind	ind	flat	3.8
14	9	south	35.12	19.04	24.7	16.36	4.89	4.27	3.62	1	abraded/lipped	3.4
14	19	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	6.1
14	8	south	22.29	17.99	23.55	27.56	5.65	5.25	4.8		flat/lipped	3.3
14	2	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	5.5
14	6	north	36.01	15.31	15.52	11.71	2.55	2.35	2.01	1	abraded	1.5
14	10	north	34.52	13.53	13.9	17.09	5.66	4.07	3.03	1	flat	3.3
14	8	south	29	15.4	18.22	12.75	2.42	2.22	1.52	3	abraded/lipped	1.3
14	12	north	ind	ind	ind	ind	ind	ind	ind	ind	flat	3.2
14	6	north	ind	ind	ind	ind	ind	ind	ind	ind	abraded	1.4
14	15	south	24.98	18.11	16.07	14.95	4.17	4.32	2.83	1	flat	2.2
14	7	north	21.44	32.76	30.1	23.28	9.6	7.85	4.25	1	flat/lipped	6.1
14	7	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.6
14	4	south	ind	ind	ind	ind	ind	ind	ind	1	flat	1
14	6	north	ind	ind	ind	ind	ind	ind	ind	ind	flat/lipped	0.6
14	3	south	45.64	22.73	20.28	19.25	15.43	14.28	8.31	1	cortex	14.6
14	1	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2.1
14	8	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2
14	17	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	3.4
14	8	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	0.9
14	9	north	24.59	15.55	23.02	14.21	3.26	5.02	2.67	2	abraded	1.8
14	7	south	31.07	23	29.39	17.96	12.54	12.27	11.51	1	flat	9
14	14	11/12pedestal	ind	ind	ind	ind	ind	ind	ind	ind	flat	0.7

				Width:			Thickness:					
XU	Lvl	Qd	Length (mm)	at 1/4	at 1/2	at 3/4	at 1/4	at 1/2	at 3/4	QPV	Platform	Weight
14	9	south	ind	ind	ind	ind	ind	ind	ind	ind	abraded	1.6
14	10	south	21.4	13.35	25.01	13.69	5.47	5.89	3.45	1	flat	2.1
14	8	south	20.48	19.41	15.12	11.08	3.57	2.79	2.12	1	flat	1.3
14	14	south	ind	ind	ind	ind	ind	ind	ind	ind	abraded	4.4
14	8	south	26.82	12.1	12.83	12.95	3.84	2.47	1.73	1	cortical	1
14	6	north	ind	ind	ind	ind	ind	ind	ind	0	non-discernable	2.7
14	9	north	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	2.1
14	3	south	22.73	10.41	17.68	18.19	3.41	2.59	2.3	2	abraded	1.3
14	4	south	23.63	8.07	14.99	13.69	1.86	2.54	1.85	1	abraded/lipped	0.9
14	15	south	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	1.8
14		11/12pedestal	ind	ind	ind	ind	ind	ind	ind	ind	complex	2.9
14	6	north	19.25	13.71	11.6	11.16	3.88	5.3	4.28	1	flat	1.2
14	9	south	26.68	18.13	15.3	13.57	3.58	3.9	3.14	1	flat	1.8
2	5	south	70.76	31.65	54.96	56.14	11.71	11.42	7.96	2	flat/lipped	35.9
2	3	west	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	26.9
2	2	west	65.91	35.91	39.49	34.09	7.46	8.21	6.54	1	flat/lipped	19.7
2	Feat.2		53.65	23.47	34.76	33.67	4.44	6.4	6.04	3	complex/lipped	11.7
2	3	east	46.04	22.33	35.3	50.4	6.41	8.73	8.03	1	flat	15.4
2	3	south	47.33	22.25	33.98	ind	5.33	6.07	5	1	abraded/lipped	9.1
2	2	west	ind	ind	ind	ind	ind	ind	ind	ind	abraded	2.6
2	9	south										
2	2	west	ind	ind	ind	ind	ind	ind	ind	ind	non-discernable	11.1

APPENDIX C: FAUNAL REPORT

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
1	3	1	2	4.07	White-tailed deer	Odocoileus virginiana	Metacarpal	Shaft	UID	None
1	3	2	1	0.90	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
1	3	3	5	1.37	Medium/large mammal		UID	Fragment	UID	Calcined
1	3	4	2	0.43	Bird/Mammal		Long bone	Shaft		None
1	3	5	9	1.77	Medium/large mammal		UID	Fragment	UID	None
1	4	1	4	1.27	Medium/large mammal		UID	Fragment	UID	Calcined
1	4	2	2	0.13	Bird/Mammal		Long bone	Shaft	UID	None
1	4	3	23	3.16	Medium/large mammal		UID	Fragment	UID	None
1	6	1	1	1.6	Large mammal		Radius	Shaft	Left	None
1	6	2	3	0.54	Large mammal		UID	Fragment	UID	Calcined
1	6	3	23	3.07	Medium/large mammal		UID	Fragment	UID	None
1	7	1	10	2.71	Medium/large mammal		UID	Fragment	UID	Calcined
1	7	2	62	10.12	Medium/large mammal		UID	Fragment	UID	None
1	8	1	3	16.85	White-tailed deer	Odocoileus virginiana	Metatarsal	Shaft	UID	None
1	8	2	1	0.06	Large bird		Long bone	Shaft	UID	Calcined
1	8	3	53	16.46	Large mammal		UID	Fragment	UID	None
1	9	1	1	0.64	Large mammal		Rib	Shaft	UID	Calcined
1	9	2	1	0.12	Medium/large mammal		Vertebral cap	Fragment	UID	None
1	9	3	1	0.74	White-tailed deer	Odocoileus virginiana	Phalanx	Proximal	UID	None
1	9	4	1	1.15	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
1	9	5	1	0.17	Small mammal		Long bone	Shaft	UID	Carnivore gnaw
1	9	6	1	0.11	Small mammal		Ulna	Proximal	Right	None
1	9	7	6	0.31	Medium mammal		UID	Fragment	UID	Calcined
1	9	8	17	6.79	Large mammal		UID	Fragment	UID	None
1	10	1	3	0.68	Medium/large mammal		UID	Fragment	UID	None
1	12	1	1	0.32	Bison	Bison bison	Tooth	Enamel	UID	None
1	12	2	4	2.12	Large mammal		Long bone	Shaft	UID	Burned black
1	12	3	9	2.67	Medium/large mammal		UID	Fragment	UID	None
1	12	4	1	2.14	Large mammal		Long bone	Shaft	UID	None
1	12	5	13	2.72	Medium/large mammal		UID	Fragment	UID	None
1	14	1	1	0.15	Small mammal		Long bone	Shaft	UID	None
1	14	1	4	2	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
1	18	1	1	0.32	Medium/large mammal		UID	Fragment	UID	None
1	20	1	1	1.65	Large mammal		Long bone	Shaft	UID	Healed break
2	1	1	1	0.36	Prong-horned antelope	Antilocapra americana	Sesamoid	Complete	UID	Burned black
2	1	2	1	0.41	Turtle	Testudines	Carapace	Fragment	UID	None
2	1	3	1	0.1	Frog/Toad	Rana/Bufo sp.	Femur	Distal	UID	Calcined
2	1	4	1	0.33	Hares, pikas, rabbits	Lagomorpha	Humerus	Distal	Left	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
2	1	5	5	0.74	Medium/large mammal		UID	Fragment	UID	Calcined
2	1	6	2	3.54	Large mammal		Long bone	Fragment	UID	None
2	1	7	16	7.29	Medium/large mammal		UID	Fragment	UID	None
2	2	9	67	22.1	Medium/large mammal		UID	Fragment	UID	None
2	2	1	1	0.07	Small mammal		Phalanx	Complete	UID	None
2	2	2	1	0.04	Indeterminate reptile		Vertebra	Nearly complete	UID	None
2	2	3	1	0.04	Gastropod	Gastropoda	Shell	Fragment	UID	None
2	2	4	10	3.18	Medium/large mammal		UID	Fragment	UID	Calcined
2	2	5	1	1.23	Prong-horned antelope	Antilocapra americana	Metapodial	Condoyle	UID	None
2	2	6	1	2.51	Large mammal		UID	Fragment	UID	Rodent gnaw
2	2	7	2	0.15	Medium mammal		Tooth	Enamel	UID	None
2	2	8	1	0.13	Gar	Lepisosteidae	Vertebra	Nearly complete	UID	None
2	2	1	1	0.9	Prong-horned antelope	Antilocapra americana	Upper second pre-molar	Nearly complete	Right	None
2	2	2	1	0.31	Large mammal		Vertebra	Articulation	Left	None
2	2	3	1	0.1	Indeterminate fish		Vertebra	Complete	UID	None
2	2	4	1	0.05	Small bird		Femur	Distal	Right	None
2	2	5	1	0.09	Small bird		Humerus	Proximal	UID	None
2	2	6	1	0.12	Brown rat	Rattus norvegicus	Innominate	Nearly complete	Right	None
2	2	7	1	0.54	Pocket gopher	Geomyidae	Mandible	Nearly complete	Right	None
2	2	8	1	0.12	Pocket gopher	Geomyidae	Upper incisor	Nearly complete	Left	None
2	2	9	4	0.69	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
2	2	10	1	0.27	Medium/large mammal		UID	Fragment	UID	Cut and Calcined
2	2	11	2	0.51	Medium/large mammal		UID	Fragment	UID	Calcined
2	2	12	2	0.27	Turtle	Testudines	Carapace	Fragment	UID	None
2	2	13	3	3.79	Prong-horned antelope	Antilocapra americana	Phalanx	Nearly complete	UID	None
2	2	14	2	7.31	Large mammal		Long bone	Shaft	UID	None
2	2	15	9	3.18	Medium/large mammal		UID	Fragment	UID	Burned black
2	2	16	112	29.82	Medium/large mammal		UID	Fragment	UID	None
2	2	1	2	1.99	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
2	2	2	1	0.45	Bison	Bison bison	Tooth	Enamel	UID	None
2	2	3	3	0.19	Small mammal		UID	Fragment	UID	None
2	2	4	1	0.43	Large mammal		Vertebra	Articulation	UID	Calcined
2	2	5	1	0.2	Turtle	Testudines	Carapace	Fragment	UID	None
2	2	6	1	0.09	Turtle	Testudines	Innominate	Fragment	Right	None
2	2	7	1	0.09	Medium bird		Rib	Proximal	Left	None
2	2	8	1	0.15	Medium mammal		Femur	Head	Right	None
2	2	9	2	0.87	Medium/large mammal		UID	Fragment	UID	Burned black
2	2	10	7	2.09	Medium/large mammal		UID	Fragment	UID	Calcined
2	2	11	1	0.39	Mussel	Bivalvia	Shell	Fragment	UID	Burned

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
2	2	12	5	0.43	Mussel	Bivalvia	Shell	Fragment	UID	None
2	2	13	118	34.99	Medium/large mammal		UID	Fragment	UID	None
2	3	1	1	0.06	White-tailed deer	Odocoileus virginiana	Deciduous tooth	Complete	UID	None
2	3	2	1	2.41	White-tailed deer	Odocoileus virginiana	Tarsal	Complete	Right	None
2	3	3	1	0.14	Large mammal		Vertebral cap	Fragment	UID	None
2	3	4	1	0.25	Small mammal		Innominate	Fragment	Left	None
2	3	5	1	0.56	White-tailed deer	Odocoileus virginiana	Sesamoid	Complete	UID	None
2	3	6	1	0.09	Small mammal		Metapodial	Proximal	UID	None
2	3	7	1	0.45	Large mammal		Rib	Shaft	UID	Cut
2	3	8	1	0.02	Small mammal		Metapodial	Proximal	UID	None
2	3	9	1	0.2	Hares, pikas, rabbits	Lagomorpha	Calcaneus	Complete	Right	None
2	3	10	7	1.45	Medium/large mammal		UID	Fragment	UID	Calcined
2	3	11	64	9.93	Medium/large mammal		UID	Fragment	UID	None
2	3	1	1	0.15	Large mammal		Tooth	Enamel	UID	None
2	3	2	1	0.04	Small bird		Long bone	Shaft	UID	None
2	3	3	1	0.11	Pocket gopher	Geomyidae	Mandible	Fragment	Left	None
2	3	4	1	0.09	Pocket gopher	Geomyidae	Humerus	Nearly complete	Left	None
2	3	5	1	0.09	Small bird		Humerus	Nearly complete	Left	None
2	3	6	1	0.09	Pocket gopher	Geomyidae	Femur	Nearly complete	Left	None
2	3	7	2	0.86	Turtle	Testudines	Carapace	Fragment	UID	None
2	3	8	4	2.46	Large mammal		UID	Fragment	UID	Calcined
2	3	9	66	14.46	Medium/large mammal		UID	Fragment	UID	None
2	3	1	13	7.3	Medium/large mammal		UID	Fragment	UID	Calcined
2	3	2	1	1.22	Large mammal		UID	Fragment	UID	Cut
2	3	3	1	0.16	Rodent	Rodentia	Maxilla	Fragment	Right	None
2	3	4	1	0.15	Rodent	Rodentia	Humerus	Shaft	Left	None
2	3	5	6	1.37	Large mammal		Tooth	Enamel and roots	UID	None
2	3	6	1	0.08	Indeterminate reptile		Vertebra	Fragment	UID	None
2	3	7	62	14.04	Medium/large mammal		UID	Fragment	UID	None
2	4	1	1	1.24	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	None
2	4	2	2	0.89	Prong-horned antelope	Antilocapra americana	Sesamoid	Complete	UID	None
2	4	3	4	1.06	Medium/large mammal		UID	Fragment	UID	Calcined
2	4	4	1	1.49	Prong-horned antelope	Antilocapra americana	Phalanx	Complete	UID	None
2	4	5	1	0.09	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
2	4	6	1	5.3	Prong-horned antelope	Antilocapra americana	Humerus	Distal	Right	None
2	4	7	1	0.07	Small mammal		Vertebra	Complete	UID	None
2	4	8	3	0.42	Turtle	Testudines	Carapace	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
2	4	9	31	7.34	Medium/large mammal		UID	Fragment	UID	None
2	4	1	1	0.02	Indeterminate fish		Pharyngeal	Nearly complete	Left	None
2	4	2	1	0.13	Rodent	Rodentia	Mandible	Fragment	Right	None
2	4	3	1	0.18	Rodent	Rodentia	Mandible	Nearly complete	Right	None
2	4	4	1	0.15	Turtle	Testudines	Long bone	Shaft	UID	None
2	4	5	17	5.83	Medium/large mammal		UID	Fragment	UID	None
2	4	1	1	0.1	Rodent	Rodentia	Incisor	Nearly complete	Left	None
2	4	2	1	0.11	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
2	4	3	1	0.14	Small mammal		Tibia	Nearly complete	Left	None
2	4	4	1	0.33	Large mammal		Tooth	Enamel	UID	None
2	4	5	1	0.19	Turtle	Testudines	Carapace	Fragment	UID	Calcined
2	4	6	2	0.34	Medium mammal		UID	Fragment	UID	Calcined
2	4	7	26	7.41	Medium/large mammal		UID	Fragment	UID	None
2	4	1	1	6.26	Large mammal		Long bone	Fragment	UID	None
2	4	2	5	1.08	Medium mammal		UID	Fragment	UID	None
2	5	1	1	0.1	Indeterminate fish		Quadrate	Nearly complete	UID	None
2	5	2	1	2.97	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
2	5	3	13	7	Large mammal		UID	Fragment	UID	None
2	5	1	1	17.64	Bison	Bison bison	Metatarsal	Distal	Left	Carnivore gnaw
2	5	2	1	0.57	Large mammal		Long bone	Shaft	UID	Calcined
2	5	3	16	5.94	Medium/large mammal		UID	Fragment	UID	None
2	6	1	5	2.71	Medium/large mammal		UID	Fragment	UID	None
2	6	1	1	0.11	Small mammal		Long bone	Shaft	UID	None
2	6	2	1	0.08	Mussel	Bivalvia	Shell	Fragment	UID	None
2	6	3	2	2.19	Large mammal		UID	Fragment	UID	Calcined
2	6	4	48	11.74	Large mammal		UID	Fragment	UID	None
2	6	1	1	0.13	Turtle	Testudines	Carapace	Fragment	UID	None
2	6	2	1	8.55	Bison	Bison bison	Long bone	Shaft	UID	None
2	6	3	10	4.56	Large mammal		Long bone	Shaft	UID	None
2	6	1	2	0.56	Medium mammal		UID	Fragment	UID	Calcined
2	6	2	13	2.74	Medium/large mammal		UID	Fragment	UID	None
2	7	1	5	0.68	Medium/large mammal		UID	Fragment	UID	None
2	7	1	1	0.96	White-tailed deer	Odocoileu s virginiana	Metatarsal	Shaft	UID	None
2	7	2	1	2.65	Large mammal		Long bone	Shaft	UID	Burned black
2	7	3	7	3.42	Medium/large mammal		UID	Fragment	UID	None
2	8	1	7	4.64	Medium/large mammal		UID	Fragment	UID	None
2	9	1	2	0.5	Medium/large mammal		UID	Fragment	UID	None
2	9	1	1	0.39	Medium/large mammal		UID	Fragment	UID	None
2	9	1	2	0.64	Medium/large mammal		UID	Fragment	UID	None
2	9	1	3	1.15	Medium/large		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
					mammal					
2	9	1	1	0.46	Turtle	Testudines	Carapace	Fragment	UID	None
2	9	2	1	0.41	Medium/large mammal		UID	Fragment	UID	None
2	9	3	1	0.67	Large mammal		UID	Fragment	UID	Calcined
2	12	1	2	0.46	White-tailed deer	Odocoileu s virginiana	Tooth	Enamel	UID	None
2	12	2	1	0.31	Prong-horned antelope	Antilocapr a americana	Metatarsal	Proximal	UID	None
2	12	3	1	0.08	Small mammal		Vertebra	Complete	UID	None
2	12	4	3	0.78	Turtle	Testudines	Carapace	Fragment	UID	None
2	12	5	1	0.33	Bison	Bison bison	Tooth	Enamel	UID	None
2	12	6	1	0.11	Mussel	Bivalvia	Shell	Fragment	UID	None
2	12	7	11	5.22	Medium/large mammal		UID	Fragment	UID	Calcined
2	12	8	139	37.91	Medium/large mammal		UID	Fragment	UID	None
3	1	1	1	0.39	Medium/large mammal		UID	Fragment	UID	Calcined
3	2	1	2	1.37	Large mammal		Long bone	Shaft	UID	Calcined
3	2	2	1	0.48	Turtle	Testudines	Plastron	Fragment	Left	None
3	2	3	5	1.68	Turtle	Testudines	Carapace	Fragment	UID	None
3	2	4	1	0.29	Hogs, pigs	Suidae	Incisor	Enamel	UID	None
3	2	5	54	14.37	Medium/large mammal		UID	Fragment	UID	None
3	2	1	2	0.01	Mussel	Bivalvia	Shell	Fragment	UID	None
3	2	2	2	0.76	Turtle	Testudines	Carapace	Fragment	UID	None
3	2	3	2	0.36	Medium/large mammal		UID	Fragment	UID	Calcined
3	2	4	1	0.35	Large mammal		UID	Fragment	UID	Worked
3	2	5	51	15.62	Medium/large mammal		UID	Fragment	UID	None
3	2	1	1	0.41	Prong-horned antelope	Antilocapr a americana	Incisor	Complete	Right	None
3	2	2	1	0.2	Turtle	Testudines	Carapace	Fragment	UID	None
3	2	3	3	1.2	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
3	2	4	1	0.32	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None
3	2	5	12	5.77	Medium/large mammal		UID	Fragment	UID	Calcined
3	2	6	71	26.99	Medium/large mammal		UID	Fragment	UID	None
3	2	1	3	1.96	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
3	2	2	2	1.26	Prong-horned antelope	Antilocapr a americana	Metapodial	Condoyle	UID	None
3	2	3	2	0.85	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
3	2	4	1	0.1	Small mammal		Long bone	Shaft	UID	None
3	2	5	3	0.43	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	2	6	2	0.76	Beaver	Castor canadensis	Upper pre-molar	Complete	Left	None
3	2	7	1	0.22	Medium mammal		Phalanx	Proximal	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
3	2	8	1	0.17	Wolves, coyotes, foxes, dogs	Canidae	Upper pre-molar	Fragment	Left	None
3	2	9	1	0.17	Turtle	Testudines	Carapace	Fragment	UID	None
3	2	10	1	2.75	Bison	Bison bison	Long bone	Shaft	UID	None
3	2	11	10	3.6	Medium/large mammal		UID	Fragment	UID	Calcined
3	2	12	105	30.18	Medium/large mammal		UID	Fragment	UID	None
3	3	1	1	0.17	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	3	2	1	0.09	Indeterminate fish		Vertebra	Nearly complete	UID	None
3	3	3	1	0.17	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
3	3	4	1	0.2	Rodent	Rodentia	Mandible	Fragment	Left	None
3	3	5	1	0.16	Indeterminate fish		UID	Fragment	UID	None
3	3	6	4	1.47	Turtle	Testudines	Carapace	Fragment	UID	None
3	3	7	1	0.9	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
3	3	8	1	0.35	Perches	Percidae	Dentary	Fragment	UID	None
3	3	9	11	5.18	Medium/large mammal		UID	Fragment	UID	Calcined
3	3	10	65	26.65	Medium/large mammal		UID	Fragment	UID	None
3	3	1	1	0.36	Large mammal		Eye orbit	Fragment	UID	None
3	3	2	1	0.13	Indeterminate fish		UID	Fragment	UID	None
3	3	3	1	0.17	Rodent	Rodentia	Femur	Nearly complete	Left	None
3	3	4	1	2.5	Prong-horned antelope	Antilocapr a americana	Ulna	Ulnar notch	Left	None
3	3	5	1	0.15	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	3	6	2	1.34	Opossum	Didelphis virginiana	Mandible	Fragment	Right	None
3	3	7	1	0.32	Rodent	Rodentia	Femur	Complete	Right	None
3	3	8	1	0.15	Indeterminate fish		Vertebra	Complete	UID	None
3	3	9	1	0.13	Rodent	Rodentia	Long bone	Fragment	UID	None
3	3	10	10	3.59	Medium/large mammal		UID	Fragment	UID	Calcined
3	3	11	5	1.2	Turtle	Testudines	Carapace	Fragment	UID	None
3	3	12	72	28.88	Medium/large mammal		UID	Fragment	UID	None
3	3	1	1	0.91	Large mammal		Skull	Fragment	UID	None
3	3	2	1	3.71	Prong-horned antelope	Antilocapr a americana	Metatarsal	Shaft	UID	None
3	3	3	1	0.08	Rodent	Rodentia	Tooth	Enamel	UID	None
3	3	4	1	0.32	Rodent	Rodentia	Mandible	Fragment	Right	None
3	3	5	1	0.1	Indeterminate fish		UID	Fragment	UID	None
3	3	6	2	0.3	Large bird		Long bone	Shaft	UID	None
3	3	7	2	2.96	Medium/large mammal		Long bone	Shaft	UID	Carnivore gnaw
3	3	8	1	0.3	Mussel	Bivalvia	Shell	Fragment	UID	None
3	3	9	1	0.1	Indeterminate fish		UID	Fragment	UID	None
3	3	10	1	0.21	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
3	3	11	13	5.46	Medium/large mammal		UID	Fragment	UID	Calcined
3	3	12	1	0.08	Rodent	Rodentia	Skull	Nasal	UID	None
3	3	13	1	3.45	Prong-horned antelope	Antilocapra americana	Metapodial	Condoyle	UID	None
3	3	14	2	0.2	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	3	15	1	0.32	Wild turkey	Meleagris gallopavo	Claw	Complete	UID	None
3	3	16	10	2.23	Turtle	Testudines	Carapace	Fragment	UID	None
3	3	17	1	0.41	Large mammal		Caudal vertebra	Nearly complete	UID	None
3	3	18	5	2.26	Large mammal		Tooth	Enamel	UID	None
3	3	19	155	33.1	Medium/large mammal		UID	Fragment	UID	None
3	3	20	3	73.24	Prong-horned antelope	Antilocapra americana	Skull	Cranial and horn fragments	Left	None
3	3	21	1	0.44	Small mammal		Long bone	Shaft	UID	Calcined
3	3	22	2	0.64	Medium/large mammal		UID	Fragment	UID	Calcined
3	3	23	1	0.17	Small mammal		Long bone	Shaft	UID	None
3	3	24	1	0.84	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
3	3	25	1	3.65	Large mammal		Long bone	Shaft	UID	Chop marks
3	3	26	20	3.96	Prong-horned antelope	Antilocapra americana	Horn Core	Fragment	UID	None
3	3	27	25	6.37	Medium/large mammal		UID	Fragment	UID	None
3	4	1	1	0.68	Prong-horned antelope	Antilocapra americana	Metacarpal	Proximal	Left	None
3	4	2	1	0.04	Indeterminate fish		Vertebra	Nearly complete	UID	None
3	4	3	1	0.21	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	4	4	1	0.11	Pocket gopher	Geomyidae	Mandible	Fragment	Right	None
3	4	5	6	1.07	Pocket gopher	Geomyidae	Skull	Maxilla and incisors	UID	None
3	4	6	9	4.27	Medium/large mammal		UID	Fragment	UID	Calcined
3	4	7	27	5.82	Medium/large mammal		UID	Fragment	UID	None
3	4	1	1	1.02	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	None
3	4	2	1	0.67	Eastern cottontail	Sylvilagus floridanus	Mandible	Fragment	Right	None
3	4	3	4	1.55	Turtle	Testudines	Carapace	Fragment	UID	Calcined
3	4	4	1	0.1	Medium mammal		UID	Fragment	UID	Calcined
3	4	5	1	0.98	Deer	Cervidae	Metapodial	Shaft	UID	None
3	4	6	22	7.22	Medium/large mammal		UID	Fragment	UID	None
3	4	1	1	0.08	Indeterminate fish		Vertebra	Fragment	UID	None
3	4	2	1	0.11	Turtle	Testudines	Carapace	Fragment	UID	None
3	4	3	21	5.28	Medium/large mammal		UID	Fragment	UID	None
3	4	1	1	0.48	Large mammal		UID	Fragment	UID	Rodent gnaw
3	4	2	1	0.14	Turtle	Testudines	Carapace	Fragment	UID	None
3	4	3	1	0.11	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
3	4	4	1	0.14	Mussel	Bivalvia	Shell	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
3	4	5	8	2.15	Medium/large mammal		UID	Fragment	UID	None
3	5	1	1	0.11	Medium/large mammal		UID	Fragment	UID	Calcined
3	5	2	5	0.89	Medium/large mammal		UID	Fragment	UID	None
3	5	1	1	6.61	Prong-horned antelope	Antilocapr a americana	Navicular cuboid	Complete	Right	None
3	5	2	2	18.16	Prong-horned antelope	Antilocapr a americana	Femur	Distal	Right	None
3	5	3	1	0.78	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
3	5	4	14	3.06	Medium/large mammal		UID	Fragment	UID	None
3	5	1	1	0.05	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	5	2	10	3.5	Medium/large mammal		UID	Fragment	UID	None
3	5	1	1	0.21	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
3	5	2	4	4.17	Large mammal		Rib	Fragment	UID	None
3	5	3	16	4.06	Medium/large mammal		UID	Fragment	UID	None
4	1	1	3	2.05	Large mammal		Tooth	Enamel	UID	None
4	1	2	1	0.47	Medium/large mammal		UID	Fragment	UID	Calcined
4	1	3	33	11.38	Medium/large mammal		UID	Fragment	UID	None
4	1	4	3	3.7	Large mammal		Long bone	Shaft	UID	None
4	1	1	1	0.31	Large mammal		Tooth	Enamel	UID	None
4	1	2	2	0.13	Turtle	Testudines	Carapace	Fragment	UID	None
4	1	3	1	0.11	White-tailed deer	Odocoileu s virginiana	Tooth	Enamel	UID	None
4	1	4	1	0.36	Small mammal		Tibia	Shaft	Left	None
4	1	5	41	11.26	Medium/large mammal		UID	Fragment	UID	None
4	2	1	1	0.87	Large mammal		Long bone	Shaft	UID	Calcined
4	2	2	1	2.76	Bison	Bison bison	Lower first pre-molar	Complete	Left	None
4	2	3	1	0.19	Indeterminate fish		UID	Fragment	UID	None
4	2	4	28	6.93	Medium/large mammal		UID	Fragment	UID	None
4	2	1	1	2.65	Prong-horned antelope	Antilocapr a americana	Upper second pre-molar	Complete	Right	None
4	2	2	1	1.58	Prong-horned antelope	Antilocapr a americana	Carpal	Complete	UID	Calcined
4	2	3	1	0.21	Rodent	Rodentia	Mandible	Fragment	Right	None
4	2	4	1	0.22	Rodent	Rodentia	Mandible	Fragment	UID	None
4	2	5	1	0.01	Small mammal		Vertebra	Complete	UID	None
4	2	6	1	0.08	Small mammal		Incisor	Fragment	UID	None
4	2	7	2	0.44	Large mammal		Tooth	Enamel	UID	None
4	2	8	4	1.31	Turtle	Testudines	Carapace	Fragment	UID	None
4	2	9	1	0.93	Large mammal		Ulna	Ulnar notch	UID	None
4	2	10	1	0.71	Large mammal		UID	Fragment	UID	Rodent gnaw
4	2	11	2	1.16	Medium/large mammal		UID	Fragment	UID	Calcined
4	2	12	95	22.87	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
4	3	1	3	0.71	Turtle	Testudines	Carapace	Fragment	UID	None
4	3	2	1	0.19	White-tailed deer	Odocoileus virginiana	Tooth	Enamel	UID	None
4	3	3	2	4.66	Large mammal		Long bone	Shaft	UID	None
4	3	4	1	0.23	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
4	3	5	1	0.14	Small mammal		Skull	Fragment	UID	None
4	3	6	1	0.25	Large mammal		Tooth	Enamel	UID	None
4	3	7	36	9.27	Medium/large mammal		UID	Fragment	UID	None
4	3	1	1	0.13	Large mammal		Tooth	Enamel	UID	None
4	3	2	1	0.52	Rodent	Rodentia	Mandible	Fragment	Left	None
4	3	3	1	0.21	Rodent	Rodentia	Mandible	Fragment	Right	None
4	3	4	1	3.4	Black bear	Ursus americanus	Radius	Proximal	Left	None
4	3	5	24	7.23	Medium/large mammal		UID	Fragment	UID	None
4	6	1	1	0.24	Medium mammal		UID	Fragment	UID	None
5	1	1	33	12.97	Medium/large mammal		UID	Fragment	UID	None
5	1	1	1	0.33	Prong-horned antelope	Antilocapra americana	Lower first pre-molar	Complete	Right	None
5	1	1	1	0.47	Large mammal		Tooth	Enamel	UID	None
5	1	2	1	0.38	Prong-horned antelope	Antilocapra americana	Phalanx	Distal	UID	None
5	1	3	1	0.19	Small mammal		Innominate	Fragment	Right	None
5	1	4	51	15.31	Medium/large mammal		UID	Fragment	UID	None
5	2	1	15	4.93	Medium/large mammal		UID	Fragment	UID	Calcined
5	2	2	1	0.35	Large mammal		Tooth	Enamel	UID	None
5	2	3	1	0.38	Rodent	Rodentia	Mandible	Nearly complete	Right	None
5	2	4	2	4.65	Large mammal		Long bone	Shaft	UID	Carnivore gnaw
5	2	5	2	0.15	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	2	6	1	0.04	Rodent	Rodentia	Radius	Proximal	Right	None
5	2	7	1	0.12	Wolves, coyotes, foxes, dogs	Canidae	Tooth	Fragment	UID	None
5	2	8	1	0.09	Rodent	Rodentia	Tibia	Proximal	Right	None
5	2	9	79	16.08	Medium/large mammal		UID	Fragment	UID	None
5	2	1	1	0.14	Rodent	Rodentia	Femur	Proximal	Right	None
5	2	2	1	0.67	Large mammal		Tooth	Enamel	UID	None
5	2	3	2	0.14	Rodent	Rodentia	Mandible	Nearly complete	Right	None
5	2	4	2	0.15	Gar	Lepisosteidae	Scale	Complete	UID	None
5	2	5	1	0.34	Medium/large mammal		Long bone	Shaft	UID	Cut marks
5	2	6	1	0.1	Turtle	Testudines	Carapace	Fragment	UID	None
5	2	7	2	0.21	Indeterminate fish		UID	Fragment	UID	None
5	2	8	1	1.13	Large mammal		Skull	Fragment	UID	None
5	2	9	4	1.58	Medium/large mammal		UID	Fragment	UID	Calcined
5	2	10	66	15.01	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
5	3	1	3	1.31	Medium/large mammal		UID	Fragment	UID	Calcined
5	3	2	1	0.1	Large bird		Claw	Complete	UID	None
5	3	3	4	0.58	Turtle	Testudines	Carapace	Fragment	UID	None
5	3	4	1	0.21	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	3	5	3	0.35	Large mammal		Tooth	Enamel	UID	None
5	3	6	1	0.04	Gar	Lepisostei dae	Scale	Complete	UID	None
5	3	7	1	0.57	Medium/large mammal		Long bone	Shaft	UID	Carnivore gnaw
5	3	8	44	11.24	Medium/large mammal		UID	Fragment	UID	None
5	3	1	3	0.86	Large mammal		Vertebral cap	Nearly complete	UID	None
5	3	2	3	0.36	Turtle	Testudines	Carapace	Fragment	UID	None
5	3	3	1	0.13	Prong-horned antelope	Antilocapr a americana	Incisor	Root	UID	None
5	3	4	1	0.01	Indeterminate fish		UID	Fragment	UID	None
5	3	5	1	0.04	Small mammal		Femur	Proximal	Right	None
5	3	6	1	0.08	Medium mammal		Phalanx	Complete	UID	None
5	3	7	1	0.13	Small mammal		UID	Shaft	UID	Rodent gnaw
5	3	8	1	0.56	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
5	3	9	1	0.13	Gar	Lepisostei dae	Vertebra	Nearly complete	UID	None
5	3	10	1	0.12	Large mammal		Tooth	Enamel	UID	None
5	3	11	1	0.16	Medium/large mammal		UID	Fragment	UID	Calcined
5	3	12	2	0.08	Gar	Lepisostei dae	Scale	Complete	UID	None
5	3	13	1	0.12	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	3	14	54	10.62	Medium/large mammal		UID	Fragment	UID	None
5	3	1	3	2.04	Prong-horned antelope	Antilocapr a americana	Mandible	Fragment	UID	None
5	3	2	2	0.16	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	3	3	1	0.2	Indeterminate fish		UID	Fragment	UID	None
5	3	4	2	0.05	Small bird		Humerus	Proximal	Right	None
5	3	5	1	0.15	Bird/Mammal		Phalanx	Proximal	UID	None
5	3	6	1	0.11	Rodent	Rodentia	Femur	Proximal	Right	None
5	3	7	1	0.07	Large bird		Tarsometatar sus	Condoyle	UID	None
5	3	8	1	0.21	Medium/large mammal		UID	Fragment	UID	Calcined
5	3	9	1	0.01	Very small/small mammal		Calcaneus	Complete	Right	None
5	3	10	1	0.02	Very small/small mammal		Tibia	Proximal	Right	None
5	3	11	1	0.52	Prong-horned antelope	Antilocapr a americana	Vertebra	Articulation	UID	None
5	3	12	2	1.22	Prong-horned antelope	Antilocapr a americana	Carpal	Complete	UID	None
5	3	13	5	1.32	Turtle	Testudines	Carapace	Fragment	UID	None
5	3	14	2	0.41	Medium/large mammal		Long bone	Shaft	UID	Calcined

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
5	3	15	1	0.13	Indeterminate reptile		Vertebra	Complete	UID	None
5	3	16	1	2.22	Large mammal		Long bone	Shaft	UID	None
5	3	17	2	0.31	Large mammal		Tooth	Enamel	UID	None
5	3	18	72	12.77	Medium/large mammal		UID	Fragment	UID	None
5	3	1	3	0.3	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	3	2	1	0.11	Rodent	Rodentia	Mandible	Fragment	Right	None
5	3	3	1	0.16	Rodent	Rodentia	Humerus	Nearly complete	Left	None
5	3	4	1	0.01	Gar	Lepisostei dae	Scale	Complete	UID	None
5	3	5	2	0.33	Large mammal		Tooth	Enamel	UID	None
5	3	6	1	0.04	Small mammal		Femur	Proximal	Left	None
5	3	7	2	0.06	Small mammal		Vertebra	Nearly complete	UID	None
5	3	8	54	7.16	Medium/large mammal		UID	Fragment	UID	None
5	4	1	3	0.53	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	4	2	1	0.45	Beaver	Castor canadensis	Tooth	Enamel	UID	None
5	4	3	1	0.55	Large mammal		UID	Articulation	UID	None
5	4	4	6	3.18	Large mammal		UID	Fragment	UID	Calcined
5	4	5	4	0.42	Large mammal		Tooth	Enamel	UID	None
5	4	6	4	0.35	Turtle	Testudines	Carapace	Fragment	UID	None
5	4	7	2	0.69	Medium/large mammal		UID	Fragment	UID	Burned black
5	4	8	1	0.41	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
5	4	9	37	4.26	Medium/large mammal		UID	Fragment	UID	None
5	4	1	1	1.65	Prong-horned antelope	Antilocapr a americana	Upper third pre-molar	Complete	Right	None
5	4	2	5	0.75	Turtle	Testudines	Carapace	Fragment	UID	None
5	4	3	1	0.19	Squirrel	Sciurus sp.	Mandible	Nearly complete	Right	None
5	4	4	1	1.19	Prong-horned antelope	Antilocapr a americana	Tarsal	Nearly complete	UID	None
5	4	5	1	0.02	Very small/small mammal		Femur	Proximal	Right	None
5	4	6	1	0.06	UID		UID	Distal	UID	None
5	4	7	1	0.06	Large mammal		Tooth	Enamel	UID	None
5	4	8	41	10.19	Medium/large mammal		UID	Fragment	UID	None
5	4	1	1	0.15	Medium mammal		Phalanx	Complete	UID	None
5	4	2	2	0.47	Prong-horned antelope	Antilocapr a americana	Vertebral cap	Complete	UID	None
5	4	3	1	0.09	Small mammal		Femur	Proximal	Left	None
5	4	4	1	0.04	Medium bird		Tibia-tarsus	Distal	UID	None
5	4	5	1	0.03	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
5	4	6	1	0.06	Indeterminate fish		Vertebra	Complete	UID	None
5	4	7	1	5.56	Bison	Bison bison	Skull	Fragment	UID	None
5	4	8	1	0.04	Small mammal		Maxilla	Fragment	UID	None
5	4	9	1	0.05	Very small mammal		Mandible	Nearly complete	Left	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
5	4	10	3	0.6	Turtle	Testudines	Carapace	Fragment	UID	None
5	4	11	40	10.01	Medium/large mammal		UID	Fragment	UID	None
5	5	1	1	0.85	Medium/large mammal		Radius	Proximal	Right	None
5	5	2	1	1.15	Large mammal		Long bone	Shaft	UID	Calcined
5	5	3	1	0.06	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
5	5	4	1	1.11	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
5	5	5	1	0.19	Medium/large mammal		Sesamoid	Complete	UID	None
5	5	6	3	0.48	Turtle	Testudines	Carapace	Fragment	UID	None
5	5	7	32	8.86	Medium/large mammal		UID	Fragment	UID	None
5	5	1	1	0.26	Medium mammal		Long bone	Shaft	UID	Carnivore gnaw
5	5	2	3	0.19	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
5	5	3	1	0.08	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
5	5	4	33	4.37	Medium mammal		UID	Fragment	UID	None
5	5	1	1	3.04	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None
5	5	2	1	2.9	Bison	Bison bison	Tooth	Nearly complete	UID	None
5	5	3	1	0.13	Small mammal		Tibia	Distal	UID	None
5	5	4	2	0.36	Large mammal		Tooth	Enamel	UID	None
5	5	5	1	0.09	Medium mammal		Metapodial	Proximal	UID	None
5	5	6	1	0.06	Turtle	Testudines	Carapace	Fragment	UID	None
5	5	7	12	3.04	Medium/large mammal		UID	Fragment	UID	None
5	5	1	1	0.08	Small mammal		Calcaneus	Nearly complete	Right	None
5	5	2	1	0.07	Small mammal		Phalanx	Proximal	UID	None
5	5	3	1	0.06	Small mammal		UID	Fragment	UID	None
5	5	4	3	0.7	Medium/large mammal		UID	Fragment	UID	Calcined
5	5	5	1	0.12	Medium mammal		Carpal	Complete	UID	None
5	5	6	25	6.06	Medium/large mammal		UID	Fragment	UID	None
5	6	1	1	0.76	Large mammal		UID	Fragment	UID	Calcined
5	6	2	1	0.72	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
5	6	3	1	1.18	Prong-horned antelope	Antilocapr a americana	Metapodial	Condoyle	UID	None
5	6	4	1	0.17	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
5	6	5	1	0.72	Prong-horned antelope	Antilocapr a americana	Upper first pre-molar	Complete	Left	None
5	6	6	1	3.96	Large mammal		UID	Fragment	UID	None
5	6	7	20	7.96	Medium/large mammal		UID	Fragment	UID	None
5	6	1	2	0.73	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
5	6	2	1	0.27	Large mammal		Tooth	Enamel	UID	None
5	6	3	3	0.23	Turtle	Testudines	Carapace	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
5	6	4	5	2.77	Medium/large mammal		UID	Fragment	UID	Burned black
5	6	5	17	3.9	Medium/large mammal		UID	Fragment	UID	None
5	6	1	3	0.3	Prong-horned antelope	Antilocapra americana	Tooth	Enamel	UID	None
5	6	2	1	0.02	Rodent	Rodentia	Incisor	Enamel	UID	None
5	6	3	1	0.02	Gastropod	Gastropoda	Shell	Fragment	UID	None
5	6	4	28	5.52	Medium/large mammal		UID	Fragment	UID	None
5	7	1	1	2.88	Prong-horned antelope	Antilocapra americana	Upper first molar	Complete	Right	None
5	7	2	1	0.34	Large mammal		Sesamoid	Complete	UID	None
5	7	3	2	5.3	Large mammal		Long bone	Shaft	UID	Rodent gnaw
5	7	4	1	0.26	Medium/large mammal		UID	Fragment	UID	Burned black
5	7	5	12	3.23	Medium/large mammal		UID	Fragment	UID	None
5	7	1	1	1.22	Prong-horned antelope	Antilocapra americana	Tarsal	Complete	Right	None
5	7	2	3	3.15	Large mammal		Long bone	Shaft	UID	None
5	7	1	2	0.7	Large mammal		UID	Fragment	UID	None
6	1	1	1	14.41	Bison	Bison bison	Tibia	Shaft	UID	Rodent gnaw
6	1	2	2	0.71	Large mammal		Tooth	Enamel	UID	None
6	1	3	1	0.3	Hares, pikas, rabbits	Lagomorpha	Maxilla	Fragment	UID	None
6	1	4	3	0.87	Medium/large mammal		UID	Fragment	UID	Calcined
6	1	5	1	0.08	Turtle	Testudines	Carapace	Fragment	UID	None
6	1	6	85	20.64	Medium/large mammal		UID	Fragment	UID	None
6	1	1	8	6.45	Bison	Bison bison	Tooth	Enamel	UID	None
6	1	2	1	0.14	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	1	3	1	0.15	Turtle	Testudines	Carapace	Fragment	UID	None
6	1	4	2	0.67	Medium/large mammal		UID	Fragment	UID	Calcined
6	1	5	40	13.82	Medium/large mammal		UID	Fragment	UID	None
6	1	1	5	4.66	Bison	Bison bison	Tooth	Enamel	UID	None
6	1	2	1	0.29	Hares, pikas, rabbits	Lagomorpha	Calcaneus	Complete	Right	None
6	1	3	1	0.05	Small mammal		Tibia	Distal	Right	None
6	1	4	1	1.66	Bison	Bison bison	Long bone	Shaft	UID	Calcined
6	1	5	1	0.98	Large mammal		Metapodial	Shaft	UID	None
6	1	6	63	21.86	Medium/large mammal		UID	Fragment	UID	None
6	1	1	2	28.69	Bison	Bison bison	Long bone	Shaft	UID	None
6	1	2	2	7.58	Large mammal		Long bone	Shaft	UID	None
6	1	3	5	2.31	Medium/large mammal		UID	Fragment	UID	Calcined
6	1	4	89	25.92	Medium/large mammal		UID	Fragment	UID	None
6	2	1	1	0.09	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	2	2	1	14.83	Bison	Bison bison	Radius	Shaft	Right	None
6	2	3	2	0.25	Rodent	Rodentia	Skull	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
6	2	4	1	0.48	Medium/large mammal		Long bone	Shaft	UID	None
6	2	5	2	0.78	Small mammal		Mandible	Body	Left	None
6	2	6	11	10.14	Beaver	Castor canadensis	Skull	Maxilla and premolars	Both	None
6	2	7	2	0.47	Medium/large mammal		UID	Fragment	UID	Calcined
6	2	8	3	0.88	Turtle	Testudines	Carapace	Fragment	UID	None
6	2	9	61	15.1	Medium/large mammal		UID	Fragment	UID	None
6	2	1	2	0.8	Turtle	Testudines	Carapace	Fragment	UID	None
6	2	2	2	0.18	Pocket gopher	Geomyida e	Incisor	Fragment	UID	Rodent gnaw
6	2	3	1	0.14	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
6	2	4	1	0.11	Small mammal		Humerus	Distal	Right	None
6	2	5	1	1.32	Prong-horned antelope	Antilocapr a americana	Metapodial	Condoyle	UID	Calcined
6	2	6	3	0.42	Large mammal		Tooth	Enamel	UID	None
6	2	7	2	0.44	Medium/large mammal		UID	Fragment	UID	Calcined
6	2	8	35	9.42	Medium/large mammal		UID	Fragment	UID	None
6	2	1	3	0.12	Rodent	Rodentia	Mandible	Fragment	Left	None
6	2	2	1	0.16	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	2	3	1	0.16	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
6	2	4	1	0.09	Turtle	Testudines	Carapace	Fragment	UID	None
6	2	5	26	4.79	Medium/large mammal		UID	Fragment	UID	None
6	2	1	1	0.17	Medium/large mammal		Canine tooth	Fragment	UID	None
6	2	2	1	0.22	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
6	2	3	1	0.79	Medium mammal		Vertebra	Nearly complete	UID	None
6	2	4	2	0.84	Medium/large mammal		UID	Fragment	UID	Calcined
6	2	5	1	0.1	Turtle	Testudines	Carapace	Fragment	UID	None
6	2	6	43	11.87	Medium/large mammal		UID	Fragment	UID	None
6	3	1	1	0.01	Frog	Rana sp.	Innominate	Nearly complete	Right	None
6	3	2	1	0.01	Very small mammal		Tibia	Nearly complete	Left	None
6	3	3	1	0.04	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	3	4	1	0.05	Large mammal		Tooth	Enamel	UID	None
6	3	5	1	0.14	Gar	Lepisostei dae	Scale	Complete	UID	None
6	3	6	2	0.53	Turtle	Testudines	Carapace	Fragment	UID	None
6	3	7	1	0.8	Large mammal		Long bone	Shaft	UID	Calcined
6	3	8	36	10.56	Medium/large mammal		UID	Fragment	UID	None
6	3	1	2	1.21	Prong-horned antelope	Antilocapr a americana	Upper pre-molar	Nearly complete	Right	None
6	3	2	1	0.09	Small mammal		UID	Fragment	UID	None
6	3	3	1	0.14	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	3	4	1	0.78	Large mammal		UID	Fragment	UID	Calcined
6	3	5	45	19.3	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
6	3	1	1	0.05	Small mammal		Humerus	Distal	Left	None
6	3	2	5	2.15	Medium/large mammal		UID	Fragment	UID	Burned black
6	3	3	1	1.3	Medium/large mammal		UID	Fragment	UID	Calcined
6	3	4	1	0.15	Small bird		Humerus	Shaft	Right	None
6	3	5	4	0.51	Turtle	Testudines	Carapace	Fragment	UID	None
6	3	6	1	1	Large mammal		Long bone	Fragment	UID	Rodent gnaw
6	3	7	1	0.06	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	3	8	1	0.41	Medium mammal		Femur	Distal	UID	None
6	3	9	1	0.55	Large mammal		Long bone	Shaft	UID	Cut marks
6	3	10	1	0.57	Large mammal		Carpal	Nearly complete	UID	None
6	3	11	4	1.47	Large mammal		Tooth	Enamel	UID	None
6	3	12	73	20.22	Medium/large mammal		UID	Fragment	UID	None
6	3	1	1	0.19	Medium/large mammal		UID	Fragment	UID	Calcined
6	3	2	2	0.15	Indeterminate fish		UID	Fragment	UID	None
6	3	3	1	0.04	Very small mammal		Mandible	Nearly complete	Left	None
6	3	4	1	0.22	Turtle	Testudines	Plastron	Fragment	Right	None
6	3	5	1	1.3	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
6	3	6	1	1.32	Prong-horned antelope	Antilocapr a americana	Ulna	Ulnar notch	Right	None
6	3	7	3	0.71	Large mammal		Tooth	Enamel	UID	None
6	3	8	2	0.43	Turtle	Testudines	Carapace	Fragment	UID	None
6	3	9	1	0.13	Coyote	Canis latrans	Metapodial	Distal	UID	None
6	3	10	51	18.28	Medium/large mammal		UID	Fragment	UID	None
6	4	1	1	0.09	Rodent	Rodentia	Mandible	Fragment	UID	None
6	4	2	1	0.04	Rodent	Rodentia	Lower incisor	Nearly complete	Left	None
6	4	3	1	0.21	Mouse	Neotomina e	Mandible	Nearly complete	Right	None
6	4	4	2	0.23	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	4	5	2	0.22	Large mammal		Tooth	Enamel	UID	None
6	4	6	1	0.54	Hares, pikas, rabbits	Lagomorp ha	Calcaneus	Nearly complete	Right	None
6	4	7	4	17.97	Large mammal		Long bone	Shaft	UID	None
6	4	8	1	0.25	Medium/large mammal		UID	Fragment	UID	Burned black
6	4	9	1	0.12	Small/medium bird		Ulna	Nearly complete	Left	None
6	4	10	1	0.17	Medium mammal		Phalanx	Nearly complete	UID	None
6	4	11	41	6.13	Medium/large mammal		UID	Fragment	UID	None
6	4	1	1	0.96	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
6	4	2	2	0.46	Turtle	Testudines	Carapace	Fragment	UID	None
6	4	3	1	0.1	Rodent	Rodentia	Ulna	Nearly complete	Right	None
6	4	4	1	0.14	Rodent	Rodentia	Mandible	Nearly complete	Right	None
6	4	5	1	0.07	Rodent	Rodentia	Tibia	Nearly complete	Left	None
6	4	6	16	6	Medium/large		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
					mammal					
6	4	1	1	0.56	Prong-horned antelope	Antilocapra americana	Phalanx	Distal	UID	None
6	4	2	1	0.15	Gar	Lepisosteidae	Vertebra	Complete	UID	None
6	4	3	3	0.26	Large mammal		Tooth	Enamel	UID	None
6	4	4	1	0.2	Rodent	Rodentia	Mandible	Nearly complete	Right	None
6	4	5	1	0.13	Rodent	Rodentia	Mandible	Nearly complete	Right	None
6	4	6	1	0.22	Indeterminate fish		Vertebra	Complete	UID	None
6	4	7	23	6.9	Medium/large mammal		UID	Fragment	UID	None
6	4	1	1	0.6	Medium/large mammal		Canine tooth	Root	UID	None
6	4	2	1	1.08	Turtle	Testudines	Carapace	Fragment	UID	None
6	4	3	1	0.78	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	None
6	4	4	9	2.06	Medium/large mammal		UID	Fragment	UID	None
6	5	1	4	0.46	Turtle	Testudines	Carapace	Fragment	UID	None
6	5	2	2	0.44	Medium/large mammal		UID	Fragment	UID	Calcined
6	5	3	1	1.01	Prong-horned antelope	Antilocapra americana	Fibula	Complete	Left	None
6	5	4	2	0.41	Large mammal		Tooth	Enamel	UID	None
6	5	5	1	1.06	Prong-horned antelope	Antilocapra americana	Phalanx	Distal	UID	None
6	5	6	1	0.35	Prong-horned antelope	Antilocapra americana	Phalanx	Nearly complete	UID	None
6	5	7	32	8.21	Medium/large mammal		UID	Fragment	UID	None
6	5	1	1	0.19	Medium/large mammal		UID	Fragment	UID	Calcined
6	5	2	2	0.13	Small mammal		UID	Fragment	UID	None
6	5	3	1	0.11	Rodent	Rodentia	Mandible	Fragment	Left	None
6	5	4	20	3.35	Medium/large mammal		UID	Fragment	UID	None
6	6	1	2	0.5	Large mammal		Tooth	Enamel	UID	None
6	6	2	1	2.03	Prong-horned antelope	Antilocapra americana	Radius	Proximal	Left	None
6	6	3	2	0.2	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
6	6	4	1	0.09	Prong-horned antelope	Antilocapra americana	Phalanx	Complete	UID	None
6	6	5	26	7.23	Medium/large mammal		UID	Fragment	UID	None
6	6	1	1	0.33	Large mammal		Sesamoid	Complete	UID	None
6	6	2	1	0.34	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	None
6	6	3	1	0.15	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	6	4	1	0.51	Raccoon	Procyon lotor	Radius	Proximal	Right	None
6	6	5	3	0.25	Turtle	Testudines	Carapace	Fragment	UID	None
6	6	6	2	0.58	Medium/large mammal		UID	Fragment	UID	Calcined
6	6	7	31	7.04	Medium/large mammal		UID	Fragment	UID	None
6	6	1	1	0.13	Non-venomous	Colubridae	Vertebra	Complete	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
					snake					
6	6	2	1	2.4	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
6	6	3	1	0.1	Rodent	Rodentia	Incisor	Fragment	Left	None
6	6	4	2	0.31	Rodent	Rodentia	Incisor	Fragment	Left	None
6	6	5	1	0.11	Turtle	Testudines	Carapace	Fragment	UID	None
6	6	6	20	3.58	Medium/large mammal		UID	Fragment	UID	None
6	6	1	7	2.51	Wild turkey	Meleagris gallopavo	Ulna	Shaft	Left	None
6	6	2	6	5.02	Medium/large mammal		UID	Fragment	UID	Calcined
6	6	3	1	0.09	Turtle	Testudines	Carapace	Fragment	UID	None
6	6	4	1	0.12	Small bird		Humerus	Shaft	Left	None
6	6	5	32	6.18	Medium/large mammal		UID	Fragment	UID	None
6	7	1	2	0.32	Large mammal		Tooth	Enamel	UID	None
6	7	2	1	0.06	Indeterminate fish		UID	Fragment	UID	None
6	7	3	2	0.2	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
6	7	4	36	7.54	Medium/large mammal		UID	Fragment	UID	None
6	7	1	1	0.47	Large mammal		Long bone	Shaft	UID	Calcined
6	7	2	21	8.68	Medium/large mammal		UID	Fragment	UID	None
6	7	1	3	6.28	Large mammal		Long bone	Shaft	UID	None
6	7	2	2	0.34	Rodent	Rodentia	Molar	Complete	UID	None
6	7	3	2	0.42	Turtle	Testudines	Carapace	Fragment	UID	None
6	7	4	3	0.45	Medium mammal		UID	Fragment	UID	Calcined
6	7	5	1	2.04	Coyote	Canis latrans	Upper canine	Nearly complete	Left	None
6	7	6	1	5.01	Prong-horned antelope	Antilocapr a americana	Proximal phalanx	Complete	UID	None
6	7	7	1	2.17	Prong-horned antelope	Antilocapr a americana	Proximal phalanx	Proximal	UID	None
6	7	8	1	1.79	Prong-horned antelope	Antilocapr a americana	Metatarsal	Shaft	UID	Rodent gnaw
6	7	9	1	2.45	Prong-horned antelope	Antilocapr a americana	Phalanx	Nearly complete	UID	Rodent gnaw
6	7	10	2	1.29	Large mammal		Long bone	Shaft	UID	Rodent gnaw
6	7	11	33	7.55	Medium/large mammal		UID	Fragment	UID	None
6	7	1	1	0.12	Turtle	Testudines	Carapace	Fragment	UID	None
6	7	2	2	1.6	Large mammal		UID	Fragment	UID	Calcined
6	7	3	20	4.53	Medium/large mammal		UID	Fragment	UID	None
6	8	1	20	6.8	Medium/large mammal		UID	Fragment	UID	None
6	8	1	1	0.06	Rodent	Rodentia	Femur	Proximal	Left	None
6	8	2	1	0.11	Turtle	Testudines	Carapace	Fragment	UID	Cut marks
6	8	3	2	0.44	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
6	8	4	1	0.22	Medium mammal		UID	Fragment	UID	Burned black
6	8	5	12	2.06	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
6	9	1	2	0.25	Medium/large mammal		UID	Fragment	UID	None
6	11	1	1	0.1	Medium mammal		UID	Fragment	UID	None
7	1	1	6	10.67	Bison	Bison bison	Long bone	Shaft	UID	None
7	1	2	1	0.12	Small mammal		Humerus	Distal	UID	None
7	1	3	1	0.25	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
7	1	4	24	7.47	Medium/large mammal		UID	Fragment	UID	None
7	1	1	2	0.57	Medium/large mammal		UID	Fragment	UID	Calcined
7	1	2	1	0.36	Bison	Bison bison	Tooth	Enamel	UID	None
7	1	3	1	0.17	Turtle	Testudines	Carapace	Fragment	UID	None
7	1	4	1	0.3	Small mammal		Ulna	Proximal	UID	None
7	1	5	31	10.44	Medium/large mammal		UID	Fragment	UID	None
7	1	1	1	2.57	Bison	Bison bison	UID	Fragment	UID	None
7	1	2	1	0.51	Bison	Bison bison	Tooth	Enamel	UID	None
7	1	3	17	5.01	Medium mammal		UID	Fragment	UID	None
7	2	1	4	1.05	Large mammal		Tooth	Enamel	UID	None
7	2	2	1	0.19	Rodent	Rodentia	Mandible	Nearly complete	Right	None
7	2	3	1	0.18	Rodent	Rodentia	Mandible	Nearly complete	Left	None
7	2	4	1	0.32	Hares, pikas, rabbits	Lagomorp ha	Calcaneus	Complete	Left	None
7	2	5	1	0.23	Medium mammal		Tooth	Nearly complete	UID	None
7	2	6	2	0.48	Turtle	Testudines	Plastron	Fragment	UID	None
7	2	7	1	0.23	Turtle	Testudines	Carapace	Fragment	UID	None
7	2	8	1	4.63	Prong-horned antelope	Antilocapr a americana	Metacarpal	Proximal	UID	None
7	2	9	2	6.23	Bison	Bison bison	UID	Fragment	UID	None
7	2	10	39	18.25	Medium/large mammal		UID	Fragment	UID	None
7	2	1	1	0.37	Large mammal		UID	Fragment	UID	Worked
7	2	2	1	0.23	Large mammal		Tooth	Fragment	UID	None
7	2	3	1	0.1	Venomous snake	Viperidae	Vertebra	Complete	UID	None
7	2	4	1	1.48	Large mammal		Vertebra	Articulation	UID	None
7	2	5	1	0.43	Medium/large mammal		UID	Fragment	UID	Calcined
7	2	6	1	0.19	Medium/large mammal		UID	Fragment	UID	Burned black
7	2	7	1	0.15	Gar	Lepisostei dae	Scale	Complete	UID	None
7	2	8	47	13.78	Medium/large mammal		UID	Fragment	UID	None
7	2	1	1	0.06	Indeterminate fish		UID	Fragment	UID	None
7	2	2	1	1.29	Bison	Bison bison	Tooth	Enamel	UID	None
7	2	3	1	0.54	Turtle	Testudines	Carapace	Fragment	UID	None
7	2	4	2	3.69	Medium mammal		Long bone	Shaft	UID	None
7	2	5	1	0.36	Small/medium mammal		Skull	Fragment	UID	None
7	2	6	35	13.71	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
7	3	1	1	0.36	Medium/large mammal		UID	Fragment	UID	Calcined
7	3	2	1	0.2	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
7	3	3	1	0.77	Beaver	Castor canadensis	Ulna	Proximal	Right	None
7	3	4	4	1.13	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
7	3	5	2	0.43	Turtle	Testudines	Carapace	Fragment	UID	None
7	3	6	1	3.19	Large mammal		Long bone	Shaft	UID	None
7	3	7	40	12.19	Medium/large mammal		UID	Fragment	UID	None
7	3	1	2	1.17	Turtle	Testudines	Carapace	Fragment	UID	None
7	3	2	1	1.87	Prong-horned antelope	Antilocapr a americana	Upper third pre-molar	Complete	Right	None
7	3	3	1	0.1	Rodent	Rodentia	Ulna	Nearly complete	Left	None
7	3	4	1	0.26	Large mammal		UID	Fragment	UID	Worked
7	3	5	1	0.42	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
7	3	6	1	0.17	Small mammal		Maxilla	Fragment	UID	None
7	3	7	23	6.38	Medium/large mammal		UID	Fragment	UID	None
7	3	1	1	0.08	Small mammal		Femur	Proximal	Right	None
7	3	2	2	0.26	Turtle	Testudines	Carapace	Fragment	UID	None
7	3	3	1	0.52	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
7	3	4	1	0.1	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
7	3	5	1	0.03	Gar	Lepisostei dae	Scale	Complete	UID	None
7	3	6	36	11.73	Medium/large mammal		UID	Fragment	UID	None
7	3	1	2	0.52	Turtle	Testudines	Carapace	Fragment	UID	None
7	3	2	1	0.16	Small/medium mammal		Mandible	Fragment	Right	None
7	3	3	1	0.23	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
7	3	4	1	3.04	Bison	Bison bison	Long bone	Shaft	UID	None
7	3	5	1	0.21	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None
7	3	6	27	8.06	Medium/large mammal		UID	Fragment	UID	None
7	4	1	3	0.64	Prong-horned antelope	Antilocapr a americana	Tooth	Enamel	UID	None
7	4	2	15	5.49	Medium/large mammal		UID	Fragment	UID	None
7	4	1	1	2.07	Prong-horned antelope	Antilocapr a americana	Lower third molar	Complete	Left	None
7	4	2	1	0.26	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
7	4	3	1	3.23	Bison	Bison bison	Long bone	Shaft	UID	None
7	4	4	1	0.57	Prong-horned antelope	Antilocapr a americana	Sesamoid	Complete	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
7	4	5	1	0.46	Medium mammal		Tooth	Enamel	UID	None
7	4	6	6	0.74	Large mammal		Tooth	Enamel	UID	None
7	4	7	1	0.15	Small mammal		Mandible	Fragment	Left	None
7	4	8	1	0.29	Small mammal		Mandible	Fragment	Right	None
7	4	9	1	0.15	Turtle	Testudines	Carapace	Fragment	UID	None
7	4	10	54	1.01	Medium/large mammal		UID	Fragment	UID	None
7	4	1	1	0.45	Prong-horned antelope	Antilocapr a americana	Fibula	Complete	Right	None
7	4	2	1	0.46	Large mammal		UID	Fragment	UID	Worked
7	4	3	1	1.57	Prong-horned antelope	Antilocapr a americana	Tarsal	Nearly complete	UID	None
7	4	4	19	7.56	Medium/large mammal		UID	Fragment	UID	None
7	4	1	1	4.41	Large mammal		Long bone	Shaft	UID	Burned black
7	4	2	1	0.19	Small/medium bird		Humerus	Nearly complete	Left	None
7	4	3	4	6.58	Medium/large mammal		Skull	Fragment	UID	None
7	4	4	4	0.54	Turtle	Testudines	Carapace	Fragment	UID	None
7	4	5	1	0.27	Prong-horned antelope	Antilocapr a americana	Sesamoid	Complete	UID	None
7	4	6	1	0.11	Large mammal		Tooth	Enamel	UID	None
7	4	7	1	0.92	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
7	4	8	24	6.28	Medium/large mammal		UID	Fragment	UID	None
7	5	1	3	0.52	Turtle	Testudines	Carapace	Fragment	UID	None
7	5	2	1	0.55	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
7	5	3	21	6.33	Medium/large mammal		UID	Fragment	UID	None
7	5	1	1	0.33	Small mammal		Mandible	Fragment	Left	None
7	5	2	1	0.18	Rodent	Rodentia	Mandible	Nearly complete	Left	None
7	5	3	1	0.14	Water snake	Nerodia sp.	Vertebra	Complete	UID	None
7	5	4	1	0.06	Small mammal		Vertebra	Complete	UID	None
7	5	5	1	1.15	Large mammal		Long bone	Shaft	UID	Burned black
7	5	6	2	0.86	Large mammal		Tooth	Enamel	UID	None
7	5	7	28	7.1	Medium/large mammal		UID	Fragment	UID	None
7	6	1	1	3.2	Large mammal		Long bone	Shaft	UID	Rodent gnaw
7	6	2	16	7.34	Medium/large mammal		UID	Fragment	UID	None
7	6	1	1	5.96	Prong-horned antelope	Antilocapr a americana	Metatarsal	Proximal	Right	None
7	6	2	1	1.54	Prong-horned antelope	Antilocapr a americana	Carpal	Complete	UID	None
7	6	3	1	0.1	Water snake	Nerodia sp.	Vertebra	Nearly complete	UID	None
7	6	4	1	0.17	Large mammal		Tooth	Enamel	UID	None
7	6	5	1	0.23	Turtle	Testudines	Carapace	Fragment	UID	None
7	6	6	15	6.5	Medium/large		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
					mammal					
7	6	1	1	1.39	Gar	Lepisosteidae	Vertebra	Nearly complete	UID	None
7	6	2	20	8.07	Medium/large mammal		UID	Fragment	UID	None
7	6	1	1	2.08	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	None
7	6	2	1	1.52	Coyote	Canis latrans	Upper first molar	Nearly complete	Left	None
7	6	3	1	0.47	Hares, pikas, rabbits	Lagomorpha	Calcaneus	Complete	Right	None
7	6	4	1	0.24	Catfish	Siluriformes	Articular	Nearly complete	Left	None
7	6	5	1	0.27	Large mammal		Tooth	Enamel	UID	None
7	6	6	15	4.81	Medium/large mammal		UID	Fragment	UID	None
8	1	1	2	0.88	Large mammal		Tooth	Enamel	UID	None
8	1	2	6	6.27	Large mammal		UID	Fragment	UID	Calcined
8	1	3	65	16.71	Medium/large mammal		UID	Fragment	UID	None
8	2	1	1	0.43	Large mammal		Phalanx	Proximal	UID	None
8	2	2	2	0.6	Large mammal		Tooth	Enamel	UID	None
8	2	3	1	0.15	Small mammal		Vertebra	Nearly complete	UID	None
8	2	4	1	0.1	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
8	2	5	1	0.09	Small mammal		Phalanx	Complete	UID	None
8	2	6	1	3.26	Prong-horned antelope	Antilocapra americana	Phalanx	Complete	UID	None
8	2	7	1	0.03	Turtle	Testudines	Femur	Fragment	Right	None
8	2	8	2	0.43	Medium/large mammal		UID	Fragment	UID	Calcined
8	2	9	86	26.46	Medium/large mammal		UID	Fragment	UID	None
8	3	1	2	5.58	Prong-horned antelope	Antilocapra americana	Metatarsal	Shaft	UID	None
8	3	1	1	0.1	Rodent	Rodentia	Innominate	Nearly complete	Left	None
8	3	2	1	0.09	Prong-horned antelope	Antilocapra americana	Incisor	Nearly complete	Right	None
8	3	3	1	0.08	Small mammal		UID	Fragment	UID	Calcined
8	3	4	23	4.54	Medium/large mammal		UID	Fragment	UID	None
8	4	1	3	0.28	Indeterminate fish		UID	Fragment	UID	None
8	4	2	4	0.69	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
8	4	3	3	0.83	Large mammal		Tooth	Enamel	UID	None
8	4	4	1	0.03	Small bird		Tibia-tarsus	Distal	UID	None
8	4	5	1	0.04	Indeterminate fish		Premaxilla	Complete	UID	None
8	4	6	1	0.06	Small mammal		Innominate	Nearly complete	Left	None
8	4	7	2	0.18	Medium/large mammal		UID	Fragment	UID	Calcined
8	4	8	1	0.29	Prong-horned antelope	Antilocapra americana	Phalanx	Complete	UID	None
8	4	9	1	0.07	Rodent	Rodentia	Skull	Fragment	UID	None
8	4	10	91	22.02	Medium/large mammal		UID	Fragment	UID	None
8	5	1	2	0.18	Large mammal		Tooth	Enamel	UID	None
8	5	2	53	10.29	Medium/large		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
					mammal					
8	6	1	1	0.09	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
8	6	2	1	0.21	Turtle	Testudines	Carapace	Fragment	UID	None
8	6	3	1	0.17	Rodent	Rodentia	Mandible	Nearly complete	Right	None
8	6	4	46	15.77	Medium/large mammal		UID	Fragment	UID	None
9	1	1	1	0.3	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
9	1	2	34	14	Medium/large mammal		UID	Fragment	UID	None
9	2	1	1	1.24	Prong-horned antelope	Antilocapr a americana	Upper second pre-molar	Complete	Right	None
9	2	2	2	2.27	Turtle	Testudines	Carapace	Fragment	UID	None
9	2	3	1	0.42	Small mammal		Mandible	Fragment	Right	None
9	2	4	1	0.62	Medium bird		Humerus	Shaft	Right	None
9	2	5	1	0.72	Bivalve	Bivalvia	Shell	Fragment	UID	None
9	2	6	1	0.08	Non-venomous snake	Colubridae	Vertebra	Nearly complete	UID	None
9	2	7	10	4.59	Medium/large mammal		UID	Fragment	UID	Calcined
9	2	8	1	0.53	Beaver	Castor canadensis	Phalanx	Complete	UID	None
9	2	9	1	0.08	Rodent	Rodentia	Tibia	Distal	Left	None
9	2	10	2	0.25	Large mammal		Tooth	Enamel	UID	None
9	2	11	3	0.81	Large mammal		UID	Fragment	UID	None
9	2	12	101	26.25	Medium/large mammal		UID	Fragment	UID	None
9	2	1	1	0.73	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
9	2	2	4	1.17	Medium/large mammal		UID	Fragment	UID	Calcined
9	2	3	2	1.73	Bison	Bison bison	Tooth	Enamel	UID	None
9	2	4	1	0.4	Bivalve	Bivalvia	Shell	Fragment	UID	None
9	2	5	53	14.42	Medium/large mammal		UID	Fragment	UID	None
9	3	1	2	0.34	Turtle	Testudines	Carapace	Fragment	UID	None
9	3	2	1	3.16	Prong-horned antelope	Antilocapr a americana	Metapodial	Condoyle	UID	None
9	3	3	3	0.21	Gastropod	Gastropod a	Shell	Complete	UID	None
9	3	4	1	0.08	Small mammal		Vertebra	Nearly complete	UID	None
9	3	5	1	0.13	Large mammal		Tooth	Nearly complete	UID	None
9	3	6	3	0.06	Bivalve	Bivalvia	Shell	Fragment	UID	None
9	3	7	1	0.7	Turtle	Testudines	Plastron	Fragment	UID	None
9	3	8	2	0.2	Indeterminate fish		UID	Fragment	UID	None
9	3	9	7	3.26	Medium/large mammal		UID	Fragment	UID	Calcined
9	3	10	2	8.69	Large mammal		Long bone	Shaft	UID	None
9	3	11	72	21.91	Medium/large mammal		UID	Fragment	UID	None
9	3	1	2	1.43	Prong-horned antelope	Antilocapr a americana	Upper second pre-molar	Complete	Right	None
9	3	2	1	0.41	Bison	Bison bison	Tooth	Enamel	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
9	3	3	4	1.21	Medium/large mammal		UID	Fragment	UID	Calcined
9	3	4	42	17.22	Medium/large mammal		UID	Fragment	UID	None
9	3	5	1	0.11	Turtle	Testudines	Carapace	Fragment	UID	None
9	4	1	3	8.86	Bison	Bison bison	Long bone	Shaft	UID	None
9	4	2	2	0.91	Bison	Bison bison	Tooth	Enamel	UID	None
9	4	3	12	1.89	Medium/large mammal		UID	Fragment	UID	None
9	4	1	1	1.04	Turtle	Testudines	Carapace	Fragment	UID	None
9	4	2	1	0.19	Small mammal		Femur	Proximal	Left	None
9	4	3	1	0.48	Medium mammal		Ulna	Proximal	Right	None
9	4	4	15	7.63	Medium/large mammal		UID	Fragment	UID	None
9	5	1	11	3.54	Medium/large mammal		UID	Fragment	UID	None
10	1	1	1	0.04	Rodent	Rodentia	Tibia	Distal	UID	None
10	1	2	1	0.04	Rodent	Rodentia	Mandible	Fragment	UID	None
10	1	3	2	0.39	Turtle	Testudines	Carapace	Fragment	UID	None
10	1	4	1	0.16	Softshell turtle	Trionychid ae	Carapace	Fragment	UID	None
10	1	5	2	0.29	Non-venomous snake	Colubridae	Vertebra	Fragment	UID	None
10	1	6	45	13	Medium/large mammal		UID	Fragment	UID	None
10	2	1	1	0.13	Small mammal		Ulna	Proximal	Left	None
10	2	2	1	0.14	Rodent	Rodentia	Mandible	Nearly complete	Right	None
10	2	3	1	0.12	Medium/large mammal		UID	Fragment	UID	Calcined
10	2	4	4	0.62	Turtle	Testudines	Carapace	Fragment	UID	None
10	2	5	1	0.4	Large mammal		Tooth	Enamel	UID	None
10	2	6	1	0.06	Non-venomous snake	Colubridae	Vertebra	Fragment	UID	None
10	2	7	41	10.12	Medium/large mammal		UID	Fragment	UID	None
10	3	1	3	1.04	Bison	Bison bison	Tooth	Enamel	UID	None
10	3	2	1	0.06	Medium mammal		Tooth	Enamel	UID	None
10	3	3	1	0.1	Medium/large mammal		UID	Fragment	UID	Calcined
10	3	4	1	0.05	Indeterminate fish		Vertebra	Complete	UID	None
10	3	5	1	0.05	Rodent	Rodentia	Innominate	Fragment	UID	None
10	3	6	1	0.08	Small/medium mammal		Phalanx	Complete	UID	None
10	3	7	6	0.84	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
10	3	8	1	0.05	Turtle	Testudines	Carapace	Fragment	UID	None
10	3	9	54	10.07	Medium/large mammal		UID	Fragment	UID	None
10	4	1	1	0.25	Medium mammal		Long bone	Shaft	UID	Worked
10	4	2	2	0.34	Medium/large mammal		UID	Fragment	UID	Calcined
10	4	3	1	0.32	Small mammal		Mandible	Nearly complete	Right	None
10	4	4	2	0.44	Water snake	Nerodia sp.	Vertebra	Complete	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
10	4	5	3	0.44	Turtle	Testudines	Carapace	Fragment	UID	None
10	4	6	45	12.73	Medium/large mammal		UID	Fragment	UID	None
10	5	1	1	11.55	Bison	Bison bison	Long bone	Shaft	UID	Rodent gnaw or cut marks
10	5	2	1	6.31	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None
10	5	3	1	1.01	Catfish	Siluriform es	Dentary	Complete	Left	None
10	5	4	1	0.13	Turtle	Testudines	Carapace	Fragment	UID	None
10	5	5	28	12.58	Medium/large mammal		UID	Fragment	UID	None
10	6	1	1	9.59	Prong-horned antelope	Antilocapr a americana	Tibia	Distal	Left	Rodent gnaw
10	6	2	1	1.18	Prong-horned antelope	Antilocapr a americana	Carpal	Complete	UID	None
10	6	3	1	0.09	Gar	Lepisostei dae	Scale	Complete	UID	None
10	6	4	1	0.12	Medium mammal		Phalanx	Complete	UID	None
10	6	5	1	1.22	Prong-horned antelope	Antilocapr a americana	Metapodial	Condoyle	UID	None
10	6	6	1	0.15	Hares, pikas, rabbits	Lagomorp ha	Scapula	Nearly complete	Right	None
10	6	7	1	0.31	Hares, pikas, rabbits	Lagomorp ha	Femur	Ball	UID	None
10	6	8	23	11.3	Medium/large mammal		UID	Fragment	UID	None
10	7	1	3	0.73	Medium/large mammal		UID	Fragment	UID	Burned black
10	7	2	37	14.28	Medium/large mammal		UID	Fragment	UID	None
10	8	1	3	0.73	Medium/large mammal		UID	Fragment	UID	Calcined
10	8	2	1	0.2	Medium mammal		Femur	Ball	UID	None
10	8	3	1	0.07	Turtle	Testudines	Carapace	Fragment	UID	None
10	8	4	24	5.54	Medium/large mammal		UID	Fragment	UID	None
10	9	1	1	5.54	Prong-horned antelope	Antilocapr a americana	Phalanx	Complete	UID	None
10	9	2	1	12.49	Bison	Bison bison	Long bone	Shaft	UID	None
10	9	3	1	1.47	Large mammal		Long bone	Articulation	UID	None
10	9	4	1	0.83	Large bird		Femur	Distal	Left	Burned black
10	9	5	1	0.16	Turtle	Testudines	Carapace	Fragment	UID	None
10	9	6	4	1.09	Medium/large mammal		UID	Fragment	UID	Calcined
10	9	7	48	9.64	Medium/large mammal		UID	Fragment	UID	None
10	10	1	1	0.52	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
10	10	2	1	3.22	Coyote	Canis latrans	Humerus	Distal	Left	None
10	10	3	15	3.75	Medium/large mammal		UID	Fragment	UID	None
10	11	1	1	0.1	Rodent	Rodentia	Incisor	Fragment	Right	None
10	11	2	1	0.93	Large mammal		Tooth	Enamel	UID	None
10	11	3	1	0.15	Venomous snake	Viperidae	Vertebra	Complete	UID	None
10	11	4	6	0.72	Medium mammal		UID	Fragment	UID	None
10	12	1	1	0.57	Medium mammal		Innominate	Fragment	Right	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
10	12	2	5	3.89	Medium/large mammal		UID	Fragment	UID	None
11	1	1	2	0.52	Large mammal		Tooth	Enamel	UID	None
11	1	2	7	2.55	Medium/large mammal		UID	Fragment	UID	None
11	1	1	1	0.65	Large mammal		Tooth	Enamel	UID	None
11	1	2	20	10.73	Medium/large mammal		UID	Fragment	UID	None
11	1	1	2	0.99	Medium/large mammal		UID	Fragment	UID	Calcined
11	1	2	9	5.5	Medium/large mammal		UID	Fragment	UID	None
11	2	1	3	0.51	Large mammal		Tooth	Enamel	UID	None
11	2	2	1	0.08	Indeterminate fish		UID	Fragment	UID	None
11	2	3	2	1.67	Large mammal		Long bone	Shaft	UID	Calcined
11	2	4	1	0.29	Turtle	Testudines	Innominate	Fragment	UID	None
11	2	5	1	0.16	Turtle	Testudines	Carapace	Fragment	UID	None
11	2	6	36	11.53	Medium/large mammal		UID	Fragment	UID	None
11	2	1	2	1.43	Deer	Cervidae	Tooth	Enamel	UID	None
11	2	2	1	0.34	Medium/large mammal		UID	Fragment	UID	Calcined
11	2	3	18	8.15	Medium/large mammal		UID	Fragment	UID	None
11	3	1	1	0.08	Indeterminate fish		Vertebra	Complete	UID	None
11	3	1	1	0.13	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
11	3	2	1	0.25	Turtle	Testudines	Carapace	Fragment	UID	None
11	3	2	1	0.17	Rodent	Rodentia	Mandible	Nearly complete	Left	None
11	3	3	1	0.1	Gastropod	Gastropod a	Shell	Complete	UID	None
11	3	3	9	5.92	Medium/large mammal		UID	Fragment	UID	None
11	3	4	2	0.03	Gastropod	Gastropod a	Shell	Fragment	UID	None
11	3	5	2	0.78	Medium/large mammal		Long bone	Shaft	UID	None
11	3	1	7	37.2	Bison	Bison bison	Lower third molar	Nearly complete	Right	None
11	3	2	1	0.25	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
11	3	3	1	0.13	Turtle	Testudines	Carapace	Fragment	UID	None
11	3	4	8	3.44	Medium/large mammal		UID	Fragment	UID	Burned black
11	3	5	16	6.96	Medium/large mammal		UID	Fragment	UID	None
11	4	1	1	0.31	Large mammal		Long bone	Shaft	UID	Calcined
11	4	2	4	4.93	Large mammal		Long bone	Shaft	UID	None
11	4	1	1	0.09	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
11	4	2	4	2.55	Medium/large mammal		UID	Fragment	UID	None
11	5	1	3	0.75	Medium/large mammal		UID	Fragment	UID	None
11	5	2	5	2.79	Softshell turtle	Trionychid ae	Carapace	Fragment	UID	None
11	5	1	1	1.43	Prong-horned antelope	Antilocapr a americana	Phalanx	Distal	UID	None
11	5	2	2	0.31	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
11	5	3	22	4.76	Medium/large mammal		UID	Fragment	UID	None
11	F.1 Area	1	1	1.15	Prong-horned antelope	Antilocapr a	Vertebra	Articulation	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
	B					americana				
11	F.1 Area B	2	3	1.42	Medium/large mammal		UID	Fragment	UID	None
13	4	1	1	2.68	Large mammal		UID	Fragment	UID	Rodent gnaw
13	4	2	1	0.81	Pocket gopher	Geomyidae	Mandible	Nearly complete	Left	None
13	4	3	24	20.26	Large mammal		UID	Fragment	UID	None
13	5	1	1	17.95	Bison	Bison bison	Long bone	Shaft	UID	Carnivore gnaw
13	5	2	1	3.24	Prong-horned antelope	Antilocapra americana	Phalanx	Proximal	UID	Rodent gnaw
13	5	3	7	4.13	Medium/large mammal		UID	Fragment	UID	None
13	6	1	5	36.83	Bison	Bison bison	Long bone	Shaft	UID	None
13	6	2	9	5.91	Large mammal		UID	Fragment	UID	None
13	17	1	1	2.47	Prong-horned antelope	Antilocapra americana	Lower third molar	Nearly complete	Left	None
13	17	2	1	8.39	Prong-horned antelope	Antilocapra americana	Proximal phalanx	Complete	UID	Carnivore gnaw
13	17	3	3	1	Medium/large mammal		Long bone	Shaft	UID	None
14	6	1	2	19.62	Prong-horned antelope	Antilocapra americana	Calcaneus	Complete	Right	None
14	6	2	1	2.87	Prong-horned antelope	Antilocapra americana	Thoracic vertebra	Spine	UID	None
14	6	3	1	5.78	Large mammal		Long bone	Shaft	UID	None
14	6	4	3	7.02	Medium/large mammal		UID	Fragment	UID	None
16	2	1	1	0.73	Medium/large mammal		Long bone	Shaft	UID	None
17	2	1	1	0.38	Softshell turtle	Trionychidae	Carapace	Fragment	UID	None
17	2	2	1	0.69	Large mammal		Scapula	Fragment	UID	None
17	3	1	2	0.66	Medium/large mammal		UID	Fragment	UID	Calcined
17	4	1	1	0.05	Gastropod	Gastropoda	Shell	Fragment	UID	None
17	4	2	4	0.55	Medium/large mammal		UID	Fragment	UID	None
18	1	1	1	2.64	Prong-horned antelope	Antilocapra americana	Metatarsal	Shaft	UID	None
18	1	2	3	1.59	Medium/large mammal		UID	Fragment	UID	None
18	1	1	1	0.35	Large mammal		Long bone	Shaft	UID	Calcined
18	2	1	1	1.17	Turtle	Testudines	Carapace	Fragment	UID	None
18	2	2	5	3.4	Medium/large mammal		UID	Fragment	UID	None
18	2	1	2	1.1	Turtle	Testudines	Carapace	Fragment	UID	None
18	2	1	2	1.17	Medium/large mammal		Long bone	Shaft	UID	Calcined
18	2	2	6	3.54	Medium/large mammal		UID	Fragment	UID	None
18	2	2	7	2.97	Medium/large mammal		UID	Fragment	UID	None
18	2	1	5	4.13	Medium/large mammal		UID	Fragment	UID	None
18	3	1	1	0.14	Small mammal		Humerus	Nearly complete	Left	None
18	3	2	1	0.12	Small mammal		Skull	Fragment	UID	None
18	3	3	1	0.26	Turtle	Testudines	Carapace	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
18	3	4	2	0.62	Medium/large mammal		UID	Fragment	UID	Calcined
18	3	5	4	1.7	Medium/large mammal		UID	Fragment	UID	None
18	3	1	1	6.6	Prong-horned antelope	Antilocapra americana	Vertebra	Body	UID	None
18	3	2	1	0.24	Medium/large mammal		UID	Fragment	UID	Calcined
18	3	3	10	8.46	Medium/large mammal		UID	Fragment	UID	None
18	3	1	1	0.32	Turtle	Testudines	Carapace	Fragment	UID	None
18	3	2	1	2.07	Prong-horned antelope	Antilocapra americana	Metatarsal	Shaft	UID	None
18	3	3	1	0.41	Medium/large mammal		UID	Fragment	UID	None
19	2	1	1	0.21	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
19	2	2	1	0.82	Large mammal		Long bone	Shaft	UID	Calcined
19	2	3	1	0.75	Prong-horned antelope	Antilocapra americana	Phalanx	Fragment	UID	None
19	2	4	25	7.68	Medium/large mammal		UID	Fragment	UID	None
19	3	1	1	0.96	Prong-horned antelope	Antilocapra americana	Phalanx	Distal	UID	Calcined
19	3	2	1	21.07	Prong-horned antelope	Antilocapra americana	Humerus	Distal	Right	None
19	3	3	22	9.01	Medium/large mammal		UID	Fragment	UID	None
19	4	1	1	0.09	Small mammal		Scapula	Articulation	Left	None
19	4	2	1	0.18	Non-venomous snake	Colubridae	Vertebra	Complete	UID	None
19	4	3	1	0.07	Very small mammal		Mandible	Nearly complete	Left	None
19	4	4	1	0.17	Large mammal		Tooth	Enamel	UID	None
19	4	5	2	0.27	Turtle	Testudines	Carapace	Fragment	UID	None
19	4	6	1	0.22	Small mammal		Humerus	Nearly complete	Left	None
19	4	7	32	10.28	Medium/large mammal		UID	Fragment	UID	None
19	5	1	1	1.04	Prong-horned antelope	Antilocapra americana	Phalanx	Distal	UID	None
19	5	2	1	0.49	Prong-horned antelope	Antilocapra americana	Sesamoid	Complete	UID	None
19	5	3	1	3.74	Prong-horned antelope	Antilocapra americana	Metatarsal	Shaft	UID	None
19	5	4	1	3.69	Prong-horned antelope	Antilocapra americana	Metatarsal	Proximal	UID	None
19	5	5	1	17.75	Prong-horned antelope	Antilocapra americana	Humerus	Distal	Left	None
19	5	6	1	6.88	Prong-horned antelope	Antilocapra americana	Radius	Distal	Right	None
19	5	7	1	1.46	Prong-horned antelope	Antilocapra americana	Phalanx	Fragment	UID	None
19	5	8	1	0.47	Wild turkey	Meleagris gallopavo	Metatarsus	Condoyle	UID	None
19	5	9	1	0.16	Large mammal		Tooth	Enamel	UID	None
19	5	10	1	0.55	Large mammal		UID	Fragment	UID	Calcined
19	5	11	42	21.32	Medium/large mammal		UID	Fragment	UID	None

XU	Level	Bone #	Count	Weight (g)	Common Name	Scientific Name	Element	Part	Side	Mod.
19	6	1	1	0.04	Small mammal		Tibia	Nearly complete	Right	None
19	6	2	2	0.48	Large mammal		Tooth	Enamel	UID	None
19	6	3	2	0.35	Turtle	Testudines	Carapace	Fragment	UID	None
19	6	4	1	0.37	Small/medium mammal		Rib	Fragment	UID	None
19	6	5	1	0.83	Large mammal		Long bone	Shaft	UID	Rodent gnaw
19	6	6	2	1.06	Prong-horned antelope	Antilocapr a americana	Phalanx	Proximal	UID	None
19	6	7	37	16.24	Medium/large mammal		UID	Fragment	UID	None

APPENDIX D: RADIOCARBON RESULTS

BETA ANALYTIC INC.
RADIOCARBON DATING, STABLE ISOTOPE RATIOS, THERMOLUMINESCENCE, X-RAY DIFFRACTION
P. O. BOX 248113 - CORAL GABLES, FLORIDA 33124 - (305) 667-5167

June 11, 1984

Dr. James F. Garber
Dept. Sociology and Anthropology
Southwest Texas State University
San Marcos, Texas 78666

Dear Dr. Garber:

Please find enclosed the results on the four charcoal samples recently submitted for radiocarbon dating analyses. We hope these dates will be useful in your research.

Particularly thorough and careful pretreatments in a separate dust-controlled room is one of our principal specialties. Your charcoals were pretreated by first picking out any rootlets that might be present. The samples were then given a hot acid wash to eliminate carbonates. They were repeatedly rinsed to neutrality and subsequently given a hot alkali soaking to take out humic acids. After rinsing to neutrality, another acid wash followed and another rinsing to neutrality. The following benzene syntheses and counting proceeded normally. Some of the samples were on the small side and this caused the larger than usual statistical errors.

We are enclosing our statement with the Texas Purchase Voucher. Would you forward this to the appropriate office for payment. If there are any questions or if you would like to confer on the dates, my direct telephone number is listed above. Both my partner and I have over twenty years experience in radiocarbon dating. Please don't hesitate to call us if we can be of any help.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

MT/hs
encs.

P.S. I'm also sending some sample data sheets for future samples or to give to your friends that might need our service.

BETA ANALYTIC INC.
(305) 667-5167
UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

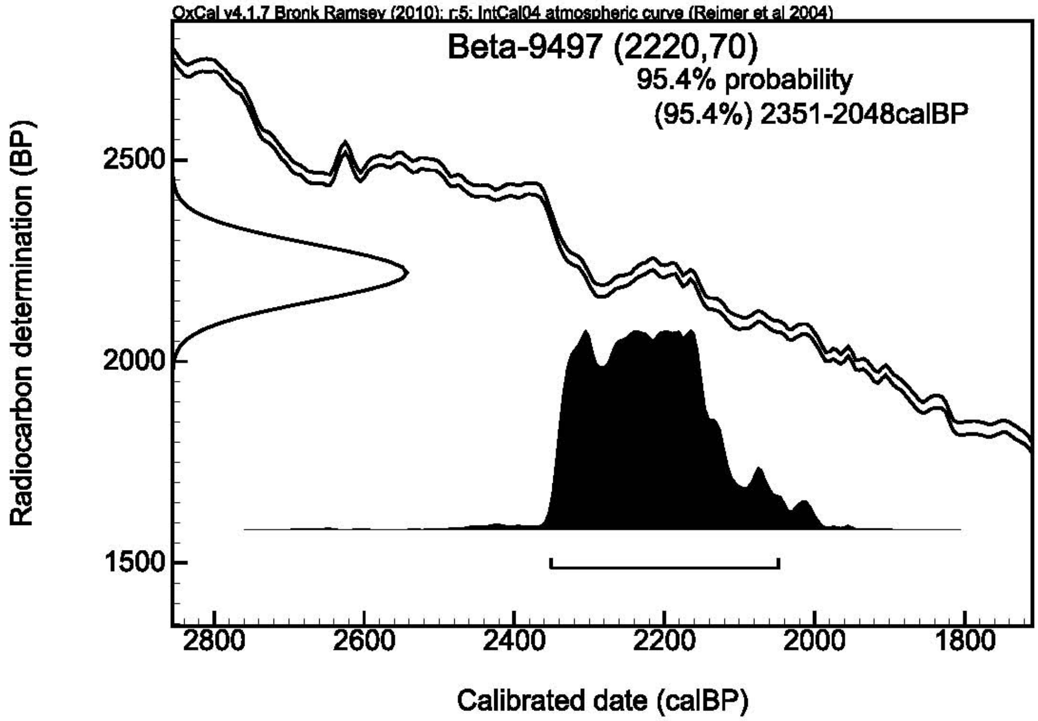
REPORT OF RADIOCARBON DATING ANALYSES

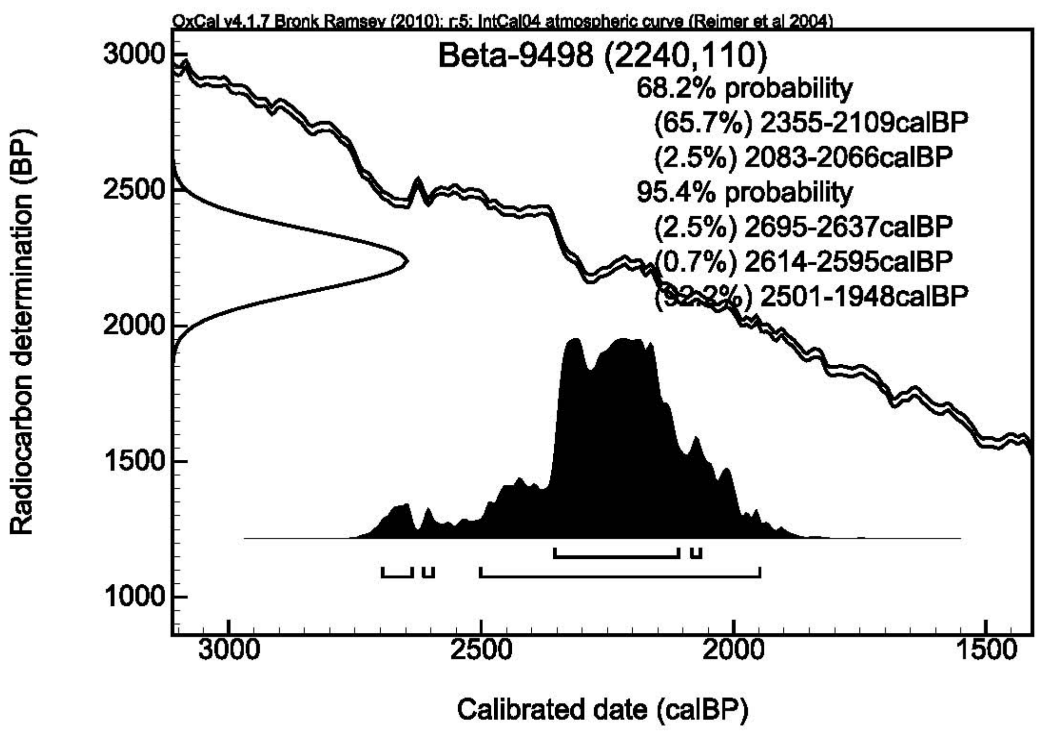
FOR: James F. Garber
Southwest Texas State University

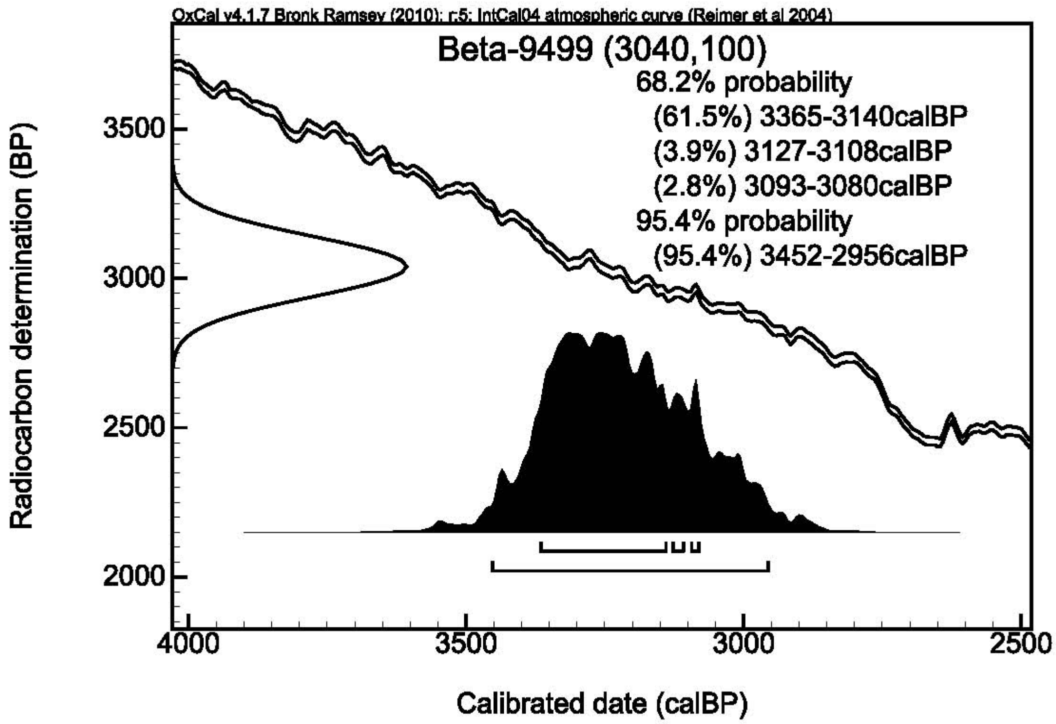
DATE RECEIVED: May 24, 1984
DATE REPORTED: June 11, 1984
BILLED TO SUBMITTER'S INVOICE NUMBER

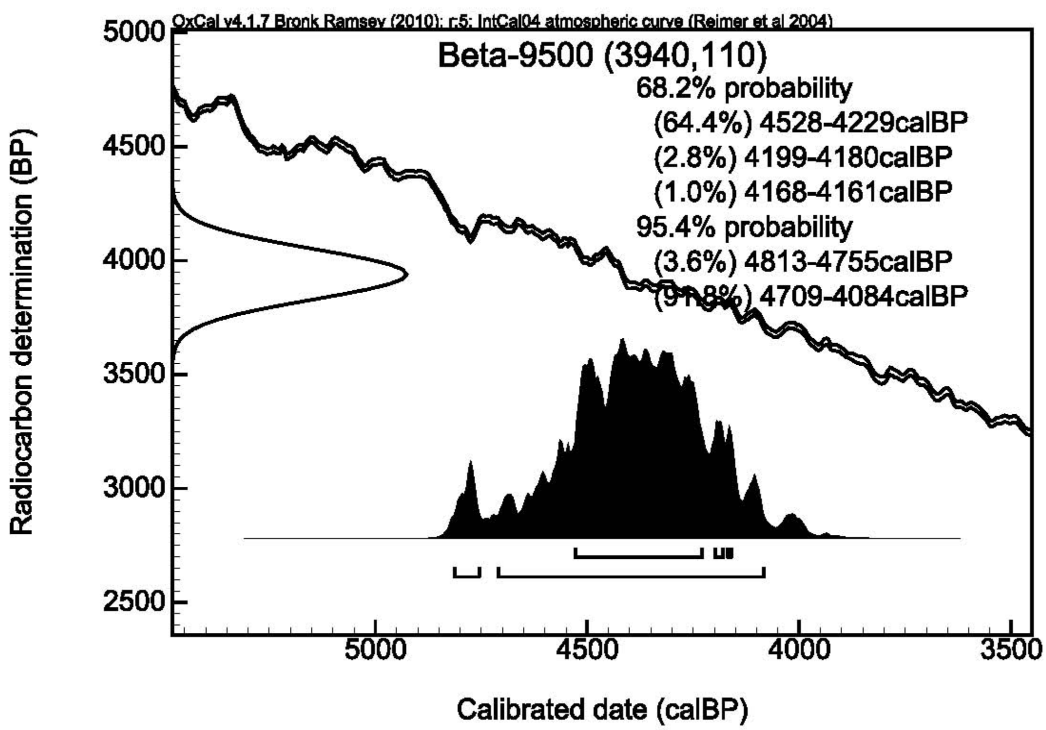
OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ
Beta-9497	41HY160-2-L6-N-Cl	2220 ± 70 B.P.
Beta-9498	41HY160-3-L3-Cl	2240 ± 110 B.P.
Beta-9499	41HY160-6-L8-E-Cl	3040 ± 100 B.P.
Beta-9500	41HY160-13-L10-N-Cl	3940 ± 110 B.P.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
Beta-9497 (2220,70)
95.4% probability
(95.4%) 2351-2048calBP
Radiocarbon determination (BP)
2500
2000
1500
2800
2600
2400
2200
2000
1800
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
Beta-9498 (2240,110)
68.2% probability
(65.7%) 2355-2109calBP
(2.5%) 2083-2066calBP
95.4% probability
(2.5%) 2695-2637calBP
(0.7%) 2614-2595calBP
(92.2%) 2501-1948calBP
Radiocarbon determination (BP)
3000
2500
2000
1500
1000
3000
2500
2000
1500
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
Beta-9499 (3040,100)
68.2% probability
(61.5%) 3365-3140calBP
(3.9%) 3127-3108calBP
(2.8%) 3093-3080calBP
95.4% probability
(95.4%) 3452-2956calBP
Radiocarbon determination (BP)
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
Beta-9500 (3940,110)
68.2% probability
(64.4%) 4528-4229calBP
(2.8%) 4199-4180calBP
(1.0%) 4168-4161calBP
95.4% probability
(3.6%) 4813-4755calBP
(91.8%) 4709-4084calBP
Radiocarbon determination (BP)
Calibrated date (calBP)

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

---For lab use only---

Average ____		X-no. 5057
Age 3400 ± 50	Age ____	Tx-no. 5057
$\delta^{14}C$ -345.4 ± 2.1 ‰	$\delta^{14}C$ ____	Published ____
$\delta^{13}C$ ____	$\delta^{13}C$ ____	
Run # 2396a	Run # ____	

Remarks ____

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: charcoal with dirt

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):
SWT Dept. Anthro. 41HY160-11-F1-C1

3. Name and number of site: Tee Box 6/41HY160

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):
200 m E of Aquarena Springs Hotel

5. Latitude & Longitude, at least to the minute:
29°53'36"N 97°55'43"W

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:
XU5 Feature 1 (50 cm BS)

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):
8/10/82

(over)

8. Context: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Hearth; Middle Archaic

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Aid in establishing cultural chronology in San Marcos area

12. Estimated sample age: Your advance guess as to the age of the sample--may be stated as a range:

Unknown

13. Signature of submitter: [signature]

Type or print name: J.F. Garber, B.T. Gray

Address, institutional affiliation: Dept. Sociol-Anthropology Southwest Texas State Univ., San Marcos, TX 78666

Date: 16 May, 1984

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

X-no. 5058

Tx-no. 5058

Published

---For lab use only---

Average

Age 1210 ± 50 Age

$\delta^{14}C$ -140.1 ± 3.5‰ $\delta^{14}C$

$\delta^{13}C$ $\delta^{13}C$

Run # 20726 Run #

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: charcoal with dirt

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):

SWT Dept. Anthro. 41HY160-13-L3-N-C1

3. Name and number of site: Tee Box 6/41HY160

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):

200 m E of Aquarena Springs Hotel

5. Latitude & Longitude, at least to the minute:

29°53'36"N 97°55'43"W

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:

XU13 L3 (20-30 cm BS)

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):

6/8/83 James F. Garber

(over)

8. Context: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Late Archaic

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Aid in establishing cultural chronology in San Marcos area

12. Estimated sample age: Your advance guess as to the age of the sample-- may be stated as a range:

Uncertain

13. Signature of submitter:

Type or print name: J.F. Garber, B.T. Gray

Address, institutional affiliation: Dept. Sociol-Anthropology

Southwest Texas State Univ., San Marcos, TX 78666

Date: ~~16 May, 1984~~

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

X-no. 5059

Tx-no. 5059

Published

For lab use only

Average

Age 480±60 Age

$\delta^{14}C$ -57.5±3.8 $\delta^{14}C$

$\delta^{13}C$ $\delta^{13}C$

Run # Run #

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: charcoal with dirt

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):
SWT Dept. Anthro. 41HY160-5-F1-C1

3. Name and number of site: Tee Box 6/41HY160

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):
200 m E of Aquarena Springs Hotel

5. Latitude & Longitude, at least to the minute:
29°53'36"N 97°55'43"W

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:
XU5 Feature 1 (30 cm BS)

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):
7/1/82

(over)

8. Context: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Hearth; Late Prehistoric - Archaic transition

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Aid in establishing cultural chronology in San Marcos area

12. Estimated sample age: Your advance guess as to the age of the sample--may be stated as a range:

Uncertain

13. Signature of submitter: [signatures]

Type or print name: J.F. Garber, B.T. Gray

Address, institutional affiliation: Dept. Sociol-Anthropology Southwest Texas State Univ., San Marcos, TX 78666

Date: 16 May, 1984

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

For lab use only

Average Age 1030±60	Age	X-no. 5060	
$\delta^{14}C$ −120.8±4.3‰	$\delta^{14}C$	Tx-no. 5060	
$\delta^{13}C$	$\delta^{13}C$	Published	
Run # 20716	Run #		

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: charcoal with dirt

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):
SWT Dept. Anthro. 41HY160-4-L5-S-C1

3. Name and number of site: Tee Box 6/41HY160

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):
200 m E of Aquarena Springs Hotel

5. Latitude & Longitude, at least to the minute:
29°53'36"N 97°55'43"W

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:
XU4 L5 (40-50 cm BS)

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):
7/25/82

(over)

8. Context: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Late Archaic

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Aid in establishing cultural chronology in San Marcos area

12. Estimated sample age: Your advance guess as to the age of the sample-- may be stated as a range:

Uncertain

13. Signature of submitter: [signatures]

Type or print name: J.F. Barber, B.T. Gray

Address, institutional affiliation: Dept. Sociol-Anthropology Southwest Texas State Univ., San Marcos, TX 78666

Date: 16 May, 1984

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

For lab use only

X-no. 5061

Average

Tx-no. 5061

Age 1620 ± 60 Age ________

$\delta^{14}C$ -183.0 ± 4.0‰ $\delta^{14}C$ ________ Published ________

$\delta^{13}C$ ________ $\delta^{13}C$ ________

Run # 20746 Run # ________

Remarks ________

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: charcoal with dirt
2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):
SWT Dept. Anthro. 41HY160-4-L6-S-C1
3. Name and number of site: Tee Box 6/41HY160
4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):
200 m E of Aquarena Springs Hotel
5. Latitude & Longitude, at least to the minute:
$29^{o}53'36''N$ $97^{o}55'43''W$
6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:
XU4 L6 (50-60 cm BS)
7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):
8/3/82 James F. Garber

(over)

8. Context: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Middle Archaic

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Aid in establishing cultural chronology in San Marcos area

12. Estimated sample age: Your advance guess as to the age of the sample--may be stated as a range:

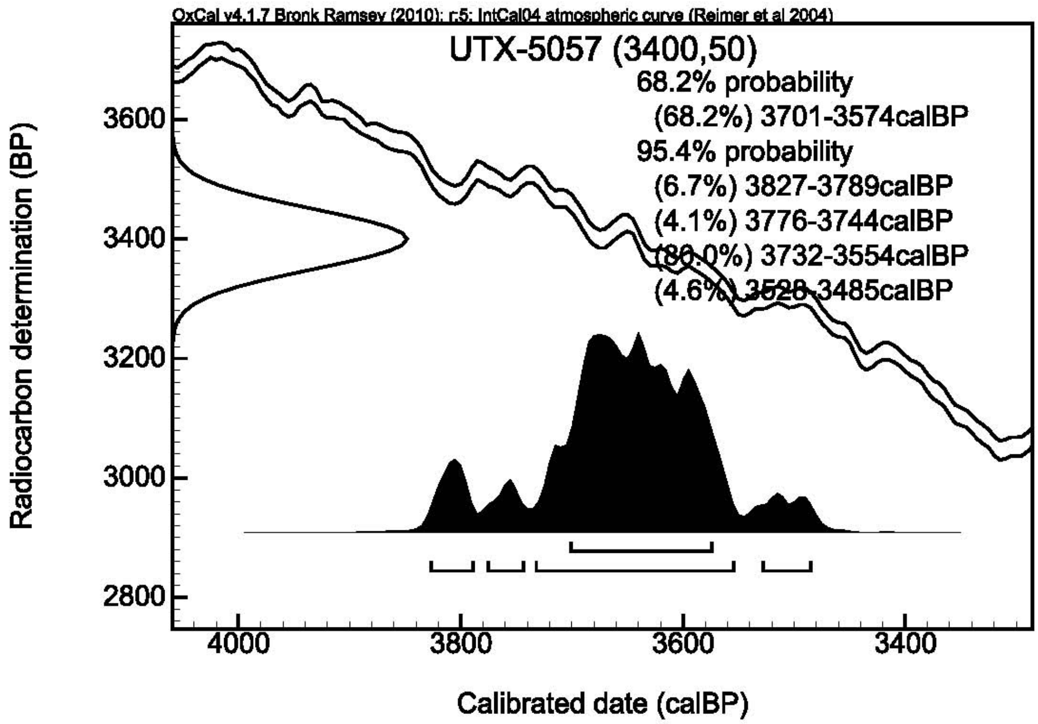
Uncertain

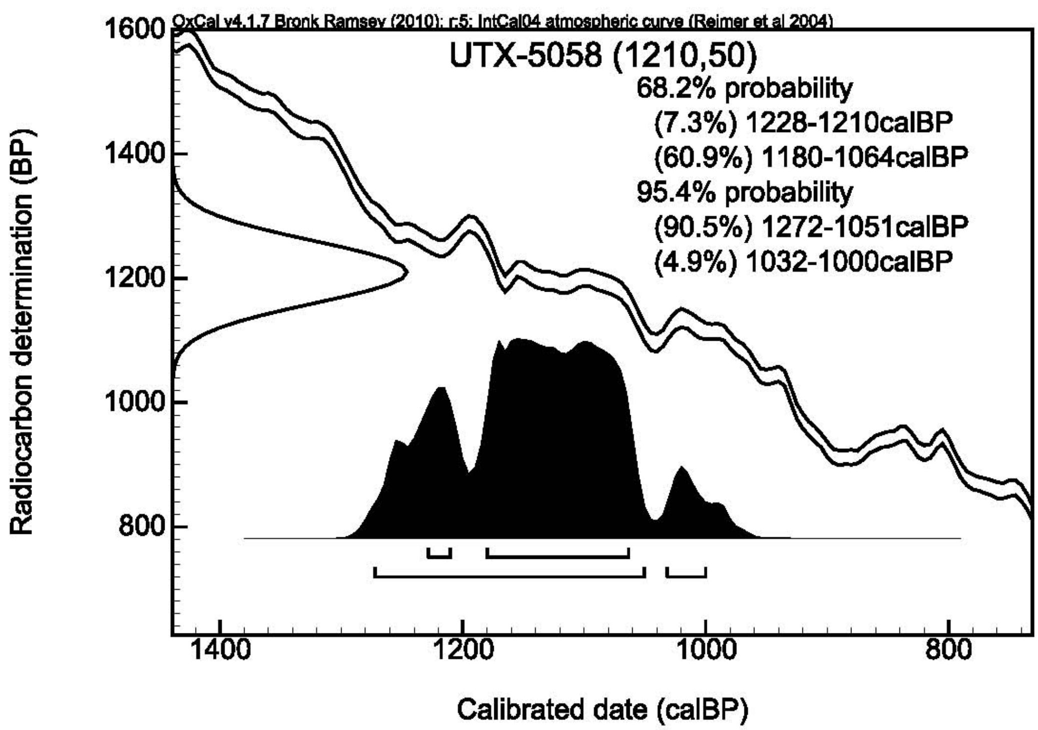
13. Signature of submitter: [signature]

Type or print name: J.F. Garber, B.T. Gray

Address, institutional affiliation: Dept. Sociol-Anthropology, Southwest Texas State Univ., San Marcos, TX 78666

Date: 16 May, 1984


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UTX-5057 (3400,50)
68.2% probability
(68.2%) 3701-3574calBP
95.4% probability
(6.7%) 3827-3789calBP
(4.1%) 3776-3744calBP
(80.0%) 3732-3554calBP
(4.6%) 3528-3485calBP
Radiocarbon determination (BP)
3600
3400
3200
3000
2800
4000
3800
3600
3400
Calibrated date (calBP)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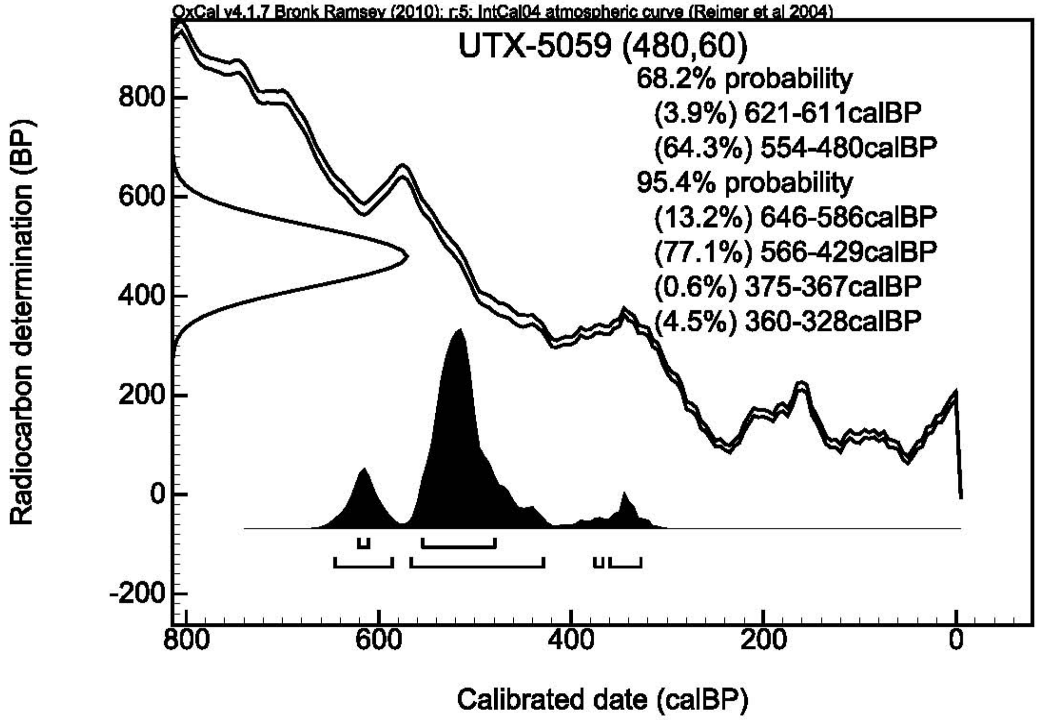
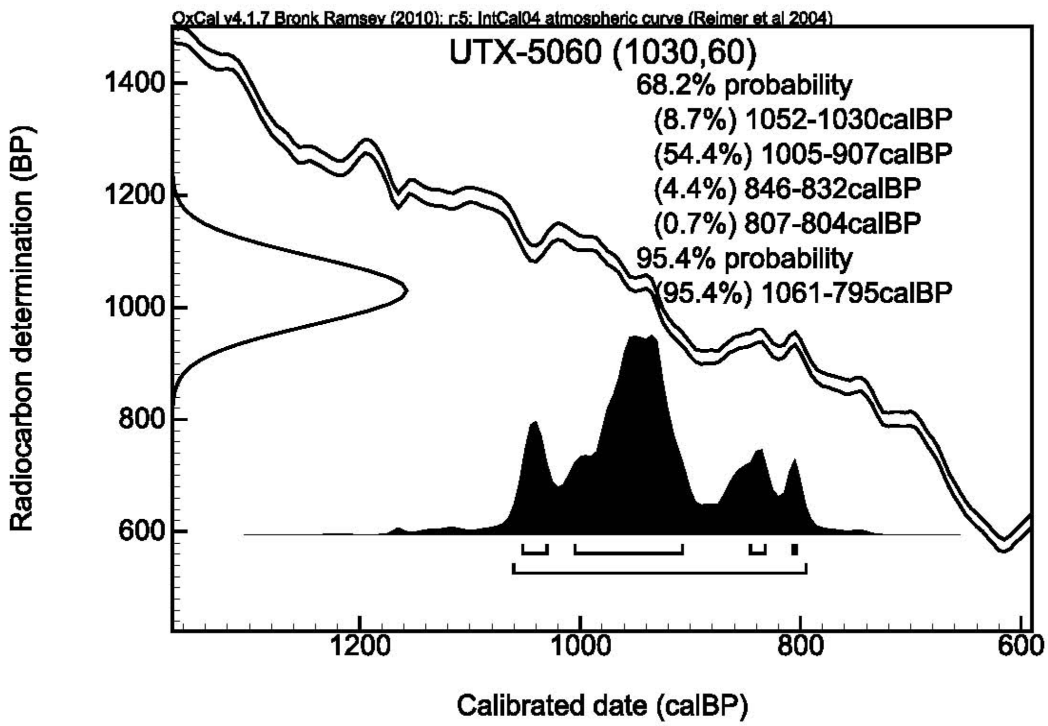
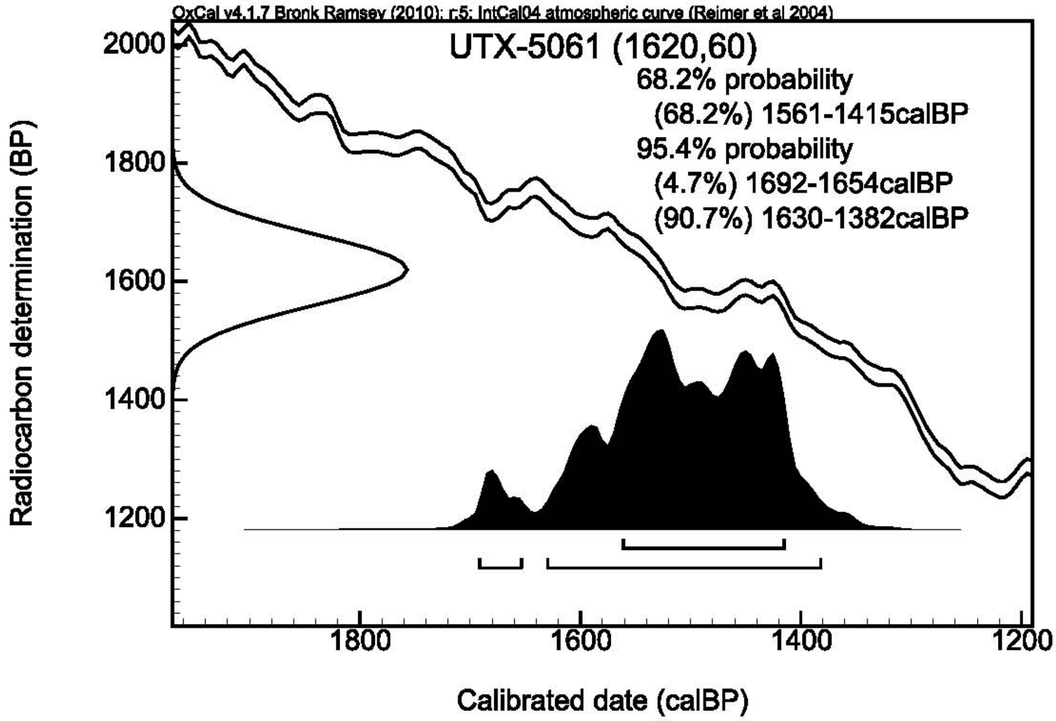
UTX-5058 (1210,50)
68.2% probability
(7.3%) 1228-1210calBP
(60.9%) 1180-1064calBP
95.4% probability
(90.5%) 1272-1051calBP
(4.9%) 1032-1000calBP
Radiocarbon determination (BP)
1600
1400
1200
1000
800
1400
1200
1000
800
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UTX-5059 (480,60)
68.2% probability
(3.9%) 621-611calBP
(64.3%) 554-480calBP
95.4% probability
(13.2%) 646-586calBP
(77.1%) 566-429calBP
(0.6%) 375-367calBP
(4.5%) 360-328calBP
Radiocarbon determination (BP)
800
600
400
200
0
-200
800
600
400
200
0
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UTX-5060 (1030,60)
68.2% probability
(8.7%) 1052-1030calBP
(54.4%) 1005-907calBP
(4.4%) 846-832calBP
(0.7%) 807-804calBP
95.4% probability
(95.4%) 1061-795calBP
Radiocarbon determination (BP)
1400
1200
1000
800
600
1200
1000
800
600
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UTX-5061 (1620,60)
68.2% probability
(68.2%) 1561-1415calBP
95.4% probability
(4.7%) 1692-1654calBP
(90.7%) 1630-1382calBP
Radiocarbon determination (BP)
2000
1800
1600
1400
1200
1800
1600
1400
1200
Calibrated date (calBP)

The University of Georgia

Center for Applied Isotope Studies

RADIOCARBON ANALYSIS REPORT

July 16, 2010

Joseph J. Haefner
Texas State University
2904 Barton Skyway #306
Austin, TX 78746

Dear Mr. Haefner

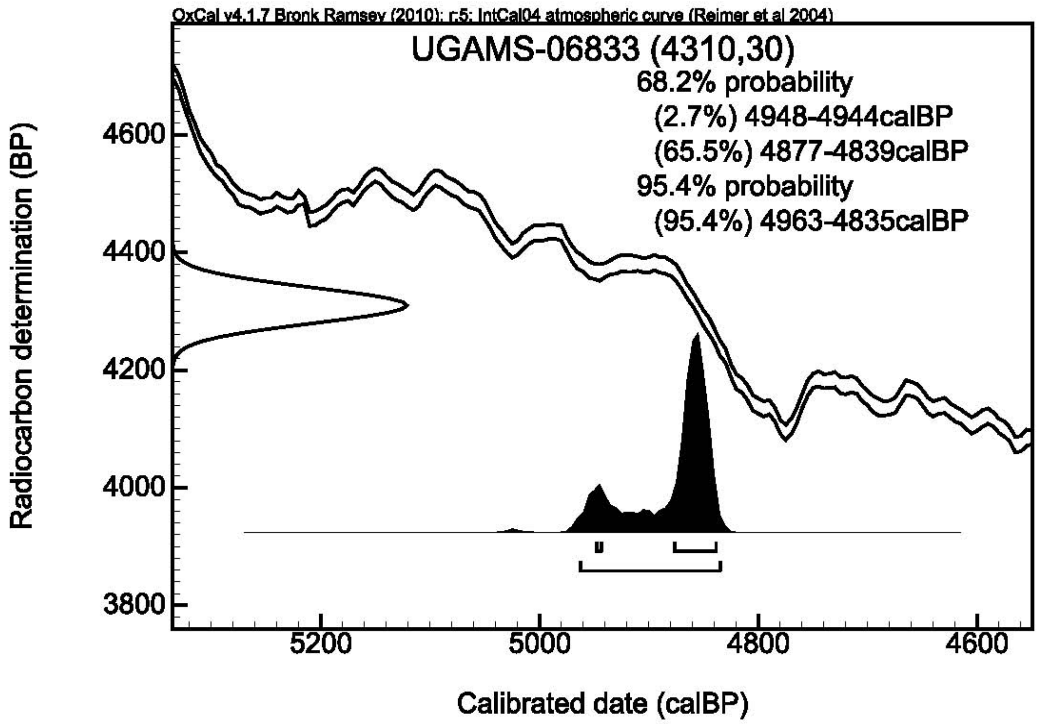
Enclosed please find the results of ^{14}C Radiocarbon analyses and Stable Isotope Ratio $\delta^{13}C$ analyses for the sample received by our laboratory on June 16, 2010.

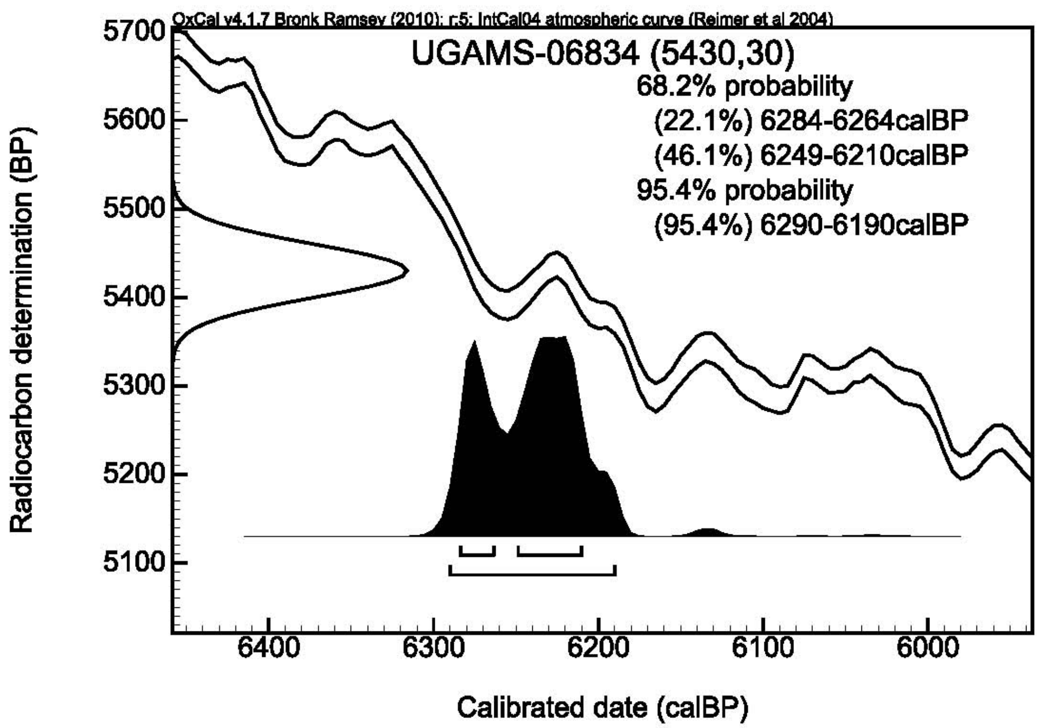
UGAMS#	Sample ID	Material	^{14}C age, years BP	$\delta^{13}C$, ‰
06833	XUI-LV17-Teebox 6	charcoal	4310±30	-23.8
06834	YUI-LV20-Teebox 6	charcoal	5430±30	-24.7

The charcoal sample was treated with 5% HCl at the temperature 80°C for 1 hour, then it was washed and with deionized water on the fiberglass filter and rinsed with diluted NaOH to remove possible contamination by humic acids. After that the sample was treated with diluted HCL again, washed with deionized water and dried at 60°C.
For accelerator mass spectrometry analysis the cleaned charcoal was combusted at 900°C in evacuated / sealed ampoules in the presence of CuO.
The resulting carbon dioxide was cryogenically purified from the other reaction products and catalytically converted to graphite using the method of Vogel *et al.* (1984) Nuclear Instruments and Methods in Physics Research B5, 289-293. Graphite $^{14}C/^{13}C$ ratios were measured using the CAIS 0.5 MeV accelerator mass spectrometer. The sample ratios were compared to the ratio measured from the Oxalic Acid I (NBS SRM 4990). The sample $^{13}C/^{12}C$ ratios were measured separately using a stable isotope ratio mass spectrometer and expressed as $\delta^{13}C$ with respect to PDB, with an error of less than 0.1‰. The quoted uncalibrated dates have been given in radiocarbon years before 1950 (years BP), using the ^{14}C half-life of 5568 years. The error is quoted as one standard deviation and reflects both statistical and experimental errors. The date has been corrected for isotope fractionation.

Sincerely,

Dr.Alexander Cherkinsky


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UGAMS-06833 (4310,30)
68.2% probability
(2.7%) 4948-4944calBP
(65.5%) 4877-4839calBP
95.4% probability
(95.4%) 4963-4835calBP
Radiocarbon determination (BP)
4600
4400
4200
4000
3800
5200
5000
4800
4600
Calibrated date (calBP)


OxCal v4.1.7 Bronk Ramsey (2010); r:5; IntCal04 atmospheric curve (Reimer et al 2004)
UGAMS-06834 (5430,30)
68.2% probability
(22.1%) 6284-6264calBP
(46.1%) 6249-6210calBP
95.4% probability
(95.4%) 6290-6190calBP
Radiocarbon determination (BP)
5700
5600
5500
5400
5300
5200
5100
6400
6300
6200
6100
6000
Calibrated date (calBP)

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