PATTERNS IN THE USE OF THE ROCKSHELTERS OF EAGLE NEST CANYON, LANGTRY, TEXAS

by

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ABSTRACT

The cultural deposits in rockshelter sites in the Lower Pecos Canyonlands contain evidence for occupation behaviors over at least 10,000 years. The use of a multifaceted approach analyses provides new insights to site formation processes and shelter use patterns. The results of small scale excavations in 2013-2014 in the adjacent Skiles Shelter (41VV165) and Kelley Cave (41VV164) were analyzed using geoarchaeological, zooarchaeological, and archaeobotanical approaches. The two shelter sites were investigated as a single occupational locus within Eagle Nest Canyon.

Results of these analyses suggest differential shelter use between the two sites by hunter-gatherers. Kelley Cave deposits dating from the Early Archaic to the Late Prehistoric periods show occupation evidence of broad habitation behavior patterns including hot rock cooking, artistic expression, and lithic and bone tool manufacture. Skiles Shelter deposits, all dated to the Late Prehistoric period, suggests occupational activities more narrowly focused to the processing and cooking of botanical and faunal resources.

Both shelters contain evidence of a catastrophic mid-14th century flood event which sealed intact cultural deposits. X-Ray Diffraction analysis also indicates that much of the shelter deposits are derived from Rio Grande alluvium, either by reworked flood deposits or by human transport into the shelter. The deposits excavated in both shelters found evidence of historic looter disturbance as well as earlier intrusions and disturbances.

In Skiles Shelter the deposits in the back of the shelter were truncated during the Late Prehistoric period by a large pit, possibly a borrow pit for earth oven construction toward the dripline.

An intact earth oven heating element in Kelley Cave was radiocarbon dated to ca. 7350 cal B.P. suggesting the baking of semi-succulents in the region intensified during the mid-Early Archaic period. A stone-lined storage cyst also dated to the mid-Early Archaic. Underground storage features and resource bundles found in other shelters in the Lower Pecos Canyonlands reinforce the hypothesis of planned shelter revisits during seasonal rounds. Statistical analysis of the frequencies of animal dung and several artifact classes suggests that Kelley Cave was intensely or frequently utilized the Early Archaic period.

This thesis provides testable data and hypotheses as the first phase in ongoing investigations by the Ancient Southwest Texas Project at Texas State University. More robust datasets will be needed to fully test these interpretations.

CHAPTER 1: INTRODUCTION

Rockshelters in the Lower Pecos Canyonlands (LPC) have been utilized by humans since the Late Pleistocene. The arid environment of this region of southwestern Texas and northern Coahuila, Mexico, has allowed for the preservation of perishable remains within the protected limestone structures. The rockshelter deposits represent evidence of shelter use, ritual behaviors, and dietary changes over a large span of time. This record represents sporadic use of the shelters by nomadic bands of hunter-gatherers. The role of rockshelters in the subsistence and settlement of the prehistoric inhabitants of the LPC is still debated.

In this thesis, I analyze data from two adjoining rockshelters in Eagle Nest Canyon, Skiles Shelter (41VV165) and Kelley Cave (41VV164), to understand behavioral use patterns within and between the two sites as well as the natural and cultural processes through which the shelter deposits formed. My thesis research encompasses a multifaceted approach with four research objectives:

1. Discern differential behavioral patterns in the use of the two shelters as a single occupational locus.
2. Assess the differential site formation processes of each shelter which may affect interpretation.
3. Analyze the botanical and faunal remains to understand the changes in diet and dietary pressures over time.

4. Compare the use of Skiles Shelter and Kelley Cave to other rockshelter sites in the LPC to evaluate proposed hypotheses regarding the roles that rockshelter use played in LPC subsistence and settlement patterns.

The Lower Pecos Archaeological Region encompasses the semi-arid Chihuahuan Desert in southwestern Texas and northern Coahuila Mexico. It is centered on the confluence of the Pecos River and the Rio Grande. The prehistoric people of this karstic region utilized caves and rockshelters for thousands of years and created the distinctive Pecos River style pictographs in the Middle Archaic period, which researchers have used to define the 150km^2 region (Turpin 2004:266).

Within the region are three ecological zones providing different exploiresources: the uplands, the canyon edge, and canyon bottom. Presently, the upland areas of the LPC are composed of eroding soils, Pleistocene Uvalde Gravels, and exposed Cretaceous limestone bedrock (Golden et al. 1982). Uvalde Gravels were a lithic resource on the uplands, as their distribution was found correlate with prehistoric quarry sites (Dering 2002:2.2). The uplands are populated by desert scrub and semi-succulent plants including: mesquite, ocotillo, Texas sage, agave lechuguilla, prickly pear cactus, sotol, tasajillo, and dog cholla cactus (*Opuntia schottii*) as well as non-native species such as buffelgrass (*Pennisetum ciliare*) introduced more recently (Appendix A). The eastern portion of the LPC, along the southeastern periphery of the Edwards Plateau, contains the semi-succulents with arid grasses, ash juniper, and live oak (Griffith et al. 2004). Pollen evidence suggests that during mesic climatic intervals, grasses were abundant across much of the region (Bryant and Holloway 1985). Animals found in the uplands include jackrabbit, cottontail rabbit, mountain lion, whitetail deer, coyote, and birds including ravens, hawks, vultures, and migratory species. Researchers posit that during the mesic intervals of increased grasslands, bison were also present in the region (Sobolik 1991; Turpin 2004).

The canyon edge is an intermediate ecological zone that provides access to the uplands and canyon bottom. Here, succulents such as lechuguilla agave, sotol, and prickly pear grow in abundance along the craggy slopes. Other plants found here include Texas mountain laurel, littleleaf ash, Mexican oregano, sumac, grape, and persimmon (see Appendix A). Animals observed along the canyon slopes include: wild turkey, cave wrens, ravens, bats, wood rats, javelina, coyote, jackrabbit, cottontail rabbit, and whitetail deer (Sobolik 1991). The canyon edge also provides access to lithic resources such as Uvalde Gravels, chert cobbles eroding out of limestone crevices, and sparse outcrops of hematite (Dering 2002; Jack Skiles personal communication, 2013).

The canyon bottom ecological zone provides ready access to resources, both terrestrial and riverine. Canyon bottom allows access to water through tinajas, springs, and rivers. The water resources also allow for a large and diverse plant population, including: oak, hackberry, wild carrot, grape, Texas lantana, cucumber plant, Mexican buckeye, willow, witchgrass, Drummond's onion, and buffalo gourd (see Appendix A). Terrestrial and riverine animal resources, drawn by the water and ample vegetation, can be exploited from the canyon bottom. These include: duck, cave wren, bat, wood rat, gopher, raccoon, coyote, turtle, fish, snail, and javelina. Upland animals such as jackrabbit, cottontail rabbit, and whitetail deer are drawn to the canyon bottom resources as well (Sobolik 1991). Earth oven cooking resources can also be easily procured here such as hardwood, cook stone, and sediment.

The archaeological evidence in the region indicates resource exploitation across all three zones. However, the behavior of the prehistoric hunter-gatherers such as habitation and landscape use remains unclear (Koenig 2012). To understand questions of diet and settlement patterns in the LPC, researchers have utilized optimal foraging theory models to test their hypotheses (Brown 1991; Dering 2007, 2008; Koenig 2012; Riley 2010).

Diet and Settlement Patterns

Diet and settlement pattern are closely related to each other. Diet and procurement systems are integral to how hunter-gatherer groups moved across a landscape (Kelley 2007). Understanding how resources were exploited in the LPC through time may shed light on how rockshelters were utilized. Researchers in the LPC have advanced several hypotheses concerning the lifeways and land use of the people of the region. These have been discussed at great length elsewhere (see Sobolik 1991; Turpin 2004; Koenig 2012). The following is a brief overview of diet and key shelter use hypotheses that have been put forth to explain the changing settlement patterns in the LPC through time.

Archaic hunter-gatherer groups in the Lower Pecos utilized the desert plants such as sotol, agave lechuguilla, yucca, and prickly pear cactus for nutrition as well as for workable fiber (Dering 1999). The consumption of these native semi-succulents began sometime in the Early Archaic and continued with increasing frequency throughout the region until the Late Prehistoric period (Turpin 2004). Hunter-gatherer groups consumed a broad spectrum of dietary resources including small and medium game such as rodents and rabbits as well as deer, mesquite pods, walnuts and other seasonal vegetation, and riverine resources such as turtles, catfish, and gar. During times of bison migration south into the region, in the Late Pleistocene and again in the Late Archaic, bison were also incorporated into the diet (Dibble 1968; Bement 1986). The dietary breadth and constituent plant/animal ratios were subject to fluctuations through time due to variable local resources and long-term environmental change (Brown 1991; Sobolik 1991).

Desert semi-succulents of lechuguilla, sotol, and yucca constituted a sportion of a broad spectrum diet by highly mobile hunter-gatherers (Sobolik 1991). Hardy and drought resistant, these plants can be found across the region. Unlike hunting which requires energy to track and kill the prey, the majority of energy (measured in kilocalories by researchers) expended on the desert semi-succulents is related to the processing and cooking of plant to make it edible. The building of an earth oven, and processing the semi-succulents has experimentally shown low yield kilocalorie returns only capable of sustaining small group for a few days (Dering 1999).

Coprolite studies in the LPC suggest only small shifts in the available dietary economy since the end of the Early Archaic. The earliest coprolite evidence for consumption of agave was found in Hinds Cave (41VV456) and dated to ca. 3,700 cal B.C. (Riley 2010; Edwards 1990; Williams-Dean 1978); however archaeological evidence below suggests a much earlier date.

Dietary variability in the coprolite studies is seen to reflect seasonal variability in the exploitation of resources at individual sites (Sobolik 1991). A recent reanalysis of coprolite data proposes that this seasonal diet is mainly composed of prickly pear fruit and nopales, sotol, and lechuguilla, and that these three plants were exploited during a more random, sporadic, occupation of shelters rather than during seasonal rounds (Riley

2008: Riley 2010). Sotol and lechuguilla began to spread across the LPC at the end of the Pleistocene (Edwards 1990:98); it was during this time that the first conclusive evidence for humans appears in Bonfire Shelter. With the appearance of both semi-succulent plants and human in the LPC by the Early Archaic, it is possible that xeric plant consumption began much earlier than the Hinds Cave coprolite studies suggest.

Diet, subsistence strategies, and population demography have been key concerns of researchers in the Lower Pecos for decades. A number of hypotheses have been put forward in the last 50 years to explain settlement patterns and dietary changes. These hypotheses are typified by four main authors: Marmaduke, Shafer, Turpin and Brown (Table 1.1).

Table 1.1. Summation of different proposed settlement models by researchers.

Researchers	Upland Use	Semi-Sedentary Shelter Use	Start of Intense Semi-Succulent Exploitation
Marmaduke	During mesic intervals or bison migration	During environmental stress, concentrate on water resources	Middle Archaic
Shafer	Mainly upland "tethered nomads"	Water territoriality	Paleoindian
Turpin and Bement	Mainly upland	Shelters only used during "warm" or "cool" seasons	Early Archaic
Brown	Moving from exhausted resource to new locale	Mainly shelter occupation	Early Archaic

In his 1978 dissertation, William Marmaduke used the frequency of projectile point types in dry rockshelters across the Trans-Pecos to the west and the Lower Pecos to infer fluctuation in population density through time. The frequency of point types were used as a proxy for site population fluctuations in shelters. He suggested that these fluctuations may indicate a greater use of nomadic upland camps during mesic intervals and periods of bison immigration (Marmaduke 1978:243). He also cautioned that the increased frequencies of projectile points do not necessarily represent an increase in population in shelters caused by a surplus of resources. Rather, the increase in projectile point frequencies may indicate intensity of use from populations confined to water sources due to environmental stresses, and therefore a decline in resource availability.

Harry Shafer (1981) argued that the Early and Middle Archaic shelter deposits represent only seasonal use by small bands of hunter-gatherers who mostly occupied the uplands to exploit the resources of the region (Shafer 1981:136). These small bands of similar ideology or language exhibited water territoriality, “tethered nomadism” (Taylor 1964), as well as regional territories, or ‘home-ranges’, denoted by similar motifs in the Pecos River Style pictographs (Shafer 1976:6; 1977:132-133). Tethered nomads exhibit Binford’s high logistical mobility, and Kelly suggests they may exhibit long distance foraging of hunter-gatherers (2007:127)

Solveig Turpin suggested deer and xeric plant exploitation began in the Late Paleoindian period and increased during the Early Archaic and through the Middle Archaic (Turpin 1994:70; Turpin 2004:269). Along with variable exploitation of these resources, Turpin interprets the appearance of the Montell point, changes in tool assemblages, and inferred dynamic changes in pictograph style as the arrival of Plains big game hunters in the Late Archaic who followed herds of bison south into the Lower Pecos (Turpin, 2004:272). Turpin and Bement hypothesized dry rockshelters were utilized by focused upland hunter-gatherers during “warm” and “cool” seasons where the shelter roof would provide protection from the weather conditions (1992:54).

Kenneth Brown (1991) proposed a model in which small semi-sedentary hunter-gatherer groups foraged within centralized economic zones for resources. He posited a foraging settlement system in which shelters represented loci for seasonally occupied habitation and plant baking sites. From these loci small groups would collect local resources, this would continue until resource exhaustion at which time the small band would relocate to a new locale.

Brown (1991) hypothesized that the archaeological evidence in the LPC should indicate narrow dietary breadth at the beginning of a single occupation in Baker Cave with increasing dietary diversity until site abandonment. He draws upon the diet breadth model of optimal forager theory and ethnographic evidence of hunter-gatherer resource procurement for evidence of shelter use. According to this model, during the initial period of a single site occupation high-value dietary resources constitute a large portion of the economy. These high-value resources are usually high-risk and high-reward game, such as deer. As local high-value resources are exhausted over time, low-value and low-risk foods such as xeric plants, rodents and insects supplant the diet (Brown 1991:100-102). Once the local resources are exhausted, the locality is abandoned. He hypothesized that evidence for dietary breadth could be found in the coprolite data as well as the faunal and botanical remains within Baker Cave (Brown 1991). However, the evidence for a dietary breadth model can only detect this decision making over a long period of time (Kelly 2007:90).

Together, these hypotheses have been grouped into two contrasting models of subsistence strategy that have been debated based on the data collected at dry rockshelters and caves: "semi-sedentary rockshelter and canyon collectors" and "nomadic foragers" (Koenig 2012:36-45). Underlying each of these settlement models are the two types of hunter-gatherer settlement systems outlined by Binford (1980): the foragers and the collectors. The foragers and collectors each exhibit two different degrees of mobility: residential (movement of entire group to another camp) and logistical (movement of small task-specific groups to leave and return to camp). Kelly aptly sums up these two types,

> Foragers move consumers to food resources, and thus map onto a region's resource locations, while collectors move residentially to key locations not necessarily defined by food (e.g. where water or firewood are available) and use long logistical forays to bring resources to camp. *In general*, Binford suggested that foragers have high residential mobility and invest little effort in logistical movements, while collectors make few residential moves and frequent, often lengthy logistical forays. [Kelly 2007:117; emphasis in original].

According to Koenig (2012), in the LPC the semi-sedentary *collectors* model suggests shelters and caves were used as seasonal habitation centers from which parties were sent to gather and process local resources. The nomadic *foragers* model suggests the nomadic people of the Lower Pecos inhabited the uplands to better exploit area resources, only utilizing shelters seasonally or during times of increased resource pressure and climatic change.

Overview of Eagle Nest Canyon

The rockshelters excavated for this thesis are located in Eagle Nest Canyon (ENC). The ENC, also called Mile Canyon, is a deeply incised, narrow, box canyon approximately 1.7 km long located just east of Langtry, Texas on Skiles Ranch. At the canyon head, the intermittent Eagle Nest Creek cascades into a large plunge pool before winding through the canyon to meet the Rio Grande at its mouth. Along the limestone canyon walls are six rockshelters with cultural deposits: the two largest shelters are

Bonfire Shelter (41VV218), Eagle Cave (41VV167). There are also four smaller shelters: Horse Trail Shelter (41VV166), Skiles Shelter (41VV165), Kelley Cave (41VV164), and Mile Spring Shelter (41VV2163). The canyon floor contains several tinajas, which fill with water after rain or flood, a prominent spring just below Mile Spring Shelter (now buried by sediment), and other small springs upstream from Eagle Cave.

The Rio Grande has historically been very shallow at the mouth of the canyon due to the sediment discharged from ENC flood events forming a gravel bar. This has made the mouth of the canyon easily traversable by horses and people (Jack Skiles 1996:135). On the Mexican side of the Rio Grande, a small section of the land gradually slopes to the river bend, creating the only easily passable river crossing for tens of kilometer. The nearest known crossing to the ENC is the Pecos River crossing, approximately 22 km downstream. Historic accounts document the use of the Eagle's Nest Crossing by the Comanche and Lipan Apache, The earliest account is from 1729,

> Jose de Berroteran was sent to explore the area searching for a site for a new presidio. His mission was also punitive, intended to halt raids by hostile Indians into northern Mexico. His troop of 89 soldiers and 46 Indian scouts paralleled the Rio Grande from Del Rio to a crossing near present-day Langtry, on to Dryden where the futility of his mission was made obvious by lack of water and difficult terrain. [Turpin 1984a:37].

The next known account of the crossing does not appear until 1875 when the Seminole Scouts, led by Lieutenant Bullis, traveled from Painted Cave to Eagle's Nest Crossing where they found a trail of horses. They followed the trail to the mouth of the Pecos where they engaged the Comanche in battle (Turpin 1984a:37). Later, during the construction of the Southern Pacific Railroad in 1881-1882, the Lipan Apache struck a Chinese work gang on the Eagle Pass extension, wiping out the camp (Turpin 1984a:28).

The Lipan Apache likely used this crossing to raid the Eagle Pass extension of the railroad.

Enclosed within its steep canyon walls, the Rio Grande would not have meandered in the area of Langtry for millennia, suggesting that Eagle's Nest Crossing was likely utilized by the inhabitants of the LPC for thousands of years prior to these historic accounts. The crossing was also a likely factor contributing to the extensive occupation of the canyon's sites, including Skiles Shelter and Kelley Cave, the subjects of this study.

Skiles Shelter (41VV165)

Skiles Shelter is a south-facing rockshelter, with a relatively shallow overhang, on the east canyon wall measuring 36 m in length and 7 m in depth (Figure 1.1). The shelter is divided into two distinct alcoves by a large tufa mound in the center. The western, upstream, recess contains long limestone steps, or benches, with numerous grinding facets and a large panel of Pecos River style pictographs along the northwest wall. The large tufa mound contains grinding facets on top and a polished surface with numerous deeply incised lines. The eastern alcove of the shelter does not contain any bedrock features or rock art, and very little sediment remains inside the dripline, possibly due to greater erosion at the downstream end of the shelter.

Figure 1.1. Skiles Shelter, view from the west. Kelley Cave is located immediately left of photo.

Canyon maps and photographs from the one of the early archaeological expeditions through the LPC, Sayles 1932 (discussed in Chapter 2), depict a large mound of alluvium ("sandy adobe") outside of the shelter (Figure 1.2). This sloping alluvial landform rises to the elevation of the floor within the shelter. An enormous amount of fire-cracked rock, charcoal, and cultural debris from shelter occupation covers the talus slope immediately below the shelter. Separating Skiles Shelter from neighboring Kelley Cave is a ten-meter-wide portion of canyon wall (see Figure 1.3). This wall contains ample small ledges on which to put one's feet and natural hand holds worn smooth from use. A more in-depth description of Skiles Shelter is presented in Chapter 4.

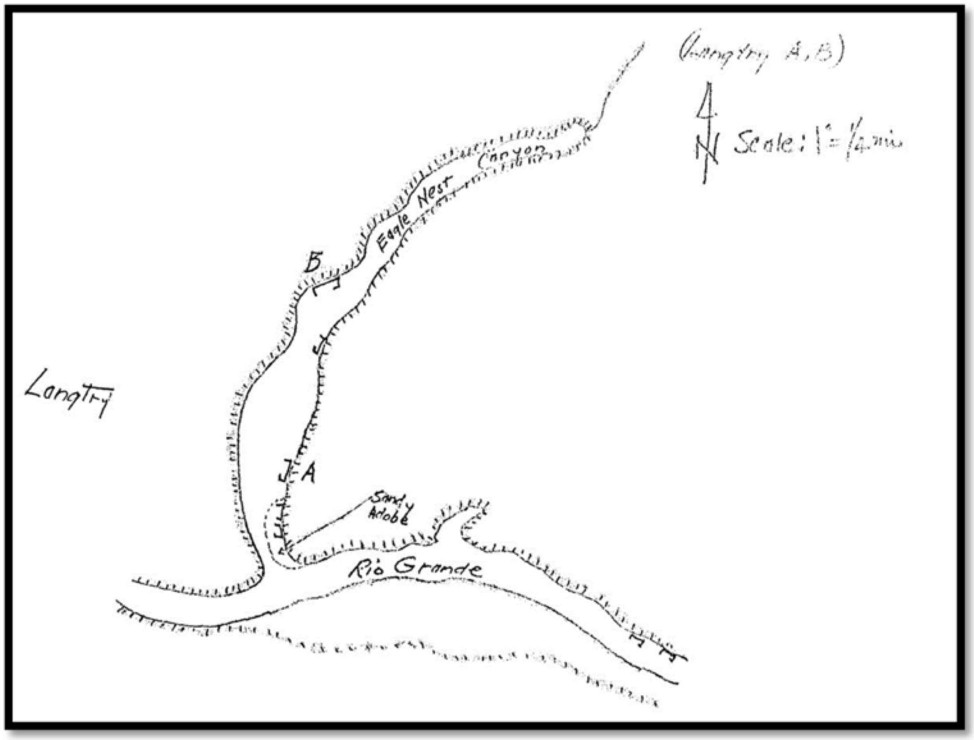


Figure 1.2. Sayles 1932 map of ENC with "sandy adobe", Skiles Shelter not labeled. Kelley Cave is "A" and Eagle Cave is "B", courtesy of Texas Archeological Research Laboratory. The two alcoves of Skiles Shelter are shown as brackets, but otherwise unlabeled.

Figure 1.3. Kelley Cave, viewed from west, with ledge leading to Skiles Shelter on the right. The upstream end of the canyon is to the left of this picture, downstream to the right.

Kelley Cave (41VV164)

Kelley Cave is a southwest facing shelter approximately 28 meters wide and 12 meters deep (Figure 1.3). The floor of the rockshelter slopes from east to west within the dripline, and the highest portion of the shelter floor in Kelley Cave measures over seven meters above the elevation of the floor in Skiles Shelter. Kelley Cave has a poorly preserved panel of Pecos River style pictographs along the southern wall with other eroded pigment sparely scattered throughout the shelter walls and low portions of the ceiling. Within the shelter are three sizeable roof blocks just inside the western dripline, two of which appear to have fallen on top of occupation deposits. The largest, relatively flat, roof block was utilized with grinding facets along its edge and a polished surface with deep striations across its face. More grinding facets are located along the western edge of the dripline and 10+ others were found along a limestone outcrop on the southeastern edge outside of the dripline. Kelley Cave's talus slope is extensively covered with fire-cracked rock. A more in-depth description of Kelley Cave is presented in Chapter 4.

Eagle Nest Canyon

The ENC represents a cross-section of shelter sites found in the LPC; with shelters ranging from large (Eagle Cave) to small (Horse Trail Shelter), and evidence of occupation dating back to Early Paleoindian times (Bonfire Shelter), and continuing at least intermittently throughout prehistory. Rockshelters and other karstic features undoubtedly occupied a critical role in the prehistoric past of the LPC. Although few new shelter excavations have been conducted in the region since Skyline Shelter in 1992 (Turpin and Bement 1992), since the 1990s there has been a growing emphasis on the importance of utilizing a multi-disciplinary approach in the excavation and analysis of these perishable sites (Brown 1991; Robinson 1997; Sobolik 1991; Byerly et al. 2005; Dering 2007; Riley 2008). In order to evaluate the previous dietary change and settlement pattern hypotheses, this study uses a multi-faceted approach incorporating focused geological, zooarchaeological, archaeobotanical analyses with data from new excavations in Skiles Shelter and Kelley Cave.

Thesis Organization

The remaining chapters are organized as follows: Chapter 2 reviews the archaeological history of the ENC, Skiles Shelter, and Kelley Cave. Chapter 3 describes the field and lab methods I used for excavations as well as those used in the geoarchaeological, archaeobotanical, and faunal analyses. Chapter 4 and 5 present the site overview, formation processes, and excavation results from Skiles Shelter and Kelley Cave, respectively. Chapter 6 includes a discussion of the identified features in Kelley Cave as well as statistical analysis of the 1/8th inch screen sort material and burned rock data from both sites. The final comparison and discussion of Skiles Shelter and Kelley Cave shelter use through time is presented in Chapter 7. This chapter also includes a comparison in material culture to other shelter sites and concluding remarks.

Appendices at the back of this thesis provide much of the data results used in the analysis and discussion. Appendix A is a list of the plants observed and recorded in the canyon area by Leslie Bush. Appendix B presents the Ground Penetrating Radar (GPR) results from Kelley Cave. Appendices C and D are examples of excavation and "Rock Sort" forms used during this investigation. The calculated excavated volumes for both sites are listed in Appendix E. The soil profile descriptions and results of the geoarchaeological analysis are presented in in Appendix F and G, respectively. Appendix H contains the artifact inventory for Skiles Shelter. The faunal analysis results for both sites is included as Appendix I, and the botanical results for Kelley Cave are included in Appendix J. Finally, Appendices K, L, and M are the artifact inventory, quantified burned rock, and 1/8th inch screen sort results for Kelley Cave, respectively.

CHAPTER 2: ARCHAEOLOGICAL BACKGROUND

In the Lower Pecos Canyonlands (LPC), the organic artifacts in rockshelters and caves can be preserved for thousands of years due to the arid climate and the environmental protection the shelters provide. Protected rockshelters contain a wealth of archaeological materials representing activities which took place within: including rituals, burials, food processing, habitation, lithic tool production, and many others (e.g. Marmaduke 1978; Turpin et al. 1986; Word and Douglas 1970; Jurgens 2005; Boyd 2003; Ross 1965). Perishable materials such as plant fibers, wood, leather, and coprolites can preserve in these dry sheltered deposits for thousands of years. Mummified human bodies, though rare, have also been recovered and retain desiccated soft tissue, thus allowing a glimpse into an individual's diet and cause of death (Bryant 1974; Turpin 1988; Reinhard et al. 2003).

Due to their potential for excellent preservation, rockshelters and caves have been the focus of the majority of archaeological investigations in the region. This focus has long biased our understanding of the prehistoric people and their use of the landscape. Slowly this focus has widened with new understanding of open-air features as relate to shelter sites and patterns of larger landscape exploitation (Saunders 1986, 1992; Dering 1999, 2002; Koenig 2012).

Unfortunately, the same preservation conditions which allowed so many artifacts to survive in the caves and rockshelters of the Lower Pecos Canyonlands for millennia lead to the destruction of the deposits in many, perhaps most, shelter sites beginning in the early 20th century through looting (Davenport 1936; McGregor 1985; Martin and Dorchester 1941; Woolsey 1936) and by complete archaeological excavation of the sites (Maslowski 1978). Archaeological investigations in the LPC began in the early 20th century with a rush of museums into the area to collect display quality artifacts leaving little in the way of recorded provenience (Black 2013, Hall and Black 2010).

During the 1930 and 1940s, many rockshelters and caves were excavated extensively by looters and early archaeologists. The desirability of well-preserved woven fiber artifacts, such as baskets, and other perishable artifacts lead many more shelter sites to be looted, a pattern that continues through the present day (Turpin 1998). In the 1960s, the Amistad Salvage Project brought more modern excavation techniques to the LPC (Black 2013). New disciplines such as geology, zoology, and palynology were used to reconstruct past climates and diet during this time (Alexander 1974). Amistad Reservoir itself destroyed the surviving deposits of many shelters through inundation, such as Arenosa Shelter (Dibble 1967). Presently, rockshelters are being damaged by the siltation of the Rio Grande by the reservoir, leading to higher and higher flood levels along the canyon walls (Black and Dering 2008). Despite the destruction from early excavations and subsequent looting there is still much that can be learned about how rockshelters were utilized in prehistoric times.

History of Investigations of Eagle Nest Canyon

Eagle Nest Canyon has been the locus of intermittent archaeological investigations since the early 1930's (Table 2.1).The earliest recorded researcher in Eagle Nest Canyon (ENC) was Mary Virginia Carson. Carson was a part of a small expedition sent by the Witte Museum, San Antonio, to investigate rockshelters near Langtry. The goal of this scouting expedition was to assess the prehistoric sites for their archaeological content and to record the rock art found therein (McGregor 1985:127). During this expedition, Carson sketched a number of pictographs during this expedition including some of those in Eagle Cave.

In May 1932, E.B. Sayles and J. Charles Kelley conducted the first documented excavations in the ENC (Figure 2.1) as part of Sayles' famous archaeological survey of Texas. Sayles labeled Eagle Cave Langtry B, with a designation of Tex:X:2:9 in his numerical site system. He also called Kelley Cave 'Langtry A' (see Figure 1.2), and in his site system notes he seems to have assigned both Tex:X:2:1 and Tex:X:2:8 to the shelter. The expedition did not excavate in Skiles Shelter, however it was mentioned in the Tex:X:2:1 notes by Sayles, and appears in two of his photographs (Figure 2.2).

Figure 2.1. Overview, from Sayles 1932, of Kelley Cave (left) and Skiles Shelter (right) with "Twin Caves" and the Rio Grande in background, courtesy of Texas Archeological Research Laboratory

Table 2.1. Previous archaeological History of Eagle Nest Canyon.

Trinomial	Site Name	Other Names	Investigators	Work Conducted
41VV167	Eagle Cave	Sayles Langtry B; Tex:X:2:9	E.B. Sayles May 14-17, 1932	27-x-5 ft trench in from dripline; numerous shallow test pits
		Kirkland's Langtry Site #1	Davenport Sept 11-23 1935, Feb. 10-Mar.12 1936	Dug massive trench: 73-x-8 ft; Also excavated trench along back wall
		H.C. Taylor's Site #46	F. Kirkland Aug. 2 1935	Recorded rock art
		"Big Cave" in Eagle Nest Canyon	G. Martin Dec. 1939	Unknown digging
			Graham and Davis 1958	Documented and surface collected
			R. Ross Sept. 25-Dec. 18, 1963	Expanded Witte trench, new units
41VV218	Bonfire Shelter	Bone Cave	Graham and Davis Feb. 1958	Documented and surface collected
		Ice Box Cave	M. Parson, fall 1962	"Probe"/test excavation
			D. Dibble Sept. 24, 1963-Feb. 27, 1964	Deep excavation
			L. Bement Nov.,Apr., 1983, Apr. 1984	Expanded excavation and added new units
			R. Byerly summer 2005	Screened backdirt
41VV164	Kelley Cave	Sayles Langtry A; Tex:X:2:8; Tex:X:2:1	T. Sayles J. Kelley May 10-14, 1932	Two small trenches, trench along back wall
		Kirkland's Langtry Site #2	F. Kirkland Aug. 2, 1935	Recorded rock art
		H.C. Taylor's Site #42	C. Martin Dec. 1939-Sept. 1940	Extensively dug into shelter deposits
		Martin's "Little Shelter"	G. Mear Dec. 27-29, 1949	16-x-4 ft trench on the south side of the shelter. Collected from only one 4-x-4 ft unit
		Mear's "Mile Canyon Shelter"	Graham and Davis Feb. 28, 1958	Documented and surface collected
41VV165	Skiles Shelter	Kirkland's Langtry Site #4	Graham and Davis Feb. 28, 1958	Documented and surface collected
		H.C. Taylor's Site #43?		
41VV166	Horse Trail Shelter	None	Graham and Davis Feb. 28, 1958	Documented and surface collected
41VV2163	Mile Spring Shelter	Taylor's "Skiles Cave" Site # 44	H. Taylor, Jr. Sept. 1947	Excavated trench(es) of unknown dimension

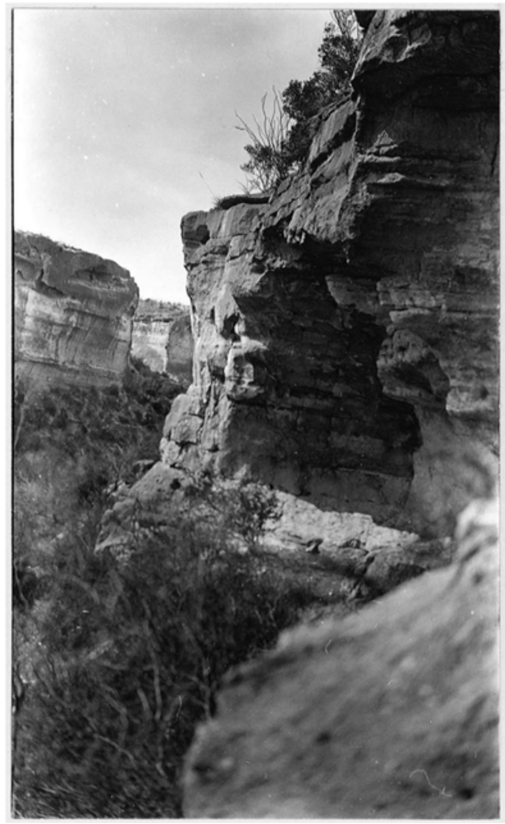


Figure 2.2. One of the earliest photographs taken of Skiles Shelter, from Sayles 1932. View looking upstream taken from downstream end of Skiles Shelter which is partially visible on right, courtesy of Texas Archeological Research Laboratory.

In Eagle Cave, Sayles and Kelley opened up a shallow 27-foot-long trench inward from the dripline of the shelter (Figure 2.3). J. Charles Kelley kept reasonably detailed notes of their excavations and some of the recovered artifacts are housed at the Texas Archeological Research Laboratory (TARL) at the University of Texas at Austin. His notes state that the trench was excavated until they encountered what they determined to be sterile clay, approximately six feet below the surface.

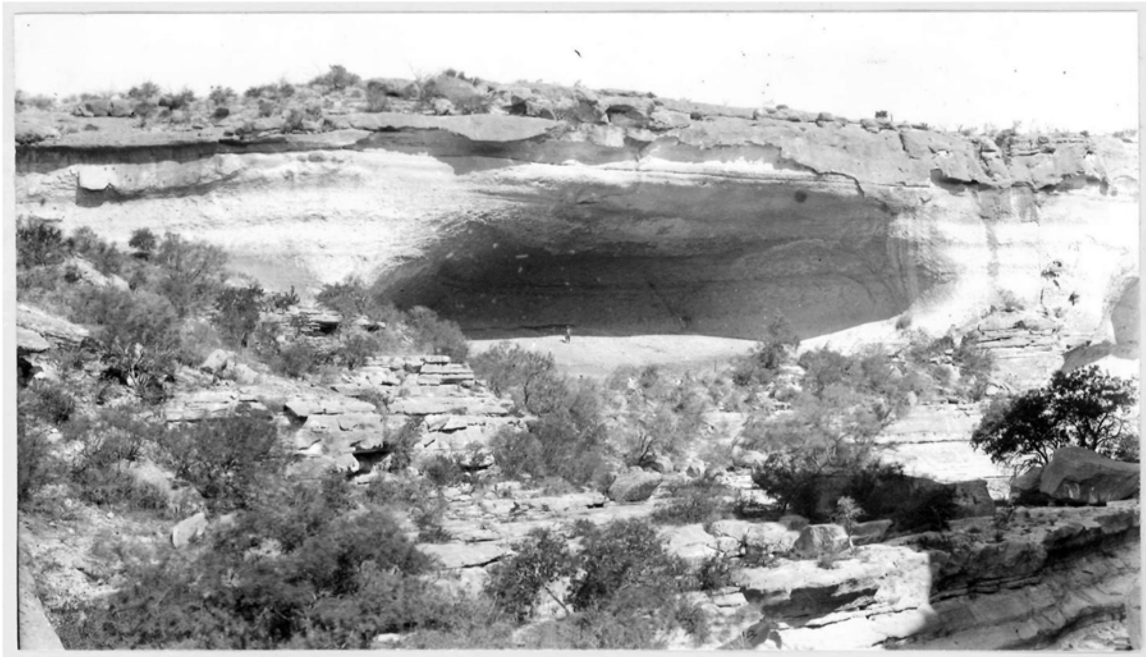


Figure 2.3. Eagle Cave with trench barely visible as shadowed line in shelter deposits, from Sayles 1932, courtesy of Texas Archeological Research Laboratory.

The Sayles' excavations in Kelley Cave consisted of a deep 14-foot-long trench along southern wall where the extant Pecos River style rock art is located. This trench, Trench 1, was dug approximately six feet deep, and terminated at a "sterile clay" layer (Kelley 1932). Sayles and J. Charles Kelley also conducted two small shallow trenches, Trench 2 and 3, toward the interior of the shelter in order to sample stratigraphy which Sayles documented in his notes (Tables 2.2, 2.3, 2.4). The excavators both noted a large amount of fiber on the surface of Kelley Cave prior to excavations (Figure 2.4). J. Charles Kelley's field notes also mention encountering infant remains in Kelley Cave with no clear signs of internment.

Table 2.2. Sayles 1932 documented stratigraphy for Trench 1, along the south wall.

Trench 1 (N. extremity)		
Description	**Thickness**	**Level**
Surface		1
Loose dust, goat dung	2"	
Adobe	3"	
Rotted fiber	5"	
Charcoal, ash, stone burned	9"	2
Burnt stone	4"	
Adobe and burnt stone underlain with rotted fiber	9"	
Adobe (not continuous)	5"	
Rotted fiber	3"	3
Ash	6"	
Adobe	4"	
Charcoal streak	6"	
Fine L.S. shale	4"	4
Heavy charcoal	2"	
Limestone shale to bedrock		5

Table 2.3. Sayles 1932 documented stratigraphy for Trench 2, in "hearth fill".

Trench 2		
Description	**Thickness**	**Level**
Surface		1
Goat dung, dust	3"	
Adobe	2"	
Fiber, burnt	4"	
Ash	4"	
Dusty ash, charcoal	2"	
Adobe on rotted fiber	3"	2
Dust, charcoal, burnt stone	2"	
Charcoal, large burnt stone	4"	
Adobe	4"	
Flat stone, charcoal, flint	10"	
Adobe on ash	7"	
Stone, charcoal, rotted fiber	6"	3-4
Heavy charcoal, ash		

Table 2.4. Sayles 1932 documented stratigraphy for Trench 3, near fiber on surface.

Trench 3 (In ash pit)		
Description	**Thickness**	**Level**
Surface		1
Loose dust and goat dung	2"	
Adobe	1"	
Fiber	3"	
Ash	5"	
Dusty ash, charcoal pushed	5"	
Adobe, concreted	2"	2
Dusty ash	9"	
Stone, charcoal	6"	
Dusty ash	12"	
Stone, adobe	7"	
Flat, burnt stone	5"	3
Ash		

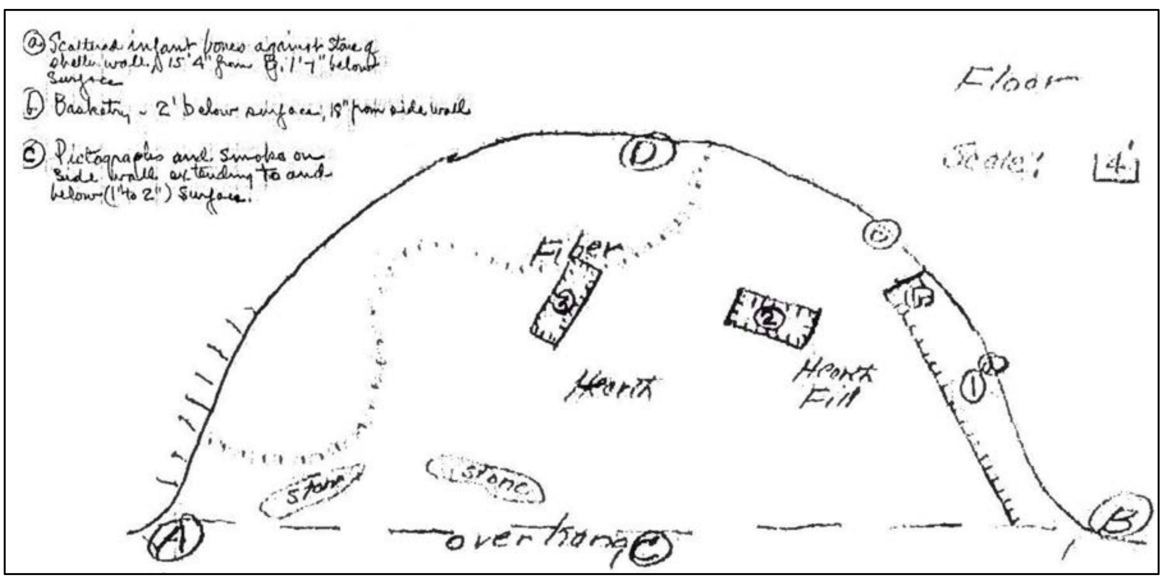


Figure 2.4. Sayles 1932 Kelley Cave investigation plan map with Trench 1 (right), Trench 2 (middle), and Trench 3 (left). The fiber layer on surface is documented with the hatch-marks on the left side of the shelter, courtesy of Texas Archeological Research Laboratory.

The Witte Museum returned to the canyon in 1935 and 1936 with J. Walker Davenport leading the expedition. The Witte expedition conducted a massive 73 ft. long trench from the dripline to the back wall and a trench along the back wall of the shelter, forming a large 'T'. The expedition terminated at a sterile "original cave deposit" below the cultural layers (Davenport 1938:23). Like many of these early investigations, the goal of the Witte Museum dig was to secure display-quality artifacts. The surviving notes housed at the Witte Museum do not detail all the artifacts found nor discuss stratigraphy beyond simplified sketches (Davenport 1935, 1936). However, the 1938 report contains somewhat more detailed stratigraphic descriptions.

In August 1935, Forrest Kirkland came through the area recording Pecos River style pictographs. Kirkland, a trained draftsman, painted water color renderings of the rock art of Eagle Cave, Kelley Cave, and Skiles Shelter (Kirkland and Newcomb 1967). During this time he also assigned his own number system to the shelter sites.

During background research at TARL a three-part photo album titled *Photographic Record of the Material Culture of the Big Bend Basket-maker* was found. This album contains mainly photographs of artifacts recovered from rockshelter excavations undertaken by the "George C. Martin Expedition" in 1939-1940. The photographs are of artifacts from shelters in Val Verde County, Mile, Skiles, and Shumla Canyons, with little detail on which shelters specifically were excavated. A few photographs depict Kelley Cave, called "little cave in Eagle Nest Cañon", and workers screening within (Figure 2.5). It is impossible to tell where within and to what extent Kelley Cave was excavated by this expedition, however one photo shows an overview of Kelley Cave with large depressions where the southern Sayles trench was placed (Martin and Dorchester 1941a, 1941b). Martin Expedition dug in several other shelters, however the extent of their excavations is unknown. A second very similar version of this photo album in the Witte Museum collection includes a few different photographs of Martin's expedition, but nothing that can be accurately attributed to Kelley Cave or Skiles Shelter.

Figure 2.5. Photographs of Martin Expedition at Kelley Cave. Note the Sayles trench along wall still open (Martin and Dorchester 1941a).

Martin was formerly associated with the Witte Museum and participated in a number of excavations prior to this time, including the Shumla Caves (Martin 1936).

However, this "George C. Martin" Expedition was likely privately funded and seemingly for the expressed purposes of collecting artifacts. Beyond these two photo albums, no other record of this expedition is known and the whereabouts of the collected artifacts is unknown.

In 1947, Herbert C. Taylor conducted fieldwork in the ENC for his Master's thesis from the University of Texas which looked at 48 sites across the LPC. Taylor's Site #44 was previously attributed in the TARL archives to what we now know as Skiles Shelter (41VV165). During background research, I discovered that Taylor's "Skiles Shelter" site description does not match the location of 41VV165,

> Skiles Cave is located about seven hundred yards above the mouth of Mile Canyon, mid-way on the eastern wall. It has a deep midden deposit, covered to some extent by rock falls, in the northern portion of the cave, The southern portion of the midden has eroded away, The shelter is located above a permnnent[sic] spring in the floor of Mile Canyon, This site was test-trenched by Nelms and Taylor in the summer of 1947. [Taylor 1949:65]

Taylor does not give any details on his excavations at the site, only an added footnote below his site description, "Taylor has since stated that his techniques employed at this site were too poor to justify analysis of the excavation." (Taylor 1949:65). No additional records or collections from Taylor's work are known to exist.

Site #44 is described as "a hundred yards or less" from Site #46, identified as Eagle Cave (Taylor 1949:65-66). This location describes a rockshelter across the canyon from Eagle Cave, which had not been recorded until the present investigation. Interestingly, Kirkland had photographed this shelter from Eagle Cave (Figure 2.6) and labeled it Langtry No 2, which is actually Kelley Cave (Kirkland and Newcomb 1967:41).

In 2013 I visited the site and found evidence of cultural activity such as chert artifacts, charcoal, and burned rock, among the dense limestone roof spall debris of the shelter floor and on the talus slope. I formally recorded the site, renamed it Mile Spring Shelter, and it was assigned the trinomial 41VV2163. Additional research at Mile Spring Shelter was not part of this thesis research.

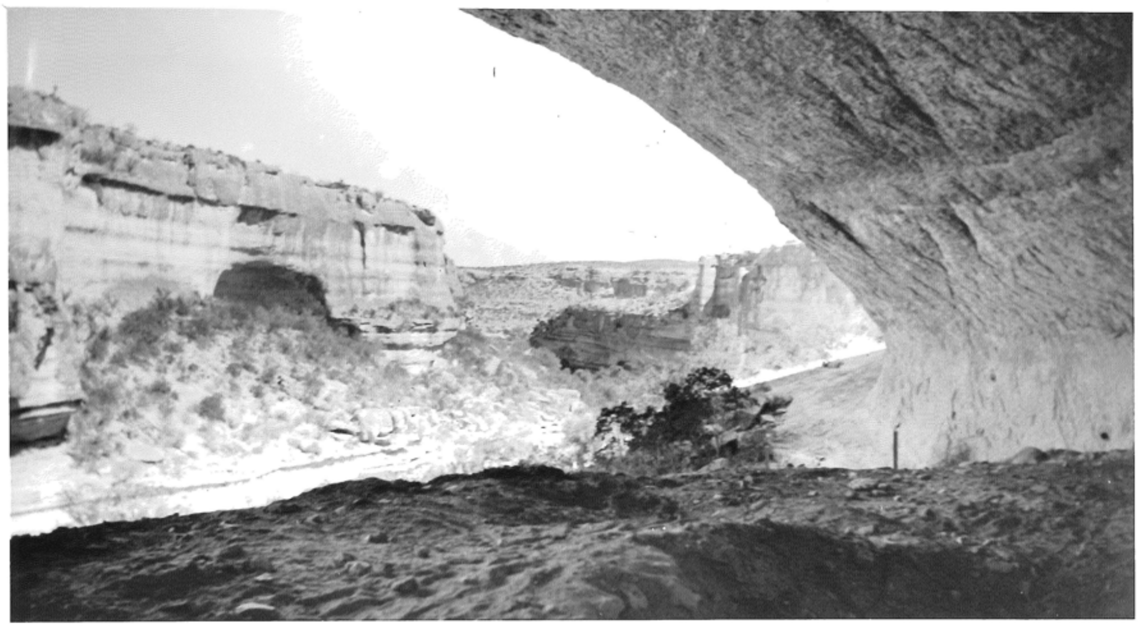


Figure 2.6. View of Mile Spring Shelter from Eagle Cave, 1935 (Kirkland and Newcomb 1967:41).

In December 1949, the Texas Memorial Museum at the University of Texas sent Gene Mear, a geologist, to the ENC to search for evidence of Paleoindian occupation. To do this, Mear spent a week excavating a 16-x-4 foot trench in the south portion of Kelley Cave looking for cultural artifacts alongside extinct Pleistocene fauna. The trench was divided into three units measuring 4-x-4 feet square. He used red paint to mark "A" and "B" on the back wall to indicate the relative position of the trench walls. Mear also painted numbers 1-4 on a low shelter roof projection to indicate the relative position of his unit walls (Figure 2.7).

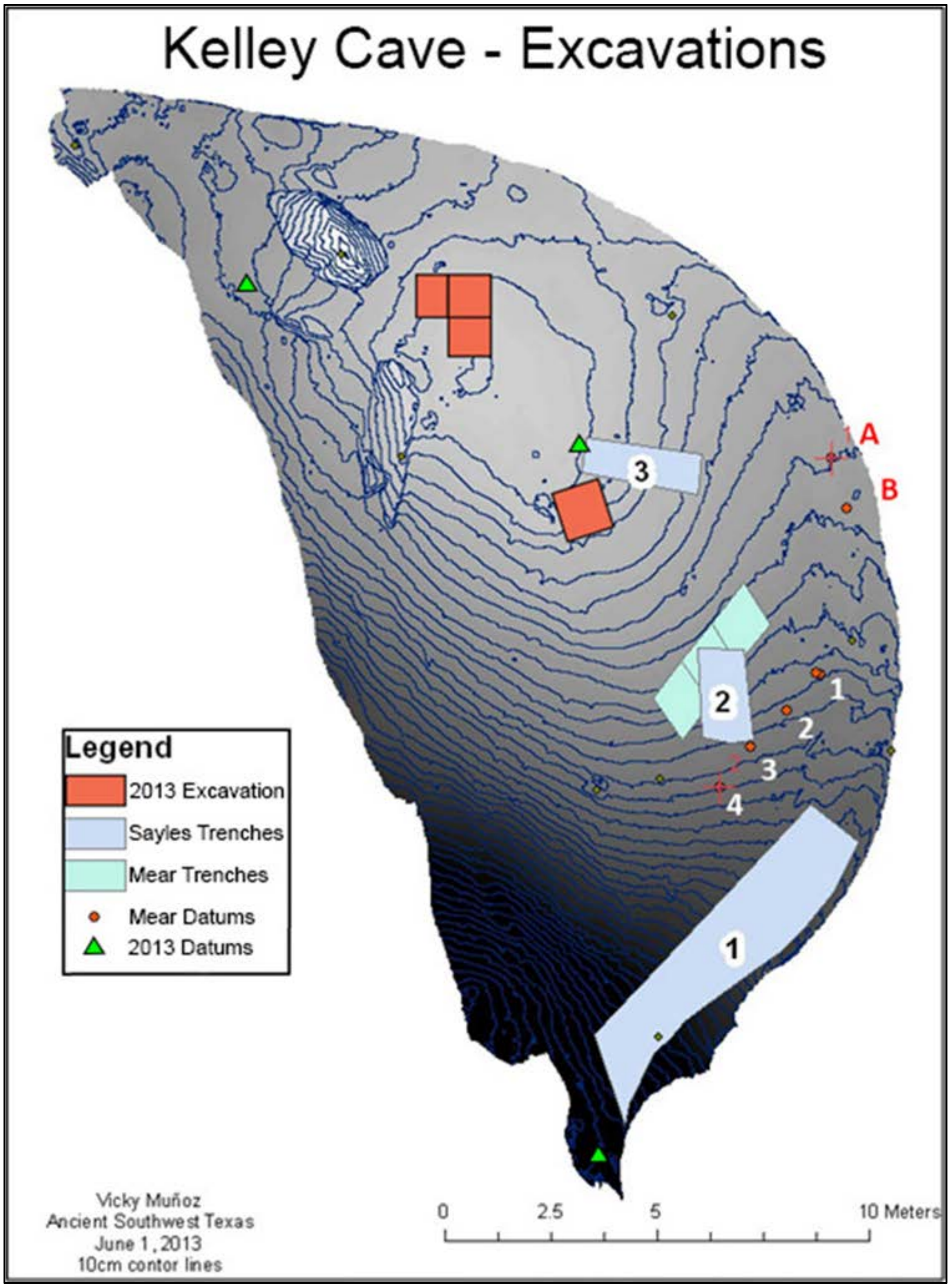


Figure 2.7. Floor of Kelley Cave with drawn Sayles Trenches (1-3) and Mear excavation units using plotted markings on wall, courtesy of Vicky Muñoz.

The Mear trench unit closest to the dripline was removed without screening in order to allow excavation of the middle unit. The majority of Mear's notes refer to his excavation of the middle trench unit with only a few notes about the upper deposits of the innermost trench unit. Mear notes that "old pits and trenches intersect" in the upper layers of his trench to a depth of 36 inches below surface. The previous excavation was likely Sayles' Trench 2 (see Figure 2.7), which Mear would not have known at the time.

Mear terminated the trench six feet below surface in a 'sterile' sand layer. At the end of his one week time, he had not found evidence in Kelley Cave of human occupation alongside extinct fauna (Mear 1949). The artifacts recovered from his excavations are curated at TARL. The collection could benefit from modern analysis.

Archaeologists later found evidence for both Paleoindian occupation and extinct Pleistocene fauna in Bonfire Shelter (Dibble and Lorrain 1968; Bement 1986). Bonfire Shelter, initially called Icebox Cave, was first excavated by Michael Collins sometime in the mid-1950's when he was in high school. As a teenager he dug a small pit, within which encountered Bone Bed 3 (Black 2001).

In 1958 John Graham and William Davis conducted preliminary survey of five of the shelter sites of the canyon as part of a broader archaeological site survey prior to the construction of the Amistad Reservoir. Graham and Davis (1958) conducted a surface survey and collection of the sites in order to evaluate their research potential for further archaeological investigation. Their initial survey led to further investigation of both Eagle Cave and Bonfire Shelter. Following this survey, Mark L. Parsons tested Bonfire Shelter in 1962 and discovered burned bone and a projectile point (Dibble and Lorrain 1968:10).

Richard E. Ross, working with the Texas Archeological Salvage Project (TASP) at the University of Texas at Austin, conducted further archaeological investigations in Eagle Cave in 1963. Ross and crew expanded the existing Witte trench in both width and depth, as well as opened up additional units on the north side of the shelter. Artifact provenience was recorded based on stratigraphic zones described in the report. Radiocarbon dates from this investigation indicated the use of Eagle Cave dated back to at least the Early Archaic (Ross 1965).

David S. Dibble supervised the extensive TASP excavations of Bonfire Shelter in 1963 and 1964. The excavation and subsequent faunal analysis by Dessamae Lorrain put forth the hypothesis that Bonfire Shelter represents a bison jump site, the southernmost in North America. The upper most bone bed, Bone Bed 3, contained hundreds of modern *Bison bison* bones which had been butchered and burned (Black 2001). It was hypothesized that these bison were driven into a blind cleft in the canyon causing numerous individuals to fall to their death on the talus cone at the downstream end of the shelter.

A second, much earlier bison jump event was inferred from the lower Bone Bed 2. Like Bone Bed 3, this bone bed contained numerous bison bones, and signs of butchering. Bone Bed 2 contained *Bison antiquus* as well as associated Folsom and Plainview points, indicating Early Paleoindian use of the canyon. Some researchers have hypothesized the relatively low quantity of lithic flakes recovered at the site, indicative of tool resharpening, suggests the shelter represents a secondary processing site from trapping bison in the canyon bottom (Byerly et al. 2005; 2007). However, this interpretation has been rejected by the previous investigators (Bement 2007; Prewitt 2007). Alternatively, the low amount of lithic flakes may be explained by the use of expedient bone tool use.

The third and lowest bone bed is Bone Bed 1. This “bed” consists of multiple layers of bone containing numerous extinct Pleistocene fauna such as elephant, camel, and horse. However there is insufficient evidence to determine if these remains are associated with humans (Dibble and Lorrain 1968:75; Bement 1986:62-63). Solveig Turpin and Leland C. Bement of the Texas Archeological Survey, of the University of Texas at Austin, expanded the still-open trenches in 1983-1984 with the objective of further investigating Bone Bed 1. From Bement argued that Bone Bed 1 was the result of human trapping of animals in the shelter and butchering the extinct Pleistocene fauna within (Bement 1986:61-64).

Chronology of the Lower Pecos Canyonlands

Based on resulting from the work on the Amistad Reservoir Salvage Project, as well as later investigations, archaeologists have created a regional chronology for the LPC. Solveig Turpin (2004) defined the most widely used chronology for the region. The chronology is divided into eleven subperiods. The Aurora (before 12,000 RCYBP), represented by Bone Bed 1, and Bonfire (10,700-9,800 RCYBP), represented by Bone Bed 2, subperiods constitute the first occupations of the area by Paleoindians. These subperiods show evidence of big game hunting (elephants and bison) at Bonfire, the only site known to contain evidence of occupation during these subperiods. The subsequent Oriente subperiod (9,400-8,800 RCYBP) signals adaptation to a more arid environment and broad resource utilization evidenced at sites like Baker Cave (Hester 1983).

According to Turpin's chronology the Viejo subperiod (8,900-5,500 RCYBP) marks the start of the Early Archaic period. During this subperiod, evidence of intensifying xeric plant exploitation appear in shelters with prickly pear-lined floors, woven mats, sandals, and body ornamentation made of sotol or lechuguilla. Cave burials occur at sites like Seminole Sink (Marks et al. 1988; Turpin 1988). The appearance of the Pandale point in the LPC marks the start of the Eagle Nest subperiod (5,500-4,100 RCYBP) and the start of the Middle Archaic period. Archaeological evidence also suggests the increasing use of lower-risk plant resources as a response to the long drying trend. This increasing exploitation may also signal greater small band mobility (Turpin 2004:270). During the San Felipe subperiod (4,100-3,200 RCYBP), the Langtry, Val Verde, and Arenosa point types appear as well as the Pecos River style pictographs (Turpin 2004:269-272).

Turpin's Cibola subperiod (3,150-2,300 RCYBP) represents the beginning of the Late Archaic. During this subperiod, evidence suggests a cooler mesic environment in the region bringing with it grasslands and southern plains bison herds (Turpin 2004). The exploitation of bison at Bonfire Shelter and elsewhere in the region, the appearance of Marshall, Castroville, and Montell point styles, and the posited creation of Red Linear style rock art led Turpin to hypothesize an intrusion of new plains bison hunters into the region (Turpin 1994:72-73). Red Linear has since been shown to be earlier than Turpin hypothesized (Boyd et al. 2013), and the intrusion of a new culture is still a matter of debate (Black and Dering 2008). As Turpin sees it, the mesic environment became the impetus for the people of the region to change their settlement patterns as they adapted, or were supplanted, by new groups. The Flanders subperiod (ca. 2,300 RCYBP) is sees the appearance of Shumla style dart points. The Blue Hills subperiod (2,300-1,300 RCYBP) signals an increase in bundle burials and greater group mobility due to a return to arid conditions (Turpin 2004:272-274). These two subperiods round out the Late Archaic.

Finally, Turpin divides the Late Prehistoric period into the Flecha (1320-450 RCYBP) subperiod and Infierno (~450-250 RCYBP) phase. The bow and arrow appear in the LPC during the Flecha subperiod and the Infierno phase exhibits highly mobile upland settlers with wickiup ring sites (Turpin 2004:274-277).

CHAPTER 3: METHODS

The excavation and documentation methods used in both Skiles Shelter and Kelley Cave were developed and modestly adapted from those in use by the ongoing Ancient Southwest Texas Project (ASWT) led by my thesis supervisor, Stephen Black. Over the course of field investigations I modified my methods to document the complex stratigraphy and cultural features encountered within the two rockshelters. My final excavation and documentation methods are discussed below.

Fieldwork was initially conducted during an archaeology field school from June 3 to July 3, 2013. Further work was carried out with volunteers during the month of August. During this time excavations were completed in Skiles Shelter. Two additional weeks of work were conducted in Kelley Cave during December and January. In total, excavations were conducted over the course of ten weeks.

Field Methods

To evaluate the conditions of the cultural deposits of Skiles Shelter, two adjacent 1-x-1 meter units were placed in the western portion of the rockshelter (Figure 3.1). The units were positioned in the approximate middle of the shelter floor to avoid previous uncontrolled digging and bioturbation along the back wall. These units were set one at a time, with the initial results of Unit A excavations guiding the placement of Unit B adjacent to the west. The excavation units were staked using large metal nails and positioned using two metric tape measures. As depth increased in Unit A, the adjacent

Unit B was stepped with the west half of the unit partially unexcavated for access while the east 0.5-x-1 m excavations continued.

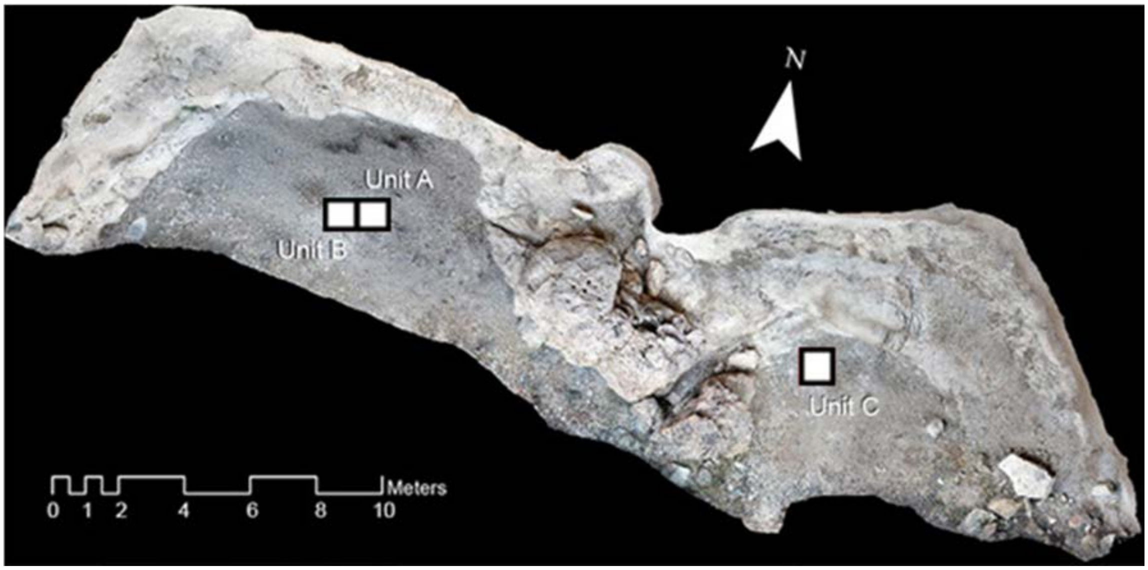


Figure 3.1. The 2013 excavation unit placement in Skiles Shelter.

Due to the long and segmented shape of Skiles Shelter, a third 1-x-1 m unit, Unit C, was placed near the front of the limestone outcrop in the eastern alcove of the shelter. Due to the low amount of cultural material found in Unit C, only one unit was needed to evaluate the deposits of the eastern alcove. The unit was slightly expanded north to expose the sloping limestone "bench" wall, denoted C-W (or Unit C to wall), which measured roughly 0.3-x-1m.

To help guide the placement of excavation units in Kelley Cave, Tiffany Osburn and Bill Pierson, of the Texas Historical Commission conducted Ground Penetrating Radar (GPR) survey of a broad swathe of the shelter floor (Figure 3.2). As discussed in Chapter 2, background research indicated a number of previous excavations had been undertaken in Kelley Cave and the approximate provenience of Sayles and Mear trenches known, but not that by Martin. By conducting a GPR survey of the shelter floor prior to excavation I wanted to avoid previous excavations and well as any large subsurface disturbances or obstacles, such as roof blocks. The results of this survey (Appendix B) indicated no shallow disturbances or roof blocks where I intended to conduct my excavations. I then placed two adjacent 1-x-1m units at this apex of the floor, behind the two large roof blocks seen on surface. This placement was also chosen to avoid the previous excavations to the south and away from the back walls, which were known to have looter and feral hog disturbances. Unit A was begun first, with Unit B opened to the south shortly after.

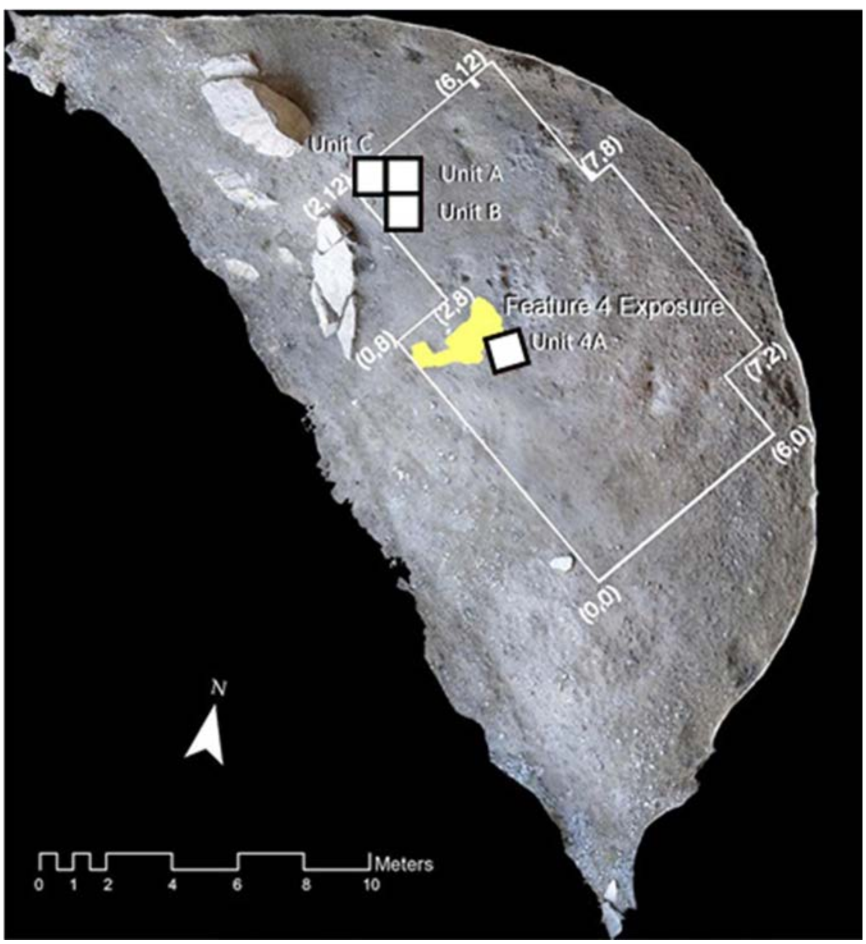


Figure 3.2. GPR survey grid in white with the 2013 excavation units in Kelley Cave. The exposed portion of Feature 4 is shown in yellow.

Once excavations in Unit A and B were sufficiently deep, Unit C was opened west of and adjacent to Unit A. The purpose of Unit C was strictly to allow access to Units A and B as they continued downward. This unit initially measured 0.9-x-1 m however after encountering a previously unknown filled-in trench, the excavation was restricted to the extent of the trench disturbance within the unit.

During the Kelley Cave investigations, a shallowly buried sloping surface of a compact fine sediment layer, deemed “mud plaster,” was exposed and designated Feature 4. The exposed surface is located approximately 2.25 m southeast of the 1-x-1m excavation units, downslope from the crest of the shelter floor; it extends and dips toward the dripline.

The initial investigation began by exposing the mud plaster surface using a soft brush and whisk broom to pull back the top 5cm or so of loose cave-dust sediment mixed with sheep/goat dung. Within the lower part of the loose upper fill we began to encounter uncharred cut leaf bases, several quids, a piece of cord, and other plant fibers. It became quickly apparent that the “mud plaster” surface was much larger than expected, and work shifted to find and expose its extent. The surface dipped downslope towards the dripline of the shelter, becoming more deeply buried.

With the exposure of Feature 4, two “Profile Cuts”, small test units, were created to investigate the underlying stratigraphy. These Profile Cuts, 4A and 4B, were dug with a trowel and knife to maintain a clean profile wall in order to expose and document the stratigraphy. The cuts measured approximately 50-x-30 cm in plan and were oriented along an arbitrary line. This profile line followed the slope of the shelter floor from the back of the shelter to the dripline. Profile Cut 4A was the easternmost profile cut on the feature, and Profile 4B was opened towards the dripline of the shelter (Figure 3.3).

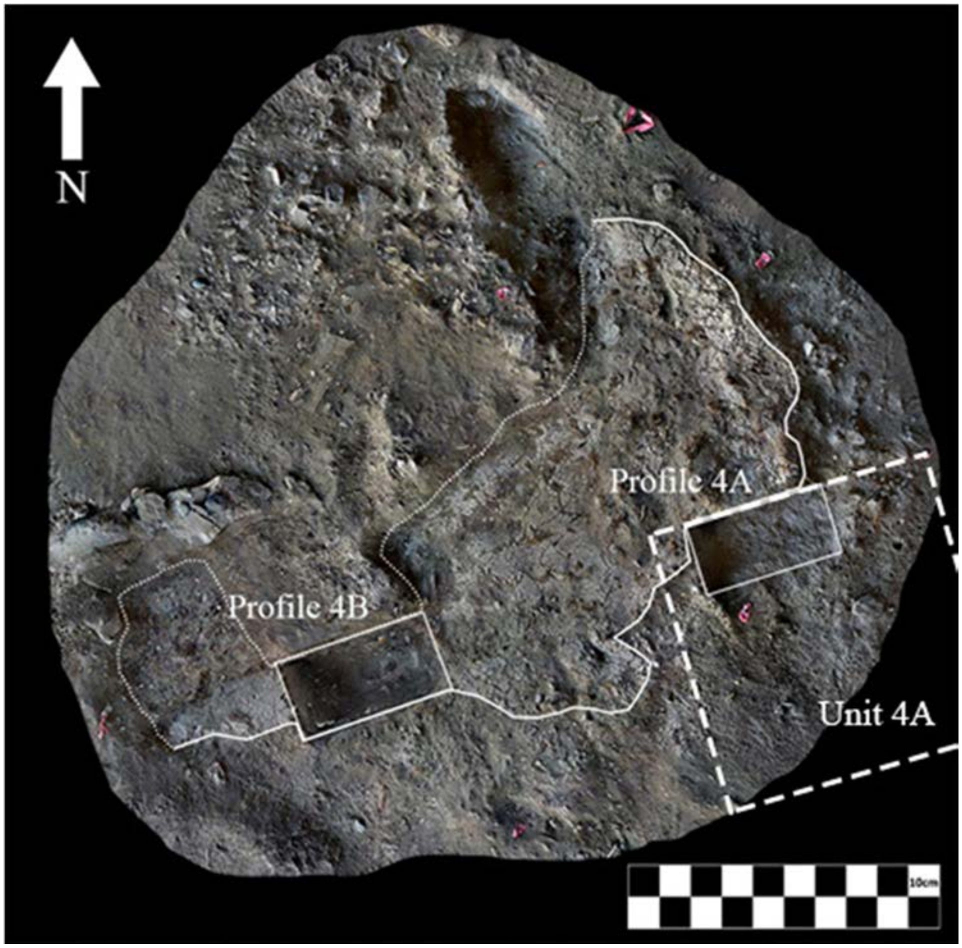


Figure 3.3. Exposed Feature 4 (outlined) with Profile Cuts 4A (right) and 4B (left).

Research into Sayles' excavation notes (Sayles 1932; Kelley 1932) after the discovery and investigation of Feature 4, prompted me to expand Profile Cut 4A into a full 1-x-1 m unit called Unit 4A. This unit was opened to investigate the lower stratigraphy of Feature 4 with the goal of finding stratigraphic layers described by E.B. Sayles in 1932 (see 2.4). Due to time constraints, excavation of Unit 4A was terminated at 60 cm below the surface.

My initial methodology called for layers to be dug following the natural stratigraphy. When the natural stratigraphy could not be discerned, an arbitrary maximum thickness of approx. 5 cm per excavation layer was followed. This method was altered in Skiles Shelter due to the homogenous nature of the cultural deposits encountered in the lower strata. Thus, the lower deposits of Skiles Shelter were excavated using natural stratigraphy or an arbitrary maximum of approx. 10 cm layers. The excavation layer methodology used was established with the goal of discerning the natural stratigraphy of the site with the aid of Structure-from-Motion (SfM) digital photogrammetry.

When cultural features were encountered, they were excavated as a single stratigraphic unit. A feature, as defined for this thesis, is an intact or partially intact remnant of patterned human behavior. The encountered features included burned rock alignments, distinct layers of thermal debris (e.g. ash and charcoal), and concentrations of culturally modified fiber material. When large enough to be practical, feature exposure layers were cross-sectioned to explore and record the internal morphology.

Due to the excellent preservation and the research value of the archaeological remains of these shelters, excavated matrix was screened though a nested screen system in order to capture a variety of artifacts and ecofacts such as charcoal, fibers, seeds, bone and debitage. These artifacts were to be used in part in this study as well as curated for future research. The nested system consisted of three stacked screens of 1/2 inch, 1/4 inch, and 1/8 inch mesh. Excavators identified and collected material from the 1/2 inch and 1/4 inch screens; all material left on the 1/8 inch screen was collected in bags. Prior to the nested screening, bulk matrix was collected, and combined, from multiple buckets from the same excavation layer. At least two liters of unscreened matrix was collected from the buckets as bulk matrix for each layer and feature, effectively treating the excavation units themselves as sample columns.

During the later Kelley Cave excavations a Field Number (FN), which served as a unique identifier, was assigned to all provenience units beginning at 10000 as part of the 2014 Eagle Nest Canyon Expedition (Koenig and Black 2014). Each rockshelter site in ENC was assigned a different ten thousand digit FN to start. The Skiles Shelter inventory was assigned FN numbers after the field, during continued Skiles Shelter excavations by the ASWT which started with FN 20000. In order to incorporate my artifacts into a single site inventory my FN system began with 25000.

The FN system is used to associate the digital data, such as artifact inventory, with all the field forms. The final version of the field forms used for Kelley Cave excavations included information on: elevation and dimension of layer, tools used, associated photos, Ground Control Points, artifacts collected, layer description, as well as rocks sorted and quantified (Appendix C).

In both Skiles Shelter and Kelley Cave, thermally altered rock recovered from each layer and feature was set aside for quantification, an ASWT protocol known as Rock Sort. Fire-cracked rock was pulled out from within the unit as well as from the 1/2 inch screen. All burned rock collected off the screen that was approximately one inch (ca. 3 cm) or greater in diameter was quantified. The >3 cm rock from each unit layer were then sorted on a sheet of plywood gridded into 7.5 cm squares to allow for effective sorting and quick photography with a scale. Rocks were sorted into three size classes: 0-7.5 cm, 7.5-15 cm, and 15 cm plus. These rocks were counted and weighed across each of these size classes to allow for comparability with previous data conducted by the ASWT in the LPC. During the last month of fieldwork at Kelley Cave, recovered burned rock was counted and weighed based on rock morphology, e.g. tabular, spall, pitted, irregular following the ASWT ENC 2014 procedure (Appendix D).

Digital Recordation

Both Skiles Shelter and Kelley Cave excavations were aligned to an arbitrary meter coordinate system of 3000 east, 5000 north, and 1000 elevation, known as the ENC Grid. All of the AWST excavations in Eagle Nest Canyon are plotted on this grid. Datums were placed along the canyon edge, opposite each rockshelter site.

During rockshelter excavations, select artifacts, contextual matrix samples, and charcoal samples were plotted *in situ* using a Sokkia Total Data Station (TDS). Diagnostic projectile points, large bone, and identifiable lithic tools were plotted, when encountered, to document their stratigraphic position. For future residue analysis some lithic tools and burned rock were mapped by the TDS and collected without being touched by bare hands.

Matrix samples were plotted from areas of different hue or mottling or from small stratigraphic layers. Charcoal was collected from the 1/2 inch screen and sometimes plotted with TDS. When possible, most point-plotted charcoal samples were taken from good context in association with features. Plotted charcoal was also collected from directly beneath burned rocks in order to minimize the possibility that the charcoal was in a secondary context. Charcoal directly beneath a medium-to-large sized rock is considered less likely to have migrated down from a more elevated context; however lateral migration from bioturbation remains a possibility.

Structure-from-Motion (SfM) was used to record the excavation progress of both rockshelters in my study. SfM utilizes digital photography to create a three dimensional model of the photographed area. In recent years SfM has become an increasingly used method to document and analyze sites in archaeology (Campbell 2012; Koenig 2012; Olson et al. 2013). Olson et al. (2013) coined the method "Total Archaeology" referring to the use of SfM to record and preserve more data during the destructive act of excavating a site.

During the course of my fieldwork, overlapping digital photographs were taken at the termination of each excavation layer, including profile walls, in each unit. SfM photography consisted of the photographer taking digital photographs of the unit at a set pacing while circling the excavation. This allowed for the digital photographs to be taken from multiple angles and with an image overlap within the photos of approximately 40 percent. These digital photographs had to be taken with the same magnification and lighting for the composite modeling, however for more detail the photographer could take closer shots or focus. Care was taken to keep equipment or people out of the photographs as they would cause matching errors in the processing. The photographer would typically make two rounds of photos around the excavation unit(s): one at shoulder height and the second at hip or knee level. Photos were also taken at oblique angles for overview shots, as well as a group of pictures looking straight down at the floor of the unit(s).

With depth, more photographs were necessary to capture the shape and detail of the excavation unit and unit profiles. Depth also necessitated the addition of artificial lighting, such as LED lighting panels used during the later Kelley Cave investigation. As the units became over a meter deep, the ambient lighting was insufficient to provide enough detail for the SfM modeling and caused distortion in the model depth and texture. Shallow unit SfM models typically needed approximately 30 photos to create a decent model; the deep excavation models required 80 to 100 photos or more.

Ground Control Points (GCP) were established with the TDS to record the position of prominent rocks or unit stakes for 3D modeling. Typically, the unit corner stakes served as GCP's, but with increasing depth of the units, selected rocks in the profile walls were used to aid in minimizing distortion of the 3D model. The exact location of the GCP point was marked by an X on these rocks (Figure 3.4). The GCP's needed to be objects held solidly in place, such as rocks in a unit wall or stakes flush with the ground, so the point on the model would match the TDS data. GCP were included in many SfM digital photographs, for each model, to allow the accurate attribution of elevation and orientation of constructed 3D models.

Figure 3.4. Charles Koenig pointing at a GCP "X" in unit wall of Kelley Cave.

The creation of these three-dimensional models of the excavation units served a two-fold purpose: first, to measure the excavation volume of each layer. As these layers do not follow the flat levels of open-area stratigraphic excavations common in North American archaeology (Renfrew and Bahn 2012; Browman and Givens 1996), the need to be able to measure the removal of irregular, three-dimensional shapes was apparent. Second, the SfM models allowed for an (interactive) record of excavation showing spatial relationships better than standard photography.

Below I briefly describe the process by which I created my SfM models. A more in depth discussion can be found within Olson et al. (2013) and Campbell (2012). Technical discussions and archaeological methods can also be found on blogs by Willis (2011) and Rabinowitz (2013).

SfM photographs were processed with Agisoft PhotoScan Professional 10.1. The photos were aligned to create a point cloud, most creating a "dense point cloud". Point clouds are numerous points created in 3D space which forms the base of all models. PhotoScan creates these points using a complex series of mathematical algorithms which align a single point of the same hue, color, and saturation across all the photos to determine perspective. Running this many times can then determine the spatial relationship from that point to others, and creates a point cloud. The point cloud is then optimized for later Digital Elevation Models (DEMs).

A "wire frame" mesh of was created from the resulting point cloud. This mesh defines the 3D shape by connecting the points in a point cloud with lines forming numerous triangles called TIN. Texture was then overlaid on the mesh. Texture is created by using the original photos to create a blended original color onto the created polygons, rendering to look much like the original picture. The model was then georeferenced by assigning the GCP points on the model the corresponding TDS data for easting, northing, and elevation. The resulting structure was then exported in .PDF, DEM, and orthographic form (.TIF).

Adobe Photoshop CS6 was utilized when issues arose in which the digital photographs were too dark within the unit to allow for the construction of a unit floor. In such situations it was deemed more important for the construction of unit volume than accurate texture. In a collection of SfM photographs, a single photograph with the best lighting was selected. This photograph was used to correct the color, contrast, and brightness of all the other photographs using a function called Color Match. The adjustment settings were noted for each use and the altered photos were saved within a new folder. To expedite this process, this process was used using File>Automate>Batch to quickly apply the same setting to every photo.

Laboratory Analysis

Laboratory processing and analysis in a repository was conducted at both a field site on the Shumla Ranch as well as the Upper Pecos Archaeological Laboratory at Texas State University. Artifacts were prepared for curation according to the Center for Archaeological Studies (CAS) standards (CAS 2014), where the artifacts and records are to be curated. Individual artifact specimens were labeled, according to CAS standards, with a FN number which serves as a unique identifier for each provenience.

Lithic projectile points and tools were identified using standard published typologies, such as Turner and Hester 2011. Elton Prewitt of the Shumla School and Mike Collins of Texas State University also provided assistance in identifying some projectile point types recovered. Formal and expedient lithic tools were identified using visual inspection and using a hand lens of 10 to 15 magnification to identify use wear and edge modification.

Due to the potential for residue and lipid analysis, ground stone and organic remains recovered from this investigation were not directly labeled prior to curation. The projectile points and lithic tools found in the 1/2 and 1/4 inch screens were lightly washed in water and labeled. A sample of burned rock and *in situ* lithic unifaces were point plotted and set aside for future residue analysis. All potential residue samples are unwashed and excavators were careful not to touch them with bare hands prior to bagging.

Analytical Sampling Method

Once the abundant quantities of cultural material were collected from the field, a sampling strategy was devised to efficiently direct the botanical, faunal, and my own laboratory analyses. Due to the complex stratigraphy encountered in the rockshelters, I was unable to effectively sample discrete stratigraphic units in Kelley Cave. Sampling was therefore chosen from excavation Unit Layers (UL) at an interval of approximately 10 cm in both shelters. These samples are from Units A, B, and 4A within Kelley Cave; and from Unit A in Skiles Shelter below the flood deposit (Tables 3.1, 3.2). The historic trench disturbance in the upper portion of Unit A in Kelley Cave and Unit A in Skiles Cave was avoided for this sampling. The material from features and Unit Layers selected were sampled for botanical, faunal, and 1/8 inch screen collection analyses.

Table 3.1. Analytical samples for Skiles Shelter.

41VV165 Skiles Shelter	Faunal Analysis	Lab Analysis
Unit Layer	**Bone from ½ and ¼ inch screen (Ct)**	**1/8th inch screen (L)**
A8	18	0.5
A10	32	0.5
A12	2	0.5
Totals	**52**	**1.5**

Table 3.2. Analytical samples for Kelley Cave.

41VV164 Kelley Cave	Botanical Analysis	Faunal Analysis	Lab Analysis
Unit Layer	**Bulk Matrix (L)**	**Bone from ½ and ¼ inch screen (Ct)**	**1/8th inch screen (L)**
Feature 1	2.5	137	0.5
B1		59	0.5
B4		8	0.5
B7		8	0.5
B10		8	0.5
B13		26	0.5
Feature 3		123	0.5
B16		17	0.5
A16		8	0.5
A19		5	0.5
A22		26	0.5
A25		44	0.5
Feature 5/A29		80	0.5
A31		32	0.5
A33		33	0.5
A36		7	0.5
Feature 6	1	23	0.5
AB38		15	0.5
AB40		16	0.5
Feature 7		0	0.5
Feature 8		0	0.5
AB42		25	0.5
AB46		5	0.5
AB48		4	0.5
AB50		17	0.5
AB53		14	0.5
AB55		13	0.5
AB57		6	0.3
4A1		45	0.5
4A4		43	0.5
4A7		9	0.5
4A10		14	0.5
4A13		20	0.5
Totals	**3.5**	**890**	**16.3**

1/8 Inch Screen Collection Sampling

All material caught on the 1/8th inch screen mesh was bagged and stored for sorting analysis. Initial sorting of this collection from the upper portions of Skiles Shelter and Kelley Cave was attempted during the field school in 2013. Unfortunately, some of the initial sorting bags were mislabeled and became mixed between shelters and could not be used for this study. I began a new "1/8th inch screen sort" after field with smaller samples used here.

The 1/8th inch screen sort method consisted of sorting a measured volume of 0.5 L for debitage, fauna, seeds and other unburned organics, apex of rabdotus shells, and when identified, a shiny black substance which may be a burned plant carbohydrate (exudate). Samples were sorted by hand using a large flat tray and utensils to separate out the different classes (e.g. debitage, botanical, dung, burned exudate, leather, etc.). Only three Unit Layers were sampled for 1/8th inch screen sorting and faunal analysis from Skiles Shelter. These three samples came from approximately 10 cm intervals in the lower cultural deposits, below the alluvial layer and historic digging disturbance.

The 1/8th inch samples from Kelley Cave were additionally sorted for identifiable sheep dung pellets or fragments. These were separated and weighed to give an approximation migration through the matrix as a measure of subsurface disturbance. Sheep herding in Langtry began at the start of the 20th century, approximately 1882 (Skiles 1996), and therefore, it has a known *terminus ante quem*.

Faunal Analysis

The faunal remains from both Kelley Cave and Skiles Shelter were analyzed using low power microscopic examination and low-angle directional lighting. A Bausch & Lomb 7 – 30x stereoscopic microscope was used to detect cut-marks, chop-marks, blow marks, and carnivore damage. The identification was conducted by Christopher Jurgens with assistance from the author. Prior to examination, faunal materials were cleaned by animal hair brushes, dental picks, and when encrusted with a carbonate or oxylate-rich sediment, soaked in a 5% acetic acid solution, followed by a soak in distilled water and air-dried. When the bone was friable, a B-72 acryloid solution was used to consolidate and repair fragile bone.

Jurgens identified the faunal material using standardized anatomical methods from veterinary anatomy, zoology, and vertebrate paleontology (Reitz and Wing 2008). Using these methods, faunal remains were classified into the Linnaean hierarchical classification system based on the morphometric differences in the remnant hard tissues, bone (2005:105-107). The faunal assemblage was identified by Jurgens based on previous zooarchaeological experience with the fauna in the region as well as osteological reference materials (Gilbert 1990; Gilbert et al. 1996; Lundberg 1970). Faunal specimen bags were selected from the ½ and ¼ inch screen context, based on the sampling strategy discussed above.

During the faunal analysis, bone fragments were generally identified to the genus and species as closely as possible. Fragments were assigned into four categories based on the treatment identified: B, BC, BMD and BA. Category B consisted of bone that had not been culturally modified. BC consisted of bone that had been culturally modified. This included: burning, smoking, calcination, dynamic fractures, cut marks and scoring. The nature of cut-marks and scoring was also noted, following the procedure used on a similar study at Arenosa Shelter (Jurgens 2005). Category BMD contained bone tool or ornament manufacturing debris. Finally, Category BA consisted of bone tools, beads, and other finished artifacts.

Geoarchaeological Analysis

Geoarchaeological sampling and evaluation was conducted in both Kelley Cave and Skiles Shelter by Charles Frederick, Ken Lawrence, and Brittney Gregory with the assistance of Jacob Sullivan and the author. Geoarchaeological sampling was conducted on the north and east walls of Units A and B in Kelley Cave. Skiles Shelter samples were taken from the north wall of unit A.

Samples for Magnetic Susceptibility (MS) and Phosphorus analysis (P) were taken from a continuous vertical profile at both sites, the north wall of Unit A. Efforts were made to sample intact stratigraphy along the profile, especially when bioturbation, or other disturbances, were apparent. Measured geomatrix samples, at least two cm^3 in volume, served for both MS and P analyses.

Samples were taken in a column at intervals of two centimeters allowing for some samples to overlap. Due to the loose matrix and limestone gravels within the walls, sharpened plastic tubes were used to collect approximately four cm^3 of material from each elevation. When gravels or rocks impeded the sampling tubes, matrix was collected in the tubes using lateral scraping. Material collected in the tubes was then transferred into a plastic bag for transport, to be later sampled and used for MS, P, and granulometric analysis.

The geological laboratory analyses were conducted by Charles Fredrick, Brittney Gregory, and Jacob Sullivan at Frederick's lab in Dublin, Texas; and by Ken Lawrence at the SWCA laboratory in Austin, Texas. Laboratory tests were conducted to measure the grain size of the collected sediment as well as the chemical composition and mineral content from both shelters and from various stratigraphic contexts.

Sediment particle size was measured for each stratigraphic sample using nested geologic sieves from the American Society for Testing and Materials (ASTM) using the larger bulk samples collected by the tubes. Particles were sorted using the Wentworth scale for sand clast materials and screened through size 10 mesh (2.00 mm), size 14 (1.41 mm), and size 45 mesh (0.35 mm). Those particles between 2mm and 1.41mm were classified very coarse, 1.41-0.35mm was classified coarse-medium, and less than 0.35mm was classified medium-fine sands. The geologic sieves were paired with the hydrometer method to define percentage of various size classes of fine sediment. Researchers also utilized a LS 13 320MW laser diffraction particle size analyzer to measure the extremely fine sediment, most notably the sediment of Feature 4 and Skiles Shelter flood deposit.

Twenty geologic samples from both shelters were sent to James Talbot of K-T Geoservices Inc. for bulk mineralogy analysis using X-Ray Diffraction (XRD). This analysis was semi-quantitative, using weight percent, and determined both rock-forming minerals and total clay minerals. Minerals analyzed using this method includes: quartz, feldspars, carbonites, pyrite, marcasite, apatite, amphibole, pyroxene, and zeolites (K-T GeoServices Inc.).

Magnetic susceptibility (MS) was conducted on the geologic samples by placing them in 2.3 cm^3 plastic cubes and analyzed in the lab using a Bartington MS2 meter and MS2b sensor. Results were measured in the standard χ (chi) and examined both the low and high frequency MS. The cubes were calculated using methods outlined in Gale and Hoare (1991:223-226).

Magnetic Susceptibility has been widely used in archaeology to help delineate and identify soil horizons or living surfaces (Goldberg and Macphail 2011:350-352). MS can vary based on environmental change such as: depositional events, pedogenesis, and cultural actives such as thermal-alteration and other activity areas based on organic content. Due to the fact that organic carbon has been shown to skew MS results, Loss-on-ignition (LOI) tests were conducted prior to MS analysis. LOI tests measure the amount of organic carbon present in the MS sample by mass quantified by percentage before and after burning off organic matter. Researchers used LOI methods adopted from Storer (2005) on all MS samples.

Due to the non-destructive nature of MS testing, researchers also conducted phosphorus analysis (P) on the same samples taken from both shelters. Archaeologists have used phosphorus testing to shed light on cultural activity areas such as cooking, food processing, solid and liquid waste, and others (Crowther 1997). Phosphorus occurs naturally in three chemical forms: inorganic (calcium bound), inorganic (aluminum or iron bound), and organic phosphorus. Phosphorus exists in nature in water, living organisms and soils in comparably low levels (Brady and Weil 2008; Busman et al. 2012). Archaeologists have been able to use phosphorus to define cultural activity areas because phosphorus does not typically drift laterally or horizontally in the matrix and does not dramatically decrease over time (Eidt 1985:180–181; Holliday and Gartner 2007). Hence, increasing phosphorus content indicates the addition of phosphorus through things such as cultural mechanism, and vice versa.

Phosphorus analysis method followed Sims (2009: 16-17) and consisted of mixing 20mL Mehlich III extraction solution and two grams of previously sieved and LOI sediment. The measurement method, outlined in several papers (such as López Varela and Dore 2010; Terry et al. 2000), consisted of placing filtered extract in a clear glass sample cell with deionized water. To this was added a packet of PhosVer 3 and agitated. The color of this combine solution was measured with a Colorimeter and converted by the researchers to phosphorus mg/kg.

Botanical Analysis

The botanical analysis of Skiles Shelter and Kelley Cave was conducted by Phil Dering, Leslie Bush, and Kevin Hanselka. Botanical analysis evaluated flotation samples from features and point-plotted organic material best suited for radiocarbon assay.

Radiocarbon samples were taken from contexts with the least possible chance of bioturbation or migration of the charcoal/organic remains. These were usually found within features or directly under stones. In the case of Skiles Shelter, three samples were taken from flotation of the bulk matrix; while one came from the matrix adhering to a mortar hole on the underside of a slab. Samples identified in Kelley Cave consisted of those associated with features, directly underneath stones, and directly under the large boulder encountered in Unit B.

Samples were identified to lowest possible taxonomic level using a comparative collection from the canyon and surrounding areas, as well as from reference works (Everitt et al. 1999; Everitt et al. 2002; Everitt et al. 2007; Everitt et al. 2011; Powell 1998; Powell et al. 2008; USDA Agricultural Research Service). The investigators used stereoscopic microscopes with a magnification from 5-35x and adhered to the standard laboratory protocol for processing botanical and radiocarbon remains (Bush 2012; Pearsall 2000). The identified samples were then returned to this investigator to select which material would be dated. I attempted to select for the short-lived economic species from each chosen context, typically *Fabaceae* or *Agavacae (Agavoideae)* to minimize the chances of identifying "old wood," or wood that died long before it was culturally modified (see Dykeman et al. 2002). In samples with no identifiable economic species, relatively short-lived charred wood was selected, e.g. *Acacia*.

Selected radiocarbon samples were then sent to Raymond Mauldin at the Center for Archaeological Research (CAR) at University of Texas San Antonio. Mauldin cleaned and prepared the samples for Accelerator Mass Spectrometry radiocarbon dating (AMS). In certain cases he divided samples into two prior to sending to the AMS lab to cross check the dating precision. Afterward, Mauldin sent the prepared samples to DirectAMS in Bothell, WA. The results were then returned to Mauldin who processed and checked control samples against known dates.

Macrobotanical analysis was conducted on two flotation samples from Kelley Cave due to the time constraints of my thesis. Skiles Shelter macrobotanical analysis was conducted due to the degradation of the uncharred organic material within the deposits. The samples analyzed consisted of a light fraction flotation bag from the field school, and a one liter bulk sample of matrix collected from the excavation buckets.

Initial flotation was carried out by students from the Texas State University field school, using the method outlined by Phil Dering. Dering's method consisted of measuring the volume of matrix to be floated and placing it in a five gallon bucket of water. This solution was then agitated using a metal stirrer and then poured slowly out into chiffon until the heavy fraction was near the pour. Water was added to the remainder in the bucket and stirred again. The process was repeated a total of three times before the chiffon with the light fraction was bound and labeled for drying. After it was deemed to be dry the light fraction was bagged and ready for analysis. Material collected after the summer, 2013, was saved for a one liter flotation conducted by the investigating archaeobotanists using methods outlined in Bush (2012).

CHAPTER 4: SKILES SHELTER RESULTS

Skiles Shelter is a south facing shelter measuring approximately 36 m in length and 7.5 m from the dripline to the wall (Figure 4.1). Pecos River style pictographs are present on the back wall of the western cove. A total of 77 grinding facets of varying depth was documented in the western limestone bench, the majority of which were already exposed (Figure 4.2). The tufa mound dividing the two alcoves has 25 grinding facets on top, three of which were deeper than 5 cm, and deep striations on its northern face; no grinding facets are present in the eastern alcove (Figure 4.3). Further research regarding the grinding facets in Skiles Shelter is being conducted by Amanda Castañeda as part of her M.A. thesis research at Texas State University.

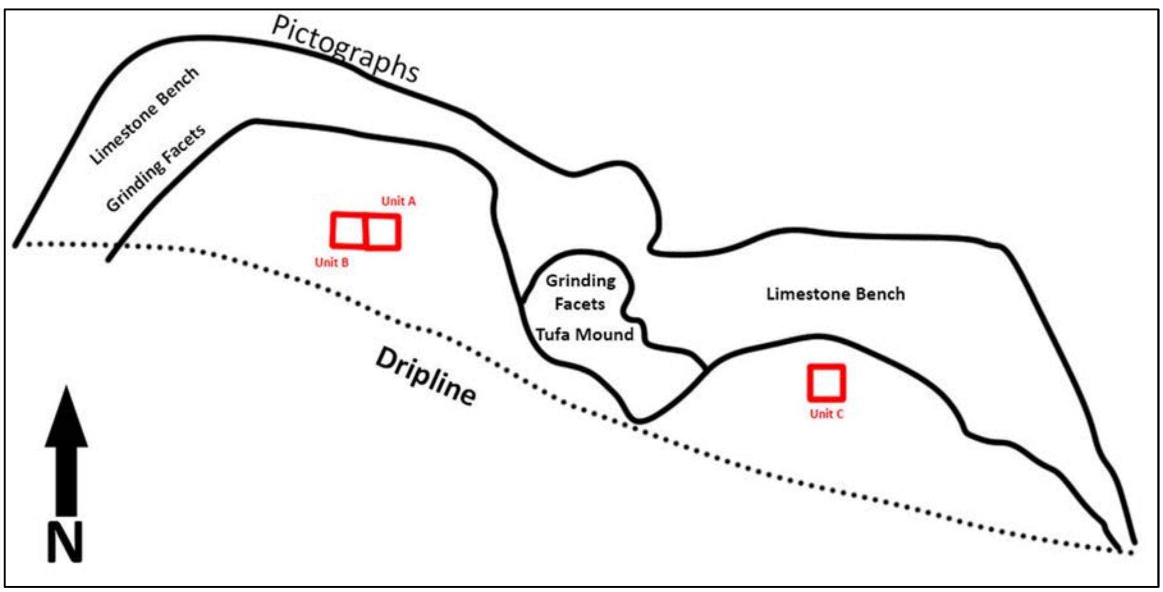


Figure 4.1. Skiles Shelter, simplified plan map.

Figure 4.2. Overview of grinding facets in western bench of Skiles Shelter (left), and with the grinding facets marked in white (right).

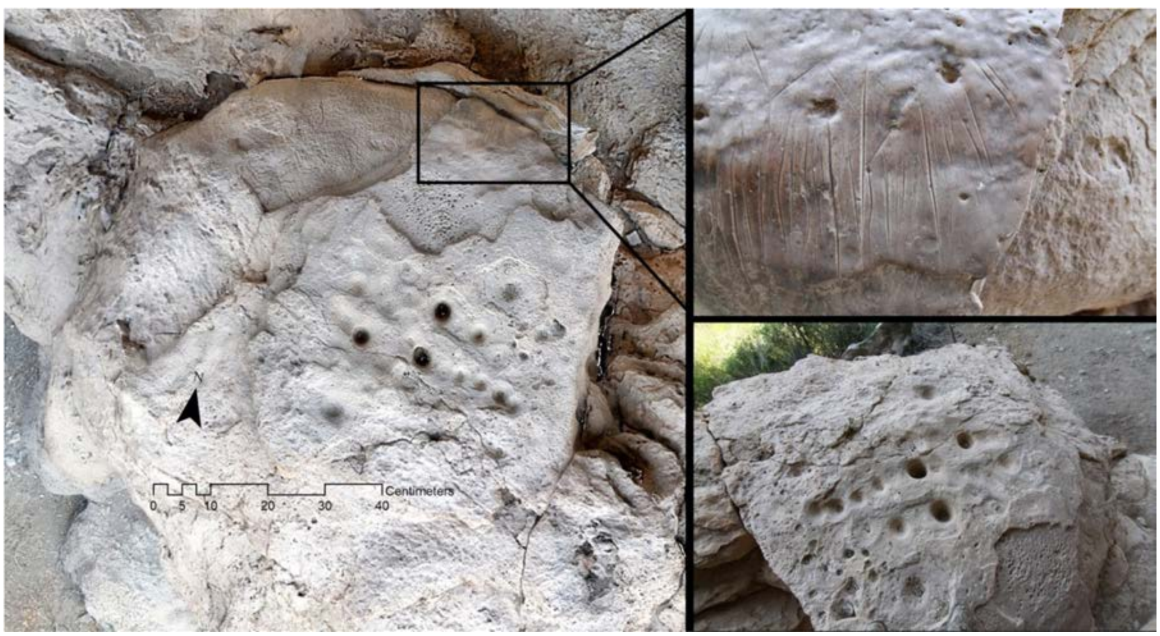


Figure 4.3. Skiles Shelter tufa mound plan view (left) with striations (upper right), facing south, and overview of the top grinding facets (bottom right), facing southwest.

Skiles Shelter Site Formation Processes: Flooding

Flooding in Eagle Nest Canyon (ENC) is sporadic and sometimes catastrophic. Two major flooding events in the last 60 years have occurred with such magnitude that they significantly affected the cultural deposits within Skiles Shelter; these occurred in

1954 and 2010 (Kochel et al. 1982; Jack Skiles personal communication 2013). During the course of my investigation I witnessed two flooding events in the canyon: a minor flood on July 24, 2013 and a massive flood June 20-21, 2014 (Koenig and Black 2014). The larger catastrophic floods in the canyon can adversely affect the cultural deposits in three ways: sedimentation, scouring, and organic degradation.

The vegetation on the uplands is mainly desert scrub growing in eroding soils. Overgrazing in the last hundred years has destroyed most of the grasses that would have stemmed erosion (Golden et al. 1982; Skiles 1996). As a result, during intense rainfall the runoff from the uplands carries with it a large sediment load (Figure 4.4).

Figure 4.4. Before and after pictures of ENC from January 4, 2013 (left) and June 21, 2014 (right) showing sediment deposited by the flood and the flood scouring of the vegetation.

The light tan line along the back wall seen in Figure 4.2 illustrates this fact. The line was caused by sediment deposited on the limestone from inundating waters of the 2010 flood (Figure 4.5). This deposit was left by the flood in only 24 to 36 hours before the waters retreated (Jack Skiles personal communication 2013). The water line reached within centimeters from the bottom of the rock art panel.

Figure 4.5. Kelley Cave (left) and Skiles Shelter (right) during the 2010 flood of ENC (courtesy of Stephen Black).

Flooding can occur in the canyon from the flow of water down the canyon and, more catastrophically, through the backing up of waters from the swelling Rio Grande into the canyon (Patton and Dibble 1982; Kochel 1988). As Skiles Shelter is located approximately 125 m from the mouth of the canyon, flooding from the Rio Grande is a major component of the floods affecting this site. With the Amistad Dam restricting the flow of the silt-laden Rio Grande, sediment has been falling out of suspension and slowly filling the reservoir with sediment (Jack Skiles personal communication 2013). Flood sedimentation has also filled in the natural spring in the canyon bottom just below Mile Spring Shelter. Over time this has allowed floods to surge from upstream and, in turn, reach higher and higher along the canyon walls each time the river swells into the canyon. This process will continue to affect Skiles Shelter and, in the future, perhaps other shelters in ENC.

The canyon floods can also cause scouring of site deposits. The canyon floor itself has gone through episodic scouring due to the energy of the flood waters, as shown in Figure 4.4. Jack Skiles has observed the movement of boulders the size of trucks down the canyon and recalls the loss of several heavy water pumps at the canyon spring through flash floods. In Skiles Shelter the position of the tufa mound may have created eddies in the flowing flood waters. The energy of these eddies in the slightly lower eastern alcove may have scoured the deposits there to a great degree than the western portion.

The sporadic monsoonal rain falling on the barren uplands also seeps into underground channels and can result in the reactivation of spring vents along the canyon walls and within rockshelters. Skiles Shelter itself has large spring vents along the rear wall of the eastern alcove. Although these vents do not flow after heavy rains today, they may have contributed to the erosion of the eastern deposits in the past.

The exposure the sporadic exposure to water, from rain as well as floods, has caused the degradation of much of the organic remains within the shelter. Numerous rootlets were observed in the flotation samples from Skiles Shelter, demonstrating that the deposits have previously retained enough water for plant growth. With the posited increasing frequency in which Skiles Shelter will be inundated in the future, the extant organic remains will continue to deteriorate.

Skiles Shelter Site Formation Processes: Bioturbation

The same attributes that made rockshelters desirable locales for human habitation—warm, dry, and protected—also make them desirable to a legion of other creatures. Insects and animals both call Skiles Shelter home and have left their own impact on the cultural deposits within. Small burrowing insects such as wasps and antlions are ubiquitous (Figure 4.6). In my experience, the greatest amount of insect turbation appears to come from native digger wasps (*Sphex lucae* or *S. texanus*) that were observed digging tunnels within the soft shelter sediment and moving material 1-2 cm in diameter out of the tunnels as well as using them to fill the tunnels back in (Figure 4.7). Their cousin the Golden Digger Wasp (*Sphex ichneumoneus*) has been observed to dig from 5 to 19 cm long tunnels diagonally into soil (Brockmann 1980) suggesting that disturbances on the same scale likely occur in these shelters (Figure 4.8).

Figure 4.6. Antlion disturbance observed in the vicinity of Feature 4, Kelley Cave.

Figure 4.7. Digger Wasp burrowing into cultural deposits in Skiles Shelter.

Figure 4.8. Plan view of the alluvial layer in Unit B, Skiles Shelter, showing rodent, lizard, and insect burrows of various sizes.

Animals found in the LPC and within the shelter range from small to large, most burrow or dig in some form. Animals native to the region include woodrat (*Neotoma sp.*), hispid cotton rat (*Sigmodon hispidus*), eastern pocket gopher (*Geomys sp.*), common muskrat (*Ondatra zibethicus*), rock squirrel (*Otospermophilus variegatus*), fox squirrel (*Sciurus niger*), Mexican ground squirrel (*Spermophilus mexicanus*), raccoon (*Procyon lotor*), ring-tail (*Bassariscus astutus*), badger (*Taxidea taxus*), spotted skunk (*Spilogale sp.*), desert cottontail rabbit (*Sylvilagus audobonii*) and Eastern cottontail (*Sylvilagus floridanus*), blacktail jackrabbit (*Lepus californicus*), porcupine (*Erethizon dorasatum*), kit fox (*Vulpes velox*), gray fox (*Urocyon cinereoargenteus*), domestic dog (*Canis* *familiaris*), bobcat (*Lynx rufus*), collared peccary (*Pecari tajacu*), and white-tailed deer (*Odocoileus virginianus*) (Holden 1937:69; Jurgens 2005; Sobolik 1991:7). The effects of rodent turbation were directly observed over the course of my excavations (Figure 4.9). As mentioned in the Chapter 2, sheep herding at the start of the 20th century caused large amount of trampling turbation on the upper matrix as well as depositing large amounts of acidic dung and urine.

Figure 4.9. Skiles Unit B July 2, 2013 (left) and Skiles Unit B Jan. 3, 2014 after rodent burrowing (right).

Native javelinas (*Pecari tajacu*), and especially feral hogs, appear to be one of the most destructive forces to Skiles Shelter, behind human agency. Javelinas probably have been using these shelters for centuries, but only in the last few decades have the more destructive feral hogs been introduced into the area. They appear to prefer rooting and bedding in the soft sediment at the back of protected shelters (Figure 4.10). Their digging, in Kelley Cave, was measured to be nearly 30 cm below surface and 50 cm in diameter, around the walls and deposit large amounts of seed-laden dung that is mixed into the upper layers.

Skiles Shelter Site Formation Processes: Human Agency

Human activities also play a role in the turbation of these shelters. Undocumented excavations by artifact hunters, discussed in Chapter 2, are not the only factor of human disturbance. Authorized tour groups, such as those conducted by the Rock Art Foundation, visiting archaeologists and students are common visitors to the shelter sites in ENC. Although great care is taken by all to insure these tours do not harm the sites, modern human visitation of the shelters has undoubtedly contributed to the trampling turbation of the upper cultural deposits. Studies in sandy loam have shown that human treading can cause small artifacts to migrate downward up to 10 cm below surface (Gifford-Gonzalez et al. 1985). Given that the softer loose silt rockshelter deposits in the ENC are barren of roots and contain numerous krotovina (filled burrows), the vertical migration may be even greater for certain size artifacts. Horizontal migration of artifacts due to human trampling disturbance is also a factor. This migration is also size dependent, as large objects were found to move farther than small objects. Nielsen measured the migration of bricks and wood objects ($\geq$17.6 cm^3 in size) moved over a meter from their original location (Nielsen 1991:492). As humans continue to visit Skiles Shelter they will also continue to redistribute the artifacts therein.

Figure 4.10. Carolyn Boyd giving a tour of Skiles Shelter rock art to archaeological field school students (2013), standing in feral hog or javelina wallows.

Skiles Shelter Excavations

Chapter 3 explains that the excavations in Skiles Shelter were initially conducted in excavated layers that attempted to follow breaks in the natural stratigraphy. When the natural stratigraphy could not be discerned, an arbitrary maximum thickness of approx. 5 cm was followed. The excavation method was increased to approx.10 cm arbitrary thickness in the lower cultural layers due to the homogeneous nature of the deposits. In total, 13 excavation Unit Layers (UL) were dug in Unit A, and 13 layers were dug in Unit B. An additional 5 excavation layers were dug Unit C and terminated at a sloping bedrock approximately 65 cm below surface (cmbs) (Figures 4.11, 4.12). Excavations in Units A and B were terminated upon encountering large travertine spalls at approximately 125 cmbs, in Unit A. A small amount of sand matrix was observed between the large spalls, but the spalls were not matrix supported. Excavators used a pickaxe to dig a 30 cm^2 test in the bottom NE corner of Unit A to 50 cm into the spalls and encountered no cultural material.

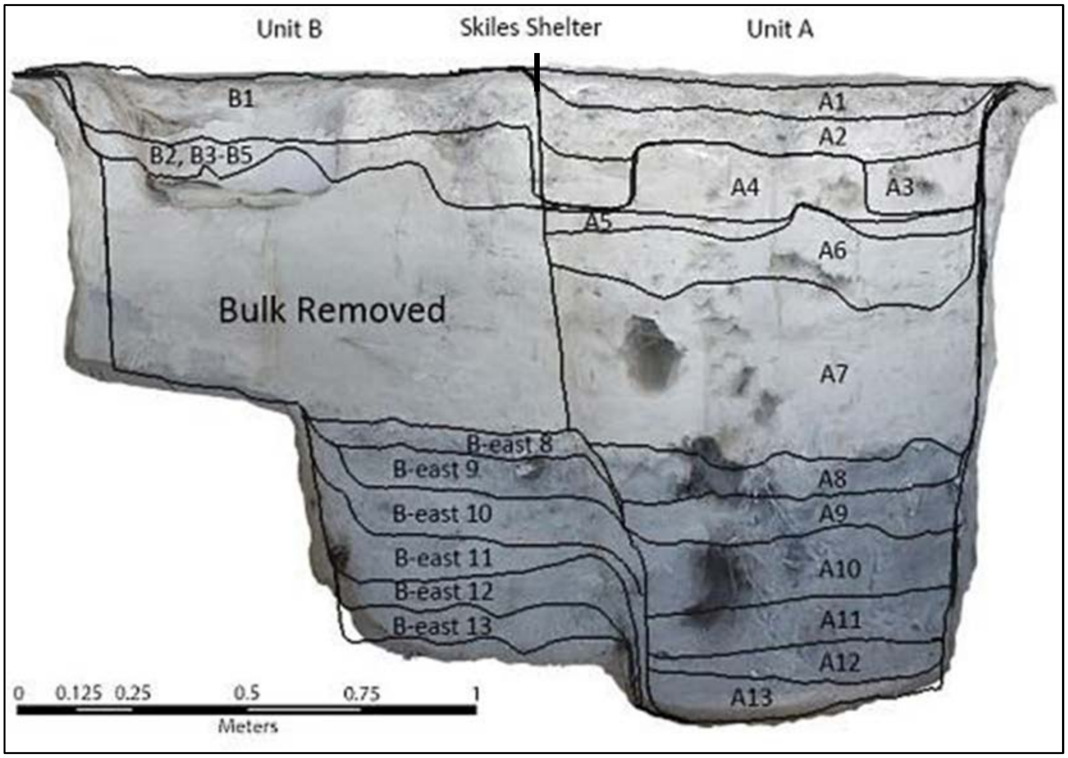


Figure 4.11. Excavation Unit Layers (UL) of Skiles Shelter units A and B, facing north.

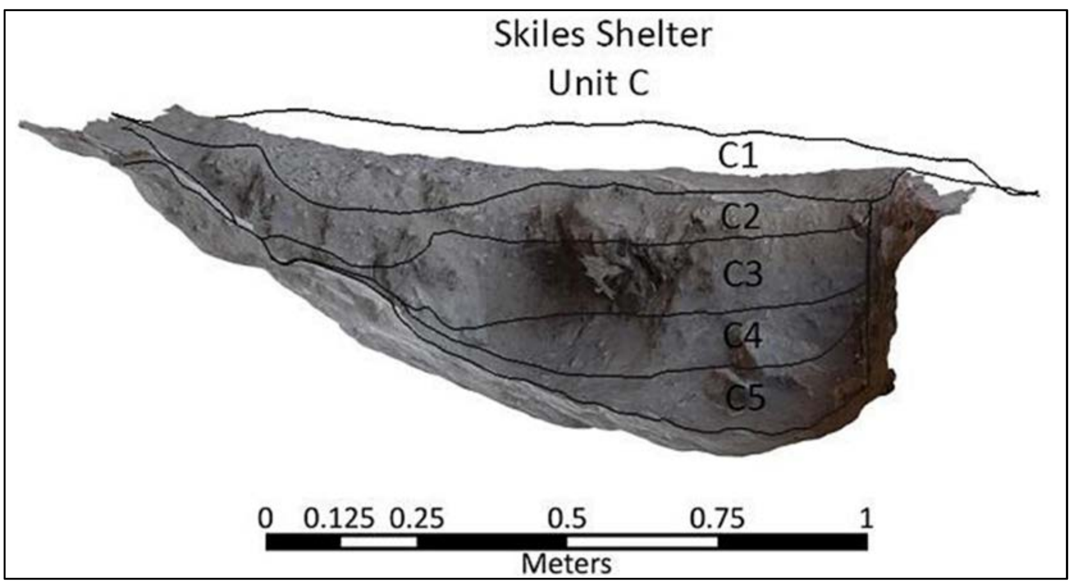


Figure 4.12. Excavation Unit Layers (UL) of Skiles Shelter Unit C, facing east.

As explained in Chapter 3, the excavated volumes of each layer were calculated using the ArcGIS Cut/Fill function to measure the change in volume between Digital Elevation Models (DEM). Due to the poor rendering of some DEMs, a few of these calculated volumes are considered to be inaccurate (Appendix E).

Skiles Shelter Stratigraphy

Skiles Shelter excavation Units A and B documented seven distinct Stratigraphic Layers (Layers) within the excavation profile, labeled Stratigraphic Layer A through G (Appendix F), and one layer of burned plant detritus labeled FN 1167 (Figure 4.13). Stratigraphic Layer A was a homogenous silty clay loam with charcoal and rabdotus shell inclusions. During excavation of Stratigraphic Layer A, very few lithic artifacts were observed on the ½ inch mesh screen. Artifact collectors commonly used ½ inch screen mesh in the early to mid- 20th century. The lack of artifacts and homogenous loose deposits suggested that the top of Unit A and a small portion of Unit B were previously disturbed from excavation. A bowl shaped depression at the bottom of Stratigraphic Layer A, clearly intrusive into Stratigraphic Layer B, supports this inference (Figure 4.14). One of the very few stone tools in this layer was a large grinding slab with red pigment (see artifact section below). This slab may have been left by the looters because of its size and weight, and it may not be in the original find spot.

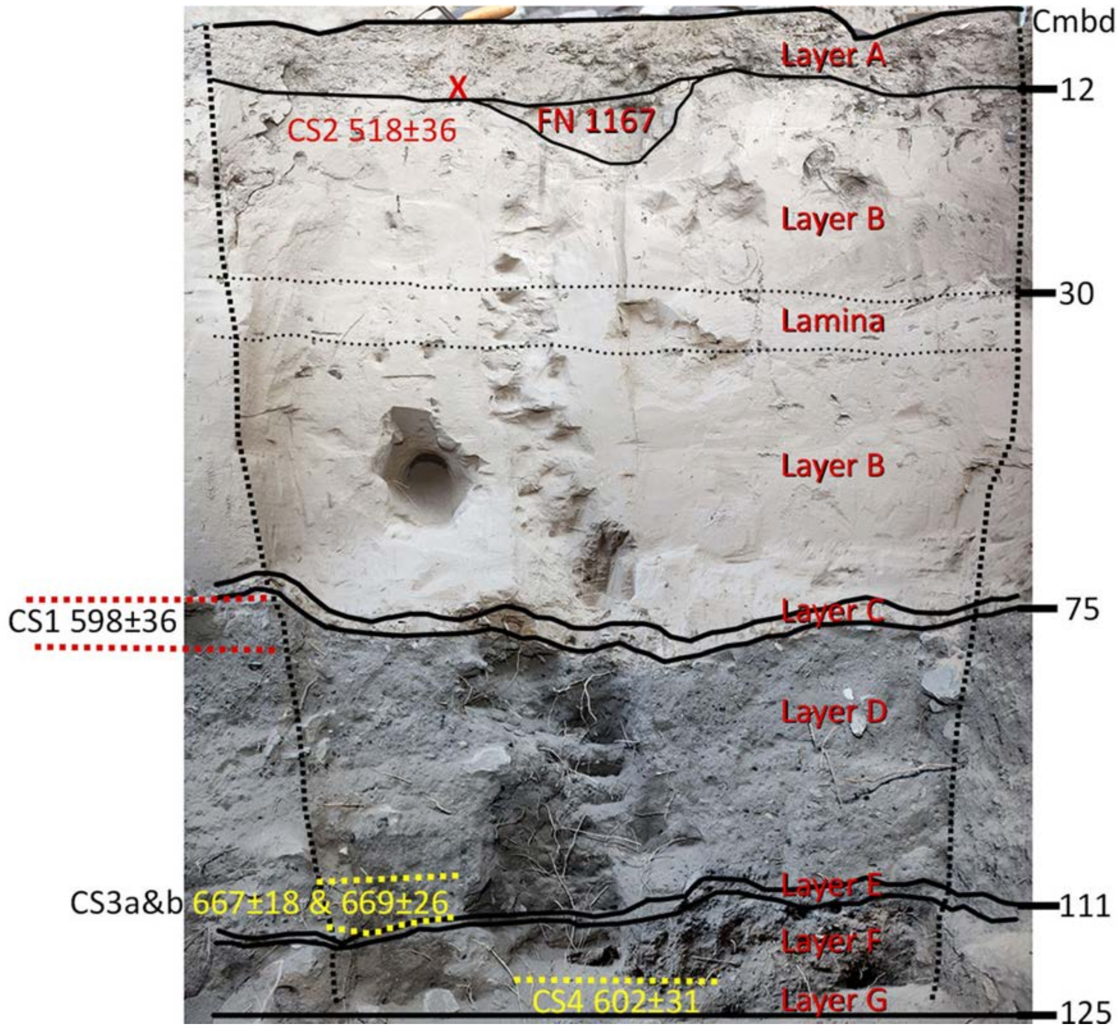


Figure 4.13. North profile wall of Skiles Shelter Unit A. Radiocarbon samples CS1-CS4 dates are given in median cal B.P. (OxCal 4.2). Dotted line around CS1, CS3, and CS4 represent approx. UL depth the dated flotation samples came from (B-east 8, A11, and A13 respectively).

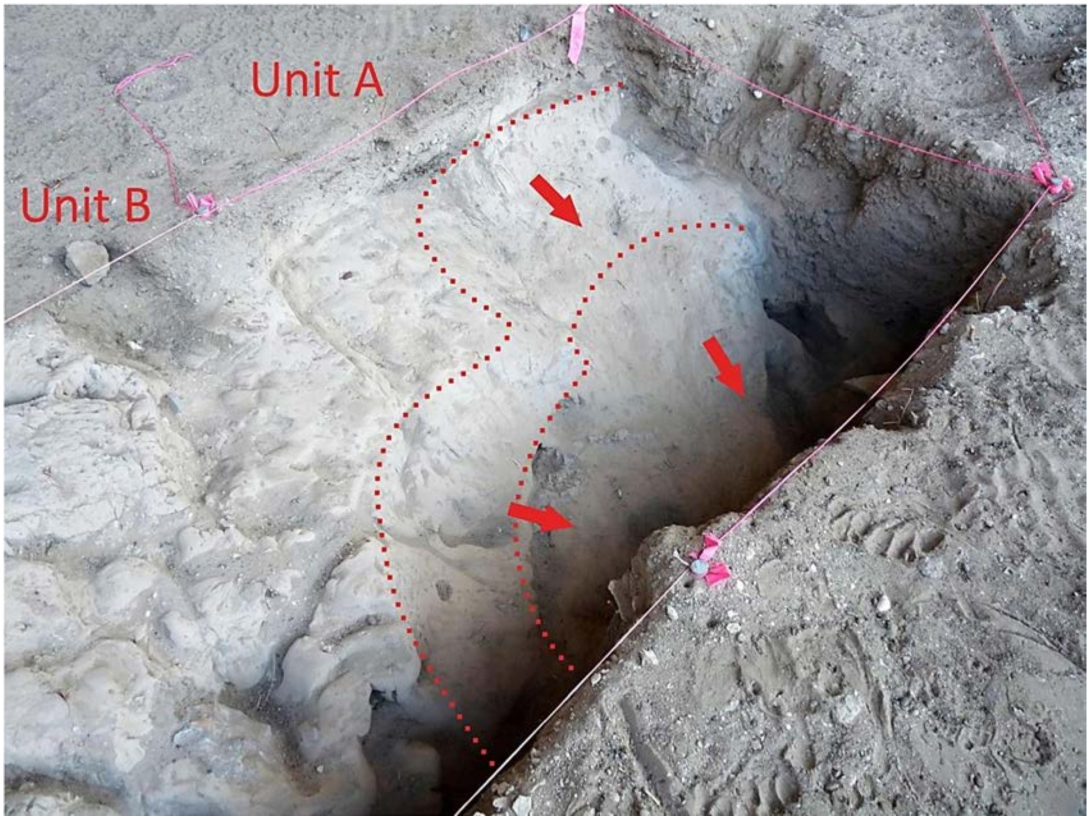


Figure 4.14. Skiles Shelter Unit A and B, facing NE. Stratigraphic Layer A has been removed showing bowl-shaped depression in Layer B that is thought to represent uncontrolled digging.

Stratigraphic Layer B was sloping, light brown fine sandy loam approximately 60 cm thick on the north wall of Unit A, and approximately 5 cm thick on the south wall. Layer B consisted of consolidated alluvial sediment and contained no cultural material. The top boundary of Stratigraphic Layer B sloped toward the south as a result of the digging intrusion discussed above (Figure 4.14). The lower boundary of Layer B sloped sharply to the north, toward the shelter wall. This alluvial sand layer was obviously deposited in a large depression during a single flood event. The Loss-on-Ignition (LOI) results showed a squantity of organic carbon throughout the layer, and results from the Magnetic Susceptibility (MS) samples indicated little variance, supporting a single depositional event over multiple smaller events (Appendix G). The Phosphorus (P) test results evidenced variable low-levels of organic phosphorus throughout the stratigraphic layer. The geoarchaeological results may be explained by the migration of phosphorus from sheep dung in the upper deposits through bioturbation or leeching by water into the lower deposit.

Stratigraphic Layer C was a thin, 2 cm thick, well-consolidated fine sandy loam interface at the bottom of the alluvial sediment. The alluvial sediment had a much stronger structure, breaking into chunks, than Stratigraphic Layer B, but was likely a part of the same flood event represented by Layer B. All three geoarchaeological tests conducted (MS, LOI, P) showed a much higher quantities of organic chemical signatures than Layer B above (Appendix G). This may have been due to the deposition and interaction of Stratigraphic Layer C with the organic-rich cultural layer beneath.

Stratigraphic Layer D was a dark gray silty loam, approximately 35 cm thick, with moderate charcoal and fire-cracked rock (FCR) inclusions. Layer D represents a buried cultural deposit containing lithic artifacts, burned limestone fragments, and some bone and preserved botanical remains. Compared to Stratigraphic Layer A, the unburned organic artifacts collected from Layer D were relatively few and in a poor state of preservation. No cultural features were encountered in the deposit, although the quantity of charcoal and FCR was indicative of clast-supported midden deposits, created by repeated hot rock cooking events such as earth ovens.

Stratigraphic Layer E was a light brown, alluvial fine sandy loam (1-5 cm thick) separating the two buried cultural deposits: Stratigraphic Layers D and F. Layer E had intermittent and irregular upper and lower profile boundaries, and did not fully extend to the north profile wall shown in Figure 4.13. Layer E extended toward the dripline of the shelter, and likely represented a smaller flood event than the flood represented by Stratigraphic Layer B. The irregular and broken boundary was likely the result of disturbance from bioturbation and reoccupation of the shelter following the flood deposition. Both the P and LOI results indicated low amounts of organic phosphorus and material similar to Stratigraphic Layer B further supporting this interpretation (Appendix G).

Stratigraphic Layer F was a pale gray silty loam, approximately 10-15 cm thick, with moderate amounts of charcoal and burned rock. The sediment and cultural material of Layer F matched those observed in Stratigraphic Layer D. Layer F was directly atop a sterile travertine rock layer, Stratigraphic Layer G. These travertine rocks, in Layer G, were large (>15 cm) irregular tabular rocks with small amounts of sand matrix in crevices.

Previous excavations in Eagle and Kelley Cave have encountered a preoccupation stratigraphic layer, typically sand, below the earliest cultural deposits (Ross 1965:19-20; Mear 1949; Sayles 1932). The lack of a pre-occupation sandy layer in Skiles Shelter may be the result of ancient flood scouring, which would have removed any existing sediments, and perhaps earlier occupation deposits, or a sign of intensive use of the sandy deposit for earth ovens.

Stratigraphic Layer FN1167 was an approx. 3 cm thick lens of densely packed fiber composed of charred succulent leaf bases and twigs (Figure 4.15). During fieldwork, FN1167 was initially recorded as a possible cultural feature, however after field it was assigned as a Stratigraphic Layer. The field number was kept for the associated data analyses. FN1167 was encountered in the north wall of Unit A and measured approximately 40-by-20 cm in plan. It sat directly on Stratigraphic Layer B and sloped with the pit to the south. It was not clear whether FN1167 represented an *in situ* fiber layer from a late occupation or a remnant fiber layer destroyed by previous digging. Unit C encountered a similar burned fiber layer near the surface, discussed below. Subsequent ASWT excavations in 2014 bin Skiles Shelter have located a third burned fiber concentration above the alluvial deposit elsewhere in the site.

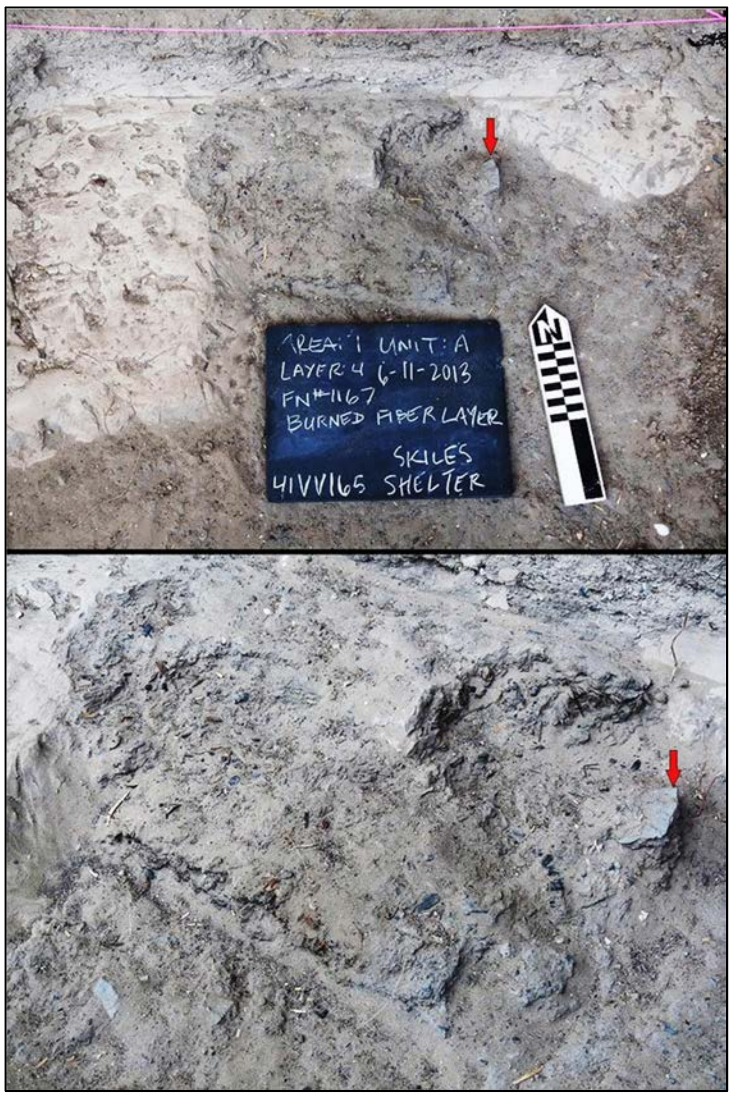


Figure 4.15. Skiles Shelter Unit A, Stratigraphic Layer FN1167: overview facing north (top) and detail facing northwest (bottom). The red arrow points to same rock.

Unit C, in the east alcove of Skiles Shelter, contained three distinct Stratigraphic Layers, H and G, and one dense fiber layer, FN1168 (Figure 4.16). The Stratigraphic Layers of Unit C were assigned after the field (Appendix F). Stratigraphic Layer H was a charcoal-rich, loose silty loam containing FCR approximately 35 cm thick. It is similar to Stratigraphic Layer A in the Unit A and B, however there is no obvious indication of previous looting. Stratigraphic Layer H encompasses FN1168 and is directly above the sloping limestone bedrock, Stratigraphic Layer G, 45 cm below datum (Figure 4.17).

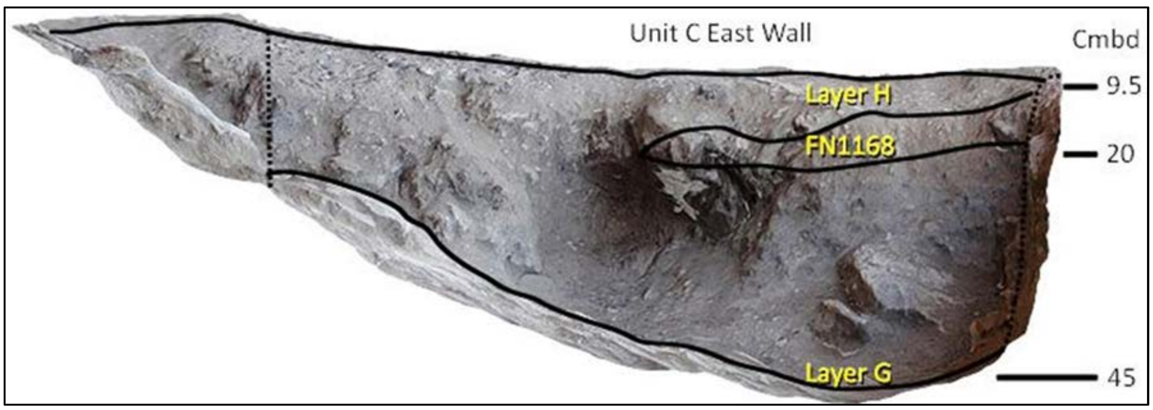


Figure 4.16. Skiles Shelter, Unit C stratigraphic profile, facing east.

The burned fiber layer, Stratigraphic Layer FN1168 resembled FN1167 in Unit A. Along with burned leafy fibers and twigs, FN1168 contained three rabdotus shells with puncture holes and several medium-sized burned rocks (Figure 4.18). Stratigraphic Layer FN1168 extended beyond the south wall of the unit and the exposed portion measured 60 cm north-south, 54 cm west-east, and approximately 10 cm thick. Much like FN1167, FN1168 may represent an *in situ* fiber layer or destroyed by previous flood scouring or unidentified looting. Stratigraphic Layer FN1168 was also kept as a field number when Stratigraphic Layers were assigned after field for the associated data.

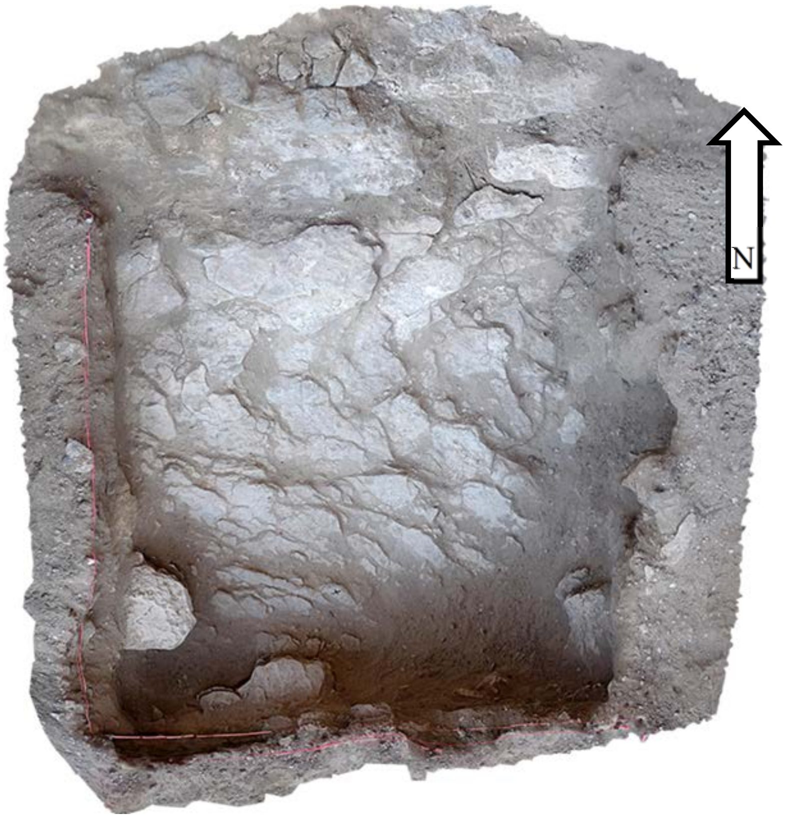


Figure 4.17. Skiles Shelter, Unit C Stratigraphic Layer G (bedrock surface) plan view. Floor slopes up to north (unit measures 1 m west-east).

Figure 4.18. Skiles Shelter, Stratigraphic Layer FN 1168 showing exposed rabdotus shell and burned fiber layer, facing north.

Due to the mixed shallow deposits encountered in Unit C no further excavations were conducted in the eastern alcove of Skiles Shelter. Many factors likely contributed to the degradation and erosion of the deposits in Unit C. Flood scouring and historic looting are the biggest factors which likely adversely affected the deposits in the eastern alcove. The shallow shelter roof and large spring vents, which are no longer active, likely contributed to the degradation in the long term. Unit C was not chosen for further botanical, zooarchaeological, or geophysical analyses.

Skiles Shelter Radiocarbon Results

Radiocarbon assays were obtained from four contexts within the excavation Units A and B, see Figure 4.13 (Table 4.1). All of the radiocarbon assays indicate a Late Prehistoric age of the deposits. In Stratigraphic Layer A, a sample (VV165-CS2) from the concreted organic material within the mortar on the underside of the grinding slab was radiocarbon dated to 518±9 cal B.P. (calibrated median).

A radiocarbon assay (VV165-CS1) taken from floated organic material directly beneath Stratigraphic Layer B dated to median 598±36 cal B.P. The date indicates that the flood event represented by the alluvial sandy deposit occurred sometime in the mid-14th century. The Perdiz style point recovered directly beneath the alluvium is consistent with this date.

Table 4.1. Skiles Shelter 2013 radiocarbon assays with corrected RCYBP and calibrated B.P. results.

ENC Sample I.D.	C.A.R. Sample I.D.	Provenience	Dated Material	Corrected Radiocarbon Years Before Present & 1σ (RCYBP)	$\delta^{13}C$ ‰	OxCal (4.2) Median Age in calibrated years Before Present (cal B.P.)	2σ Range in cal B.P.	Calibrated probability ages
VV165-CS1	CAR 301	Flotation Sample UL B-east8	Charcoal; Rhys sp. (Sumac)	564±28	-21.8	598±36	644-525	1306AD (53.2%) 1363AD, 1385AD (42.2%) 1425AD
VV165-CS2	CAR 302	Mortar hole, underside of slab UL A4	Charcoal; Indeterminate	478±24	-22.6	518±9	537-502	1413AD (95.4%) 1448AD
VV165-CS3a	CAR 303	Flotation Sample UL A11	Charcoal; *Agavaceae* (Sotol/lechuguilla/yucca)	732±28	-4.6	667±18	726-655	1224AD (2.6%) 1234AD, 1242AD (92.8%) 1296AD
VV165-CS3b	CAR 306	Flotation Sample UL A11	Charcoal; *Agavaceae* (Sotol/lechuguilla/yucca)	711±26	-7.6	669±26	690-569	1260AD (89.8%) 1300AD, 1368AD (5.6%) 1382AD
VV165-CS4	CAR 304	Flotation Sample UL A13	Charcoal; *Fabaceae* (Mesquite-Acacia)	607±27	-28.7	602±31	654-546	1296AD (95.4%) 1404AD

A split radiocarbon sample VV165-CS3a and VV165-CS3b were taken from floated organic material in the Unit Layer directly atop the lower alluvial deposit, Stratigraphic Layer E. The floated organics in Layer E were dated to median ca. 670 cal B.P. The dated flotation sample (VV165-CS4) from the lowest Unit Layer, UL A13, dated to median 602±31 cal B.P. Although the lowest assay (VV165-CS4) does not fit stratigraphically with the other dates, however all of the dates strongly overlap at two sigma standard deviation suggesting all of the dated deposits may well be contemporaneous. The cultural deposits in Skiles Shelter may have been heavily modified during the Late Prehistoric period.

Skiles Shelter Artifacts

Over the course of fieldwork thousands of artifacts were collected from Skiles Shelter. These artifacts include bone (n=595), two bone tools, lithic debitage (n=1053), 15 expedient and formal lithic tools, two etched pebbles, rabdotus and mussel shell fragments, ochre, and ground stone (n=1). I will limit my results to those artifacts which will be used for my comparative analysis. A summary of the recovered artifacts is in Appendix H.

Only three diagnostic projectile point/projectile point fragments were recovered within my excavation units at Skiles Shelter (Figure 4.19). All three points came from Stratigraphic Layer D, in the excavation Unit Layers below the alluvial layer in Unit A and B. The identified Perdiz arrow point and Ensor dart point were recovered from UL A8 and B-east8 respectively (see Figure 4.11). The point styles date to the Transitional Archaic (Ensor) and Late Prehistoric (Perdiz) periods. Discussed above, the Perdiz point was found directly beneath the sandy alluvium. Additionally, three other distal fragments of possible projectile points were found in Stratigraphic Layer D.

Figure 4.19. Projectile points from Skiles Shelter, Perdiz (left), Ensor (middle), and Langtry proximal fragment (right).

The third diagnostic point was a Langtry dart point stem fragment recovered in excavated UL B-east10. The Langtry style dates to the latter half of the Middle Archaic, and into the beginning of the Late Archaic period (Turpin 2004:270) and predates all of the radiocarbon dates at the site by ca. 3,000 years. The radiocarbon dates from the top and bottom of Stratigraphic Layer D are in chronological sequence, suggesting the Langtry point has been moved from older deposits at the site by bioturbation or human agency. The more extensive excavations of Skiles Shelter undertaken in 2014 recovered a much larger sample of diagnostic projectile points from the talus slope and toward the dripline. These point styles suggest a more continuous occupation record from the Middle Archaic to the Late Prehistoric (Koenig 2014).

Two limestone slabs were also found at the site possessing grinding facets. One slab, measuring approximately 95-x-45 cm, has five shallow grinding facets on one side (Figure 4.20) and was found on the talus slope at the upstream end of the site. The second slab, measuring approximately 56-x-40 cm, was found in the top layer, Layer A, of Unit A. The slab has red pigment and a shallow grinding facet on the top face and two deeper grinding facets on the bottom (Figure 4.21).

Figure 4.20. Grinding facets on limestone slab from talus slope of Skiles Shelter.

The Rock Sort, burned rock data, collected during the field school was unfortunately incomplete due to mistakes and omissions during the recording process. The most complete Rock Sort dataset comes from Unit A. The data showed no large (15+ cm) FCR and only single medium (7.5-15 cm) size rock in the top deposits, Stratigraphic Layer A (Table 4.2). The lack of rocks greater than 7.5 cm in diameter indicated an obvious sorting, and removal, of FCR sizes expected from a backfilled looter pit. Below the alluvial Stratigraphic Layer B, the Rock Sort showed all three size classes.

Figure 4.21. Skiles Shelter, limestone slab with grinding facet and pigment found facing up (left) in Unit A. The underside of slab (right) had mortar hole, highlighted, with concreted organic material that was radiocarbon dated (VV165-CS2).

Table 4.2. Skiles Shelter, quantified burned rock in Unit A.

Strat. Layers	Unit Layers	Count		Weight (kg)		
		Medium (7.5-15 cm)	Large (>15cm)	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)
A	A1	1	0	0.79	1.11	0
A	A2	0	0	0.3	0	0
A	A3	0	0	0.78	0	0
B	A7	0	0	0	0	0
D	A8	2	1	0.24	0.3	1.08
D	A9	7	2	0.58	1.98	2.62
D	A10	15	1	1.95	4.38	0.41
D,E	A11	12	3	0.62	0.7	2.1
F	A12	4	3	0.62	0.6	2.17

1/8 Inch Screen Sort Results

In Chapter 3 I outlined my method for collecting and sampling the material that remained on the nested 1/8th inch screen. The 1/8th inch Screen Sort artifact classes were weighed and counted for selected Unit Layers within the Skiles Shelter. Three unit layers, approximately 10 cm apart, were sampled from Stratigraphic Layers D and F within Unit A (Table 4.3). These three Unit Layers were chosen from the only undisturbed contexts in my Skiles Shelter excavations. The sorted samples from the 1/8th inch screen indicated a large amount of lithic debitage, with an increasing amount of bone with depth. The density of sorted unburned botanical remains was low given the amount of charcoal that was preserved in the soil matrix; this was likely due to poor preservation of identifiable organic remains discussed in the flooding site formation processes in this chapter.

Table 4.3. Skiles Shelter, 1/8th inch screen sort samples. (*)= not measured

Strat. Layers	Unit Layers	Description	Quantity	Weight (g)
D	A8	bone	74	*
		botanical		1.1
		debitage	69	
		Rabdotus shell	6	
D	A10	bone	130	4.5
		botanical		0.9
		burned exudate		<0.1
		debitage	163	*
		Heliodiscus shell	1	
		Rabdotus shell	9	
F	A12	bone	113	5.5
		botanical		1.5
		burned exudate		0.1
		debitage	156	*
		possible red ochre	2	0.3

Skiles Shelter Faunal Analysis

Faunal remains were identified from the same three Unit Layers as the 1/8th inch Screen Sort, within Stratigraphic Layers D and F (Appendix I). A total of 61 bones were analyzed, 2 of which were whole. The faunal assemblage contained 20 fragments with signs of cultural modification, including burning, and cut marks. Twelve fragments had signs from slight burning to calcination, of these three had cut marks on their surface.

Eleven bones in total had cut marks, all of which are either rabbit or small to medium game.

Cut marks on the bone fragments are a conclusive indicator of human processing of the animal, such as butchering and skinning. Burned or calcined bone fragments are not directly indicative of human consumption. Thermally altered bone fragments may be due to human cooking, if partially burned or discarded into the fire afterward. Alternatively, burned bone may have initially been introduced into the shelter by the death of a small animal, say a rodent in a burrow, which was then burned due to the proximity of the fire.

A Minimum Number of Individuals (MNI) calculation, conducted on the identified portions of bone fragments for each taxon in each Unit Layer, shows that rabbit constitutes the bulk of the faunal assemblage in Skiles Shelter, followed by rodents (Table 4.4).A single riverine resource, boney fish, was recovered from the sample. A larger boney fish faunal assemblage was expected, given the proximity of the shelter to the Rio Grande, however the small sample size was likely a biasing factor.

The identified deer bone in faunal assemblage was a bone tool showing signs of edge modification and polish. The Number of Identified Specimen (NISP) calculation had five indeterminate large mammal bones; two of which were slightly burned conjoining pieces. Again, my interpretation of Skiles Shelter is limited by the small sample size obtained in the lower intact deposits; however like other rockshelter deposits, the bones of various ordinary animals were recovered.

Table 4.4. Skiles Shelter faunal sampling, Minimum Number of Individuals (MNI) and Number of Identified Specimen (NISP). Radiocarbon dates show all three UL fall within the Late Prehistoric period.

MNI			Avian					Turtle					Boney Fish							Reptiles			Rodents				Rabbits				Canine				Deer			
Area	Unit	Layer	Accipitridae	Anatidae	Anseriformes	Aves	Geococcyx californianus	Apalone spinifera	Apalone spinifera emoryi	Apalone spiniferus	Chelonia	Testudinae	Catostomidae	Ictaluridae	Ictalurus furcatus	Ictalurus punctarus	Ictalurus sp.	Osteichthyes	Teleostei	Reptilia	Serpentes	Squamata	Otospermophilus variegatus	Sigmodon sp.	Neotoma sp.	Rodentia	Leporidae	Lepus californicus	Sylvilagus floridanus	Sylvilagus sp.	Canidae	Canis sp.	Carnivora	Urocyon cinereoargenteus	Artiodactyla	Odocoileus sp.	Odocoileus virginianus	Total Number
1	A	8																							2		1	1		2	1							7
1	A	10				1	1							1									1	1			1	1		1						1		9
1	A	12																												1								1
		Totals	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	2	0	2	2	0	4	1	0	0	0	0	1	0	
		Class Totals	1					0					1							0			2				8				1				1			

NISP			Avian					Turtle					Boney Fish							Reptiles			Rodents				Rabbits				Canine				Deer			Indeterminate				
Area	Unit	Layer	Accipitridae	Anatidae	Anseriformes	Aves	Geococcyx californianus	Apalone spinifera	Apalone spinifera emoryi	Apalone spiniferus	Chelonia	Testudinae	Catostomidae	Ictaluridae	Ictalurus furcatus	Ictalurus punctarus	Ictalurus sp.	Osteichthyes	Teleostei	Reptilia	Serpentes	Squamata	Otospermophilus variegatus	Sigmodon sp.	Neotoma sp.	Rodentia	Leporidae	Lepus californicus	Sylvilagus floridanus	Sylvilagus sp.	Canidae	Canis sp.	Carnivora	Urocyon cinereoargenteus	Artiodactyla	Odocoileus sp.	Odocoileus virginianus	Small Mammal	Medium Mammal	Large Mammal	Mammalia	Total Number
1	A	8																							2		1	5		9	1									1		19
1	A	10				3	1							1									1	2			1	2		9						1		7	6	4		38
1	A	12																												1								1				2
		Totals	0	0	0	3	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	2	0	2	7	0	19	1	0	0	0	0	1	0	8	6	5	0	
		Class Totals	4					0					1							0			5				28				1				1			19				

CHAPTER 5: KELLEY CAVE RESULTS

Kelley Cave is a southwest facing rockshelter that measures approximately 28 m long and 12 m deep from the dripline (Figure 5.1). The shelter has faded pictographs, in the Pecos River style, along a panel of the south wall. When initially described by the 1932 Sayles and Kelley expedition, the lower portion of this rock art was covered by cultural deposits. Nondescript pigmentation can also be seen on a few low shelves along the back walls of the shelter; however they are too faded to discern shape or style.

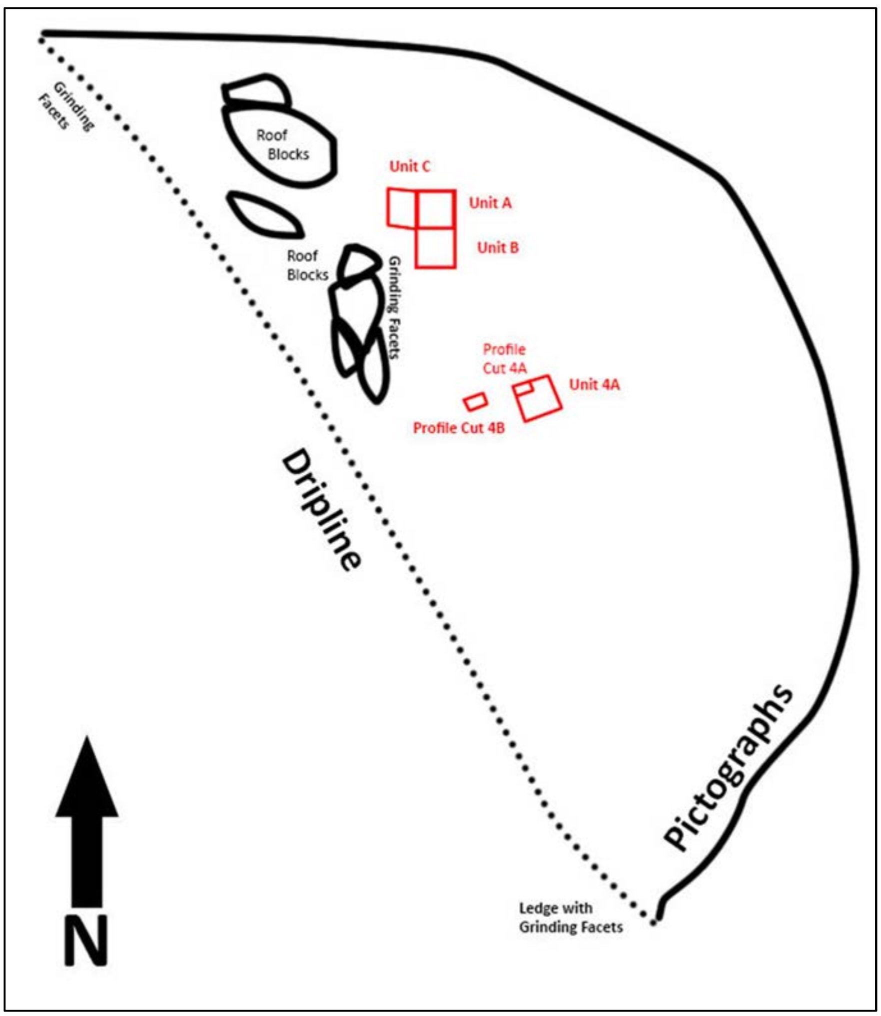


Figure 5.1. Kelley Cave simplified plan map.

During the 2013 investigations, a total of 27 grinding facets of varying depth were recorded. Three facets were found on the northwestern corner of the shelter dripline on freshly exposed limestone bedrock (Figure 5.2). Nineteen more grinding facets were uncovered on limestone ledge at the southeastern corner of the shelter outside the dripline (Figure 5.3). A large roof block just inside the shelter also has five grinding facets along its edge as well as striations and a slick surface from processing on its flat side (Figure 5.4). On the shelter floor there was also a limestone grinding slab, measuring approximately 70-x-50 cm, with three grinding facets on a single side (Figure 5.5). Several other fragments of exhausted grinding slabs, worn through on both sides were observed on surface. Although resistant to many of the formation processes, most of the grinding slab and fragments on surface are likely the result of previous excavations in the shelter.

Site Formation Processes: Flooding

Kelley Cave is located approximately 170 m north of the canyon mouth. Although the proximity to the Rio Grande, as well as the hydrologic factors of the canyon, make Kelley Cave susceptible to the flooding previously discussed in Skiles Shelter, the elevation of the shelter floor protects the deposits from regular flooding. The lowest point of the shelter floor in Kelley Cave, within the dripline, is approximately two meters above the shelter floor in the adjacent Skiles Shelter: 968.52* m vs. 966.47 m. The apex of the shelter floor in Kelley Cave is over six meters higher than its neighbor, 972.78 m. The difference in elevation allowed the deposits to escape inundation during the 2010 flood which affected Skiles Shelter (Figure 5.6). However, catastrophic floods of a

* All elevation measurements given in the arbitrary grid discussed in Chapter 3.

greater magnitude and rarer occurrence can and have affected the cultural deposits within the shelter, as will be discussed in the Feature 4 section below.

Figure 5.2. Grinding facets at northwest edge of dripline, Kelley Cave, north arrow given for scale but points east.

Figure 5.3. Grinding facets outside of Kelley Cave on south end, view down talus slope.

Figure 5.4. Above, grinding facets on roof block in Kelley Cave, facing southeast. Below, a close-up of striations long the sloping surface, facing SE.

Figure 5.5. Grinding slab on floor of Kelley Cave.

Site Formation Processes: Crystal Growth Stresses

Water plays a role in the formation processes of the rockshelter itself, and affects the cultural deposits therein. Previously, the rockshelter formation mechanism was thought to be erosion from lateral drift of stream channels (Patton and Dibble 1982). More recently it is thought that lateral drift plays only a minor role, if any, in the creation of rockshelters. Currently it is thought to be a combination of factors with cryoclastism and salt weathering as the main forces.

Cryoclastism, or frost spalling, occurs in areas of extreme climatic fluctuations. Limestone carrying moisture through the rock or from the air spalls off through the cyclical process of freeze-thaw. The process is then accelerated by the cracks left behind by previous spalls and over time creates rockshelters (Collins 1991). Robinson (1997) studied this process in Bonfire Shelter (41VV218) and reported that during the 1982/1983 winter excavations, investigators observed an average of three to four spalls falling per week.

Figure 5.6. Flooding in Skiles Shelter (right), missing Kelley Cave (left), on July 4, 2010, facing east. High water reached the middle of the talus slope in Kelley Cave, but remained 3-4 meters below the lowest point of the floor.

Salt weathering is a process that has not been discussed in the LPC but may be a mechanism of rockshelter formation which also affects the cultural deposits (Charles Frederick personal communication, 2013). Salt weathering is a phenomena in which porous rock, like limestone, is saturated with water carrying soluble salt minerals. These salt minerals collect into crystalline efflorescences on the surface and in fissures of the rock through evaporation. Over time the efflorescence exerts enough force to spall limestone off the shelter wall (Goudie et al. 1970; Goudie 1999; Kramar et al. 2010). In the LPC, the salt weathering process is suggested to function through the dissolution and recrystalization of gypsum minerals carried through porous limestone (Charles Fredrick personal communication, 2015). Beyond the LPC, gypsum salt weathering has been well documented (Doehne 2002).

Calcite crystal efflorences were observed on bone fragments, rock, and hollow voids in ash matrix near the surface (Figure 5.7). I hypothesize that the crystals reflect diagenic processes occurring within intact deposits near the surface of the shelter. The burning of wood ash introduced increased quantities of CaCO, calcium oxalate crystals, into the matrix. With the introduction of water and alkaloid phosphorus, likely from the urine and feces introduced from sheep and goats (and native javalinas), the pH balance of the ash deposit changed and formed a highly soluble calcium hydroxide, $Ca(OH)_2$. The calcium hydroxide reacted with CO_2 in the atmosphere to form calcite crystals, $CaCO_3$, in a dry state. This diagenic process only occurs within *in situ* deposits (Karkanas et al. 2000; Karkanas et al. 2002). The porosity of bone may cause a capillary action which could serve to concentrate the mineral. Further analysis would be necessary to chemically identify if the mineral is struvite, which could confirm the role of introduced ammonia (urine and feces) in this process.

Figure 5.7. Calcite crystal efflorences on bone found in ash layers in Kelley Cave.

Site Formation Processes: Bioturbation

The animal and insect agents of bioturbation in Kelley Cave are the same as those observed in Skiles Shelter, as discussed in Chapter 4. In Kelley Cave, historic sheep and goat herding has left a great deal of dung on the surface, and due to the aridity afforded by protection from floods, the upper deposit of Kelley Cave carries a strong smell of ammonia. Sheep and goats are no longer raised in the canyon today. But the shelter floor shows ample evidence that the javelinas and feral hogs which inhabit the canyon sleep, defecate, and dig in Kelley Cave, and javelinas were chased out of the shelter and down the talus slope in the early mornings several times during this investigation.

Site Formation Processes: Human Agency

Aside from hogs, humans have added to erosional and trampling damage of the talus slope and shelter floor. To access the shelter from the canyon bottom, one must follow an eroding path up the canyon edge and through the talus slope. This path was littered with loose fire-cracked rock (FCR) and chert material displaced by traffic. At the outset of this investigation a stairway was constructed using railroad ties and rebar to help prevent this erosion, as well as injury to the crew. Like Skiles Shelter, authorized tours visit Kelley Cave adding to the trampling displacement of objects on the talus slope and shelter floor. The fine dust kicked up from foot traffic within the shelter may also contribute to the deterioration of the shelter's pictographs. For this reason, heavy rubber mats were placed in a path inside the shelter to keep the dust at a minimum during this investigation. These improvements remain on site.

As discussed in Chapter 2, Kelley Cave received archaeological and looting attention in the mid-20th century. The documented excavations by Sayles and Mear provided the approximate provenience of their trenches; however the extent of digging by the Martin expedition and others is unknown. Undoubtedly, all of the digs were screened within or at the dripline of the shelter itself. The screening has likely left many cultural artifacts on surface in secondary context, such as the grinding slab (Figure 5.5).

Kelley Cave Excavations

As discussed in Chapter 3, excavations at Kelley Cave were conducted following breaks in the natural stratigraphy when possible. If no natural breaks were apparent, each Unit Layer was excavated to a maximum thickness of approximately 5 cm. Unit C, originally opened to provide better access to a deep Unit A, was dug following the breaks natural stratigraphy but with an arbitrary maximum Unit Layer thickness of approximately 10 cm. Once a trench pit was identified in Unit C, excavation shifted to excavate the backfill from within the pit.

In total, 36 excavation Unit Layers (ULs) were dug in Unit A, 31 in Unit B, and an additional 20 Unit Layers in the lower combine unit AB (Figure 5.8); Unit C was dug in 9 Unit Layers, and 13 Unit Layers were excavated in Unit 4A (Figure 5.9). Excavations in Units A and B were terminated at approximately 240 cmbs due to the increasing presence of large roof blocks within the excavation units and time constraints (Figure 5.10). The lowermost Stratigraphic Layer encountered, a fine sandy loam I surmise represented a pre-occupation deposit. An additional hand-auger test was conducted at the lowest Unit Layer which continued for an additional 20 cm in the fine sandy loam until contact with another large buried rock for a total depth of 262 cm below surface (cmbs), from 972.78 to 970.16 m. Excavation volumes for each layer were calculated using ArcGIS Cut-Fill function which measures the difference between two Digital Elevation Models (DEMs). Due to the poor rendering of some of the DEMs, especially those in the lower depths, a few of the calculated volumes are considered to be inaccurate and the volumes were estimated (see Appendix E).

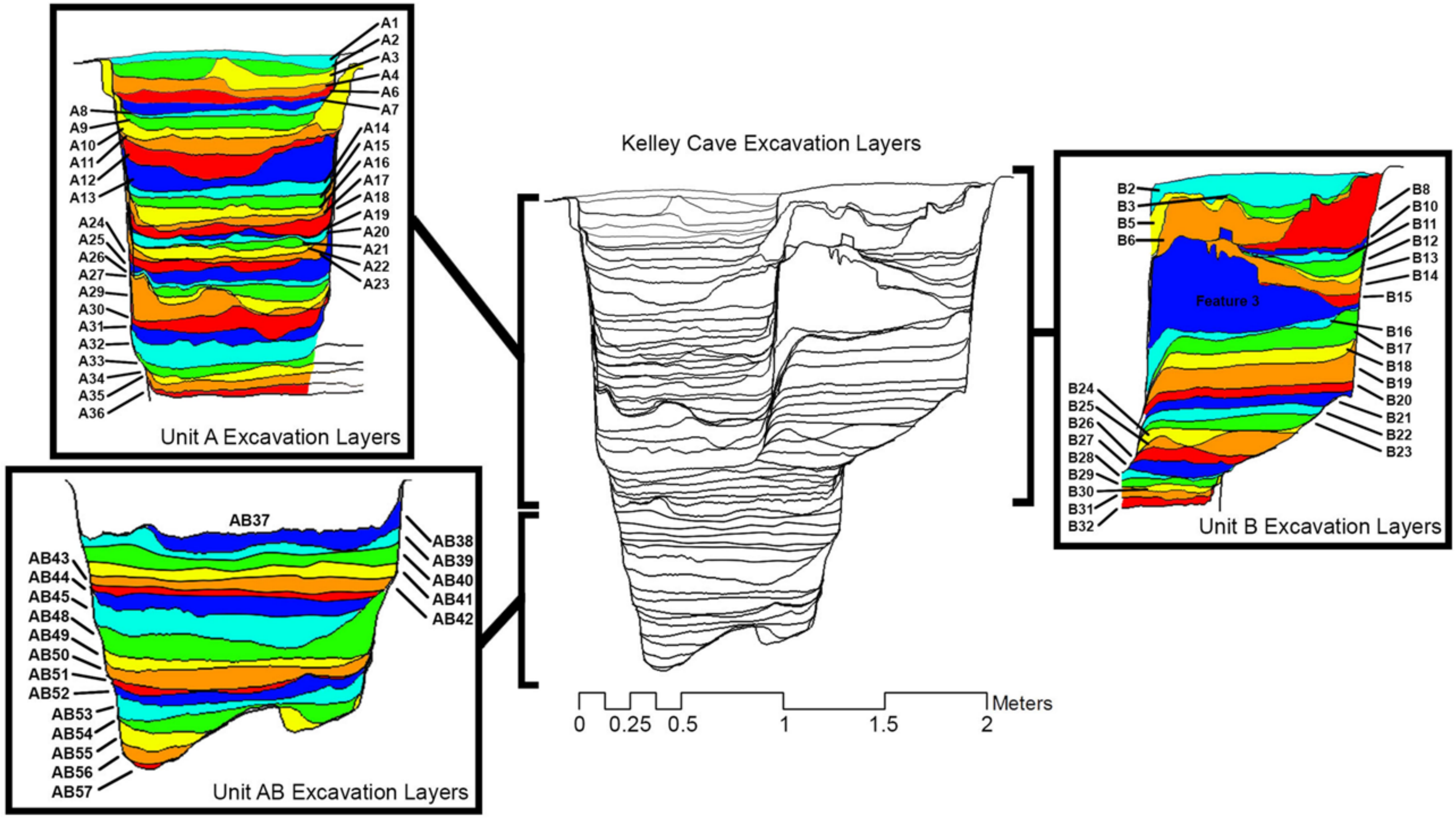


Figure 5.8. Kelley Cave, Schematic depiction showing extent of excavation Unit Layers along east profile wall.

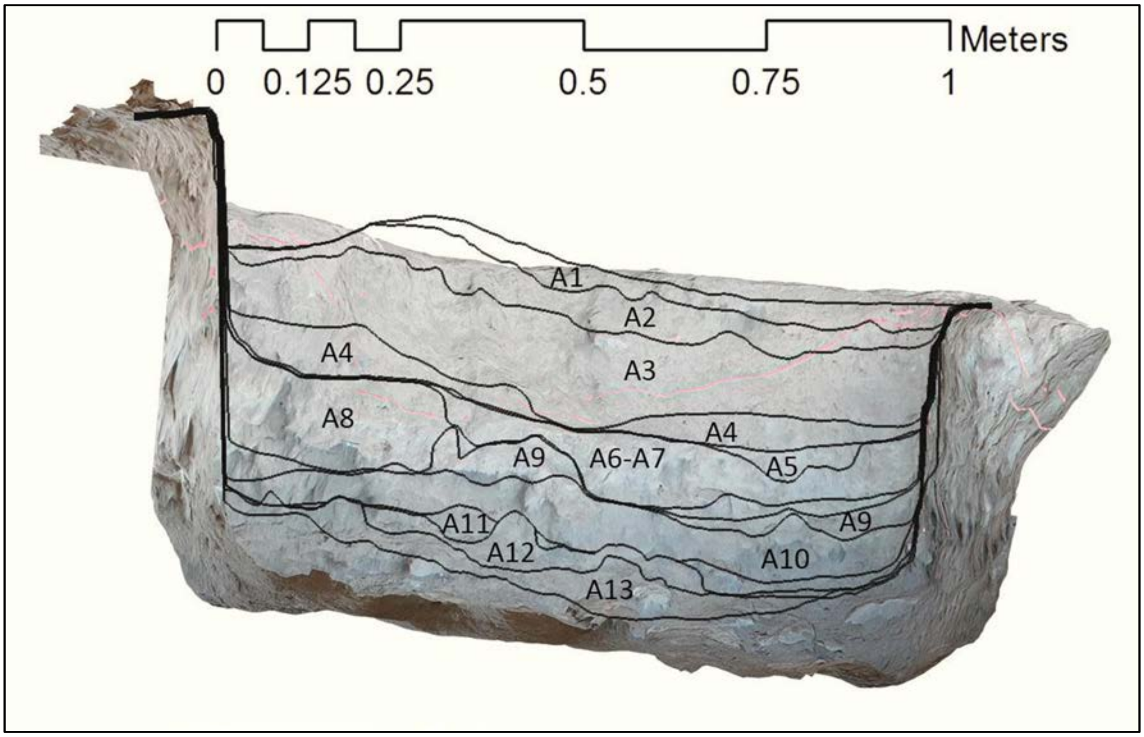


Figure 5.9. Excavated Unit Layers in Unit 4A in Kelley Cave, facing east.

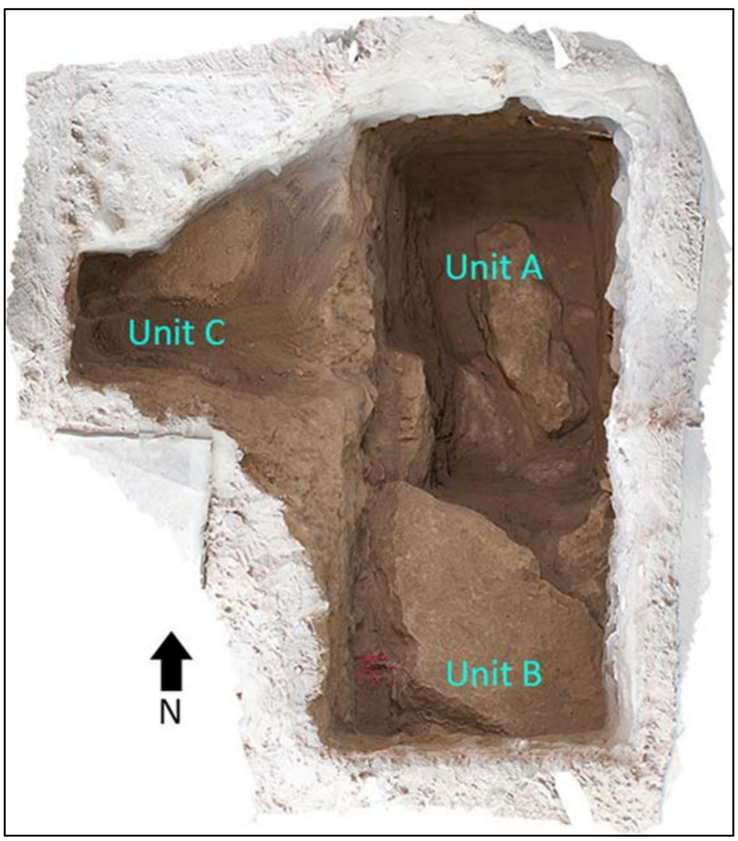


Figure 5.10. Kelley Cave, plan view of completed excavations with numerous roof blocks and large spalls visible in Units A and B.

Kelley Cave Stratigraphy

Excavation Units A and B documented 19 distinct Stratigraphic Layers within the excavation profile (Figure 5.11), labeled A through H (Appendix F). Within these two units seven cultural features were documented, Features 1-3 and 5-8. Over the course of excavations it was also determined that the uppermost deposits in Units A, B, and C were partially disturbed by an old looter “trench” (Figure 5.12). A wall of the trench was encountered in Unit C. The trench walls were not straight, and the lower boundary is uneven. The trench was filled with very loose matrix, which caused many minor wall collapses during the 2013 excavations. Within the loose fill, a few early 20th century materials were recovered near the surface. Using the loose matrix as a guide, the maximum depth of the looter trench is approximately 65 cmbs, and intrudes into both Feature 1 and Feature 3. Evidence for a second possible “trench” encountered in the upper deposits of Unit B will be discussed in Chapter 6.

Stratigraphic Layers A, AA, and AB were distinct compact ash lenses (approx. 23 cm thick) with burned rabdotus shell inclusions which constituted Feature 1 (Figure 5.13). The ash Layers extended across the intact portions of Units A and C, and in the northeast corner of Unit B. The Feature 1 Stratigraphy is discussed in more detail below.

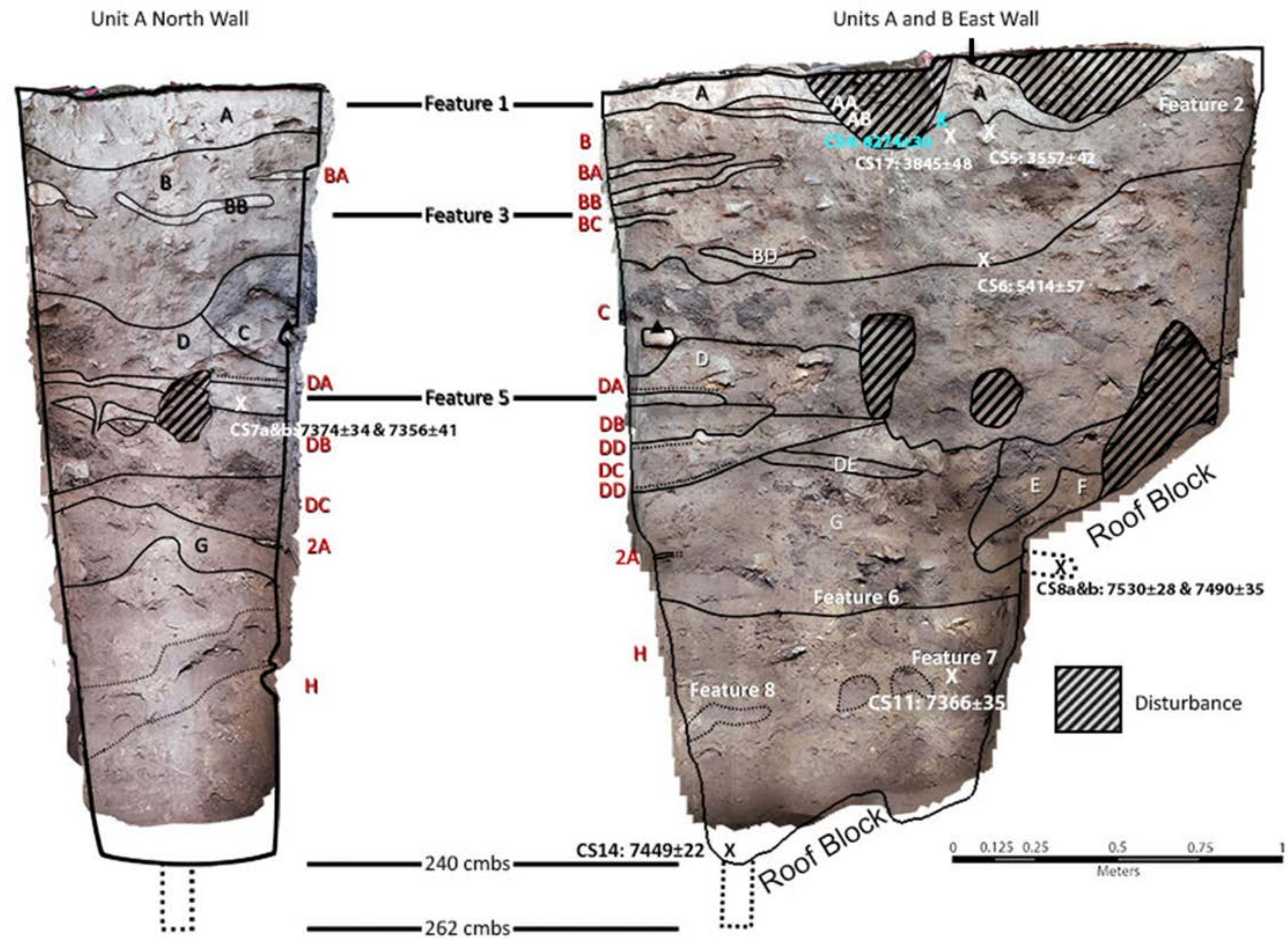


Figure 5.11. Kelley Cave profile wall of Units A and B Stratigraphic Layers AA through H (in red), and radiocarbon results (in median cal B.P.). Relative feature locations are also shown on profile.

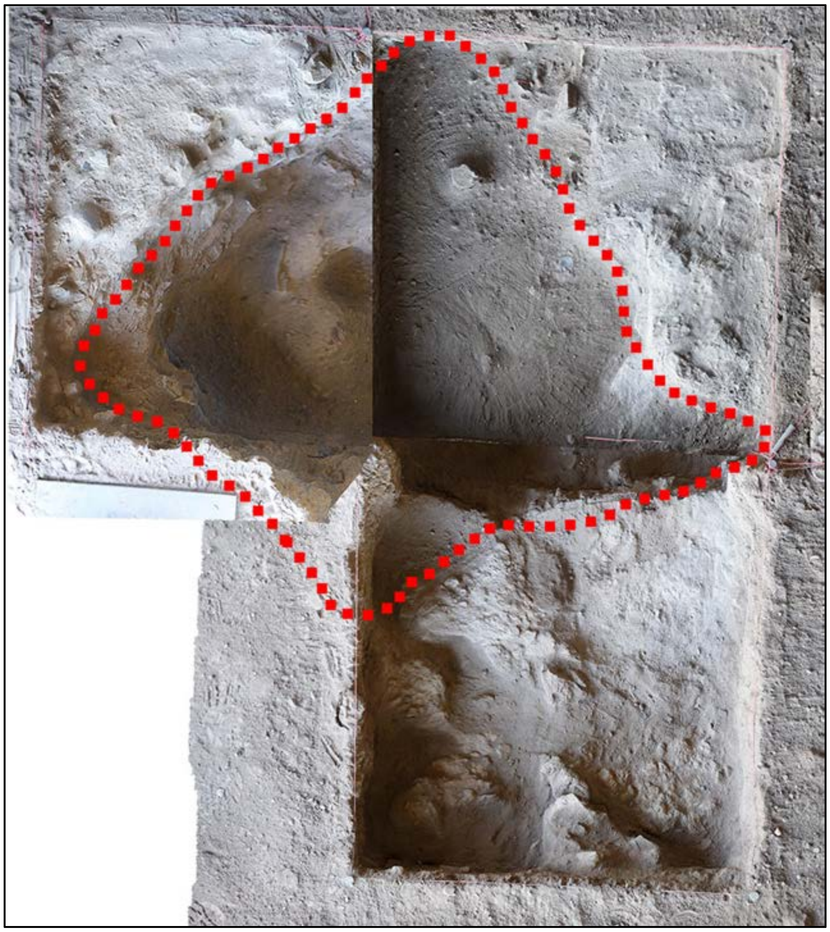


Figure 5.12. Outline of looter trench in Kelley Cave from composite of UL A3, B5, and C6, north is to the top.

Figure 5.13. Burned and punctured rabdotus shell in the ash (Stratigraphic Layers A, AA, AB) of Feature 1.

Stratigraphic Layer B was a compact brown charcoal-laden loam approx. 60 cm thick, which makes up Feature 3. Layer B contained multiple thin ash lenses (Stratigraphic Layers BA, BB, BC, and BD) and numerous krotovina, or in-filled burrows. Throughout the profile rodent burrows have disturbed a great deal of the stratigraphy. Yet intact segments of many stratigraphic layers can still be seen. Along with the ash lenses, multiple basin-shaped lenses of charcoal were observed sloping south and also to the west. More detail is given in the Feature 3 description below.

Stratigraphic Layer C was dark brown sandy loam approximately 70 cm thick with very large mottles of charcoal-rich sediment, concentrated in the northeast corner of Unit A. The largest rodent burrows observed in Units A and B were in this layer, some 10-15 cm in diameter (see Figure 5.11). The sediment in Stratigraphic Layer C was slightly less compacted than Layer B above. Several open rodent burrows were encountered during excavation directly below Feature 3. Some of these burrows had inner coatings of dried mud (Figure 5.14). I surmise that the historic looter trench, infilled with loose cave dust, allowed rodents easy access to deposits below Feature 3, into Stratigraphic Layer C.

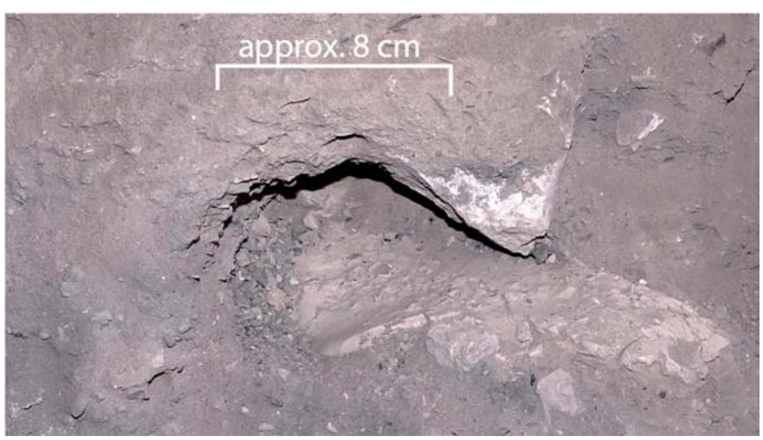


Figure 5.14. Exposed rodent burrow in UL A16 with a thin mud lining, facing east.

Stratigraphic Layer D was a coarse, thermally altered sandy silty loam (approx. 25 cm thick) which contained small ash lenses and charcoal. There was a significant increase in FCR from Stratigraphic Layer C to Layer D (Figure 5.15), with the quantified FCR increasing with depth. Feature 5, composed of heated limestone slabs and ash lenses, was encountered in Layer D and will be discussed in more detail.

Figure 5.15. Kelley Cave, top surface of UL A18, beginning of increased burned rock layer (top). Many of which still had charred plant fibers adhering to the underside of the rock (bottom).

Stratigraphic Layer D contained numerous thin strata (Stratigraphic Layers DA, DB, DD, DC, and DE) all of which were a part of Feature 5; in the northeast corner of Unit A. Stratigraphic Layer DA was a mix of silty clay with charcoal-rich shelter material above the ash lens of Feature 5. Below the ash of Feature 5, Stratigraphic Layer DB was a charcoal and small-gravel mix between the two defined ash lenses of Feature 5 and Layer DC. The two DD Stratigraphic Layers, above and below Layer DC, were thin lenses of charcoal, likely associated with the burning events of Feature 5. Finally, Stratigraphic Layer DE was a mixed matrix with charcoal and few small rocks and bone. Layer DE sloped to the south and was likely related to the repeated firing events of Feature 5.

Stratigraphic Layers E, a gray silty loam, and Stratigraphic Layer F, a yellowish brown silt, were encountered in the south corner of Unit B, directly above the large roof block. This area was observed to have a high degree of burrowing disturbance. Excavators noted a rat nest in the same corner, suggesting rodent disturbances may have transported and mixed later sediment, such as tan alluvium (Figure 5.14) into the matrix creating the stratigraphy. Both Stratigraphic Layers E and F contained low amounts of charcoal and bone fragments.

Stratigraphic Layer G, a coarse gray silty loam, approximately 50 cm thick, was the lowest stratigraphic layer with significant amounts of charcoal and FCR. Layer G contained the greatest amount of quantified burned rock of any defined Layer, with pockets of charcoal throughout. Many in-filled krotovina were observed in the profile wall of Layer G. Additional roof blocks, below the roof block previously discussed with Layer E, protruded from the both the west and east walls of Unit B (Figure 5.10).

In the northeast corner of Unit A, a 3 cm thick compact silty clay lens was observed, labeled Stratigraphic Layer 2A, which may represent an ancient flood deposit within Stratigraphic Layer G. The nomenclature for Stratigraphic Layer 2A was kept for the association of geoarchaeological samples. The lower boundary of Layer G was irregular and broken by many krotovina, and sediment matching that of Layer G was observed throughout the krotovina in Layer H.

Stratigraphic Layer H was the lowest defined stratigraphic layer encountered in Kelley Cave. Layer H was light brown fine sandy loam with numerous krotovina disturbances. In Layer H, artifact counts dropped significantly, and continued to as depth increased, and bone recovered from the fine sandy loam were badly eroded. Charcoal fragments were observed to be small (<1 cm) and rounded; FCR fragments were also small (<7.5 cm) and, with increasing depth, the majority of rocks observed were small unburned spalls. Three cultural features were documented within Stratigraphic Layer H, Features 6, 7, and 8. Evidence suggests all three features were placed in pits dug into the fine sandy loam. These features are described below. I infer that Layer H represents a pre-occupation deposit which has been mixed and disturbed by subsequent human and animal use of the shelter.

In Unit 4A, five Stratigraphic Layers (Layers) were documented below Feature 4 (Appendix F). These Layers were labeled I through M (Figure 5.16). Profile Cuts 4A and 4B documented the fine stratigraphy of Feature 4 into 8 Sub-layers. The Profile Cut Sub-layers will be described with Feature 4 below. The deposits in Unit 4A contained numerous krotovina throughout, much like Units A and B, but no other sign of turbation, such as historic digging, was noted below the surface. Excavations in Unit 4A were terminated at approximately 65 cmbs due to time constraints.

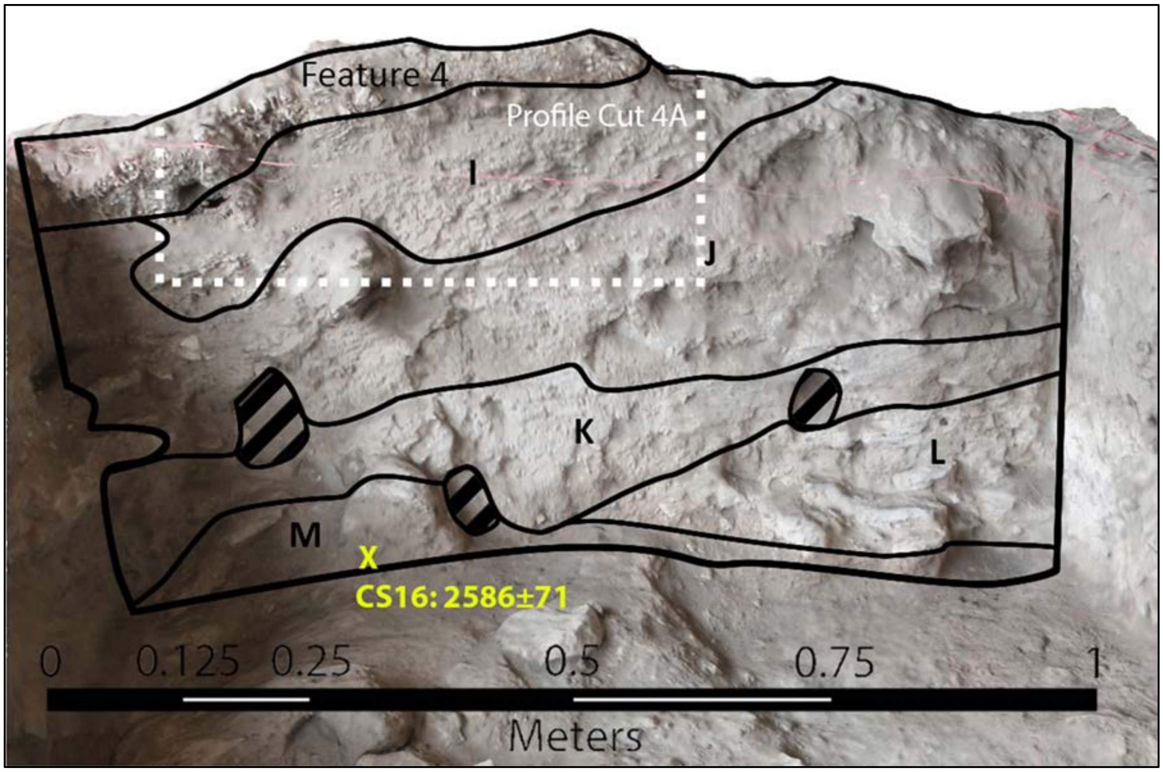


Figure 5.16. Unit 4A, north wall Stratigraphic Layers I-M, with white dotted line approx. position of Profile Cut 4A. Radiocarbon sample VV165-CS16 in median cal. B.P.

Stratigraphic Layer I, directly below Feature 4, was an extremely compact gray ash and silt matrix approximately 20 cm thick. Layer I contained numerous small heated rock fragments (<5 cm) and some unburned plant fiber which has been concreted into the matrix. Both upper and lower boundaries of Stratigraphic Layer I sloped with Feature 4 toward the dripline of the shelter, to the southeast. Due to this alignment, Layer I was likely associated with the events that created Feature 4, as discussed below.

Stratigraphic Layer J (approx. 30 cm thick), was less compact than Layer I, but had a similar texture, FCR and fiber content. A rodent burrow was documented containing a cache of little walnuts. The lower boundary of Stratigraphic Layer J has a slight slope toward the dripline of the shelter like the surrounding layers.

Stratigraphic Layers K, a 10 cm thick gray silt loam, and Layer L, a 20 cm thick sandy clay loam, both had high amounts of white ash within the matrix. Both Layers had clusters of small charcoal within the ash and sloped toward the dripline of the shelter. Stratigraphic Layer K contained significantly more FCR than lower Layer L. Stratigraphic Layer L had horizontal ash stratigraphy indicative of multiple burning events.

Unit 4A excavations concluded 10 cm into the top of Stratigraphic Layer M. Layer M was a return to loose gray silt containing small and medium sized burned rock and clustered charcoal fragments. The top of Layer M appeared to be relatively horizontal, with an increase in medium-sized burned rocks. The 2014 ASWT investigations expanded on Unit 4A to the west during their continued investigation of Feature 4. Their investigation found multiple distinct burned rock and ash layers at lower elevations than where I concluded the unit.

Kelley Cave Radiocarbon Results

Ten radiocarbon assays were obtained on samples from Units A and B (Table 5.1). Three other assays were taken from Profile Cut 4B, in Feature 4, and one assay from Unit 4A for a total of 14. The assays were calibrated using OxCal 4.2 and the median dates will be discussed here. The earliest dates, those from Feature 5 (VV164-CS7a&b), immediately below the roof block (VV164-CS8a&b), Feature 7 (VV164-CS11), and the loose charcoal in the lowest excavation level, UL AB57 (VV164-CS14), all grouped ca. 7400 cal B.P.

All of the results fit expected chronologic order, increasingly older with depth, except for sample VV164-CS4. The charcoal used for this assay was within the ash of Feature 1, and is likely the result of previous digging in the shelter. A second sample (VV164-CS17) was taken from below Feature 1, but 40 cm west of VV164-CS4 in the same profile. The assay date was relatively contemporary to the dated sample taken from the top of Feature 3 (VV164-CS5) confirming that Feature 1 post-dates ca. 3560 cal. B.P. and was likely dug into older deposits.

The majority of radiocarbon assays were taken from samples in feature contexts and will be discussed in the Feature section below. In excavation Units A and B, the radiocarbon dates span the Early to Middle Archaic periods, from median ca. 7530 (VV164-CS8a) to ca. 3560 cal B.P. (VV164-CS5). In Unit 4A, a charcoal sample taken from beneath the ash layers, Stratigraphic Layer K and L, was dated to median ca. 2590 cal B.P. (VV164-CS16). Unburned fiber samples from above and below the mud in Profile Cut 4B, which are also found at the surface of Unit 4A, dated to ca. 640 cal B.P. (VV164-CS1-CS3) suggesting that the deposits excavated in Unit 4A span from the Late Archaic to the Late Prehistoric periods. The dated unburned fiber in Profile Cut 4B also indicates that the event which created Feature 4 occurred during the Late Prehistoric, as will be discussed in more detail in the Feature 4 section below.

Table 5.1. Kelley Cave Radiocarbon Results.

ENC Sample I.D.	C.A.R. Sample I.D.	Provenience	Dated Material	Corrected Radiocarbon Years Before Present & 1σ (RCYBP)	$\delta^{13}C$ ‰	OxCal (4.2) Median Age in calibrated years Before Present (cal B.P.)	2σ Range in cal B.P.	Calibrated probability ages
VV164-CS1a	CAR 282	Profile Cut 4B, sub-layer 3c	Uncharred leaf, *Agavaceae,* cf. Agave	612±22	-26.1	602±31	654-550	1296AD (95.4%) 1400AD
VV164-CS1b	CAR 283	Profile Cut 4B, sub-layer 3c	Uncharred leaf; *Agavaceae,* cf. Agave	635±20	-30.5	593±34	663-556	1288AD (38.5%) 1324AD, 1345AD (56.9%) 1394AD
VV164-CS2	CAR 284	Profile Cut 4B, top of sub-layer 5	Uncharred leaf; *Agavaceae,* cf. Agave	668±25	-14.9	642±40	674-561	1276AD (52.8%) 1316AD, 1354AD (42.6%) 1390AD
VV164-CS3	CAR 285	Profile Cut 4B, bottom of sub-layer 5	Uncharred leaf; *Agavaceae* of sotol	640±22	-22.7	593±35	665-556	1285AD (39.6%) 1324AD, 1344AD (55.8%) 1394AD
VV164-CS4	CAR 286	Bottom of Feature 1, Exposure 5	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	5463±27	-26.7	6274±30	6305-6209	4356BC (55.1%) 4310BC, 4305BC (40.3%) 4260BC
VV164-CS5	CAR 287	Top of Feature 3, Exposure 4B	Charcoal; Indeterminate	3325±26	-25.1	3557±42	3632-3478	1683BC (95.4%) 1528BC
VV164-CS6	CAR 288	Bottom of Feature 3, Exposure 2B	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	4617±27	-25.9	5414±57	5450-5297	3501BC (63.9%) 3428BC, 3381BC (31.5%) 3348BC
VV164-CS7a	CAR 289	Feature 5, under slab rock	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	6466±29	-31.4	7374±34	7431-7321	5482BC (95.4%) 5372BC
VV164-CS7b	CAR 290	Feature 5, under slab rock	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	6413±28	-32.4	7356±41	7419-7277	5470BC (95.4%) 5328BC
VV164-CS8a	CAR 291	Unit B, under roof boulder	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	6643±27	-34.1	7530±28	7576-7476	5626BC (95.4%) 5526BC

ENC Sample I.D.	C.A.R. Sample I.D.	Provenience	Dated Material	Corrected Radiocarbon Years Before Present & 1σ (RCYBP)	$\delta^{13}C$ ‰	OxCal (4.2) Median Age in calibrated years Before Present (cal B.P.)	2σ Range in cal B.P.	Calibrated probability ages
VV164-CS8b	CAR 292	Unit B, under roof boulder	Charcoal; *Fabaceae* (woody legume, mesquite, or acacia)	6597±28	-18.6	7490±35	7564-7433	5615BC (19.7%) 5584BC, 5570BC (75.7%) 5484BC
VV164-CS11	CAR 329	Feature 7, under rock	Charcoal; *Fabaceae,* woody legume	6537±27	-21.1	7366±35	7426-7306	5476BC (95.4%) 5357BC
VV164-CS14	CAR 334	Unit AB, EL 57, loose charcoal	Charcoal; *Fabaceae,* woody legume	6537±27	-19	7449±22	7497-7421	5548BC (95.4%) 5472BC
VV164-CS16	CAR 331	Unit 4A, EL 11, beneath ash layer	Charcoal; *Condalia sp.*	2483±21	-28.6	2586±71	2718-2486	768BC (95.4%) 536BC
VV164-CS17	CAR 335	Below Feature 1, Exposure 5	Charcoal; *Acacia sp.*	3548±24	-26	3845±48	3904-3723	1954BC (70.9%) 1867BC, 1848BC (24.5%) 1774BC

Kelley Cave Geoarchaeological Results

X-Ray Diffraction (XRD) was conducted on sediment samples from Unit A spanning from 0-123.5 cmbs. The XRD results indicate large quantities of calcite, quartz, K-feldspar, and plagioclase in the samples (Figure 5.17). The high amounts of quartz, K-feldspar, and plagioclase are not derived from the canyon limestone, and must be from the Rio Grande alluvium. The results indicate high indices of Rio Grande deposits which may be the results of reworked flood deposits in the shelter. It may also be an indicator of occupational behavior in which alluvium from the canyon bottom was brought into the shelter for use with earth oven cooking. Results from LOI, MS, and P show sporadic readings typical of mixed occupation deposits, with decreasing mean phosphorus and organics below Feature 6, in the fine sandy loam of Layer H (Figure 5.18).

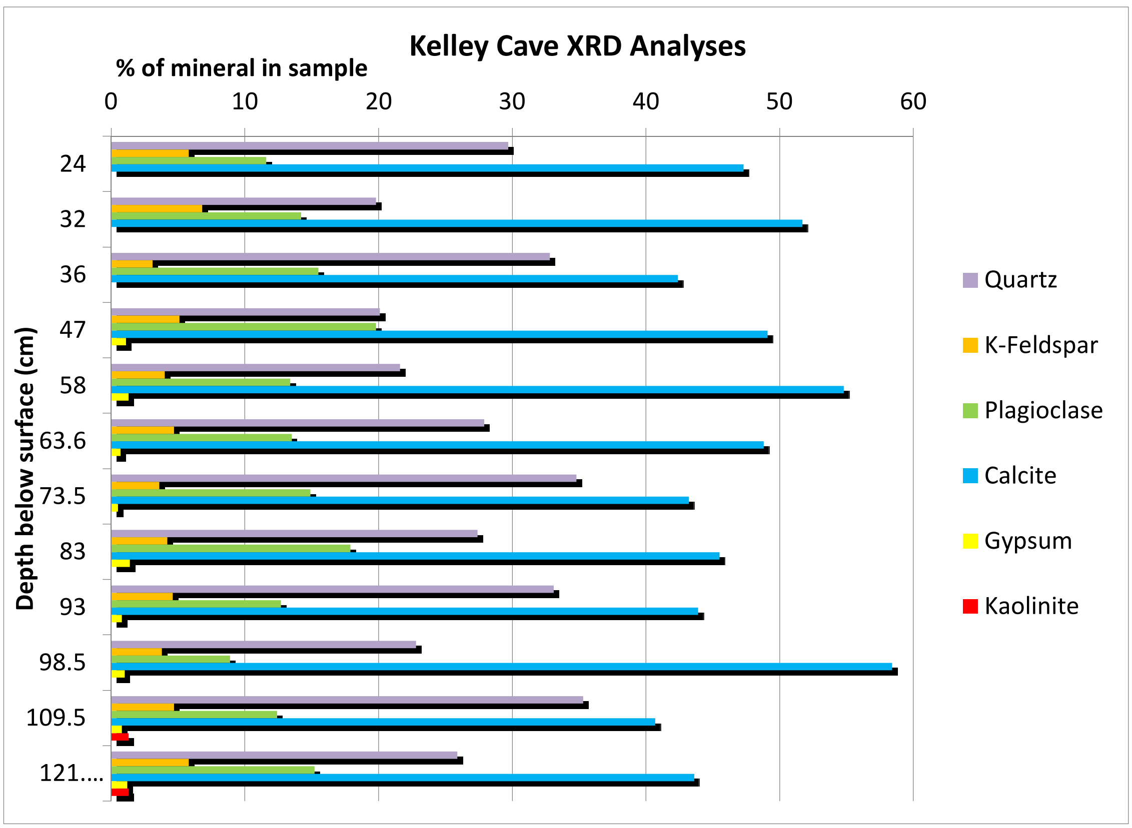


Figure 5.17. Kelley Cave XRD results (courtesy of Charles Frederick).

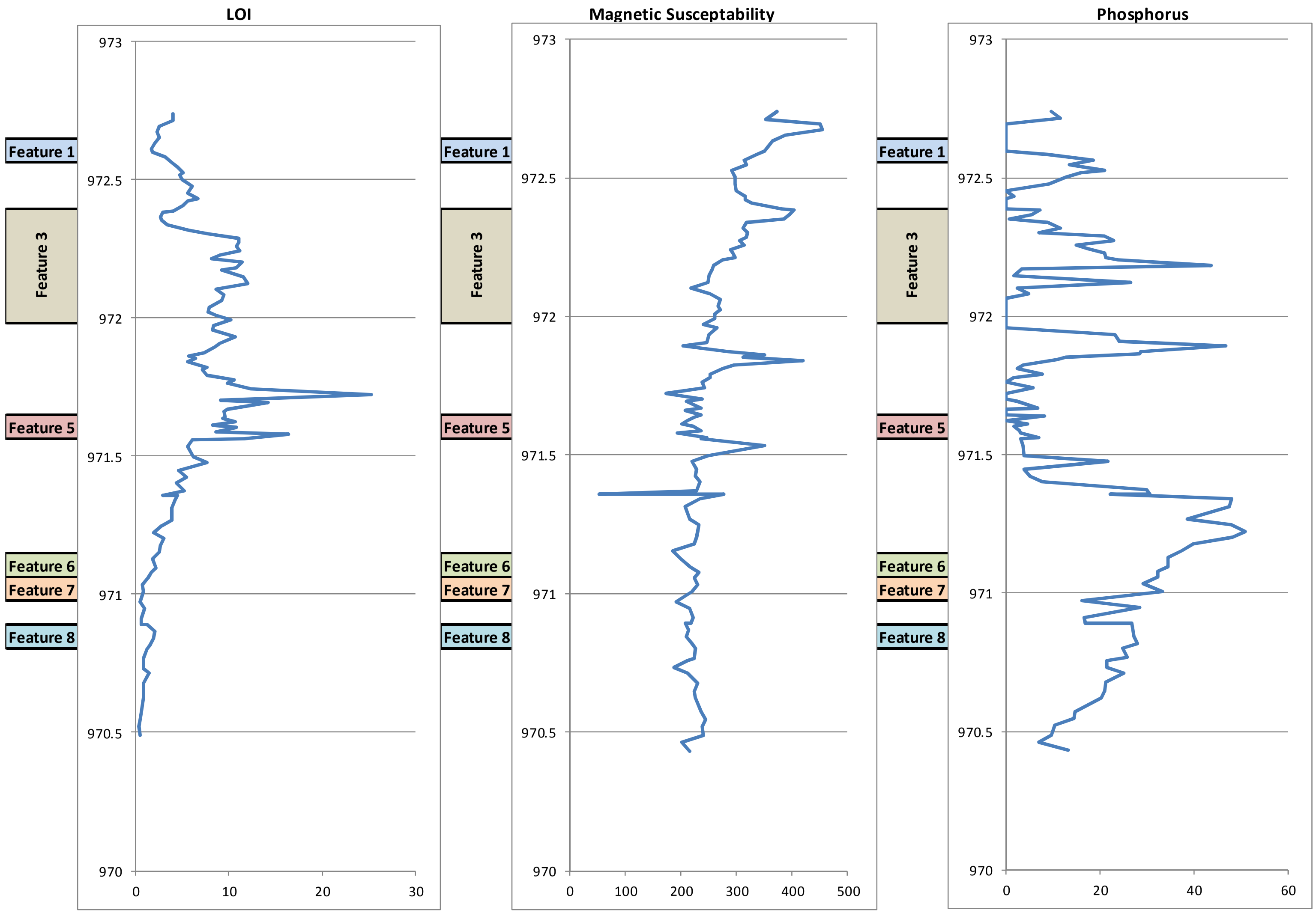


Figure 5.18. Kelley Cave LOI, MS, and P results, arbitrary meter elevations (courtesy of Ken Lawrence).

Kelley Cave Features

Seven cultural features (Features 1-3, 5-8) were documented in excavation Units A and B. These features appear to have been created by multiple events or behavioral patterns, discrete burning/cooking events, and possible underground storage. Outside of the excavation units, a mud and fiber feature was uncovered on surface (Feature 4). Below is a description of each feature and the associated artifacts from within Units A and B followed by Feature 4. The interpretation and discussion of the Kelley Cave features follows in Chapter 6.

Feature 1. This feature was composed of multiple thin lenses of ash and a large amount of burned rabdotus shell from 0-24 cmbs, 972.78-972.54 m elevation (Figure 5.19). The trench disturbance, discussed above, removed the western half of this feature in Unit A, and left only a small portion in the northeast corner of Unit B. The ash lenses were documented again along the trench wall exposed in Unit C, suggesting the feature extended beyond the excavation area. Some of the rabdotus shells were observed to have puncture marks similar to those found in Skiles Shelter Unit C.

Four cross-section exposures were documented in approximately 15 cm intervals working west to east; a fifth exposure 10 cm south into Unit B, showed that very little of Feature 1 remained. Exposure 1 was still partially in the trench disturbance and did not reveal informative morphology. Exposures 2 and 3 showed multiple ash lenses within the feature. The base of Exposure 3 shows a basin-shaped ash lens with rubified, reddened from thermal alteration, sediment sloping to the south (see Figure 5.19). In both exposures many of the larger flat stones are oriented sloping south. Little charcoal was present in the feature.

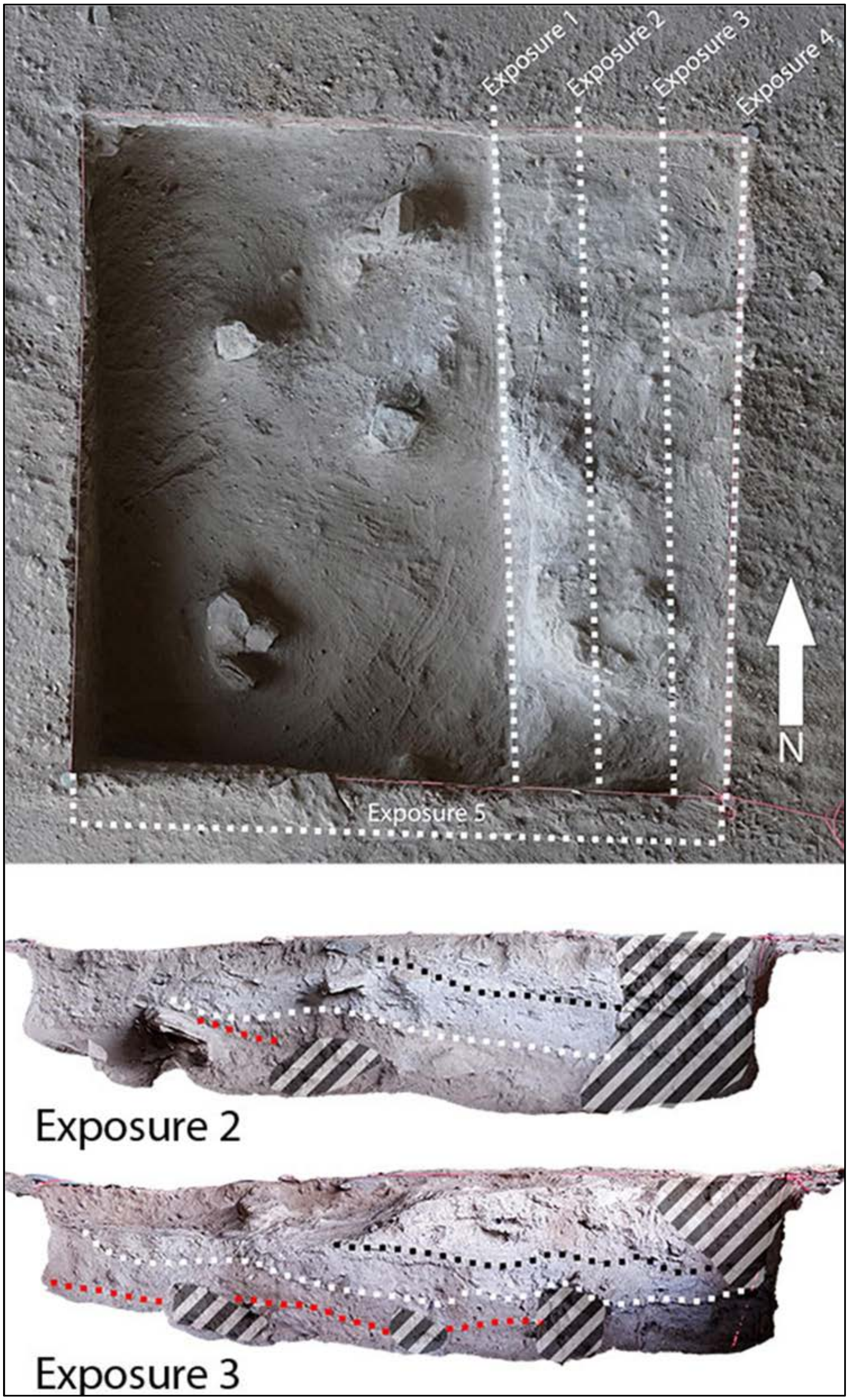


Figure 5.19. Kelley Cave Feature 1 exposures in plan view (top) in Unit A. Exposures 2 (middle) and 3 (bottom) with boundary of ash lenses in black and white dots, and rubified ash lens in red. Rodent burrows and other disturbances are marked with hatch-marks.

A rock sample was point-plotted and collected from the Feature 1 ash for possible future residue analysis. Two charcoal samples were also point-plotted, one from within the ash, and one below the ash, which were used for radiocarbon dating (VV164-CS4 and CS17 respectively). Bulk matrix samples were also collected from Feature 1 which were floated for botanical analysis.

Lithic tools collected in association with Feature 1 included two bifacial chert scrapers, one complete finely work chert perforator/drill, one expedient chert flake tool, and three ground stone fragments. The charred tip of a wooden tool, perhaps a digging stick, was also recovered from the ash lenses. Four diagnostic projectile points were recovered from Feature 1 and identified as Marshall, Desmuke, Frio, and Langtry point styles. Both the Marshall and Langtry points were heavily thermally damaged, while the Frio point showed only minor heating (Figure 5.20).

Feature 1 contained most of the bone beads recorded at Kelley Cave. A total of five bone bead fragments were recovered from the ash; all of which are in early stages of manufacture. Bead manufacturing may have taken place near Feature 1, which may have included the punctured rabdotus shells.

Two radiocarbon dates were obtained from samples associated with Feature 1. The first sampled that was dated (VV164-CS4: ca. 6270 cal. B.P.) was collected from charcoal directly within the ash lenses of the feature, but did not fit with the other radiocarbon dates. The dated material was undoubtedly in secondary context, likely derived from earlier deposits during prehistoric pit digging. This date is rejected as a valid indication of the age of Feature 1. The second charcoal sample that was dated

(VV164-CS17) was collected from below the ash in Exposure 5. The second assay dated to median ca. 3850 cal B.P. which is only slightly older than the age of sample CS17, from the top of Feature 3. Unfortunately, neither radiocarbon sample directly dates the intact ash lenses of Feature 1.

Figure 5.20. Feature 1 projectile points, Frio (left), Desmuke (left middle), Marshall (right middle), and Langtry (right).

Macrobotanical analysis of the Feature 1 floated samples identified plant taxa observed in the canyon or on the slope to the canyon (Appendix J). These identified plants included ash, white oak, mesquite, acacia, and Texas persimmon. Also identified were burned hackberry seeds, unburned prickly pear seeds, P*oaceae* (grass), and *Verbenaceae* (flower) seeds.

Feature 2. This feature was initially thought to be a remnant of a small basin-shaped cluster of limestone slabs partially exposed along the south was of Unit B (Figure 5.21). The exposed portion measured 22 cm north-south, 30 cm west-east, and approx. 10 cm thick. Feature 2 was uncovered 10 cmbs (972.69-972.59 m elevation) in what my analyses, see Chapter 6, suggest is an old pit along the south half of Unit B. The surrounding matrix was loose cave dust with compact patches of ash which I surmise was a highly disturbed remnant of Feature 1 (Figure 5.12). The remnants of ash from Feature 1 and the analyses in Chapter 6 suggest the pit predates historic looting.

Approximately six tabular burned rocks make up the exposed portion of the feature, most sloping toward the south. A single piece of cut baked plant leaf (sotol or agave) was found resting on one stone. No radiocarbon assay was taken of Feature 2, and no other artifacts could be definitively associated with the feature.

Figure 5.21. Kelley Cave Feature 2, Unit B south wall. I interpret the feature to be a fortutious cluster in a disturbed context.

Feature 3. This feature, part of Stratigraphic Layer B, was a thick layer of rubified, charcoal-rich sediment encountered from approximately 30-65 cmbs (972.45-972.10 m elevation). Like Feature 1, Feature 3 represented a deposit created by multiple behaviors rather than a discrete cultural feature or event. Feature 3 was irregular in plan view, due to the trenches previously mentioned (see also Chapter 6), and extended into Units A and B (Figure 5.22). The feature continues into the east and north profile walls of both A and B Units.

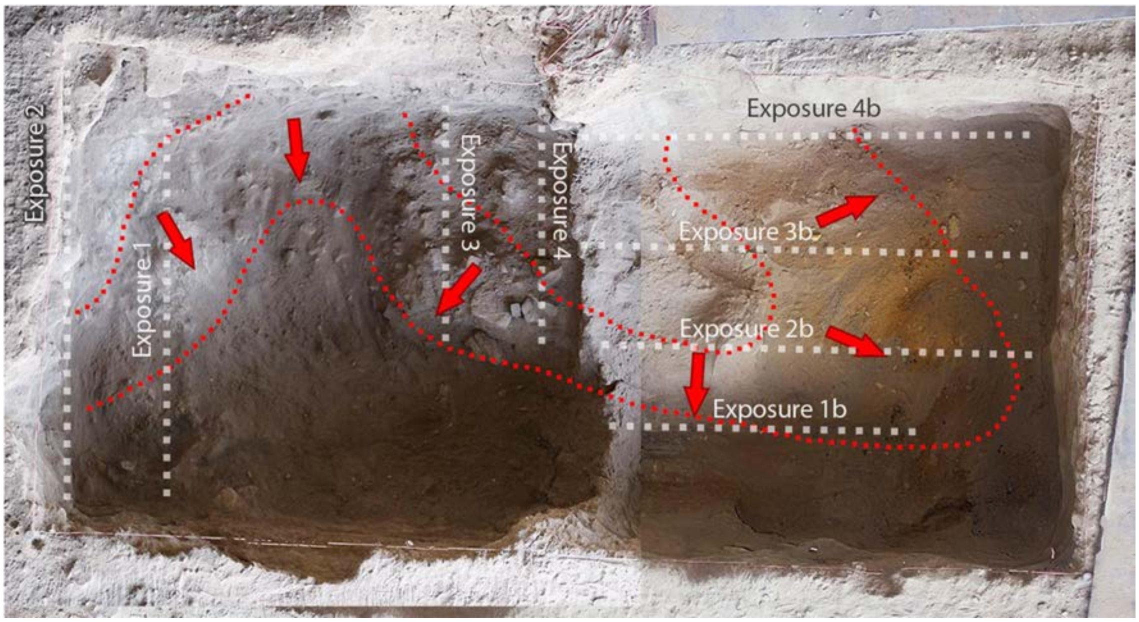


Figure 5.22. Kelley Cave Units A and B, merged to depict Feature 3 shape with slope (red dotted line and arrows), facing east. Exposure cuts 1-4 in Unit A (top), and 1b-4b in Unit B (bottom) depicted with white dotted line.

Feature 3 was documented with four exposure cuts Unit A, and four additional exposure cuts in Unit B. Due to the apparent looter trench (Figure 5.12), exposures in Unit A were conducted with two 10 cm cuts to the north wall and two 10 cm cuts to the south wall. In Unit B, exposures were cut 15-20 cm working from west to east (the east wall representing Exposure 4b). In Unit A, the north wall (Exposure 2) and the first exposure working south (Exposure 3) showed the clearest stratigraphy in Unit A. The ash and rock of Stratigraphic Layers BB, and BC can be seen clearly in Exposure 2 (Figure 5.23). The stratigraphy in Exposure 3 has suffered extensive turbation but a small portion of intact stratigraphy shows two burned organic layers 1cm thick divided by a 13 cm thick ashy matrix (see Figure 5.23) In Unit B, Exposures 2b and 3b showed three turbated layers of charcoal, burned organics, and burned rock sloping to the south (Figure 5.24).

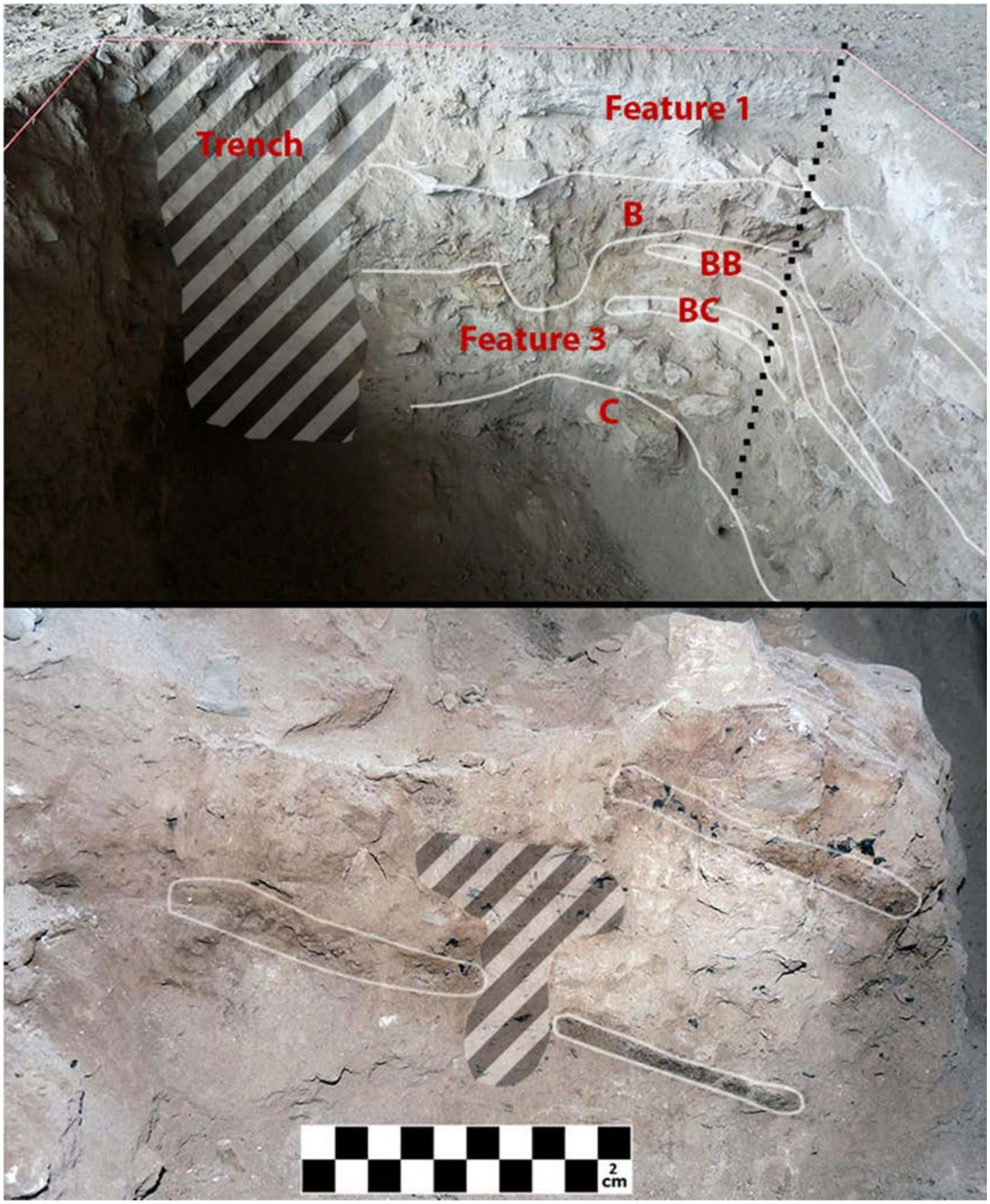


Figure 5.23. Unit A, Feature 3 Exposure 2 (top) with Stratigraphic Layers outlined and labeled, facing north. A “corner” of the looter trench continued into the north wall of Unit A (above). Unit A, Exposure 3 (bottom) shows charcoal lenses outlined in white and a hatch-marked rodent burrow, facing south.

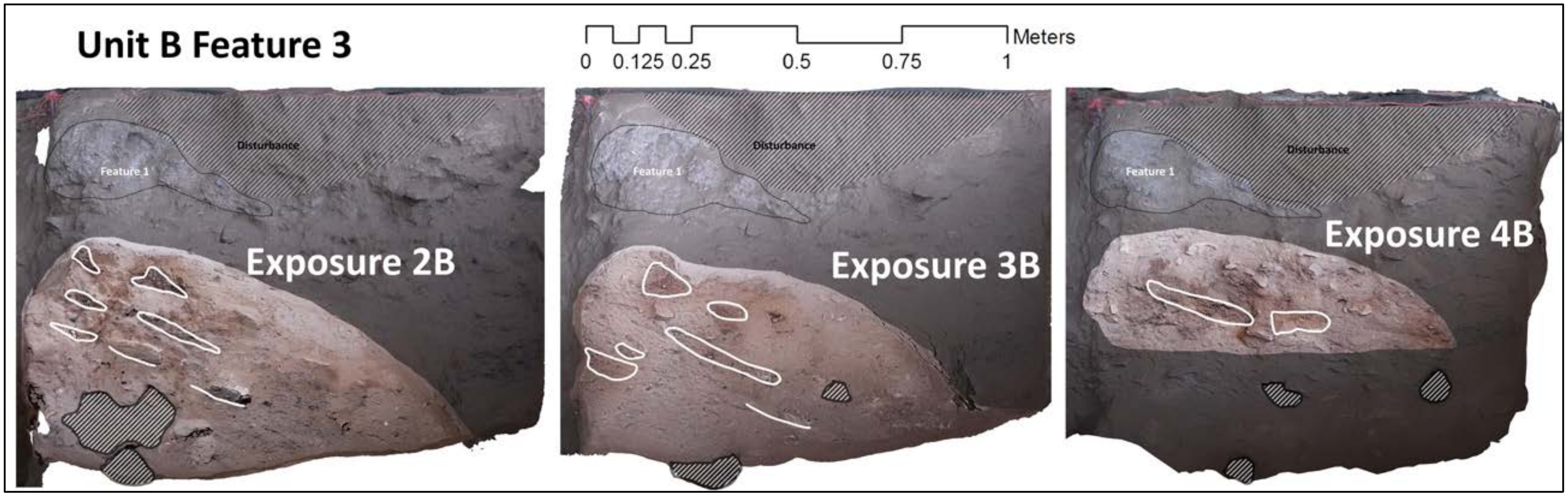


Figure 5.24. Feature 3, Exposures 2b, 3b, 4b, back wall in shadow, facing east. Charcoal lenses outlined in white and rodent burrows in hatch-marks. The burrows at the bottom of the profiles were hollow.

Nine charcoal samples were point-plotted within Feature 3, two of which were used as radiocarbon assays (VV164-CS5 and CS6). Two matrix samples were also collected: one from the compact brown matrix and the other from the charcoal lens in Exposure 2b. Along with the charcoal and matrix samples, one burned rock sample was collected for future residue analysis.

Artifacts collected from Feature 3 included fauna, charred wood, clay, and stone tools. The faunal artifacts collected from Feature 3 included one antler tine medial fragment, two bone bead preforms, and one possible deer bone tool fragment or manufacturing debris. The lithic artifacts included one mano/hammer stone, two pieces of ground stone, and three small fragments of ochre. The chert tools recovered from the feature consisted of a dart point shoulder fragment, a distal fragment of a perforator or projectile point, two biface fragments, two utilized flakes with use wear, and six crude unifacial expedient tools. Other material recovered consisted of two possible charred wooden tool fragments, both distal ends, and a clay.

Most notably, a number of artifacts were recovered with adhering red pigment. One bifacial and one unifacial scraper were observed to have red pigment on a single side. The pigment on the bifacial scraper appears to be a congealed paint while the unifacial scraper pigment appears to be an applied powder (Figure 5.25). Also found in Feature 3 was a burned rock fragment with a red brush mark (Figure 5.26).

Figure 5.25. Feature 3 scrapers with red pigment.

Figure 5.26. Burned rock fragment with brush mark of red pigment.

Four fragmentary diagnostic projectile points were recovered from Feature 3. The point styles were identified as Marshall, two Palmillas, and one point so extensively reworked that it could not be identified (Figure 5.27). One of the Palmillas points was heavily thermally damaged, and all but the reworked point have the distal ends broken off. The stem edges of the reworked point are alternately beveled and heavily ground. A Montell point was also recovered in the cleaned trench wall of Unit C, and is likely associated with Feature 3.

Figure 5.27. Feature 3 dart points, Palmillas (left two), Mashall (right center), and unidentified reworked type (right).

Two radiocarbon samples were taken from directly beneath rocks: at the top and bottom of the intact portion of Feature 3, in Unit B. These radiocarbon dates returned median dates of 3560 cal B.P. and 6270 cal B.P. respectively (Figure 5.1). The results fit stratigraphically with the other assays. The large span of time between the two dates further suggests that Feature 3 does not represent a discrete event or series of events, but accumulated over a lengthy span of time

Feature 5. This feature was a slightly sloping slab-lined basin 107.5-116 cmbs (971.79-971.70 m elevation). The feature was composed of large burned tabular rocks in a circular alignment approximately 45-by-50 cm in diameter (Figure 5.28). A burned mano was located in the center of this feature, above many of the large rocks. Two ash lenses were associated with Feature 5, one direcly covering the feature rocks, and a second directly below the rocks (Figure 5.29). The ash lenses were divided by approximately 5 cm of charcoal-rich silt matrix and extended into the north and east walls of Unit A and approximately 20 cm into the north portion of Unit B.

Figure 5.28. Feature 5 with removed mano location drawn, facing north.

In Stratigraphic Layers C and D directly above the feature, the excavated matrix (approximately 40 cm thick) was heavily laden with charcoal and FCR fragments suggestive of extensive hot rock cooking use in the excavation area. Feature 5 may be the earliest remnant of an intact earth oven heating element from this series of events. Many of the burned rocks above and below the feature had remnants of burned sotol or agave fibers directly beneath the stones, seemingly *in situ*.

Figure 5.29. Feature 5, Unit A, Top ash layer (left) and bottom ash layer with slabs (right), facing north.

Excavation Unit Layers A27 and A29 had a noted increase in the ratio of rounded river gravels to angular limestone gravels (5:1). The increase may be due to the transportation of large amount of gravel-laden sediment into the shelter for capping earth ovens. One of these river gravels shows a clear red paint splatter on one side, including a void from a bubble in the drying liquid. I surmise that the pebble is in relatively good context due to the lack of visible intrusions in the ash layers surrounding it.

Three point-plotted charcoal samples were collected from beneath the limestone slabs in Feature 5. Also recovered from Feature 5 was a burned mano (see Figure 5.28) and a large, 1-2 cm, piece of red ochre from beneath the slabs. Within the matrix between the two ash lenses a possible Langtry style point fragment was also recovered.

The large “Langtry” point fragment was recovered from the screen from the excavated Unit Layer, UL A27, between the two ash lenses and cannot be definitely associated with Feature 5. The point is very heavily fire-craized to the degree that individual flake scars cannot be seen. There was no indication of burrowing intrusion in the ash lens above which would could have moved the point down into an earlier context, however given the nature of earth oven construction, the point is likely not in original context. The point fragment may also be a variant of an Early Archaic style.

A charcoal sample collected from under one of the low limestone slabs in Feature 5 was divided and radiocarbon dated to median ca. 7370 and 7360 cal B.P. The assay results fit stratigraphically with the other radiocarbon dates.

Intermittent lenses of white ash were recorded below Feature 5 in Unit Layers A29-A31. The ash lenses contained very little burned rock, however below UL A31 the burned rock quantity increased significantly, from ~971.5-971.3 m, until the boundary with Stratigraphic Layer H. It is likely that the ash lenses and increase in burned rock is due to the proximity of the excavation units to burned rock features close by.

Feature 6. This feature was a discrete concentration of tabular burned rock fragments with a slight basin-like morphology. The Feature 6 was located in the southeast wall of Unit AB, positioned in near the crevice created by the large roof blocks in Unit B. The feature measured 35 cm north-south, 70 cm west-east, and 20 cm thick (Figure 5.30). Feature 6 was encountered 140 cmbs (971.31-971.17 m elevation) at the bottom of Stratigraphic Layer G, and continued into Stratigraphic Layer H within a distinct soil change indicative of pit dug into the lower layer. The sediment directly below the feature was rubified, suggesting the lower rocks were heated in place. In the center of the feature was a pocket of a charcoal-rich matrix with no large rocks. Feature 6 likely represents multiple rock-lined pits constructed on top of each other.

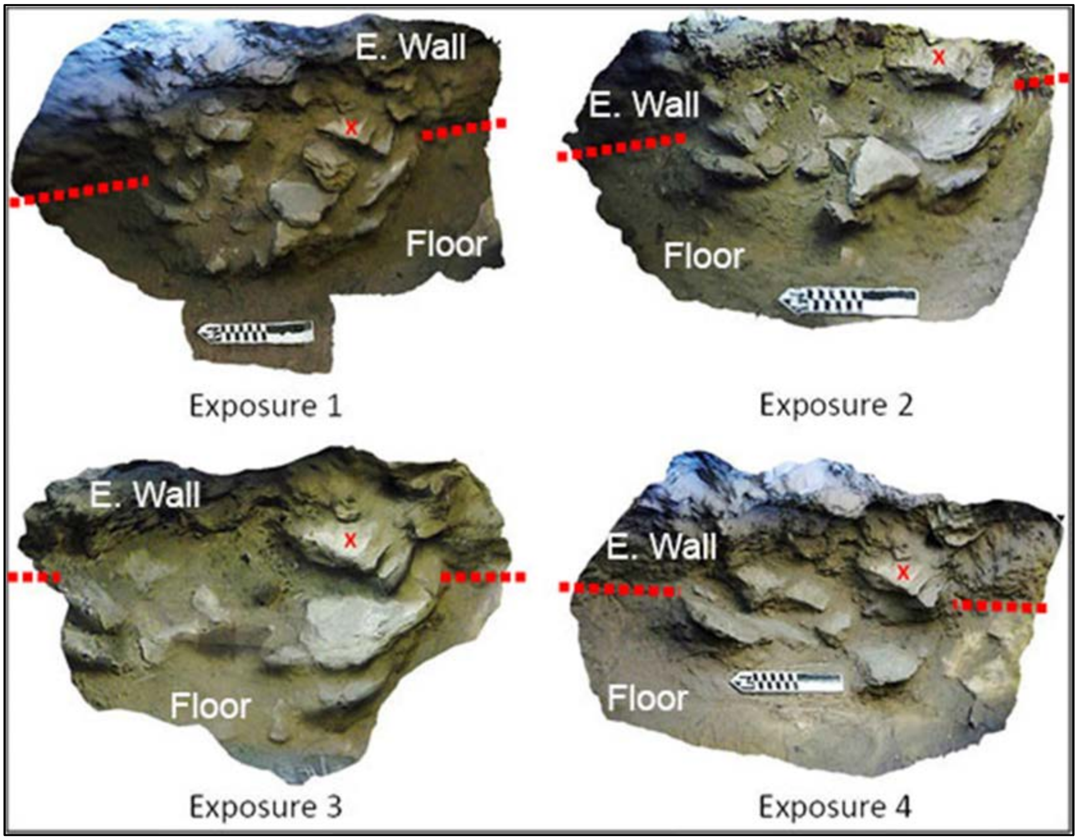


Figure 5.30. Feature 6 horizontal Exposures 1-4. Oblique view facing east with "X" for orientation. The red dotted line demarcating the East wall and floor of Unit.

Feature 6 was excavated in four horizontal exposures cuts and a matrix sample was taken in from the center in an area lacking burned rocks. Although a rodent burrow was noted higher in elevation, to the south, no rodent disturbance was observed during the exposures. Ochre, five rabdotus shell, and a mussel shell fragment were found within the feature. No other artifacts were associated. Radiocarbon dates from Feature 5 (above) and Feature 7 (below) suggest that Feature 6 dates to roughly 7400 cal B.P.

Initial botanical analysis was conducted by Leslie Bush on the matrix collected from the center of the feature. The results indicated the use of acacia, *rhamnaceae*, mesquite, and Texas persimmon. Burned and unburned agave leaves were present, as well as 20 bulb cloaks from Drummond's onion. A large variety of unburned seeds were identified, including chenopodium, prickly pear, hackeberry, and *Asteraceae* (daisy family). Most notably, Bush identified 1150 *Setaria sp*. (bristlegrass) and 86 prickly pear seeds. The bristlegrass seeds were all lacking the grains, with only the paleas and lemmas recovered (Figure 5.31). The palea and lemma are the upper and lower parts, or bracts, that enclose the grass floret; or to put it simply, the two parts of the seed coat. A possible explanation for the lack of grains is discussed in Chapter 6.

Figure 5.31. Feature 6, *Setaria sp*. seeds, scale in mm (courtesy of Leslie Bush).

Feature 7. This feature was a circular slab-lined depression uncovered from 160-70 cmbs (971.14-971.07 m elevation). The feature measured 36-by-33 cm in diameter, and approximately 10 cm in height (Figure 5.32). The feature was composed of a circle of large tabular rocks on end, only four of which show discoloration from heating. The largest of these slabs shows visible signs of scratching/scoring on one surface. After removal of a few of the horizontal rocks in the middle, a horizontal floor was found composed of 4 closely grouped slabs. Feature 7 is entirely situated in the find sandy loam, Stratigraphic Layer H, just below and slightly west from Feature 6. Charcoal observed within the Feature 7 matrix was no greater than charcoal observed in the unassociated sandy loam. The presence of Feature 6 may have obscured or even destroyed the upper portions of this Feature 7.

Figure 5.32. Feature 7, Exposure 1 (left) and Exposure 2 (right).

Three rocks were collected as samples for future residue analysis. A bulk matrix sample was collected from within the basin but was not analyzed for this thesis due to time constraints. Two charcoal samples were also collected from below the rocks within the feature. No other artifacts were associated with Feature 7.

A radiocarbon assay taken from charcoal directly underneath the lowest stone in the feature returned a median date of ca. 7370 cal B.P. The date result fits stratigraphically with the other assays.

Feature 8. The lowest feature encountered in this investigation, Feature 8, was a circular cluster of large tabular rocks exposed by the north wall of Unit AB (Figure 5.33). Feature 8 measured 35-50 cm in diameter, encountered at a depth of 176.5-183 cmbs (971.03-971.00 m elevation). All of the rocks in the feature were horizontally aligned with six rocks directly atop two other. A total of three rocks showed visible signs of thermal discoloration, including a large spall with a white mineral encrustation. Three of the tabular rocks, the large spall and the two lower stones, had charcoal adhering to the underside of the rocks. The feature matrix was fine sandy loam with a slight charcoal admixture and reddish-orange, rubified, sandy loam beneath the tabular stones. Excavators noted a diffuse cluster of charcoal in the Unit Layers above the feature, which suggests the stones may have been place in a pit which was then covered and mixed after disuse.

Bulk matrix samples were collected from between and below the stone alignment. Two samples of charcoal adhering to the underside of the rocks were collected. One of the charcoal samples was sent for radiocarbon analysis, but was not dated in time for this thesis. A burned rock was taken for possible future residue analysis. No other artifacts were associated with Feature 8.

Figure 5.33. Feature 8 Exposure 1 (left) and Exposure 2 (right), facing north.

Feature 4. This feature was observed partially exposed on the shelter floor approximately 2.25 m southeast of Unit B (Figure 5.34). The loose disturbed surface debris was swept off to determine the extent of the feature and partially expose the compact fine sediment layer, “mud plaster” and fiber approximately 1.5-by-1.7 m in size (Figure 5.35). In order to investigate the underlying stratigraphy, two Profile Cuts, or small trenches, were placed at the periphery of the mud layer: Profile Cut 4B toward the dripline (Figure 5.36), and Profile Cut 4A which was later expanded to 1-x1 m Unit 4A (Figure 5.37).

Prior to the assignment of Stratigraphic Layers in Kelley Cave, the Profile Cuts recorded fine stratigraphic changes within Feature 4, labeled Stratigraphic Sub-layers (Sub-layers). Six Sub-layers were defined in Profile Cut 4B along the north wall, numbered Sub-layer 1 through 6 (Figure 5.36).

Figure 5.34. Feature 4 compacted mud and fiber chunks eroding out of surface, facing west.

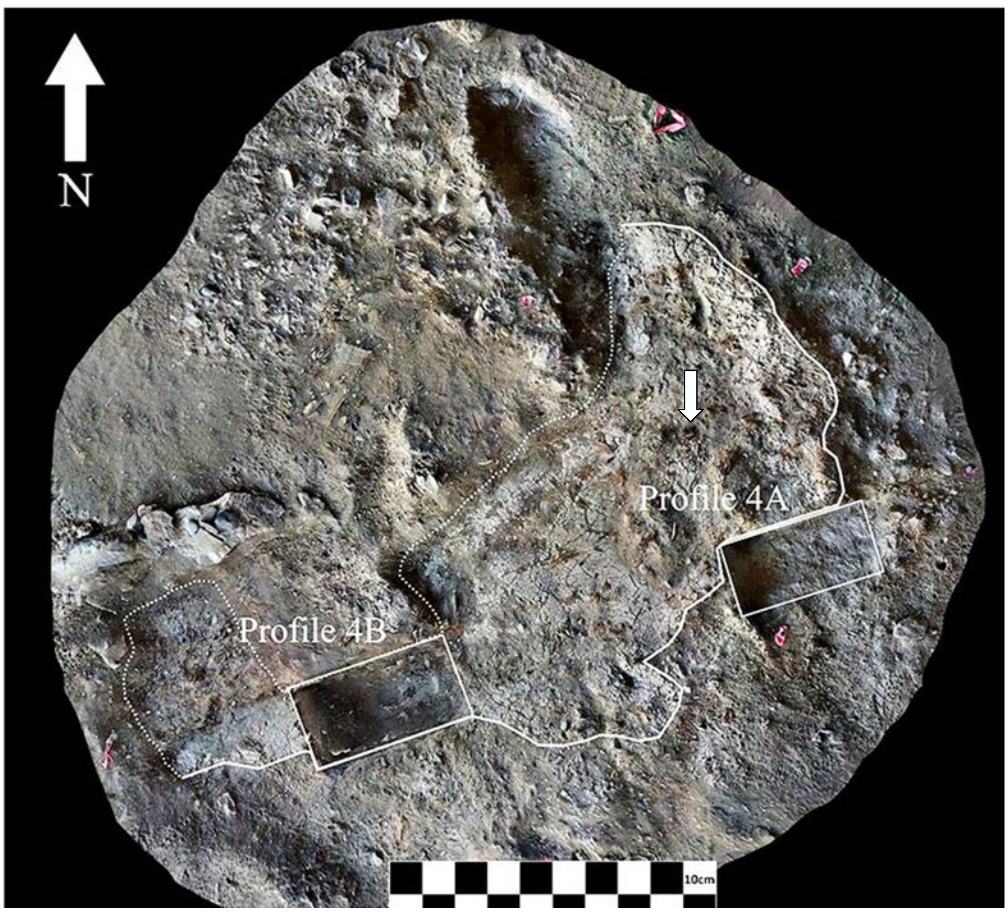


Figure 5.35. Final exposed portion of Feature 4, white outline denotes exposed mud surface and white arrow marks exposed cordage.

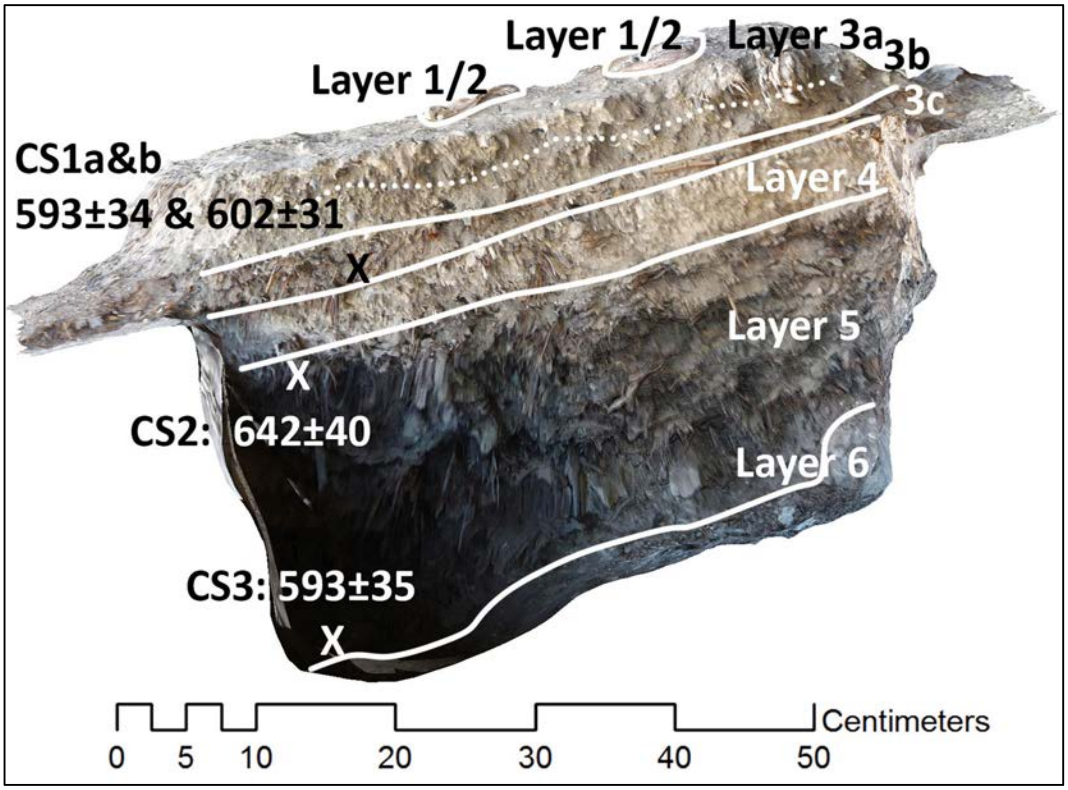


Figure 5.36. Feature 4, Profile Cut 4B, Sub-layers 1-6 with radiocarbon samples (VV164-CS1-CS3) given in median cal B.P.

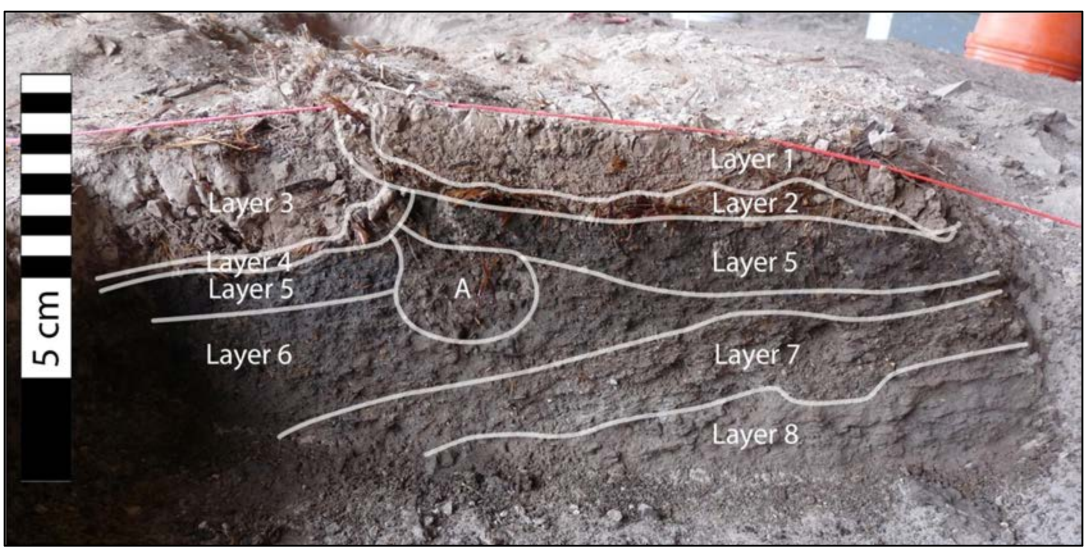


Figure 5.37. Feature 4, Profile Cut 4A (wet) with Sub-layers 1-8 labeled, facing north. Sub-layer A was a rodent burrow.

Within Profile Cut 4B, Sub-layers 1/2 represented small chunks of compacted mud and fiber observed on the surface of the shelter floor. Sub-layer 3a/3b appeared to be a loose shelter dust and debris containing very little plant fiber. Sub-layer 3c was a dense fibrous layer containing burned twigs, numerous quids, cut leaf bases (sotol and/or agave), and other baked vegetal material. Sub-layer 4 was an approximately 4 cm thick deposit of alluvial sediment sloping toward the dripline. Fiber layers are impressed into this mud from both the top and lower boundaries. Below the mud, Sub-layer 5 was a thick layer of plant fiber detritus similar to Sub-layer 3c (Figure 5.38). Sub-layer 5 increased in thickness as Feature 4 sloped toward the dripline of the shelter. Sub-layer 6 was an abrupt change to a very compact ashy matrix with medium size burned rocks and some yellow colored sediment. The ashy matrix dipped drastically down in the west corner of Profile Cut 4B.

Figure 5.38. Sample of plant fiber detritus from Feature 4. Plant fiber was mostly unburned remnants of cut leaf bases of sotol/agave, quids, and twigs.

Profile Cut 4A (Figure 5.37) recorded eight Stratigraphic Sub-layers within the north profile wall. The alluvial mud and plant fiber sub-layers of Profile Cut 4A correspond to Sub-layers 1/2 and 4/5 in Profile Cut 4B (Figure 5.36), which differences in overall stratigraphy did not allow for similar numbering. In Profile Cut 4A, Sub-layers 1/2 partially overlap with Sub-layers 3/4 with no intervening dust and fiber layer. The mud/fiber layers are also of different thicknesses (Sub-layers 3/4 are 5 cm thick, Sub-layers 1/2 are 3 cm thick) within Profile Cut 4A. Below the mud/fiber deposits, Sub-layers 5 through 8 were compact ash-mixed matrix with decreasing plant fiber as depth increased. Sub-layers 5-7 and Sub-layer 8 correspond to the larger Stratigraphic Layers I and J, respectively, and were likely transitional from the dark, organic-rich Feature 4 matrix to ashy Stratigraphic Layers I and J (see Figure 5.16).

Three radiocarbon assays were taken from fiber samples both above and below Sub-layer 4 in Profile cut 4B (Figure 5.36). The results bracketed the dates of sub-layer 4 between median dates 602±31 and 642±40 cal B.P. (Table 5.1). Both a split sample from Sub-layer 3c (593±31 & 602±31cal B.P.) and the bottom of Sub-layer 5 (593±35 cal B.P.) had statistically identical median dates. All three radiocarbon dates strongly overlap at one sigma.

Feature 4 contained numerous quids (n=50+), charred and unburned cut leaf bases of semi-succulent plants (sotol/agave), walnuts and other seeds, charred cordage fragments, and numerous twigs. From within Profile Cut 4B, three large bulk samples of plant fiber were collected, and six point-plotted fiber samples were taken. Above the alluvial deposit, lithic debitage and some tools, bone, and FCR were observed, but not collected.

Chunks of mud/fiber initially eroding from the location of Profile 4A were analyzed by Charles Frederick and Brittney Gregory. Particle size analyses from two of these chunks denote reverse upward grading (Patton and Dibble 1982:102). Reverse upward grading is a process by which grain size increases with elevation, from clay/silt to sand, which I discuss in Chapter 6 (Figure 5.39).

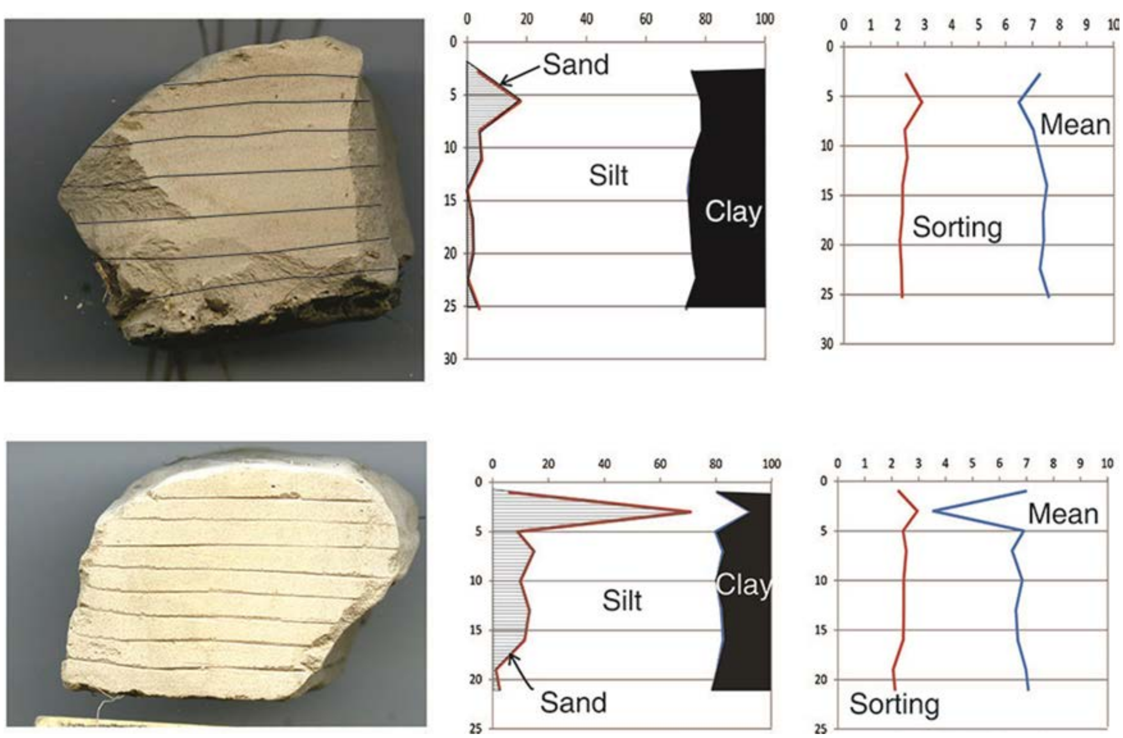


Figure 5.39. Feature 4 mud layer particle size results (top facing up), courtesy of Frederick and Gregory.

After my field excavations were concluded, Kevin Hanselka, volunteering with the ASWT ENC 2014 project, excavated an exposed knotted fiber from Sub-layer 3 just north of Profile Cut 4A (Figure 5.35). The knotted fiber was wrapped around folded prickly pear pads containing what appeared to be a bundle of fibers (Figure 5.40). This bundle has not yet been opened and analysis is ongoing.

Figure 5.40. Feature 4 bundled prickly pear pads and fibers (Handselka 2014).

Kelley Cave Artifacts

Although, thousands of artifacts (mostly debitage) were collected from Kelley Cave, I will limit my results to those artifacts which will be used for my comparative analysis. A summary of the artifacts recovered is presented in Appendix K, the full artifact inventory is on file at Texas State University.

The excavations at Kelley Cave recovered 37 diagnostic points including those previously discussed with the features as well as others found on the shelter floor (Table 5.2). Along with diagnostic points, 16 projectile fragments (distal ends, broken barbs, fragmentary stems) were recorded. Of the 53 total point fragments, a single distal tip was recovered from Unit 4A; all others were recovered from Units A, B, and C. The majority of points recovered were styles associated with the Middle Archaic period. Middle

Archaic style points were found throughout the upper half of the profile primarily due to the looter trench disturbance above 972.4 m elevation. All of the point styles, taken together, show a range from the Middle Archaic to the Late Prehistoric in Kelley Cave.

Table 5.2. All of the diagnostic projectile points recovered from Kelley Cave by elevation. (*) = elevations estimated based on depth of UL.

Cmbd	Elevation	Area	Unit	Layer	Point Style	Time Period
0	-	Surface			Pedernales Point	Middle Archaic
0	-	Surface			Langtry Point	Middle Archaic
0	-	Surface			Shumla Point	Late Archaic
0	-	Surface			Shumla Point	Late Archaic
0	-	Surface			Conejo Point	Late Archaic
0	-	Surface			Ensor Point	Transitional Archaic
0	-	Surface			Langtry Point	Middle Archaic
0	-	Surface			Marshall Point	Late Middle Archaic
0	-	Surface			Val Verde Point	Middle Archaic
2.11	972.8*	1	A	1	Sabinal Point	Late Prehistoric
3.14	972.79	1	B	1	Val Verde Point	Middle Archaic
11.32	972.71	Feature 1	A	5	Marshall point	Late Middle Archaic
16.49	972.65*	1	B	5	Lange or Palmillas Point	Late Archaic
16.49	972.65*	1	B	5	Val Verde or Langtry Point	Middle Archaic
16.9	972.65	Feature 1	B		Langtry Point	Middle Archaic
17.25	972.65*	1	C	1	Frio Point	Transitional Archaic
17.25	972.65*	1	C	1	Pandale Point	Middle to Late Archaic
17.25	972.65*	1	C	1	Langtry Point	Middle Archaic
24.55	972.57	Feature 1	A	5	Desmuke Point	Late Archaic
30.96	972.51	1	B	6	Val Verde or Langtry Point	Middle Archaic
31.61	972.5	Feature 3	B		Unknown Point	
34.75	972.47*	1	C	8	Langtry Point	Middle Archaic
38.49	972.43*	1	A	10	Val Verde Point	Middle Archaic
38.49	972.43*	1	A	10	Val Verde Point	Middle Archaic
40.36	972.42	1	C	9	Montell Point	Late Archaic
44.65	972.37	1	B	13	Ensor Point	Transitional Archaic
46.39	972.36*	1	A	12	Pandale Point	Middle Archaic
49.46	972.32	Feature 3	B		Marshall Point	Late Middle Archaic
62.39	972.2*	Feature 3	A		Palmillas Point	Middle to Late Archaic
62.39	972.2*	Feature 3	B		Palmillas Point	Middle to Late Archaic
64.16	972.18	1	C	9	Pandale Point	Middle Archaic
68.64	972.13*	1	A	15	Val Verde Point	Middle Archaic
69.05	972.13	1	B	Wall	Arenosa Point	Middle Archaic
70.65	972.11	1	B	16	Langtry Point	Middle Archaic
86.74	971.95*	1	B	19	Val Verde Point	Middle Archaic
111.79	971.7*	1	A	27	Langtry Point	Middle Archaic
208.81	970.73*	1	AB	50	Bulverde Point	Middle Archaic

Kelley Cave excavations recovered a large quantity of formal and expedient lithic tools (n=102). These included utilized flakes, bifacial tools, sequent scrapers, formal perforators, spoke shavers, and gravers. In excavation Unit Layer B7 (972.5059 m elevation), a large finely worked biface fragment was recovered (Figure 5.41). This biface fragment measures approximately 4 mm thick and does not show macroscopically obvious use wear.

Figure 5.41. Large finely worked biface fragment from UL B7, both sides.

Perhaps most notable artifacts found within Kelley Cave are those with pigmentation, nearly all of which is red. A third lithic scraper with red pigment on both sides of the worked edge was recovered from the top of Unit B, Unit Layer B1 (Figure 5.42). A total of five lithic flakes and four limestone fragments with pigment stains were also in the upper 45 cm (Figure 5.43). The pigment on the lithic flakes and stone fragments appears incidental with two exceptions: one lithic flake contains pigment on its edge (Figure 5.43A); and red pigment found on the rounded end of a limestone rock may have been used to grind said pigment (Figure 5.43B). During the faunal sample analysis a jackrabbit mandible with remnant red pigment on the mandible and one molar was identified in Unit Layer A22 (Figure 5.44).

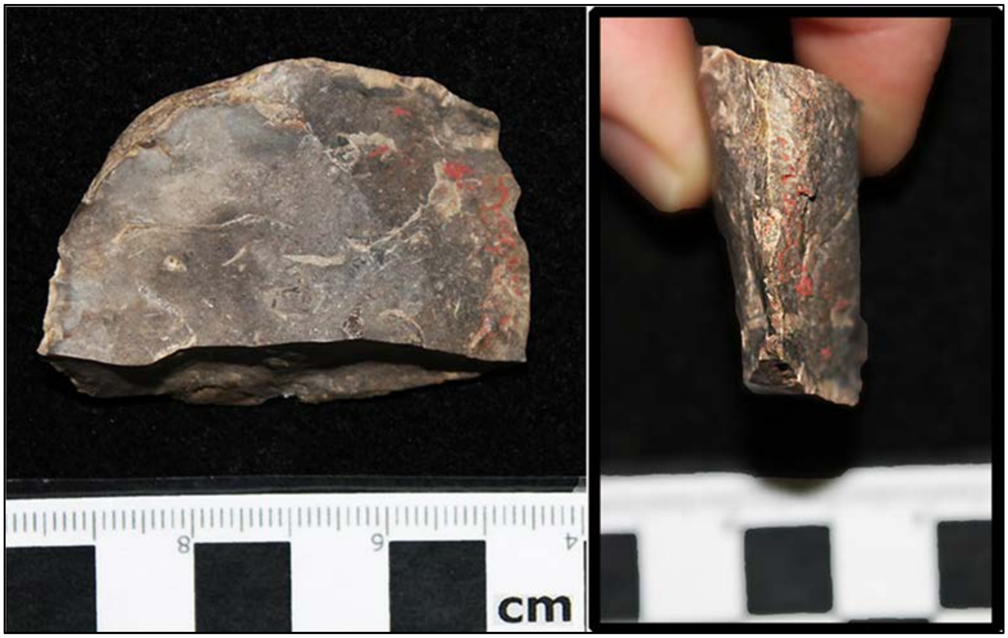


Figure 5.42. Lithic biface with red pigment on both sides of steep worked edge, found in top 5 cm Unit B.

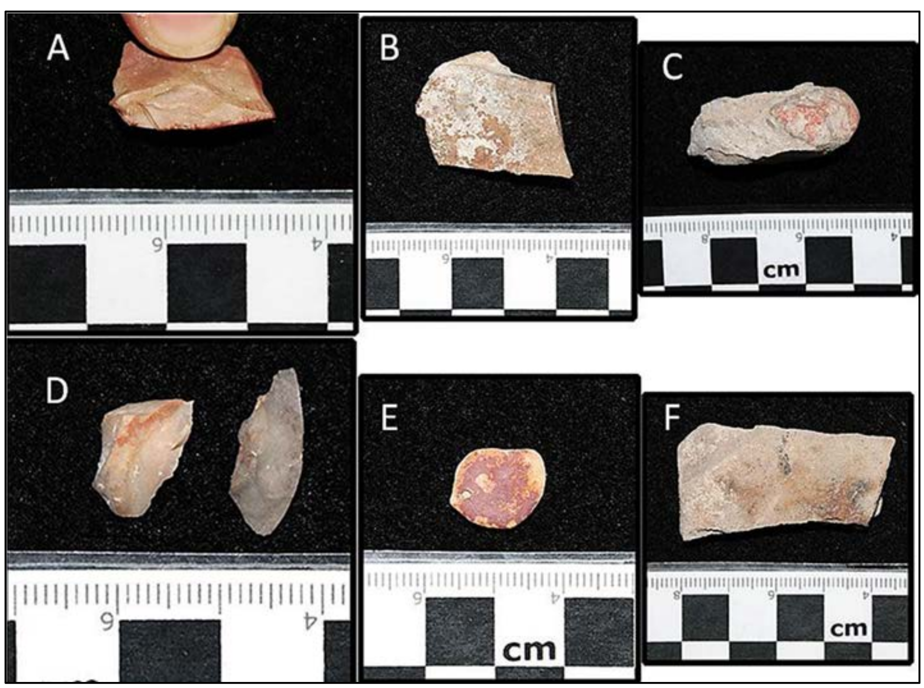


Figure 5.43. Sample of artifacts with pigment: (A) lithic flake with red pigment on edge; (B) degrading red pigment on limestone fragment; (C) limestone rock with red pigment on round end; (D) sample of lithic flakes with some remaining red pigment on crevices; (E) pebble with red paint covering one side; (F) limestone fragment with possible red, yellow, and black pigments.

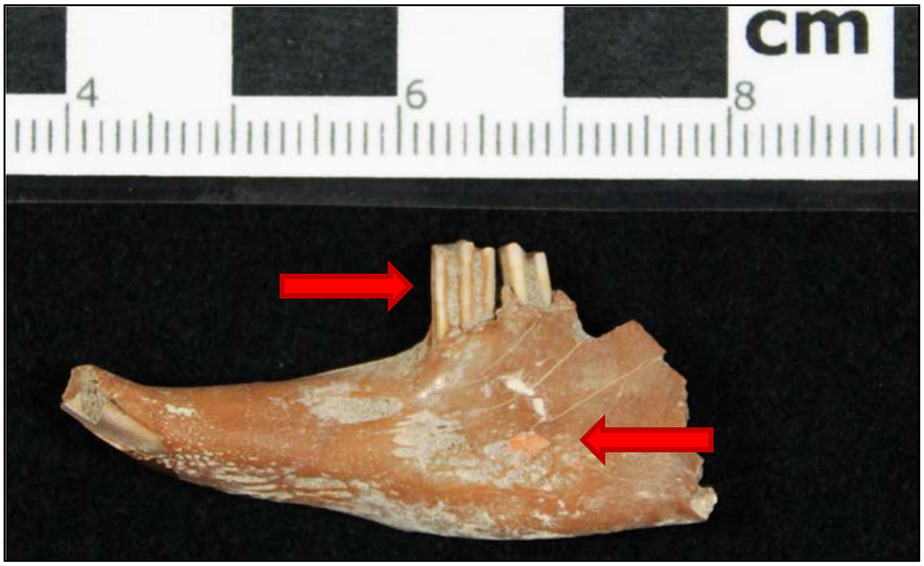


Figure 5.44. Jackrabbit mandible with red pigment on jaw and molar found in UL A22.

Figure 5.45. Battered medial fragment of antler tine (left) and antler needle with groove (right). The bone has a red hue in picture, but this is not from red pigmentation. Antler needle did not fall within faunal analysis interval; identified in UL B15.

Very few antler and bone tools were identified during my investigation of Kelley Cave. Two antler tools fragments were recovered. A medial antler fragment heavily battered and rodent-gnawed was found near Feature 3 in the looter trench (Figure 5.45). The proximal end of the antler fragment has been cut by the groove-and-snap technique.

A second antler tool fragment was heavily polished from wear with a longitudinal groove suggesting it functioned as a weaving needle tool. The antler needle had been shaped down to the trabecular bone and has been worn to a smooth sheen (Figure 5.45).

Seven bone and shell beads were recovered from Kelley Cave as well. Modified/grooved mussel shell fragments were observed, however only one completed mussel shell bead was recovered, from UL B17 (Figure 5.46). Feature 1 contained five of the seven bone beads recorded; Feature 3 contained two bone beads. All of these are in early stages of manufacture (Figure 5.46).

Figure 5.46. Complete mussel shell bead (left), and early stage bone bead fragment, delaminating (right).

Two clay balls, both approximately 5 cm in diameter, were recovered: one in Feature 3, and another in UL B11. Although chunks of clay, like those in Feature 4, were observed in the upper layers of the excavation units, these two clay balls were visibly shaped by humans (Figure 5.47). The clay appears to have been sunbaked or simply left to dry in the shelter.

Figure 5.47. Rounded clay ball found in UL B11.

Two small isolated human bones were recovered from disturbed contexts during excavations in Kelley Cave. An intermediate 2nd cuniform from a left foot was found in the looter trench fill of UL C3, and a left patella was recovered from UL B21 within an area of bioturbation. Although both E.B. Sayles and George C. Martin may have encountered human burials in Kelley Cave (see Chapter 2), no indications of purposeful interments were encountered during my excavations.

Kelley Cave Fauna

Faunal remains were analyzed from samples taken from Units A and B, with care taken to avoid the known looter trench, as well as Unit 4A (Appendix I). Of the 928 bones analyzed in Kelley Cave, 490 were culturally modified, including burning, cut marks, polish, scoring, and manufacture. Of the 490 modified bones: 435 were burned or calcined, four were early stage bead fragments, six showed tool use (polish/scrape marks), five fragments were bone tool manufacturing debris, and 48 bones showed clear cut-marks from skinning or defleshing.

The Minimum Number of Individuals (MNI) and Number of Identified Specimen (NISP) analyses indicate rabbit constitutes the bulk of individuals in the faunal sample (Tables 5.3, 5.4). Boney fish, particularly catfish, represent a larger portion of the faunal remains than rodents. Deer bone fragments representing 18 individuals were recovered. Overall, both the NISP and MNI indicate a substantial portion of the faunal remains are small to medium mammals.

Kelley Cave 1/8 Inch Screen Sort

The 1/8th inch sort was conducted on 31 0.5 liter bags from Units A, B, and 4A (Appendix M). Sample bags from UL A33, A36, and AB38 were found to have the greatest diversity of unburned seeds of any other sampled Unit Layer. With the help of Leslie Bush, seeds from UL A36 were identified (Table 5.5). Notably a seed from a native grape species is observed in both A36 and B10 (approx. 972.4-971.3 m elevation).

Table 5.3. Kelley Cave faunal Minimum Number of Individuals (MNI) with time period approximations based on radiocarbon dates. LP= Late Prehistoric, LA=Late Archaic, MA=Middle Archaic, EA=Early Archaic.

MNI				Avian					Turtle					Boney Fish							Reptiles			Rodents				Rabbits				Canine				Deer			
	Area	Unit	Layer	Accipitridae	Anatidae	Anseriformes	Aves	Geococcyx californianus	Apalone spinifera	Apalone spinifera emoryi	Apalone spiniferus	Chelonia	Testudinae	Catostomidae	Ictaluridae	Ictalurus furcatus	Ictalurus punctarus	Ictalurus sp.	Osteichthyes	Teleostei	Reptilia	Serpentes	Squamata	Otospermophilus variegatus	Sigmodon sp.	Neotoma sp.	Rodentia	Leporidae	Lepus californicus	Sylvilagus floridanus	Sylvilagus sp.	Canidae	Canis sp.	Carnivora	Urocyon cinereoargenteus	Artiodactyla	Odocoileus sp.	Odocoileus virginianus	Total Number
	1	B	1				1														1						2		1		2	2						1	10
	Feature 1			1			1		1		1								1				1						3		3		1	1			1		15
	1	B	4																								1				1							1	3
	1	B	7																												1								1
	1	B	10																			1							1		1							1	4
	1	B	13									1								1							1		1		1								5
	1	B	16											1																	1					1			3
MA	Feature 3						1				1		1		1			1		1						2	1		3		4	1		1			3		21
	1	A	16											1													1				2								4
	1	A	19				1																						1		1								3
	1	A	22													1		1			1					1			2		1								7
	1	A	25													1		1											2	1		1				1			7
EA	Feature 5	A	29											1			1			1						2	1		2	1	2	1	1	1					14
	1	A	31				1			1										1						2	1		1	1									8
	1	A	33												1					1									1		1	1	1						6
	1	A	36																										1			1							2
	1	AB	38												1							1					1		1		1							1	6
	Feature 6																	1	1								1		1		2								6
	1	AB	40		1										1												1		1		1	1						2	8
	1	AB	42								1											1				1			1		1								5
	1	AB	46																									1	1									1	3
	1	AB	48												1														1										2
	1	AB	50											1															1		1							1	4
	1	AB	53																																				0
	1	AB	55										1													1													2
	1	AB	57																																				0
LP	Feature 4	4A	1				1							1				1								1	1	1	1		1	6					1		15
LA	Feature 4	4A	4			1	1								1				1									1	1		3			1	1		1		12
	Feature 4	4A	7										1																		1						1		3
	Feature 4	4A	10	1			1																								1								3
	Feature 4	4A	13				1											1									1				1						1		5
			Totals	2	1	1	9	0	1	1	3	1	3	5	6	2	1	6	3	5	2	3	1	0	0	10	13	3	28	3	34	14	3	4	1	2	8	8	
			Class Totals	13					9					28							6			23				68				22				18			

Table 5.4. Kelley Cave faunal Number of Identified Specimen (NISP) with time period approximations based on radiocarbon dates. LP= Late Prehistoric, LA=Late Archaic, MA=Middle Archaic, EA=Early Archaic.

NISP				Avian					Turtle					Boney Fish							Reptiles			Rodents				Rabbits				Canine				Deer			Indeterminate				
	Area	Unit	Layer	Accipitridae	Anatidae	Anseriformes	Aves	Geococcyx californianus	Apalone spinifera	Apalone spinifera emoryi	Apalone spiniferus	Chelonia	Testudinae	Catostomidae	Ictaluridae	Ictalurus furcatus	Ictalurus punctarus	Ictalurus sp.	Osteichthyes	Teleostei	Reptilia	Serpentes	Squamata	Otospermophilus variegatus	Sigmodon sp.	Neotoma sp.	Rodentia	Leporidae	Lepus californicus	Sylvilagus floridanus	Sylvilagus sp.	Canidae	Canis sp.	Carnivora	Urocyon cinereoargenteus	Artiodactyla	Odocoileus sp.	Odocoileus virginianus	Small Mammal	Medium Mammal	Large Mammal	Mammalia	Total Number
	1	B	1				3														1						3		4		5	2						3	8	19	11		59
	Feature 1			1			6		4		2								2				1						14		29		1	2			11		39	20	21		153
	1	B	4																								1				2							3		1	1		8
	1	B	7																												1								1	3	3		8
	1	B	10																			1							2		2							1	1	1			8
	1	B	13									1								1							1		1		2									13		7	26
	1	B	16											1																	3					2			6	5			17
MA	Feature 3						1				1		2		5			1		4						2	3		16		30	1					12		7	24	19	5	133
	1	A	16											1													2				3								2				8
	1	A	19				1																						1		1											2	5
	1	A	22													1		2			2					2			4		2								2	2		9	26
	1	A	25													1		4											9	5		3				1			18	2			43
EA	Feature 5	A	29											1			1			4						3	7		9	1	9	1	1	2					9	27		5	80
	1	A	31				1													1						2			4	5									13	3			29
	1	A	33												1					5									2	2		1	5						10	5	2		33
	1	A	36																										2			1							1	2	1		7
	1	AB	38												1							1					1		5		2							1	3		1		15
	Feature 6				1										1												1		1		3	1						2	4	1		1	16
	1	AB	40															1	1								1		4		13								2	3			25
	1	AB	42								1									2		1				1			1		4								9	5	1		25
	1	AB	46																									1	1									1	2				5
	1	AB	48												1														2										1				4
	1	AB	50											3															1		1							1	1		1		8
	1	AB	53																																						3		3
	1	AB	55																	1						1																	2
	1	AB	57																																						1		1
LP	Feature 4	4A	1				3							1				5								1	3	1	10		7	7							1	1			40
LA	Feature 4	4A	4			1	1								1				2									1	1		9			1	1			3	12	6	3	3	45
	Feature 4	4A	7										1																		1						3			4			9
	Feature 4	4A	10	1			1																								5								3	1	1		12
	Feature 4	4A	13				1											4									1				2						1		2	8	2		21
			Totals	2	1	1	18	0	4	0	4	1	3	7	10	2	1	17	5	18	3	3	1	0	0	12	24	3	94	13	136	17	7	5	1	3	27	15	157	156	71	32	
			Class Totals	22					12					60							7			36				246				30				45			416				

Table 5.5. 1/8th inch Screen Sort identified seeds from Unit Layer A36.

Description	**Quantity**
Celtis sp. (-*laevigata*, -*laevigata* var. *reticulata*, -*ehreubergiana*) seeds	48
Colubrina texensis leaf	1
Diospyros texana, persimmon leaf	2
Diospyros texana, persimmon seeds	1
Euphorbia Karwinskia seeds	5
Euphoriba Croton seed	1
Fabaceae seed skin	1
Indeterminate seed fragments	2
Juglans microcarpa, shell fragments	3
Optunia sp. Seeds	76
Poaceae seeds	3
Prosopis sp. Leaf	1
Prosopis sp. Seeds	11
Rhus virens, Sumac, seed	1
Ungnadia speciosa, Mexican buckeye -skins	4
Unknown seed #1	1
Unknown seed #2	1
unknown spatulate leaf	1
Vitis sp.	1

In Chapter 3, I outlined the method used quantifying dung pellet fragments throughout the sample Unit Layers as a way to gauge the rate of turbation and migration of artifacts within the matrix. The results of the 1/8th inch Screen Sorting found variable quantities of fibrous dung fragments throughout the excavation profile. I surmise that this is due to the inclusion of ancient preserved fragments from animals (or possibly even humans) who occupied the shelter prior to historic sheep herding. The presence of fibrous dung in every UL makes the determination of migration rate via sheep pellets impossible without another form of analysis. See Chapter 6 for analysis of the Kelley Cave 1/8th inch screen sorted results.

Kelley Cave Burned Rock

The quantified burned rock collected from excavation Units A and B (Appendix L) shows sporadic distribution of fire-cracked rock sizes in the rockshelter occupation deposits signaling many construction events (Figure 5.48, 5.49). Burned rock distribution in Unit 4A shows increased amounts of FCR in the upper deposits likely associated with Feature 4 (Figure 5.50).

The distribution of rock sizes in UL 4A2 and 4A3 fits with what a hypothetical multiple-use earth oven deposit may look like (Black and Thoms 2014). Rocks used in hot rock cooking break down due to exposure to high temperatures. Rocks thermally fractured in earth oven heating elements and depending on their size/desirability were cleaned out or reused for the next oven. During the reuse of a locale, the small fragments created from the previous firing, would not be completely cleaned out before construction of an oven with new medium to large size stones. I hypothesize that earth oven reuse would stratigraphically place the quantity of small FCR at a lower elevation, below the medium and large size stones in the deposit.

The quantified burned rock from Unit A and Unit B (Figure 5.48, 5.49) show the sporadic process of earth oven construction and cleaning over a grand time scale. The processes of cleaning out of an old oven or digging oven pits into forgotten ones have mixed and churned rocks in the deposits, creating noise in the data. There are three very clear peaks in the quantified burned rock where no feature was observed: UL A10, A18, and A33. These increases are likely due to the placement of excavation units close to features present outside the unit boundaries. When Unit Layers encountered the fine sandy loam, below UL A36, the quantified burned rock decreases significantly, coinciding with increases in the large quantities of unburned spalls.

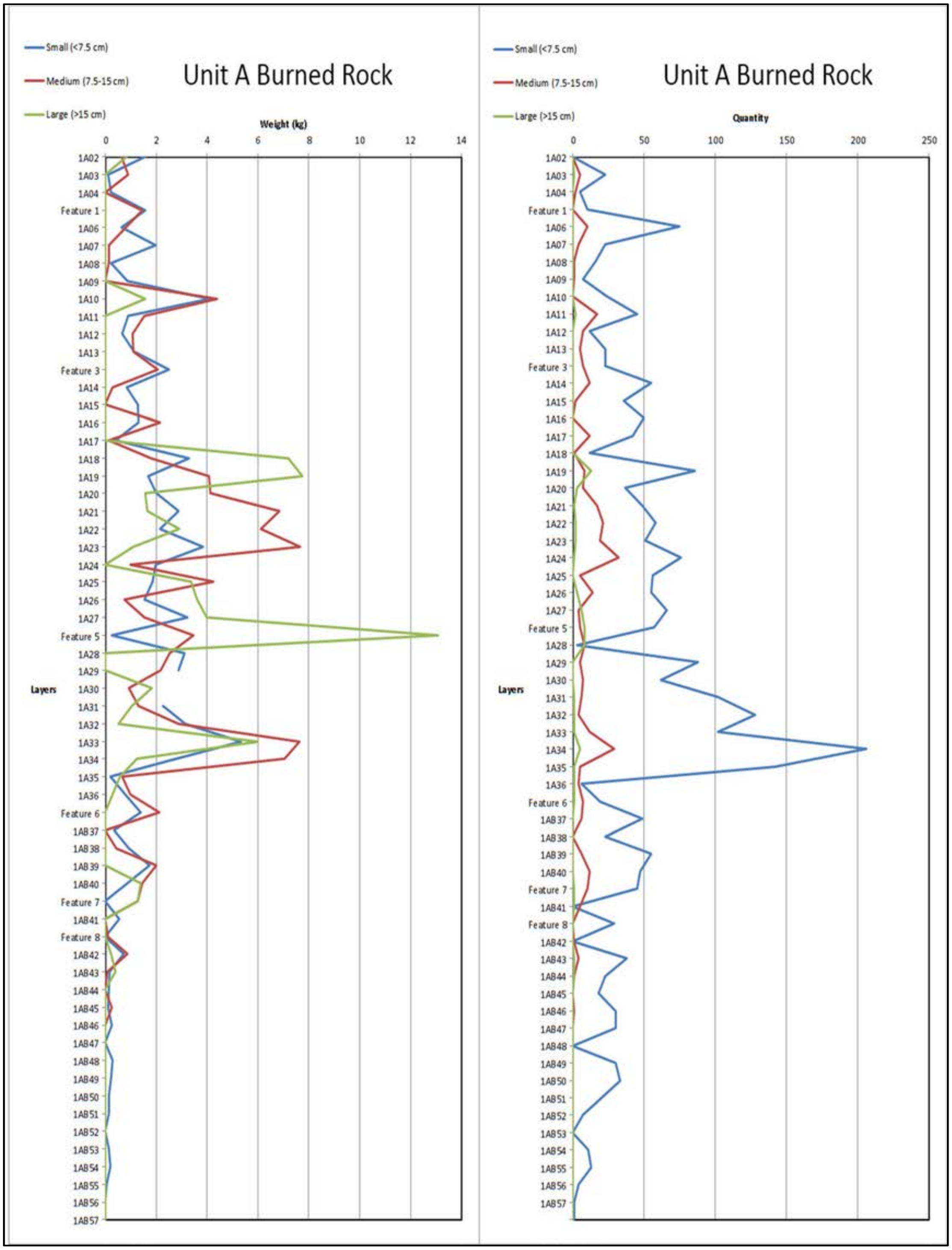


Figure 5.48. Quantified burned rock from Unit A &AB, Kelley Cave. The blue line represents Small (<7.5 cm) burned rock, the red line represents Medium (7.5-15 cm), and the green represents (>15cm).

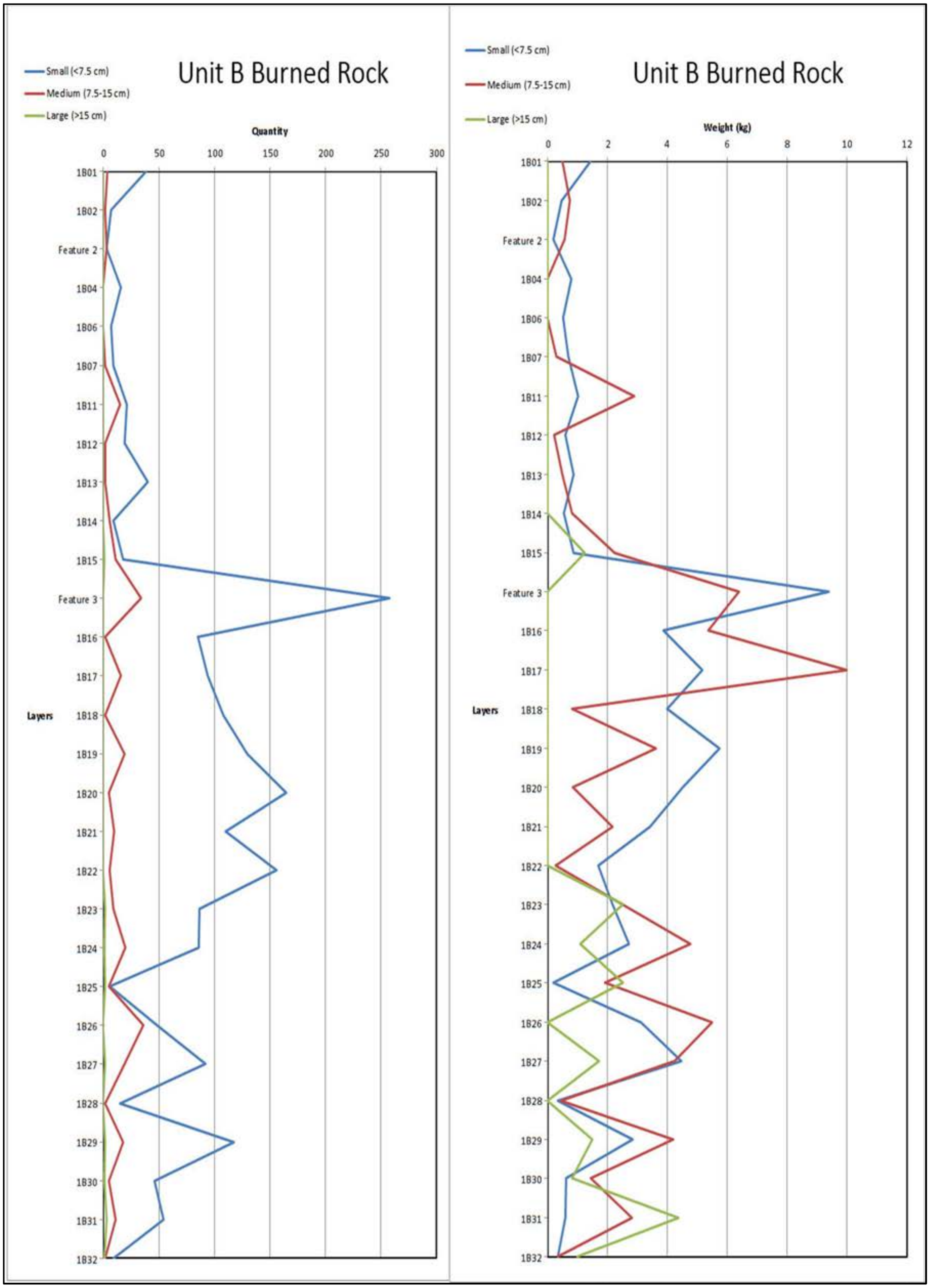


Figure 5.49. Quantified burned rock from Unit B, Kelley Cave. The blue line represents Small (<7.5 cm) burned rock, the red line represents Medium (7.5-15 cm), and the green represents (>15cm).

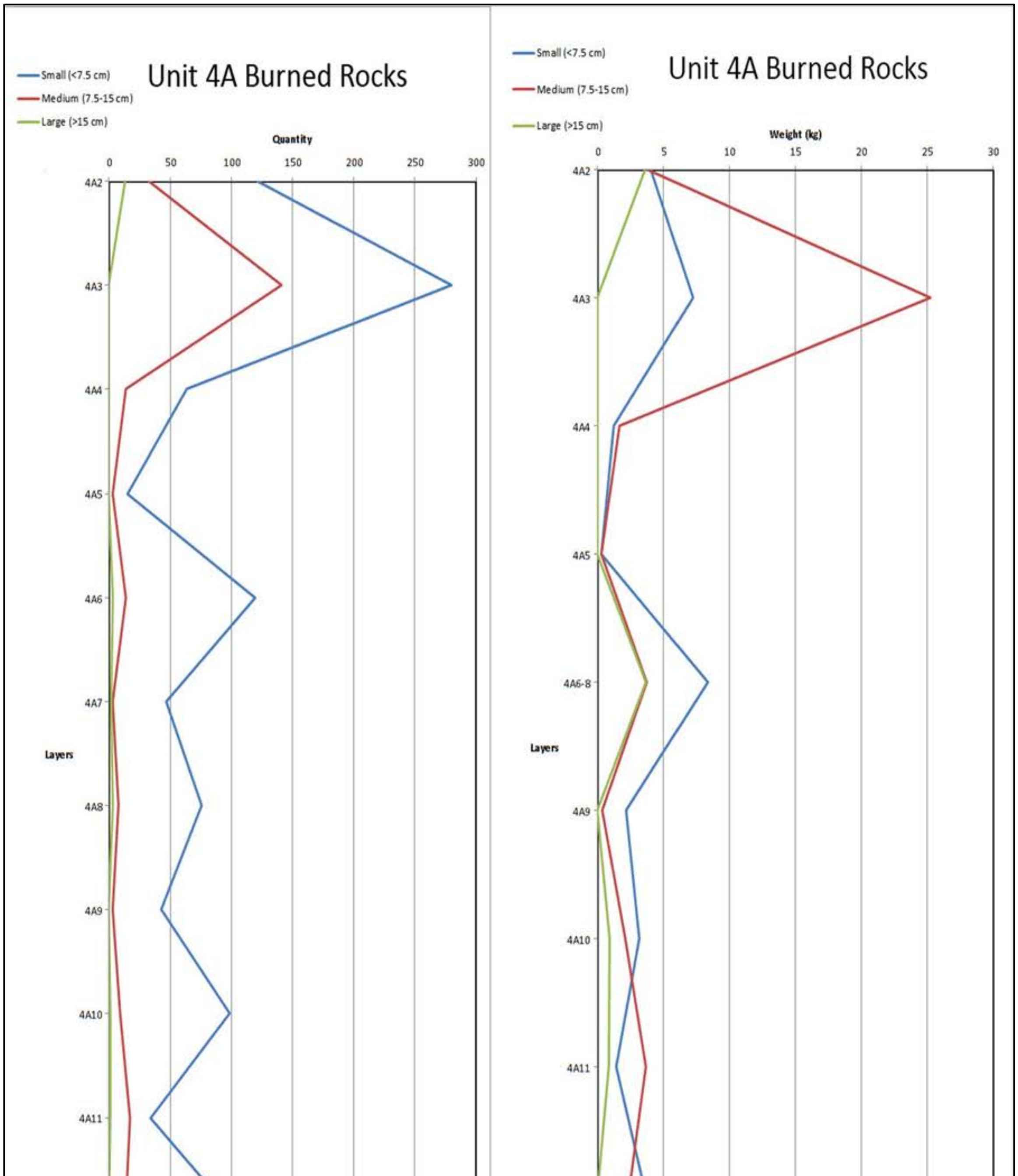


Figure 5.50. Quantified burned rock from Unit 4A, Kelley Cave. The blue line represents Small (<7.5 cm) burned rock, the red line represents Medium (7.5-15 cm), and the green represents (>15cm).

CHAPTER 6: FEATURES AND ANALYSIS OF ARTIFACT CLASS DISTRIBUTIONS IN SKILES SHELTER AND KELLEY CAVE

My excavations at Kelley Cave, like that many rockshelter sites, yielded a complex and abundant dataset from which to work. In order to better understand the human record at Kelley Cave this chapter presents analyses of the features, 1/8th inch screen sort, and burned rock data from Kelley Cave and makes comparisons to Skiles Shelter.

Kelley Cave Features

Eight cultural features were recorded in Kelley Cave. The radiocarbon dates, descriptions, and analysis results for each of these are presented in Chapter 5. The discussion below is a synthesis of the archaeological, geoarchaeological, faunal, and botanical data to interpret the features in Kelley Cave. No intact features were documented in Skiles Shelter, although two small apparent remnants of disturbed fiber-filled pits (FN 1167 and FN 1168) were observed, as discussed in Chapter 4.

Feature 1. Although defined as a cultural feature, Feature 1 was composed of multiple basin-shaped ash lenses, representing multiple events, near the surface of the shelter (Figure 5.19). The multiple layers of ash with slight basin shapes suggests repeated small open-air burning events which allowed the wood fuel to burn completely, leaving low amounts of charcoal. Relatively little burned rock was recovered, suggesting the burning events were not associated with hot rock cooking.

The initial radiocarbon assay for Feature 1 (VV164-CS4) dated to 6270* cal B.P. This date did not fit stratigraphically with the other dates and was likely older matrix introduced by pit digging and/or rodent disturbance. I rejected the assay as a valid association with the feature. A second assay (VV164-CS17), taken from the same elevation below the ash, returned an age of 3890 cal B.P., which is close in age to the top of Feature 3, encountered directly below. Thus, while this sample does not directly date the ash layers of Feature 1, it suggests that Feature 1 postdates 3890 cal. B.P.

Rabdotus shells were observed throughout the Feature 1 ash, the majority of which were blackened from burning. A few of these shells had puncture holes similar to rabdotus shell beads described from Fate Bell Shelter (Pierce and Jackson 1932:29). Faunal analysis also showed the majority of bone bead fragments recorded from the site were recovered from Feature 1. Jurgens (2005:159) found that the majority of bone beads at Arenosa Shelter were associated with the Late and Terminal Late Archaic time periods. Like Arenosa, the bone beads in Kelley Cave were identified avian, when possible, suggesting selection of bird bones for certain bead manufacture. However, Kelley Cave excavations indicate relatively low production of bone beads, relative to Arenosa, and no finished bone bead specimens.

Feature 2. This feature was a small group of stones with a slight sloping alignment on the south side of Unit B (Figure 5.21). No signs of thermally altered matrix or ash layers could be definitely associated with the stones. The data presented in Chapter 5, projectile points, 1/8th inch Screen Sort below, and mapped disturbances all suggest that Feature 2 was located within a previously unknown pit predating historic looting.

Due to this, Feature 2 is considered to be fortuitous alignment of stones in a disturbed infilled pit and is no longer considered to be a valid cultural feature.

Feature 3. This feature contained multiple, sloping lenses of charcoal and ash in an organic-rich, rubified, sandy loam (Figure 5.23, 5.24). The charcoal lenses exposed in Unit A indicate two repeated burning events at the lowest level, sloping toward the west. Above these two lenses, in Unit B were three more charcoal lenses, suggesting that later construction events were placed toward the south side of Unit B.

The increased charcoal and high frequency of small and medium size burned rock (<7.5 and 7.5-15 cm) suggest Feature 3 matrix has been used repeatedly for hot rock cooking and possibly rockless hearths. The exposed charcoal and ash lenses, with few associated burned rocks, are similar in morphology to simple pit hearths studied elsewhere (March et al. 2014:16). The red hue and compact nature of the Feature 3 sediment may also indicate a high degree of rubified sediment mixed with the other matrix (Mentzer 2014:651). Future researchers may be able to verify this interpretation with additional microscopic analysis of the grain shape and structure, which were not conducted due to the time constraints of this thesis.

Four diagnostic dart points are associated with Feature 3: two Palmillas (Middle to Late Archaic), a Marshall (Late Middle Archaic), and Montell (Late Archaic). Given the disturbances of human occupation, such as digging oven pits, and bioturbation, these points may not be associated with the feature. Radiocarbon assays from the top (VV164-CS5) and bottom (VV164-CS6) of the feature returned ages of 3560 and 5410 cal B.P. which encompasses the Middle Archaic period. Five other Middle Archaic points were recovered at the same elevation as Feature 3 (Langtry, Val Verde, and Pandale styles) but in disturbed contexts.

The majority of artifacts with red pigment found within the site were collected from Feature 3 or within the disturbance around it. The pigment may be remnants of Middle Archaic symbolic expression (Turpin 1996). The ubiquitous Pecos River style pictographs across the LPC have been radiocarbon dated from approximately 4,200 to 2,750 RCYBP (Rowe 2009:1732; Boyd et al. 2013:458). Rock art researchers have previously suggested that the pictograph panel in Kelley Cave represents one of the earliest pictographs of the Pecos River style, citing Sayles' 1932 description of finding the figures partially buried by later occupation deposits (Boyd personal communication, 2013). Although the panel may not be able to be dated directly, due to the possible contamination by kerosene (Sayles 1932: Langtry A photos), Feature 3 may provide a hint as to when the use of pigment for artistic expression intensified in the rockshelter.

Lithic debitage and small rocks with pigment were found sparsely scattered throughout the profile of Units A and B. These small artifacts are prone to vertical migration due to the looter trenches above Feature 3, and the bioturbation below. The largest artifacts with pigment, lithic scrapers and large burned rock fragments, are less prone to migration and are concentrated within the feature. A scraper with red paint drops was plotted with at an elevation of 972.34 m, level with the top of Feature 3. The Montell point was also recovered near this elevation, 972.42 m, approximately 1.2 m to the west of the scraper. Another scraper with pigment and burned rock fragment with a red brush mark were collected from the matrix in the top half of Feature 3 (approx. 972.2-972.45 m elevation). Based on the vertical provenience of the artifacts with pigment and the radiocarbon dates, I infer that the use of red pigment may have intensified during the latter half of the Middle Archaic.

Feature 5. This feature was a horizontal cluster of burned rock with lenses of ash in charcoal (Figure 5.35, 5.36). Radiocarbon assays (VV164-CS7a &b) from Feature 5 date to ca. 7370 cal B.P., which falls within the latter part of the Early Archaic period. The matrix above Feature 5, approximately 40 cm thick, is heavily laden with charcoal and burned rock fragments indicating extensive hot rock cooking events, of which Feature 5 may be the earliest remnant. Many of the burned rocks above and below the feature had remnants of burned sotol or agave leaves directly beneath the stones.

A burned mano was uncovered protruding out of the upper ash lens, while the lower tabular stones were exposed immediately beneath the same lens. I infer the mano was placed during a second burning event represented by the upper ash layer. The purpose of the burned mano in the feature is unclear. The mano is not broken or heavily used, and the canyon bottom contains many easily accessible large rocks for cooking.

Excavation layer A27 and UL A29 had a noted increase in the ratio of rounded river gravels to angular limestone gravels (Table 5:1). I infer this may be due to the transportation of large amount of gravel laden sediment into the shelter for capping earth ovens. One of these river gravels shows a clear red paint splatter on one side, including a void from a bubble in the drying liquid. I surmise that the pebble is in relatively good context due to the lack of visible intrusions in the ash layers surrounding it.

Intermittent lenses of white ash were recorded below Feature 5 in UL A29-A31. These ash lenses contained very little burned rock. Below UL A31 the burned rock quantity increased significantly, from ~971.5-971.3 m, until the fine sandy loam of Stratigraphic Layer H. It seems likely that the ash and increase in burned rock was due to the proximity of the excavation units to buried features close by, beyond the unit bountaries.

Feature 6. This feature was a discrete burned rock pile with the exterior tabular stones sloping in a slight basin shape (Figure 5.37). The sediment directly below the feature was rubified indicating the lower rocks were heated in place. In the center of the feature is a pocket of a charcoal-rich matrix with no large rocks. I hypothesize that Feature 6 represents repeated rock-lined cooking pits. Stones may have been removed from the feature, creating the pocket of matrix, and during later firing events stones were added above. I infer that the placement of Feature 6 to the north of, and immediately adjacent to, the large roof blocks in Unit B would have allowed the boulders to act like a windbreak or heat reflector inside the shelter.

Preliminary botanical analysis of Feature 6 recorded 1150 bristlegrass seed coats (*Setaria sp*.), 79 prickly pear seeds (*Opuntia sp.*), as well as other grass, hackberry, and flowering plant seeds (*Asteraceae*). The vast majority of these seeds were unburned. The bristle grass seed fragments recovered were the paleas and lemmas with the seed grains absent (Figure 5.31). The large quantity of unburned seeds raises the possibility of rodent turbation and caching of grains in the feature, however excavators did not see any visible rodent disturbance in the discrete feature or the central portion from which the matrix for botanical analysis was collected. Thus, I surmise that the seeds are *in situ.*

The 1/8th inch screen sample from Feature 6 also showed one of the lowest mammal dung quantities of the entire study, suggesting very little rodent activity occurred within Feature 6 (see 1/8th inch analysis below). A study of rodent and insect deterioration in the Southwest found that rodents cracked seeds (watermelon, bottle-gourd, and juniper), only enough to gain access to the soft portion of the seed, but still left visible incisor marks on the surface (Gasser and Adams 1981:187). I hypothesize that even though bristlegrasses are morphologically different from those in the study, incisor markings should still be present on the paleas and lemmas if they were scavenged. Further experimental research is being conducted by Leslie Bush to determine the effect of rodent scavenging on bristlegrass seeds.

The lack of chaff (e.g., stems and leaves) with the *Setaria* seeds may signal that the seeds were winnowed prior to their final deposition (Gremillion 2004:224). In an experimental study processing *Setaria*, pounding the seed produced lengthwise splitting while leaving much of the glumes intact (Callen 1967). Very few of the bristlegrass paleas and lemmas from Feature 6 show longitudinal breakage. The seeds may have been exposed to indirect heat through parching to weaken the coats (Weiss et al. 2004:130). Setaria seeds recovered in cave in Tamaulipas Mexico were identified by Callen as having been roasted (Hanselka 2011:132).

Radiocarbon dates from Feature 5 (above) and Feature 7 (below) suggest that Feature 6 dates to roughly 7400 cal B.P. In Hinds Cave, two woven parching tray fragments were recovered of similar age, dating to around 8,000 uncal B.P. (Andrews and Adovasio 1980; Lord 1984). Coprolites indicate the consumption of grass seeds from the *Poaceae* family grass seeds throughout the Early Archaic (Edwards 1990:85-88). A woven fiber fragment was also recovered from Stratum V in Eagle Cave with numerous unidentified seeds adhering to its surface (Ross 1965:123).

It is also worth mentioning that three of the bristlegrass seeds identified by Bush were significantly larger than the rest. *Setaria* seeds have been found in caches and coprolites at cave sites in Tamaulipas and Tehuacán, central and south Mexico, dating to ca. 7500 B.P. *Setaria* consumption then decreases starting from ca. 5500 B.P. to Spanish contact (Hanselka 2011:90-91). Some researchers have hypothesized that the appearance of larger grains indicates minor cultivation or selection in Tamaulipas, but the evidence is unclear (Austin 2006). Further study of the Feature 6 seeds, may prove fruitful.

Feature 7. This feature was a small, tabular stone-lined basin encountered in the tan fine sandy loam (Figure 5.32). The basin does not show signs of use as a cooking feature. Some of the slabs that make up the feature walls and floor appear gray and may have once been used in hot rock cooking prior to their placement in the feature. There was no increase in charcoal or burned rock fragments above or within the feature. The matrix below the stones of the feature floor shows no signs of thermal alteration/rubification. I interpret Feature 7 to represent an underground stone-lined storage cyst.

The feature was constructed directly north adjacent to the large roof blocks which would have served as good landmarks to relocate the underground storage. The radiocarbon sample (VV164-CS11) taken from directly beneath a rock in the feature floor dated to 7370 cal B.P. suggesting that underground storage may have been used during the Early Archaic.

Feature 8. The lowest feature encountered, and the earliest, Feature 8 was a small circle of horizontal tabular stones in the inferred pre-occupation fine sandy loam, as discussed in Chapter 5 (see Figure 5.33). A concentration of charcoal and small fire-cracked rock, mostly spalls, was observed 10 cm above the feature proper. The thermally altered spalls are likely incidental as unburned spalls of the same size and texture are found throughout the fine sandy loam. Only a few tabular stones, including a large spall, in the feature show an obvious discoloration from heating; however numerous charcoal chunks were adhered to the underside of several stones. The fine sandy loam immediately below the Feature 8 stones has a thin lens of orange, rubified sediment.

I surmise that Feature 8 may be a cook-stone griddle. The horizontal alignment of the stones and charcoal directly beneath match the characteristics outlined by Thoms (2009:578). The large tabular stones would have allowed for the direct cooking of food on their surface. The lack of significant discoloration of the limestone may also be due to the low intensity of the heat they were exposed to or, perhaps more likely, the difficulty in discerning thermal alteration in the low-light conditions of the deep excavation unit layers. There were no cracked in place stones, or stones that appeared to be later additions to the Feature 8, which suggests that the feature represents a single cooking event.

Given the elevation of Feature 8 relative to the other dated features (approx. 60 cm below Feature 5 and ~10 cm below Feature 7 storage pit), it may date to the first half of the Early Archaic. The initial attempt to obtain a radiocarbon assay from Feature 8 was unsuccessful. A second sample is being processed, but the results were not ready in time for the completion of this thesis.

Feature 4. This feature is a plant fiber and mud drape located southeast of my main excavation units (Figure 5.35). Profile Cuts 4A and 4B indicated Feature 4 slopes toward the dripline of the shelter. The slope was infilled with mostly unburned cut leaf bases, quids, and twigs which have been capped by an alluvial drape followed by a second interval of fiber directly atop the mud. Below the fiber is a compact ashy matrix with burned rock somewhat similar to Layer I in Unit 4A. Further work by the Ancient Southwest Texas Project in 2014 expanded the profile cuts toward the dripline. This later work suggests that Feature 4 represents a complex set of large earth oven pits filled with layers of fiber, ash, and charcoal, capped by an alluvial event.

The fiber within Feature 4 appears to be plant detritus from each stage of earth oven baking: cutting leaves, cooking the heart, oven cleanout, and disposing of the waste after consumption. Also among the fibers were charred fragments of fiber cordage and desiccated tasajillo cactus stems. The quantity of lithic debitage also spikes at the lower boundary of Layer I, Unit 4A, which may indicate the feature was utilized as a general trash pit during occupation.

As detailed in Chapter 5, during my initial investigation of Feature 4 the mud drape was initially thought to represent an intact tamped dirt floor. Grain size analysis conducted on mud and fiber chunks eroding off Feature 4 indicated reverse fining upward, grain size sorting from fine to coarse as elevation increases (Patton and Dibble 1982:102). The reverse fining is a natural process created from slack water flood events. Similar flood deposits were noted in Arenosa Shelter (Kochel and Baker 1982). If the mud was intentionally added as a layer by humans, the grain size would be heterogeneous with no grading. The mud drape must be interpreted as a natural flood deposit within the shelter.

Three radiocarbon assays were obtained from fibers above and below the mud lens (VV164-CS1-3) which dates the alluvial deposition to sometime around 600 cal B.P. The age of the mud layer in Feature 4 nearly matches the radiocarbon result from beneath the alluvium, Stratigraphic Layer B, in Skiles Shelter. The alluvial deposits in both shelters clearly indicate a catastrophic flood event in the ENC in the Late Prehistoric period in the mid-14th century.

The assays also indicate that the fibrous deposits are from the same time. The lower basin feature itself may be from an older earth oven pit, later used as a trash pit. This inference is supported by the radiocarbon assay VV164-CS16, taken from Unit 4A, which dated to ca. 2590 cal B.P .There were no projectile points recovered in association with Feature 4 or Unit 4A to compare to the radiocarbon results, and the lower deposits comprising Feature 4 have not yet been dated.

Kelley Cave 1/8th Inch Screen Sort Analysis

In Chapter 5 I stated that my initial attempt to gauge migration of material using historic sheep dung pellets failed due to the presence of preserved fibrous dung fragments throughout the excavation profile. When I plotted the weight of dung fragments in my 1/8th inch screen samples alongside the debitage and bone weights a correlation was evident between the three classes (Figure 6.1). In Excel, I ran the Phi Coefficient to test for correlation between weights of bone, debitage, dung, botanical remains, and burned exudate from layer 1B4 to 1AB57. The results showed the bone, debitage, and dung were strongly correlated (Table 6.1).

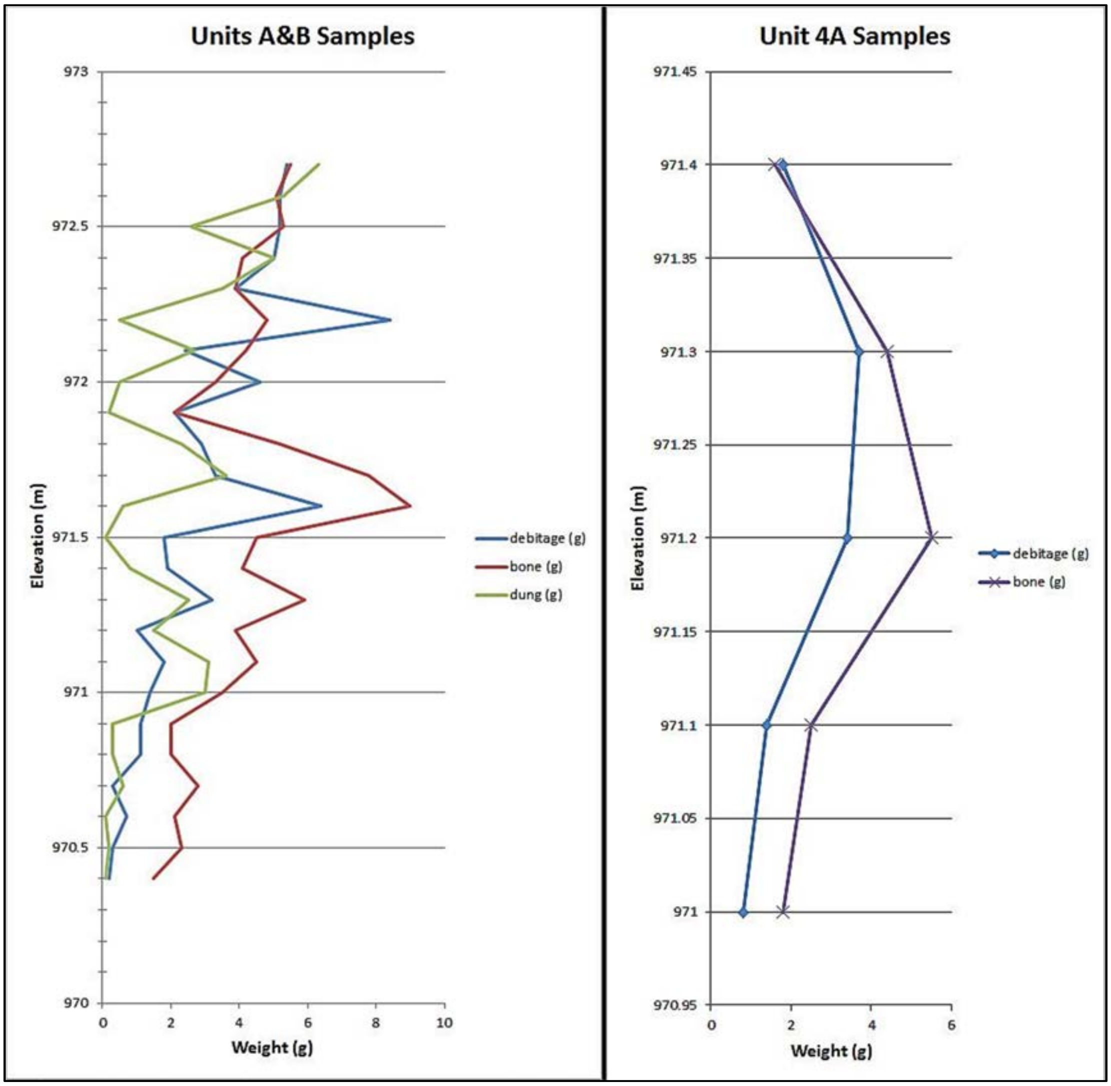


Figure 6.1. The 1/8th sorted bone (red), debitage (blue), and dung (green) plotted by relative elevation.

Table 6.1. The results of Phi Coefficient run on 1/8th sort categories.

	dung	bone	debitage	exudate	botanical
dung	1				
bone	0.770685	1			
debitage	0.611035	0.777584	1		
exudate	-0.11635	0.089865	-0.10557	1	
botanical	0.197806	0.098243	-0.17429	0.103693	1

The discontinuity in the layers directly below Feature 3, 972.1-971.9 m elevation, is likely the result of a looter trench or old pit, discussed in Chapter 5. The bottom of the trench in Unit C, as well as my own experience in Skiles (see Chapter 4 bioturbation), demonstrates that the loose infilled matrix of a trench appears to be desirable for burrowing mammals. The bottom of Unit C undulated with many clearly visible krotovina, and obviously created after the artifact collector's digging had ceased. The looter trench, especially if left open, would have allowed burrowing mammals to reach depths below surface not normally reached. Although the charcoal lenses in Feature 3 indicated that it is at least partially intact, the encountered trenches and numerous burrows directly below the feature are likely connected, and have affected the artifact distributions.

Scatter plot analysis of the layers below this disturbance, UL A19 to AB57, show positive correlation (R^2) between bone, debitage, and small fibrous dung fragments (Figure 6.2, 6.3, 6.4) with the debitage and bone again showing a very strong correlation. The bone and dung collection from UL A29 appear to be an outlier in the dataset. The outlier may be due to the formation processes of Feature 5; however the reason for such a significant increase in bone and debitage in this one Unit Layer is unclear.

I subsequently conducted regression analysis on all three pairings. Bone and debitage analysis returned an R^2 result of 0.80042 and a significance of F=0.000003 (highly significant); bone and dung returned an R^2 of 0.289944 and significance of F=0.031407 (significant); debitage and dung results were an R^2 of 0.0971 and F=0.240049 (not significant).

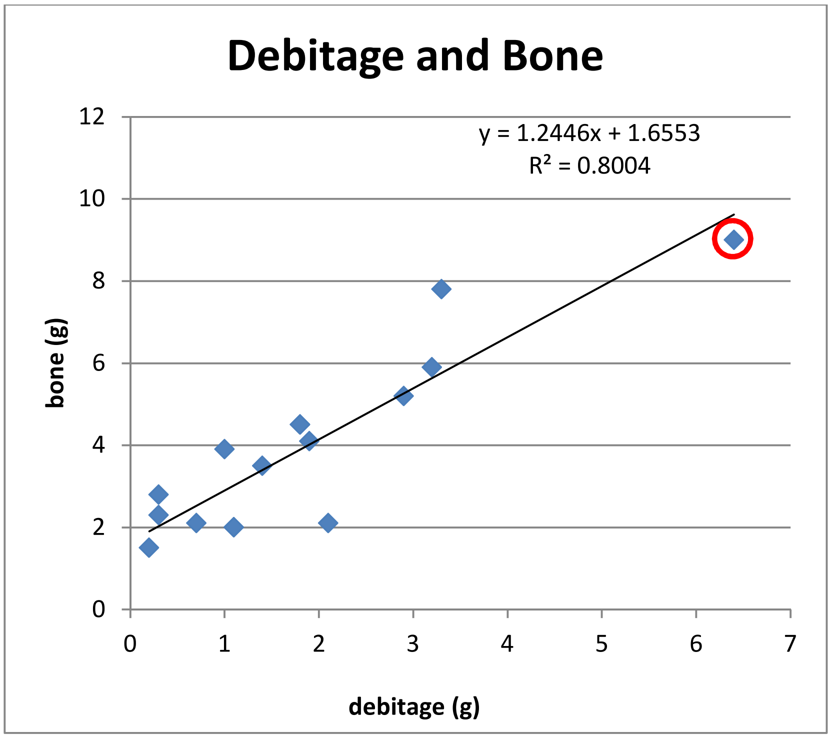


Figure 6.2. Kelley Cave scatter plot of bone and debitage weights from 971.9-970.4 m elevation. Outlier UL A29 circled in red.

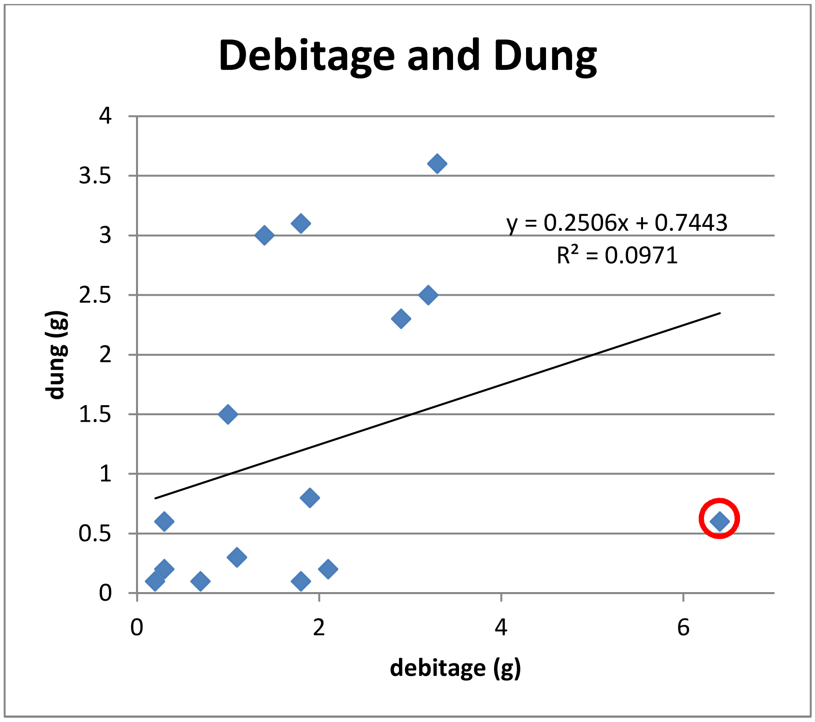


Figure 6.3. Kelley Cave scatter plot of debitage and dung weights from 971.9-970.4 m elevation. Outlier UL A29 circled in red.

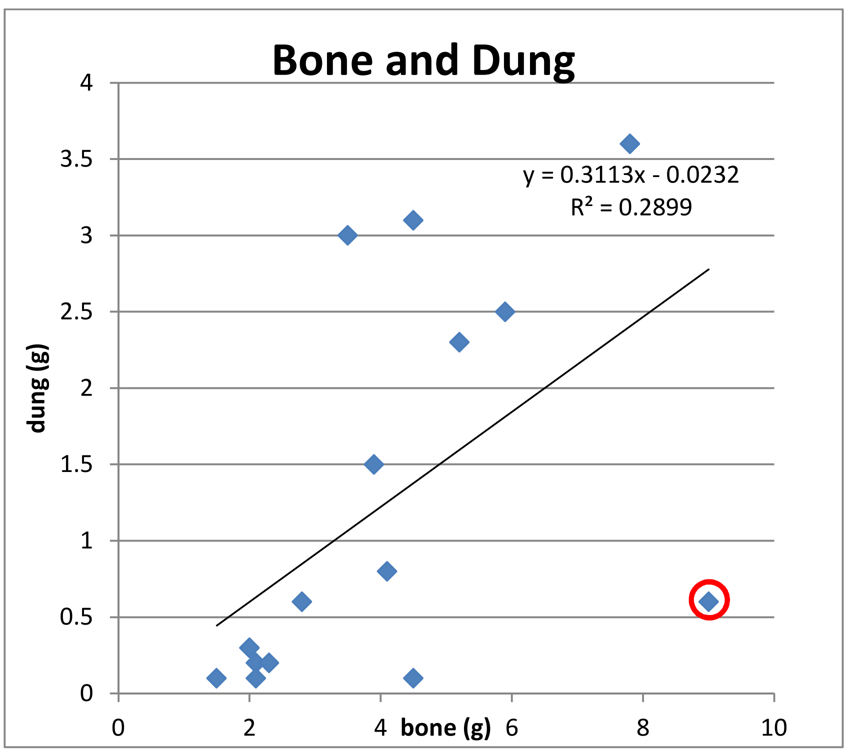


Figure 6.4. Kelley Cave scatter plot of bone and dung weights from 971.9-970.4 m elevation. Outlier UL A29 circled in red.

1/8th Inch Screen Sort — Hypothetical Model

The correlation of bone, lithic debitage, and dung fragments may have to do with variations in the shelter use and disuse frequencies over long periods of time. A rockshelter provides desirable environmental protection and soft, easily-dug sediment for small burrowing mammals, specifically rodents. As a natural process, these burrowing mammals dig, defecate, and die contributing to the dung and bone quantities of the shelter. When humans occupy the shelter it becomes less favorable a habitat for rodents. Humans either scare off (or eat) the rodents while also bringing in game and producing lithic tools. Human shelter use would result in an increase in lithic debitage and bone and a decrease in rodent dung. Once the humans left, rodents would reoccupy the shelter. The subsequent reoccupation may also be aided by the desirable trash, such as bone and meat refuse, which would cause an influx in the shelter "use" intensity by the rodents.

The quantities of the three artifact classes shown in elevations 971.9- 971.5 (Figure 6.1) may be explained by a hypothetical model of shelter use/disuse: an immediate increase in debitage and bone with a delayed increase in dung. The debitage and bone weights in Unit 4A also fit in this model. The data from Unit A, however, reflects a larger span of time than a single event. These peaks are more a reflection of numerous events, indicating an increased frequency of shelter use and reuse by humans which has kept the animal population low, until at a later time the shelter becomes much less visited by humans and the mammal population surges again.

The peaks in the data from approx. 971.3 m represent the layers at the boundary of Stratigraphic Layers G and H (fine sand). Below this influx, at ~971.2-971.1 m, the dung increases in Stratigraphic Layer H. The increase may be the result of the first post-human burrowing mammals, and the depth of their burrows. The vertical distribution of dung below this point, as well as debitage and bone, appears similar to models of artifact distribution in "faunalturbated" sites presented by Morin (2006). The myriad of human processes that affect rockshelter deposits along with faunalturbation make it difficult to test his model, and beyond the scope of this thesis.

Above Feature 3, starting at approx. 972.3 m in elevation, the weights for all three classes become sporadic with irregular peaks and declines, a trend also seen in the mixing of projectile point styles (Table 5.2). This is likely due in large part to the looting disturbance encountered in the upper layers. The upper layers of the 1/8th sort were taken from Unit B to avoid the known trench comprising most of Unit A and only a small portion of B. The disturbances in the 1/8th inch sort data as well as those noted at the top of Unit B profile suggests a second disturbance may have been encountered.

The alignment of Feature 3 (see Figure 5.22) suggests a depression in the southeast quadrant of Unit B. Excavators documented small patches of compact ash likely related to Feature 1 (see Figure 5.12 UL B5), and the Rock Sort data (Appendix L) from the Unit Layers immediately above Feature 3 show a moderate quantity of small and medium sized fire cracked rock (FCR). I infer the pit may have been the upper portion of Feature 3, including the FCR, and was subsequently infilled with loose matrix and rock.

Skiles Shelter and Kelley Cave Comparison

Statistical comparison between the quantified FCR in Kelley Cave with that of Skiles Shelter may indicate the degree and variability of cooking in the two shelters. Due to small excavations and larger excavation volumes in Skiles Shelter, when compared to Kelley Cave, any statistical comparison between the two shelters suffers from small sample bias. Below I will discuss some statistical comparison results which point to additional considerations with a more robust data set from the 2014 ASWT investigation of Skiles Shelter.

To compare the two shelters, the bone (count) and lithic debitage (count) collected from the ½ and ¼ inch screens were used with the total burned rock weight. The added mesh collections maximized the number of comparable samples in Skiles Shelter. Due to the difference in excavation volumes between each site, the data was then adjusted based on the measured volumes, e.g. weight/m^3 or count/m^3. The resulting data compares the intact Unit Layers of Kelley Cave, UL A20-AB57, with the intact unit layers of Skiles Shelter, UL A8-A12.

The Skiles Shelter and Kelley Cave results suggest similar trends in variability of bone and debitage (Figure 6.5). I infer that like 1/8th inch screen sort analysis, Skiles Shelter bones are a factor of human occupation, as indicated by the lithic debitage. Regression analysis of the bones and lithics of Skiles Shelter resulted in R^2= 0.6245, but F=0.1107, not quite within two standard deviations of significance.

The variability in lithics and burned rock appears to be significantly different in Skiles Shelter and Kelley Cave (Figure 6.6). Regression analysis shows Skiles Shelter to have an R^2 of 0.9389, F= 0.0065. The data suggests that in Skiles Shelter lithic flaking and hot rock cooking may have occurred together far more often than in Kelley Cave, where flintknapping and hot rock cooking are not as strongly connected.

The analysis of bone and burned rock variability between the two shelters (Figure 6.7) also shows a strong correlation in Skiles Shelter; R^2=0.659, but a significance of F=0.09516. The regression analysis F value is below two standard deviations for significance, but still within 0.10. A larger sample size is needed to determine the significance of the R^2, but there are signs of significant differences in use.

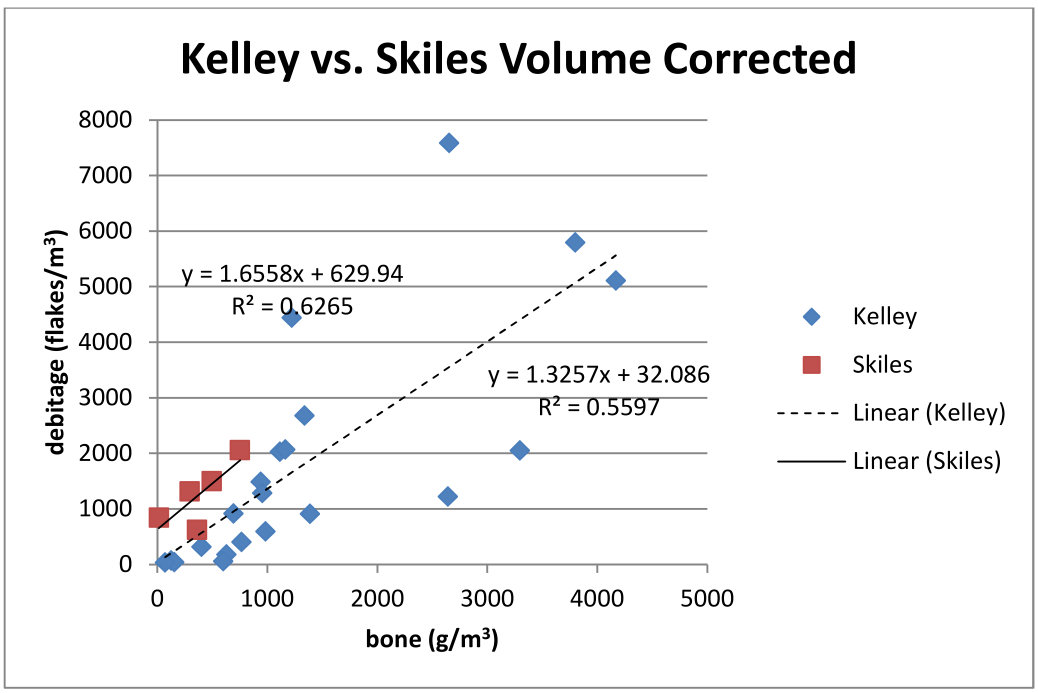


Figure 6.5. Statistical comparison of the two shelter sites using volume of debitage and bone.

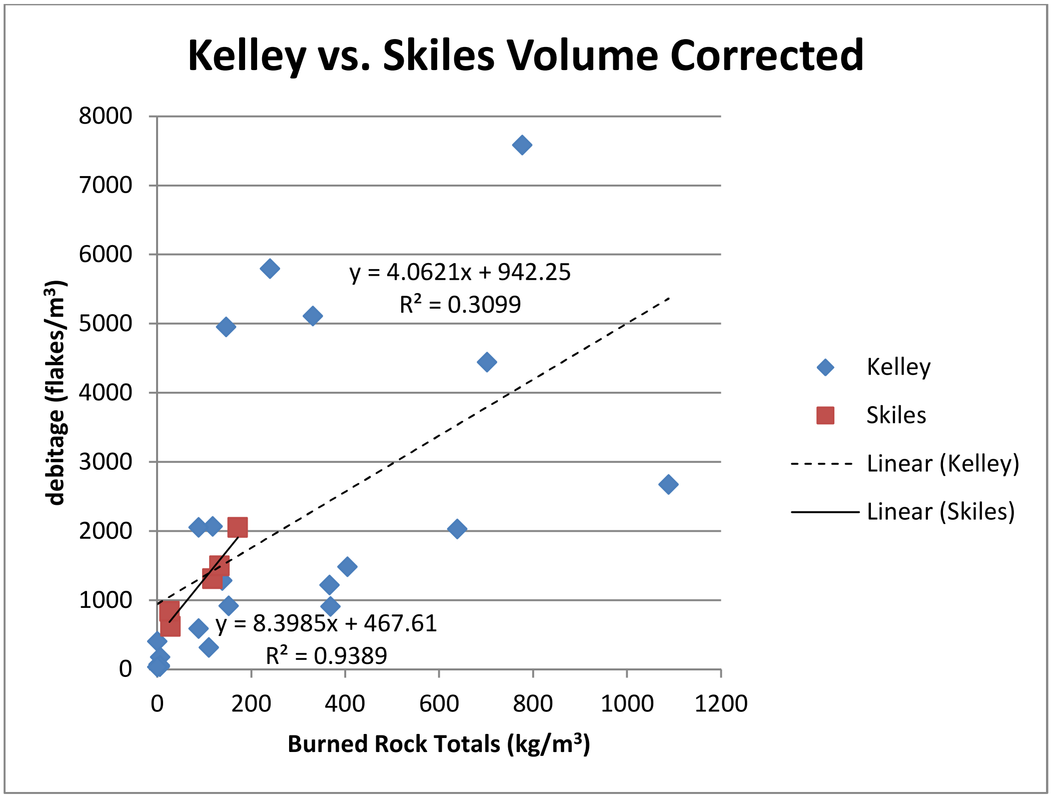


Figure 6.7. Statistical comparison of the two shelter sites using volume of debitage and burned rock.

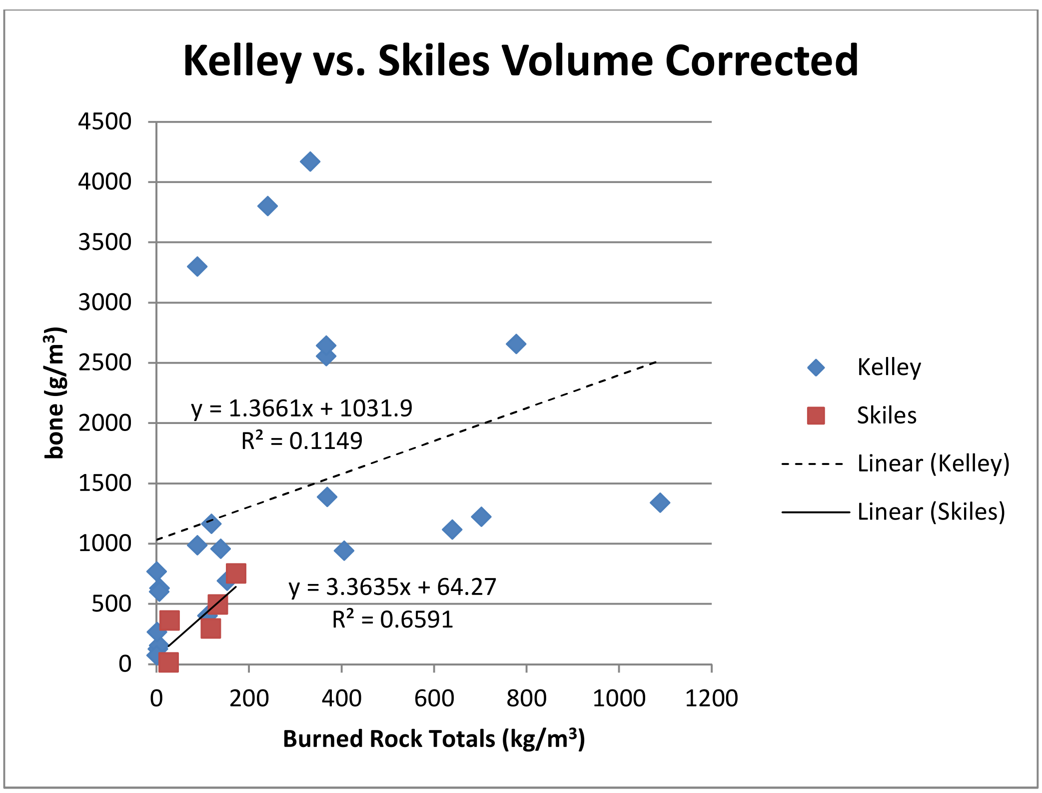


Figure 6.6. Statistical comparison of the two shelter sites using volume of bone and burned rock.

Excavation Unit Layers from Unit 4A, in Kelley Cave, were then compared to Skiles Shelter, with the hope that the smaller sample size would make a better comparison. Unit 4A has an upper fiber layer dated to ca. 600 ca. B.P. (VV164-CS1a&b) and lower UL 4A11 dated to 2590 cal B.P. (VV164-CS16). These dates indicate the deposits in Unit 4A are roughly contemporary with the projectile point chronology and radiocarbon dated deposits of Skiles Shelter.

Analysis of the previously discussed artifact classes was corrected for excavated volumes in Appendix E. The R^2 correlation trends between lithic debitage and bone remained very close to those previously discussed. In Unit 4A, the R^2= 0.355 due to an outlier in UL 4A2. The outlier may represent a single intense knapping episode near the earth oven feature. When the outlier is removed, the trend corrects to R^2=0.695.

The scatterplots of burned rock totals with bone and debitage show a stark difference in correlation between the shelters (Figure 6.8, 6.9). Kelley Cave 4A shows no correlation between burned rock totals and bone and debitage. Given the proximity to an earth oven feature, this suggests the hot rock cooking has little to no correlation with flintknapping or animal bone processing in this area of the shelter.

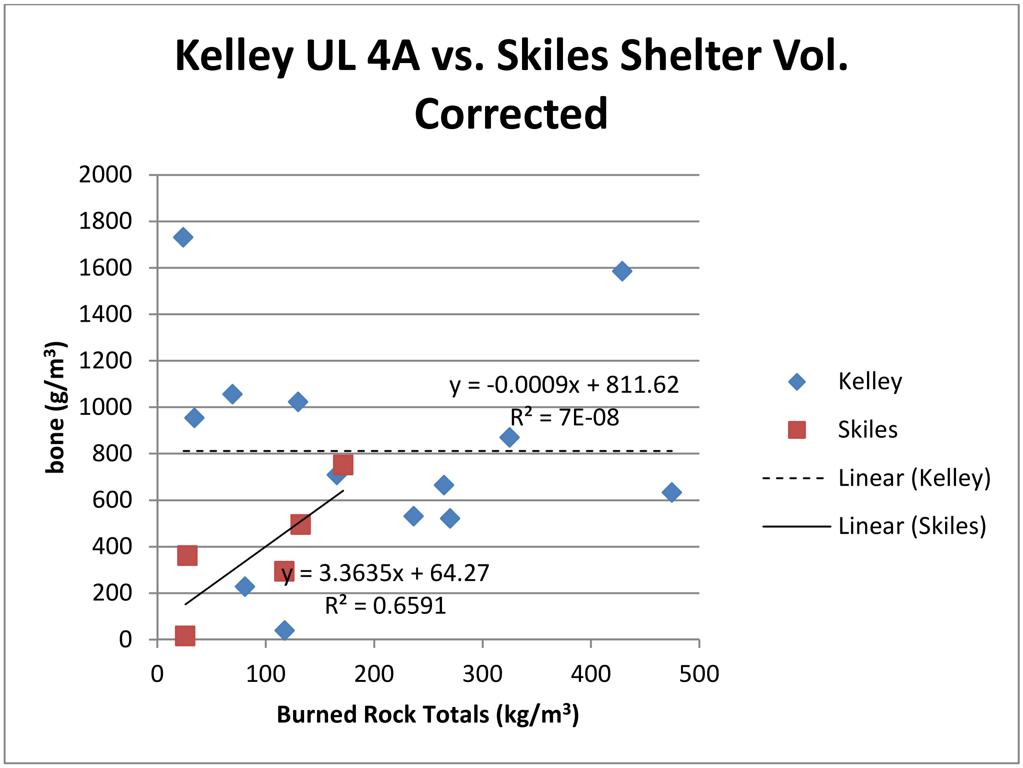


Figure 6.8. Statistical comparison of the Unit 4A and Skiles Shelter using volume of bone and burned rock.

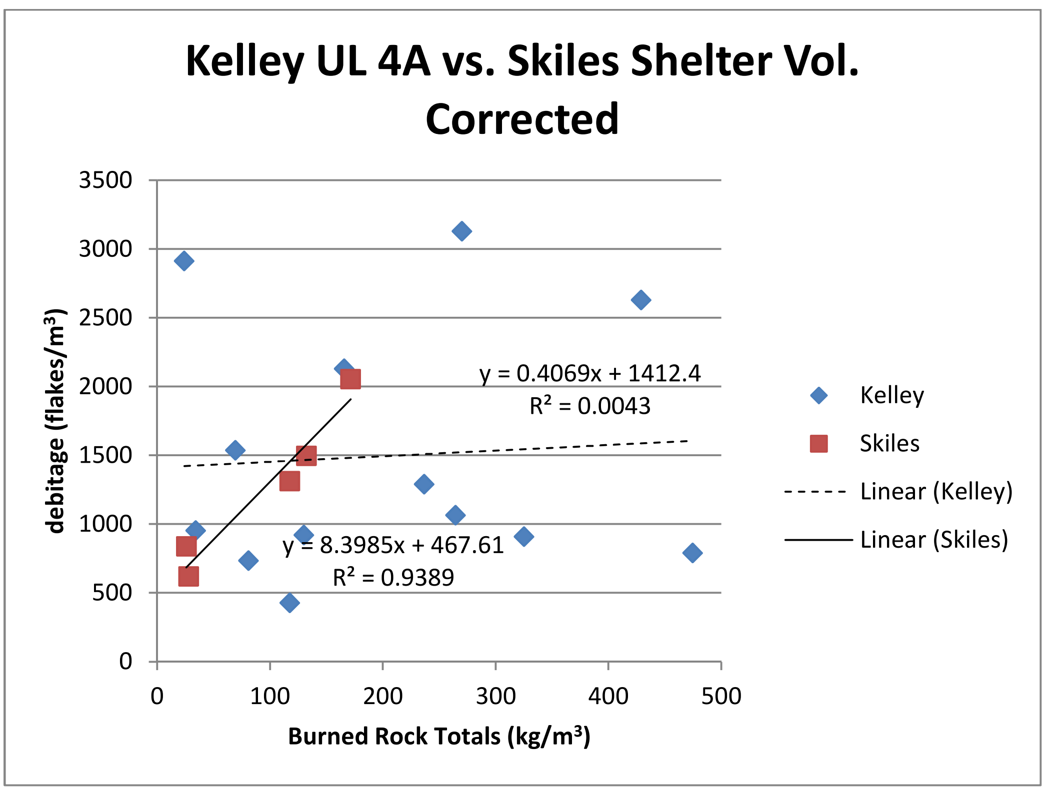


Figure 6.9. Statistical comparison of the Unit 4A and Skiles Shelter using volume of debitage and burned rock.

Rock Sort — Hypothetical Model

Both of the statistical analyses in this chapter show the same strong correlation between lithic debitage and faunal remains which is relatively constant between shelters. The difference between the shelters becomes apparent when comparing the debitage and bone to the hot rock cooking.

Lithic debitage is a byproduct of lithic production and maintenance and a definite indicator of human occupation. The correlation between lithic debitage and bone is inferred to be the sign of human occupation and the transport of fauna into the shelter for processing and consumption. Burned rock in the shelters is an indicator of hot rock cooking, specifically earth-oven cooking of plants. This assumption is based on the prevalence of earth-oven cooking of sotol/lechuguilla in the LPC from the Early Archaic to the Late Prehistoric (Turpin 2004).

I infer that the correlation between burned rock and lithics and bone in Skiles Shelter indicates that all three are related to food processing and consumption. The lack of correlation in Kelley Cave suggest that lithic production and animal consumption took place independently from hot rock cooking. According to this interpretive model, Skiles Shelter activities were more directed toward food processing (knapping of cutting tools for plants and animals, hot rock cooking of plants and animals) while Kelley Cave shows a broader range of habitation activities. The low quantity of formal lithic tools in Skiles Shelter suggests knapping activities may have mainly concentrated on producing expedient tools. I hypothesize the stronger correlation between lithic debitage and fire-cracked rock than bone and fire-cracked rock indicates that lithic tool production is more related to the processing of plants than the processing of animals within the shelter (Figure 6.10).

The accuracy of my comparison of these two shelters is a factor of the amount of data collected. Kelley Cave had far deeper intact deposits, for this study, than Skiles Shelter. Hopefully the 2014 ASWT excavations of Skiles Shelter will be able to remedy some of the shortcomings of my small dataset.

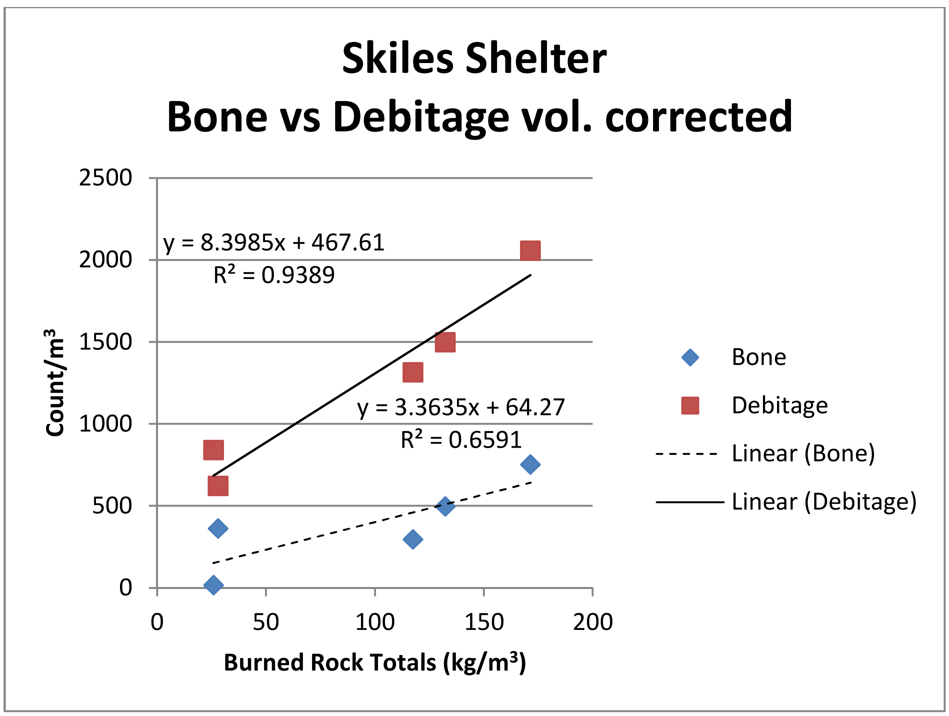


Figure 6.10. Statistical comparison of the bone and debitage counts within Skiles Shelter.

CHAPTER 7: SHELTER USE DISCUSSION AND CONCLUSION

The excavations of Skiles Shelter (41VV165) and Kelley Cave (41VV164) have allowed for the study of two adjacent rockshelter sites through a single methodology. The majority of previous excavations of Lower Pecos Canyonlands (LPC) shelters have investigated single shelter sites through a variety of methods over the decades, making comparisons difficult. Previous researchers have posited the idea of differential shelter use. In his historic investigation of the Shumla Caves, George C. Martin was the first to suggest that the shelters served differential occupation roles, e.g. "Fisherman's cave" and "Artist's cave" (1933:10). Unfortunately, the Shumla Cave report, like many reports from the time, lacked detail on provenience of the artifacts documented and even the precise location of the sites in his study, as well as other data necessary to evaluate Martin's characterizations.

Archaeologists who came after Martin did not discuss differential shelter use beyond sites like Bonfire Shelter (Dibble 1968; Bement 1986; Byerly et al. 2007). Given the complexity of archaeological deposits in rockshelters and the enormous depth of time represented within, the general logic was that LPC shelter sites were seen as residences within which all manner of domestic activities took place. The idea of differential shelter use was not broached again until the 1980s and 1990s. Solveig Turpin hypothesized some shelters represented separate spaces for gender specific ritual or for isolation of specific groups such as pregnant women (1984b:194-195; 1994:72). Turpin inferred this segregation using the distribution, and content, of Red Linear style pictographs with shelter sites containing large cultural deposits and painted sites lacking evidence of occupational debris. At the time Turpin suggested this occurred during the Late Archaic, based on her inferred dating of Red Linear. More recent analysis has shown the style to date much earlier, and possibly contemporary (or earlier than) with the Middle and Late Archaic Pecos River style (Boyd et al. 2013).

In this chapter I compare Skiles Shelter and Kelley Cave in terms of evaluating possible segregation of the single occupation. I also discuss how these two shelters relate to Eagle Cave (41VV167) and the overall use of ENC. Finally, I discuss similarities between the material culture from Skiles Shelter and Kelley Cave with the material recorded from early shelter excavations in the LPC to infer behavioral change through time.

Skiles Shelter

As discussed in Chapter 4, the results of my investigation and analysis of Skiles Shelter lead me to infer that it was used concurrently with Kelley Cave. The chronology of the sparse projectile point record indicates site use from the Middle Archaic to the Late Prehistoric. The depression in the cultural deposits, Stratigraphic Layer D, in the back of the shelter suggests the removal of cultural deposits prior to the flood in the mid-14th century. The apparent removal of existing deposits means that the depression was infilled with deposits that are Late Prehistoric in age. Expanded excavations by the ASWT in 2014 suggests that the depression may represent a large Late Prehistoric a borrow pit for earth ovens that were built toward the dripline of the shelter.

In excavation Units A and B, the quantity of lithic tools recovered in Stratigraphic Layers D and F were low: consisting of eight modified flakes or edge-worked tools, three diagnostic projectile points, and two point fragments. The burned rock analysis in Chapter 6 shows a positive correlation between lithic debitage, burned rock, and bone in Skiles Shelter. I hypothesize that the correlation indicates the majority of lithic manufacture is related to the processing of food, and more specifically the plants used for earth oven cooking. The 103 grinding facets in the shelter would have also been used to process plants and seeds (through pulverizing and grinding), although not necessarily those processed in earth ovens.

The small faunal sample analyzed in Skiles Shelter shows 20 percent of the assemblage was culturally modified (burned or cut). Ten of the modified bones showed processing cut marks indicative of skinning or defleshing. These processed bone fragments were identified as prey species typically consumed by hunter-gatherers in the region: *Sylvilagus sp*. (n=5), *Lepus californicus* (n=1), unidentified medium mammal (n=3), and unidentified small mammal (n=1). The total analyzed faunal assemblage consisted of mainly rabbit and rodent bones. The sample also contained five fragments of large mammal bones, possibly deer, but they could not be definitively identified. A single bone tool was recovered but no debris to indicate the manufacture of bone ornamentation at the site.

The faunal assemblage suggests a shelter occupation behavior where animal resources are being procured from a constrained resource area. Animals such as whitetail deer and black-tailed jackrabbit occupy the uplands almost exclusively, using the open area to run from predators. Animals such as woodrats and cottontail rabbits utilize the dense brush to hide from predators and are mainly found in the brushy canyon and slope areas. Both the Minimum Number of Individuals (MNI) and Number of Identified Specimen (NISP) calculations indicate a focused exploitation of the canyon fauna.

The rock art aside, Skiles Shelter shows little signs of habitation or any other cultural behavior beyond those linked to processing and cooking botanical and faunal resources. There is very little evidence of any symbolic expression in the lower deposits beyond a single piece of ochre, nor is there evidence of bead manufacture, storage, or other occupational activity seen at Kelley Cave.

Analysis indicates that the site has been subject to intense impact by both human occupants and ancient floods. The south-facing shallow roof of Skiles Shelter provides little protection from the sun, wind, and rain which likely made the site undesirable as a habitation locale during certain times of the year.

Kelley Cave

Radiocarbon dates in Kelley Cave indicate the site has been repeatedly utilized from the Early Archaic to the Late Prehistoric. Twenty-six diagnostic projectile points show occupation from the beginning of the Middle Archaic to the Late Prehistoric. The excavation depths representing the Late Archaic to the Late Prehistoric periods were found to be heavily disturbed due to two previously unknown trenches/pits and animal burrowing. My discussion of Kelley Cave follows the time periods represented.

Early Archaic. Median radiocarbon dates from Stratigraphic Layers D-H fall within an approx. 250 year span, 7575-7325 cal. B.P. (VV164-CS7, CS8, CS11, and CS14), see Figure 5.11. The close grouping of ages suggests that these deposits are associated with the latter part Early Archaic period. Given the nature of human and animal turbation of the cultural deposits within Kelley Cave, the transition from Early Archaic into the Middle Archaic cannot be clearly defined in the stratigraphy. However, the Early Archaic deposits constitute the thickest (~1.5 m) and most thoroughly radiocarbon dated, and therefore best defined, cultural zone in A & B Units.

I hypothesize the stone griddle or cooking pit (Feature 8) dates from beginning to mid- Early Archaic, and represents the earliest human evidence in the shelter. A Bulverde stem fragment was recovered approx. 20 cm below the feature suggesting the lower deposits were subject to the same sorts of displacement by burrowing animals and humans as the later deposits. The provenience of the stem fragment within Early Archaic deposits also makes the Bulverde identification suspect. Excavation Unit Layers sampled for faunal analysis show an increase in burned and calcined bone in the deposits above and below Feature 8. The MNI and NISP (Tables 5.3, 5.4) both show an increase in rabbit, rodent, and deer bones from the deposits below. At the same time the Rock Sort data shows low indices of fire-cracked rock. I posit that Feature 8 was constructed before the beginnings of semi-succulent plant exploitation in the shelter.

In Kelley Cave, deposits dating to the latter half of the Early Archaic period, designated by Turpin as the Viejo subperiod, is represented by evidence for extensive hot rock cooking and underground storage (Features 5, 6, and 7) in Units A and B. The clearest evidence for earth oven cooking was Feature 5 which dated to ca. 7400-7300 cal B.P. Adhering to the underside of many burned rock fragments above the feature, from elevations ca. 971.9-971.3 m, were charred remains of semi-succulent leaves, possibly sotol but more likely lechuguilla.

There is also a wide variety of seeds being consumed and likely disposed of in Feature 6, including Mexican buckeye, walnuts, grape, mesquite, prickly pear, evergreen sumac, and Euphorbia seeds. During the 1/8th inch Screen Sort, the seed diversity noticeably decreased in later deposits. I surmise that seeds like grape, euphorbia, and sumac were high value resources (by diet breadth standards), due to easy accessibility, minimal processing requirements, and possible medicinal value (Dering 2006).

Faunal analysis indicated an increase in the breath of species occurring in the shelter during span of the Early Archaic period. Rabbit continued to be exploited as the most frequent faunal group in the assemblage. There was a marked increase in the frequency of boney fish and rodents, and the first *Canidae* fragment with butchering marks in the faunal sample. Evidence for deer or antelope exploitation in the Unit Layers was low during this time period, with *Atriodactyla* and unidentified large mammal bones making up 6 of the 238 specimen analyzed from the Early Archaic deposits.

The 1/8th inch Screen Sort analysis, presented in Chapter 6, and the posited underground storage feature (Feature 7) suggest a high frequency of shelter occupation during the latter half of the Early Archaic. Frequent reuse of the site prohibited intensive reoccupation of excavated area by the local fauna. The possible underground storage cyst suggests planned returns to the shelter, reinforcing the inferred high shelter use frequency.

The construction of earth ovens and processing of semi-succulent plants begins in the excavation units during the latter Early Archaic period, around 7400 cal B.P. During this time, the 1/8th inch Screen Sort analysis model suggests frequent reuse of Kelley Cave indicative of hunter-gatherer seasonal rounds. The evidence for exploitation and exhaustion of high-value seed resources and inclusion of low-risk small mammals during the Early Archaic period matches the model of semi-sedentary site use posited by Brown (1991) in some respects.

The dietary breadth model outlined by Brown is a “saw-tooth” with initial occupation exploiting only high-value resources and expanding over time (Brown 1991:101). This may account for the later addition of burned rodent bones in the faunal record, but botanical diversity is high in the Unit Layers at the bottom of Stratigraphic Layer G (my inferred start of cultural deposits). However, the burning of bones is not wholly indicative of human consumption, see Chapter 4 Faunal analysis.

The inferred botanical variability may better fit a patch-choice model (Kelly 2007:94). The ENC represents a resource patch, and during occupation high-value resources are not collected to the exclusion of others. The exhaustion of the high-value resources (those with low processing cost or seasonal such as cactus fruit) then narrowed the diet to the perennial and ubiquitous semi-succulents which require high processing costs (Dering 1999).

The inferred high frequency of occupation in this patch may have initiated underground food storage, or “loading” (Bettinger 2009), as the high-value resources disappeared from the patch through over exploitation. In foraging theory, the term front-back loading refers to the mitigation of resource collection or processing cost by caching resources during surplus for later use. Front-loading refers to processing resources prior to storage, and back-loading refers to storage of resources to be processed later (Bettinger 2009:48).

The Early Archaic deposits in Kelley Cave correspond to the lowest occupation deposits in Eagle Cave (Ross 1965:19-20). Stratigraphic Layers G (burned rock, ash, limestone with iron oxide) and Layer H (fine sand with small spalls) in Kelley Cave mirror the descriptions of Eagle Cave Stratum IV (burned rock, ash, oxidize limestone) and V (light yellowish soil with small spalls). Screen collected charcoal from Stratum IV (Sample: Tx-139) at Eagle Cave was radiocarbon dated to ca. 6100 uncal. RCYBP (Turpin 1991:4). There is also a striking similarity to the descriptions of Hearth Pit 1 and Pit 2 in Eagle Cave (Ross 1965:23) to my Feature 8 and Feature 7 in Kelley Cave. Hearth Pit 1 and 2 were radiocarbon dated (Samples: Tx-107, 108) to ca. 8700 and 8600 uncal. RCYBP (Pearson et al. 1965:31). The manifestation of similar features in both shelters suggests that changes from griddle/pit cooking to underground storage and hot rock cooking may represent a wider subsistence pattern.

Middle Archaic. The Middle Archaic cultural deposits in Kelley Cave are less discernable than the lower Early Archaic due to mixing disturbances (cooking pits, rodent burrows, historic trenches) and few radiocarbon dates (VV164-CS5, CS6). The Middle Archaic zone may include a portion of Stratigraphic Layer C and upward through Layer B (Figure 5.11). Feature 3 represents the only discernable intact Middle Archaic deposits in the current excavation area, ca. 5400-3500 cal B.P.

The feature dates span Turpin's Eagle Nest through San Felipe subperiods. The sediment matrix from this period is organic-rich and heavily rubified from reuse with charcoal lenses of simple pit hearths. The quantified FCR from Feature 3 is roughly equivalent, by density, to the Early Archaic Unit Layers, however no large (>15 cm) burned rocks were recovered. I infer that the burned rock data from within the feature to represent heavy reuse of the burned rock until exhaustion.

The faunal assemblage from Feature 3 deposits appears to fully reflect the arid landscape adapted diet researchers find across the LPC region (Turpin 2004:270). Of the 140 bone fragments analyzed, 102 were culturally modified by burning or cut marks. Fragments with cut marks constituted 18 of the 102 culturally modified bones. The taxa with cut marks consist of: *Lepus californicus* (n=2), *Sylvilagus sp.* (n=2), *Odocoileus sp.* (n=5), unidentified large mammal (n=3), unidentified medium mammal (n=5), unidentified small mammal (n=1). The modified bone fragments suggests the consumption of fauna in all three ecological zones (upland, canyon edge, canyon bottom) with an increase in upland exploitation compared to the Early Archaic. The MNI and NISP indicate high frequencies of deer and black-tailed jackrabbit in the assemblage suggesting ranged upland hunting of animals and transport into the shelter. Medium mammals, such as coyote, are found in all three zones and the utilization of riverine species such as boney fish and softshell turtle suggest continued and intensifying exploitation of the immediate canyon resources.

Feature 3 and Stratigraphic Layer B contain evidence of increasing production and use of red ochre and pigment not seen in the Early Archaic deposits. The majority of projectile points recovered in Kelley Cave date to the Middle Archaic period. Maramduke (1979) equates the increase of Middle Archaic projectile points at other shelters with increased shelter use or the frequency of populations around water resources, adaptation to riparian oases. The data from Kelley Cave cannot provide evidence for the population size at the site.

Feature 3 presents a well-developed "economy of scale" model by Brown (1991). In the economy of scale, energy intensive foods like semi-succulents required a significant investment of labor (digging, collecting wood, grass, rocks, etc.). The FCR from this feature indicates the occupants maximized the energy returns of earth ovens with heavy reuse of rock in the shelter (Brown 1991:123).

Late and Transitional Archaic. The upper deposits representing the Late and Transitional Archaic periods were not identified in Units A and B. These deposits may have been removed by artifact collectors. In 1932, Sayles noted a thick layer of plant fiber on the surface of Kelley Cave (Figure 2.4) that is no longer present. Sayles reported finding "adobe" approximately 2-3 inches below the surface in all three of his trenches. His adobe is likely the same alluvial drape that was exposed in Feature 4. The lack of a defined mud drape in the Units A and B suggests the upper deposits have been removed and disturbed. Small chunks (1 cm diameter) of sediment identical to the mud in Feature 4 were observed and collected in looter fill.

Feature 1 contains Late and Transitional Archaic point styles, but given the degree of disturbance in the upper deposits, they may have been displaced. Unfortunately, the ash lenses could not be directly radiocarbon dated. Feature 1 denotes a distinct change in the use of the excavated area in Kelley Cave. Multiple ash lenses were encountered in Units A, B, and C suggests repeated open-air fire events in the site either as hearths for warmth or open-air cooking. There is no obvious evidence of earth oven construction in association with Feature 1.

Feature 1 contains a faunal assemblage equivalent to the Middle Archaic Feature 3, with similar proportions of rodent, rabbit, deer, and fish, suggesting no dramatic change in animal consumption other than in increase in the use of birds. Of the 86 total bone fragments analyzed, 18 showed evidence of cut or scrape marks and one dynamic fracture: *Odocoileus virginianus* (n=3), *Lepus californicus* (n=2), *Sylvilagus sp*. (n=6), *Canis sp*. (n=1), unidentified large mammal (n=4), and unidentified medium mammal (n=2). Both the MNI and NISP show similar ratios of taxa in the total faunal assemblage as the fragments indicating human processing above. The faunal analysis suggests a continued exploitation of the uplands with a possible increase in avian exploitation. Riverine species such as boney fish and terrapin are absent from the feature suggesting the population may have been more focused on exploiting upland and canyon mammals.

The bird bones may be related to bone bead production which seems to have occurred near the feature. A number of beads from Kelley Cave and Arenosa (Jurgens 2005) were found to be from avian species. The botanical sample from the ash lenses of Feature 1 contained very little *Agavaceae,* suggesting the earth oven cooking of semi-succulents moved to another area of the shelter, possibly Feature 4, or that Kelley Cave was not occupied with the same frequency throughout the Late to Transitional Archaic periods.

Late Prehistoric. Abundant evidence of oven cooking of sotol and lechuguilla is represented by the detritus filling Feature 4. A folded bundle of prickly pear pads encased in the mud drape was also recovered (Figure 5.40). The plant fibers within the feature dated to the mid-14th century (VV164-CS1-CS3). Two arrowpoints overall were found during my investigation in both shelters, Perdiz and Sabinal, which date ca. 12-14th century.

The faunal analysis from Unit 4A suggests processing of black-tailed jackrabbit (n=2) and catfish (n=2) with burned *Canidae* fragments (n=6), possibly discard, near the surface. The frequency of deer/ large mammal, avian, and fish in the total assemblage (by both NISP and MNI) is similar to the surface deposits of Units A and B.

Large limestone grinding slabs were observed in the disturbed upper deposits, or on surface, in both Skiles Shelter and Kelley Cave. In Skiles Shelter, adhering organic material dated the last use of the slab to the Late Prehistoric period (VV165-CS2). Grinding slabs have been documented in the upper deposits of shelters across the LPC. Four grinding slabs were found in the upper deposits of Baker Cave (Word and Douglas 1970:61); two in the upper deposit of Fate Bell Shelter (Pearce and Jackson 1933:72). Eleven grinding slabs, "metates" were recorded in Conejo Shelter: four on surface, five in human burial contexts, and two from Lens 50 and Lens 65 (Alexander 1974:128). Lens 50 was radiocarbon dated (Sample: Tx-1761) to ca. 3300 uncal. RCYBP (Turpin 1991:6). Additionally, Arenosa Shelter had a grinding slab in the top stratum and numerous "mortars" in limestone slabs extending from the upper stratum to Stratum 9 which was radiocarbon dated (Sample: Tx-285) to ca. 2200 uncal. RCYBP (Dibble 1967:61, 70; Patton and Dibble 1982:106; Turpin 1991:7). I surmise from the shallow deposition and roughly associated radiocarbon dates that the use of grinding/mortar slabs appears in the shelter sites at the beginning of the Late Archaic and continues into the Late Prehistoric period. Future radiocarbon dating of deposits and possible lipid analysis may be able to determine the age and purpose of these non-portable artifacts.

The construction of “wind screens”, or separated spaces, seems to also occur in the later deposits of many shelter sites in the region. The best known evidence is the arc of 53 cut lechuguilla stalks placed in an arc around a boulder at Baker Cave (Word and Douglas 1970:18). Several early reports indicate the remains of upright stakes found in the upper deposits of Murrah Cave (Holden 1937:66) and Fate Bell Shelter (Pearce and Jackson 1933:49-51). In Shumla Cave No. 7, a structure of three bent saplings interwoven with small sticks and sotol stalks was recorded to be partitioning off an alcove (Martin 1933:9). All three reports describe the upright stakes positioned approximately two feet apart, suggesting continuity in construction technique. A large wooden post and wooden stakes were recorded in the surface deposits of Moorehead Cave (Maslowski 1978:66) but there is no mention of their relative position to each other. Finally, Charred wooden stakes in an “L” shape were also described by Sayles at shelter site 41VV2079 in Pump Canyon (Mock 2012:193).

Epstein (1963) recorded an L-shaped “wind screen” in the upper deposits of Coontail Shelter thought to be associated with the Late Archaic. Two of the wooden posts from the feature were radiocarbon dated (Sample: Tx-78, 79) to ca. 4500 and 4000 cal. RCYBP (Turpin 1991:5-6). Tuprin (1991) states that many of the radiocarbon dates in Coontail Shelter do not correlate with the other LPC shelters, based on radiocarbon dates associated with point styles. Using the projectile points later identified by researchers (Nunley, Duffield, and Jelks 1965), she concludes the posts came from a disturbed stratum (Turpin 1991:28). Given the degree of disturbance described, old wood bias may be a factor, with later occupants reusing preserved wood from the shelter. In Conejo Shelter, a number of wooden stakes, cut sotol, and cut cane were observed between excavation layers radiocarbon dated (Sample: Tx-1761, Tx-1759) to ca. 3300 and ca. 2700 uncal. RCYBP (Alexander 1974:135,290-292; Turpin 1991:4-7). The provenience data for the wooden stakes in Conejo Shelter is relatively sparse, but there is a high frequency of these artifacts at the outset of the Late Archaic. More direct radiocarbon dating is needed to test if the construction of wooden features in rockshelter sites is related to Late Archaic occupants.

Similarities in Material Culture between Shelter Sites

During comparative analysis of artifact from Kelley Cave with the material culture in early rockshelter reports, other similarities appeared. Most of the material cannot be assigned to a time period due to insufficient providence data, however the organic artifacts discussed below could be radiocarbon dated. The similarities in the material culture discussed below provide an example of new avenues of research and interpretations using the material recorded in early shelter excavations.

Possible Significance of Rabbit Mandibles. The Kelley Cave faunal analysis identified a jackrabbit mandible with red pigment on the mandible and molar (Figure 5.45). Rabbit mandibles at three other shelter sites suggest treatment beyond simple consumption. Most notably, a woven bag in Horseshoe Ranch Caves contained eleven separated Jackrabbit mandibles, ten of which were the left side and one right side (Woolsey 1936:24). A buckeye seed from within the bag was radiocarbon (Beta 259574) dated to ca, 4850-4790 cal. B.P. (Shafer 2009). Additionally, one cottontail rabbit mandible was found wrapped with sinew in Baker Cave (Word and Douglas 1970:95-97); Sayles 1932 excavation notes from Eagle Cave also mention a possible rodent jaw tied with sinew. Two more fiber-wrapped mandibles were recovered from the Perry Chalk Site, 41VV87 (Black and Dering 2008; NPS Museum Collections).

Walter Talyor (1966) attributes the rodent and rabbit mandibles of Coahuila to scarifiers used for bloodletting or to scar/tattoo designs into the skin. Mandible scarifiers have been found south of Cueva Pilote, in northern Coahuila (Turpin and Eling 1999). The differential treatment of mandibles, especially rabbit, I suspect may reflect symbolic expression or ritual behavior associated with scarification.

Bundles. Bundles, like the bundled of prickly pear pads and fiber recovered from the Kelley Cave Feature 4 mud drape (Figure 5.34), appear in shelters throughout the LPC. Bundles of leaves, grasses, twigs, prickly pear pads, and seeds appear in nearly every source in my comparative analysis (Holden 1937:70, 73; Sayles 1932; Martin 1933:10-11, 78; Maslowski 1978:267-269; Woolsey 1936:24; Pearce and Jackson 1933:30, 38, 92, 115; Word and Douglas 1970:15-18; 82). In general, there are three types of bundles: twig/wood, fiber (sotol, yucca, and lechuguilla), and grass. These three types appear to be supplies left for the next occupation. The tied bundles of nonperishable materials would have remained usable for a long period of time in the dry shelters. There is no mention by investigators of indications that the bundles were purposely buried; in fact, a tied prickly pear bundle in Baker Cave was located by an unused pit (Word and Douglas 1970). Bundles such as grass may have functioned as expedient tools such as brooms used for shelter housekeeping, but it is difficult to argue that bundles such as wood and lechuguilla fibers functioned in any capacity other than a resource cache for later use.

The bundling of resources for future use would be the same behavior of front-loading resources that are modeled in foraging theory (Bettinger 2009) and discussed above. The caching of resources is likely behavior that has continued since the Early Archaic period, and the bundles recovered from the upper, presumably younger, deposits in LPC rockshelters may represent only the most recent abandoned bundles. Bundles or caches from the Early and Middle Archaic periods would have undoubtedly been used and exhausted. I also infer the lack of obvious caching of these resources to suggest the ancient shelter occupants were not worried about other hunter-gatherer groups occupying the shelter after they moved on. The bundling of grass and wood may also indicate a planned return during a season when those resources were most needed, like winter.

Conclusions

Analysis of Skiles Shelter and Kelley Cave indicated extensive intermittent use of the shelter sites from the Early Archaic to the Late Prehistoric. The shelters are closely linked together as a single occupational locus by their proximity and projectile point chronologies, Pecos River style rock art, and the worn hand holds and foot paths observed between the two. Given the small sample size analyzed in my thesis, both from the 1-x-2 m excavation units and the size of the undisturbed lower deposits, these conclusions should be reevaluated with a larger more robust datasets. The four main research objectives of my thesis are summarized below.

Discern differential behavioral patterns in the use of the two shelters as a single occupational locus.

I surmise that the intact cultural deposits within my excavation units in Skiles Shelter suggest a distinct difference in use from those in Kelley Cave. Quantities of Skiles Shelter lithic debitage, bone, and burned rock are all strongly correlated. The correlation is interpreted to signify that human activity was directly associated with earth oven cooking and plant processing activities during the Late Prehistoric period. The lack of correlation between these three classes in Kelley Cave is indicative of human activity not solely focused on plant processing and hot rock cooking. Overall, Kelley Cave also contains a wider array of stone and bone tools, evidence of pigment use, and a greater variety of flora and fauna than does Skiles Shelter. Thus Kelley Cave represents a broad spectrum of occupation activities and habitation while Skiles Shelter was mainly utilized as a segregated space for food processing and preparation.

With the limited excavation units placed in high points of the two rockshelters, my analysis results are subject to intra-site and inter-site use differences. More extensive excavations of Skiles Shelter may yield a more comparable dataset with which to compare the two shelters over a longer period of time than represented in my investigation.

Assess the differential site formation processes of each shelter which may affect interpretation.

The geoarchaeological analysis and radiocarbon dates indicate a massive flood occurred in the mid-14th century that affected the deposits of both shelters. The Late Prehistoric flood deposits in both Skiles Shelter and Kelley Cave sealed intact lower cultural deposits in places not intruded into by historic digging.

As the Amistad Reservoir continues to fill with silt, Eagle Nest Canyon will be at greater risk from flood waters from the Rio Grande. Skiles Shelter is in particular danger due to the relatively low elevation of the site and its proximity to the river.

The X-Ray Diffraction (XRD) results from both shelters also indicate high amounts of quartz, K-feldspar, and plagioclase minerals within the cultural deposits. These three minerals are not contained within the limestone bedrock of the canyon and must have been derived from the Rio Grande alluvium. The results show high indices of Rio Grande alluvial deposits within both shelters. The alluvium may have been deposited in the shelters by ancient catastrophic backflooding, and were subsequently reworked by human and animal site processes. Alternatively, and in addition to flood deposition, the Rio Grande alluvium may have been brought in from the canyon bottom during human occupation of the rockshelters for use in capping earth ovens.

Historic undocumented digging has also affected at least the top 0.5-1 m of both sites. My excavations encountered multiple trenches/pits were encountered in Kelley Cave (Mear also documented a looter trench 2.5 ft. deep) and in Skiles Shelter. The artifact collectors have likely removed the upper deposits of much of Kelley Cave, as the shown by the fact that the thick fiber deposit observed by Sayles in 1932 is no longer extant. In Kelley Cave, a radiocarbon date from the top cultural deposits in Units A and B was thousands of years older than the surrounding assays, further documenting the extent of the disturbance

Looter trenches have also allowed digging mammals to burrow deeper into the soft backfill, mixing deposits below the initial trench disturbance. Deposits dating from the Middle Archaic to the Late Prehistoric period have been greatly affected by these disturbances.

Analyze the botanical and faunal remains to understand the changes in diet and dietary pressures over time.

Evidence suggests that earth oven construction and baking of semi-succulents began ca. 7400 cal B.P. in the excavated area of Kelley Cave. The intact Early Archaic deposits in Kelley Cave show the greatest diversity in botanical remains with a narrowing in botanical dietary breadth over time; while faunal data suggests a widening of dietary breadth over time. The changes in dietary diversity suggest a foraging model more in line with patch-choice than dietary breadth. Additionally, the Early Archaic underground storage feature may have been utilized to supplement energy requirements during occupation. Caching through underground storage or bundling likely continued into the Late Prehistoric period as a way to help offset the seasonal resource pressures in the arid LPC.

The Middle Archaic data from Kelley Cave Units A and B suggests consumption and foraging similar to the “economy of scale” discussed by Brown (1991:123). The deposits indicate heavy reuse of burned rocks and shelter sediment, and a broad faunal diet, with deer and rabbit composing the majority of the assemblage. The dietary population does not change through the Late Archaic deposits, but hot rock cooking seems to give way to open-air burning, suggesting a decrease in semi-succulent processing in the excavation area, and likely a shift to a large earth oven facility several meters south in the central part of the shelter.

The Late Prehistoric evidence for semi-succulent consumption in Kelley Cave is found in Feature 4. The fiber detritus of Feature 4 indicates intensive cooking, processing, and consumption. The faunal analysis from an adjacent Unit 4A indicates a slight dietary shift from the upper deposits of Units A and B, with less large mammals and more fish and bird. More research is needed to determine what role the invention of the bow and arrow may have played in the apparent increase of birds in subsistence remains from the rockshelter.

Compare the use of Skiles Shelter and Kelley Cave to other rockshelter sites to evaluate proposed hypotheses regard the roles rockshelter use played in subsistence and settlement patterns.

I am unable to determine if the rockshelters were used semi-sedentarily or seasonally by hunter-gatherers. However, the results of comparative analysis between Kelley Cave and Skiles Shelter show a complex use of rockshelters not just as individual sites, but as portions of a larger occupation locus: Eagle Nest Canyon. The data compiled here reflects only a single type of site, rockshelters, and would benefit from the inclusion of upland sites of comparable age. The faunal analysis from Skiles Shelter suggests the used of localized canyon resources including rabbits and rodents. In Kelley Cave, the faunal and botanical analyses suggests an expanding resource gathering range over time with upland animals and plants, such as jackrabbit, deer, sotol, and lechuguilla becoming more prevalent in the deposits.

The Early Archaic deposits, in Kelley Cave, suggest a greater focus on the canyon edge and bottom ecological zones and use of aquatic resources. By the Middle Archaic, the shelter occupants were utilizing all three ecological zones including ranged exploitation of the uplands and continued exploitation of aquatic resources. The deposits postdating the Middle Archaic show an increased focus on upland fauna and continued exploitation of upland plants (sotol/lechuguilla) with very little evidence of aquatic resource consumption, until the Prehistoric-Late Prehistoric age deposits where the shelter occupants seem to have shifted back to an emphasis on canyon bottom resources, as seen in both rockshelters. The frequency in which upland resources appear in the deposits may be due to the degree of mobility by the groups occupying the shelter, although multiple lines of evidence are needed to test this hypothesis.

Although my data does not measure settlement duration, the results of my analysis suggest intense or frequent use of Eagle Nest Canyon during the latter half of the Early Archaic period. The presence of storage cysts and bundled materials suggests the occupants had planned seasonal rounds, such as those modeled by Sobolik (1991, 2008), a behavior that continued to the Late Prehistoric period.

Critique

My thesis has a number of shortcomings that experience has since taught me better. If I the chance to conduct my investigation again, there are a number of things I would have done differently. First and foremost would be to pick a more manageable thesis topic: the excavation and analysis of the complex stratigraphy of a single rockshelter would have been more than enough! In Skiles Shelter I would have maintained planned 5 cm arbitrary excavation layers in order to maximize my statistically comparable dataset. I would have also relied less on the documentation and measuring power of the SfM models, and more on making sure field dimensions, feature photographs, and excavator notes were accurate and thorough. The method of recording stratigraphy through three dimensional modeling was still being developed during my thesis adding to the numerous insufficient data and pratfalls that comes with the learning curve. The method used today by ASWT is better developed and useful, aided by better computer processing power and documentation, than it was during my fieldwork.

My thesis project served as the first phase of the ASWT Eagle Nest Canyon work, providing essential test data for ongoing investigations. The excavation approach I used served as the "learning curve" for future shelter excavations in the canyon. I hope my numerous mistakes help improve future stratigraphic excavation and documentation methods employed in the ENC.

Future Research

This thesis illustrates the not only the interpretive power of a multidisciplinary approach, but also the data that can still be gleaned from the analysis of the early archaeological reports. Further research is needed to expand and refine this dataset with contemporary upland sites and other rockshelters not included here. A more complete botanical analysis paired with the faunal analysis here may also be able to better discern dietary shifts in Kelley Cave over time.

My thesis is part of the ongoing ASWT investigations in Eagle Nest Canyon which will allow reconsideration of the ideas presented herein. In 2014, the ASWT conducted a much more intensive excavation of Skiles Shelter which will provide a larger sample for statistical comparison like that presented in Chapter 6. The further investigations of Feature 4 may also help to determine the location and behaviors related to plant processing and intra-site use in Kelley Cave.

The results of my thesis provide clues to a complex relationship between ancient people and the canyon and shelters they occupied. Rockshelter sites provide not just a vast time depth of occupation, but possible signals to differential shelter use and behaviors beyond the obvious catch-all “habitation.” Future research in the Lower Pecos Canyonlands should continue to investigate shelters not as sites within themselves but as locales subject to differential occupational behaviors within canyon resource patches.

APPENDIX A: PLANTS OBSERVED IN EAGLE NEST CANYON BY L. BUSH

This botanical inventory was created by Leslie Bush. The inventory contains plants identified in and around the canyon in May, 2014. Each plant is labeled with the geographic location in which it was observed such as canyon slope or uplands.

Table App A.1. Location legend for Plants Observed at Eagle Nest Canyon 5/3/2014 by Leslie Bush.

Abbreviation	**Location**
B	Canyon Floor
LCF	Lower Canyon Floor
UCF	Upper Canyon Floor
U	Uplands
S	Slope
LS	Lower Slope
US	Upper Slope
BF	Bonfire Shelter
MS	Miles Spring

Table App A.2. Plants Observed at Eagle Nest Canyon 5/3/2014 by Leslie Bush.

Taxon	**Common Name**	**Location**	**Family**	**Notes**
Agave lechuguilla	Lechuguillla	S	*Agavaceae*	
Agave sp.	Agave (planted, near house)	U	*Agavaceae*	
Yucca torreyi	Torry yucca	U	*Agavaceae*	Other yuccas probably present as well
Rhus virens	Everygreen sumac	U, S	*Anacardiaceae*	
Toxicodendron radicans	Poison ivy	UCF	*Anacardiaceae*	
Torilis arvensis	Hedge parsley	B	*Apiaceae*	Non-native
Daucus pusillus	Wild carrot	B	*Apiaceae*	
Spermolepis cf. inermis	Scaleseed	B	*Apiaceae*	
Matelea reticulata	Pearl milkweed vine	B	*Asclepiadaceae*	Not blooming. Not twinevine because glabrous
Artemisia ludoviciana	Artemesia aka whitesage	B	*Asteraceae*	
Baccharis salicina	Willow baccharis	B	*Asteraceae*	
Calyptocarpus vialis	Horseherb	B	*Asteraceae*	
Centaurea solstitialis	Yellow star thistle	B	*Asteraceae*	Non-native
Cirsium texanum	Texas thistle	B	*Asteraceae*	Purple flowered thistle, blooming
Flyriella parryi	Chisos mountain brickellbush	B	*Asteraceae*	Sample of blossoms and upper leaves collected; identified by photo in Morey 2008
Gallardia pulchella	Indian blanket	S, UCF	*Asteraceae*	
Gutierrezia/Haploesthes	Snakeweed/false broomweed	U	*Asteraceae*	
Helenium microcephalum	Small headed sneezeweed	B	*Asteraceae*	Blooming, abundant on canyon floor near trucks
Palafoxia cf. callosa	Small palafoxia	B	*Asteraceae*	
Ratibida columnifera	Mexican hat	B	*Asteraceae*	

Table App A.2. Continued.

Taxon	Common Name	Location	Family	Notes
Wedelia texana	Zexmenia	B	*Asteraceae*	
Mahonia trifoliata	Agarita	B, S	*Berberidaceae*	
Chilopsis linearis	Desert willow	UCF	*Bignoniaceae*	
Descurainia pinnata	Tansymustard	B	*Brassicaceae*	
Lepidium cf. lasiocarpum	Lepidium	B	*Brassicaceae*	
Carnegiea gigantea	Saguaro	U, near guest house	*Cactaceae*	Not native to area, planted per J. Skiles
Cylindropuntia leptocaulis	Tasajillo	U, S	*Cactaceae*	
Echinocereus sp.	Pitaya/Claret-cup	U	*Cactaceae*	
Opuntia schottii	Dog cactus	U	*Cactaceae*	
Opuntia spp.	Prickly pear	S, U	*Cactaceae*	> 1 species, including *O. englemanii var. linguiformis* (cow's tongue) on canyon road below guest house - planted?
Koeberlinia spinosa	Spiny allthorn	U	*Capparaceae*	
Schaefferia cuneifolia	Desert yaupon	U, S	*Celastraceae*	
Atriplex acanthocarpa	Armed saltbush aka huaha	UCF, S	*Chenopodiaceae*	
Chenopodium cf. berlandieri	Chenopodium	B	*Chenopodiaceae*	
Tinantia anomala	False dayflower	B	*Commelinaceae*	Syn. *Commelinantia anomala*
Cucurbita foetidissima	Buffalo gourd	B	*Cucurbitaceae*	
Diospyros texana	Persimmon	U, S	*Ebenaceae*	In washes
Phyllanthus polygonoides	Knotweeed leafflower	B	*Euphorbiaceae*	
Acacia greggii	Uña de gato	U, S	*Fabaceae*	*A. neovernicosa* (whitethorn) and *A. roemeriana* (roundflower catclaw) prob. present too
Acacia rigidula	Blackbrush acacia	U, S	*Fabaceae*	
Acacia berlandieri	Guajillo	S	*Fabaceae*	Blooming

Table App A.2. Continued.

Taxon	**Common Name**	**Location**	**Family**	**Notes**
Prosopis glandulosa	Mesquite	MS, S, U	*Fabaceae*	*P. pubescens* may be present also; none seen in fruit
Rhynchosia senna	Texas snoutbean	B	*Fabaceae*	3-leafed legume vine
Sophora secundiflora	Texas mountain laurel	S	*Fabaceae*	
Vicia ludoviciana	Deer pea vetch	B	*Fabaceae*	
Quercus sp.	Red group oak	B	*Fagaceae*	
Fouquieria splendens	Ocotillo	U, US	*Fouquieriaceae*	
Nama jamaicense	cf. Jamaican nama	B	*Hydrophyllaceae*	Small, tender unknown, low and spreading. collected
Phacelia congesta	Blue curls	B	*Hydrophyllaceae*	
Juglans microcarpa	Little walnut	UCF	*Juglandaceae*	
Marrubium vulgare	Horehound	B	*Lamiaceae*	Non-native
Dasylirion sp.	Sotol	S	*Liliaceae*	Reported *D. texanum* in Seminole Canyon
Sida abutifolia	Prickly sida	B	*Malvaceae*	
Cocculus carolinus	Snailseed	B	*Menispermaceae*	
Morus cf. rubra	Mulberry	LCF	*Moraceae*	Not native to area; planted in Langtry and bird-dispersed from there per J. Skiles
Fraxinus greggii	Littleleaf ash	S	*Oleaceae*	
Argemone albiflora	White prickly poppy	B	*Papaveraceae*	Most Argemone in fruit, not flower. *A mexicana* (yellow) probably present also but not seen blooming in canyon
Passiflora tenuiloba	Slenderlobe passionflower	BF	*Passifloraceae*	
Proboscidea cf. louisianica	Devil's Claw	B	*Pedaliaceae*	Plant not found; dry fruit only
Plantago rhodosperma	Red-seeded plantain	B	*Plantaginaceae*	
Aristida purpurea	Purple three awn	U, S	*Poaceae*	
Arundo donax	Giant reed	LCF	*Poaceae*	Non-native

Table App A.2. Continued.

Taxon	Common Name	Location	Family	Notes
Bothriochloa ischaemum	KR bluestem	UCF	*Poaceae*	Non-native
Bouteloua trifida	Red grama	U	*Poaceae*	
Chloris sp.	Windmill grass	U	*Poaceae*	
Digitaria cognata	Witchgrass	B	*Poaceae*	
Leptochloa sp.	Sprangletop	S	*Poaceae*	
Panicum cf. hallii	Hall's panicum	U, S	*Poaceae*	
Paspalum sp.	cf. Dallisgrass	F	*Poaceae*	Some species non-native
Pennisetum ciliare	Buffelgrass	U	*Poaceae*	Non-native
Setaria sp.	Bristlegrass (short)	LCF	*Poaceae*	
Rumex sp.	Dock	F	*Polygonaceae*	Non-native
Samolus ebracteatus	Brookweed	F	*Primulaceae*	
Colubrina texensis	Hog-plum aka snakewood	U	*Rhamnaceae*	
Condalia ericoides	Javalina bush	F	*Rhamnaceae*	
Condalia spathulata	Knifeleaf condalia	U	*Rhamnaceae*	
Karwinskia humboldtiana	Coyotillo	S	*Rhamnaceae*	
Ziziphus obtusifolia	Lotebush	U	*Rhamnaceae*	
Cephalanthus occidentalis	Buttonbush	B	*Rubiaceae*	
Galium texense	Galium	B	*Rubiaceae*	
Salix nigra	Willow	B	*Salicaceae*	
Ungnadia speciosa	Mexican buckeye	B	*Sapindaceae*	
Leucophyllum candidum	Cenizo	U, S	*Scrophulariaceae*	
Penstemon baccharifolius	Baccharisleaf beardtongue	B, UCF	*Scrophulariaceae*	Blooming, small plant with large red flowers in crevices on canyon floor

Table App A.2. Continued.

Taxon	Common Name	Location	Family	Notes
Nicotiana glauca	Tree tobacco	LCF	*Solanaceae*	
Nicotiana repanda	Fiddle-leaf tobacco	LCF	*Solanaceae*	
Physalis cinerascens	Ground cherry	B	*Solanaceae*	Fruiting
Solanum elaeagnifolium	Silverleaf nightshade	B	*Solanaceae*	Flowers and fruits
Tamarix sp.	Tamarisk aka salt cedar	B, LCF	*Tamaricaceae*	Non-native, invasive
Celtis ehrenbergiana	Spiny hackberry aka granjeno	BCF, S, B	*Ulmaceae*	Syn. *Celtis pallida*
Celtis laevigata	Netleaf hackberry	B, UCF	*Ulmaceae*	Identified by elimination: *only C. ehrenbergiana* and *C. laevigata* recognized in Powell 1998
Parietaria pensylvanica	Cucumber plant	B	*Urticaceae*	
Aloysia gratissima	Whitebrush	B	*Verbenaceae*	
Lantana urticoides	Texas lantana	B	*Verbenaceae*	
Lippia graveolens	Mexican oregano	S	*Verbenaceae*	
Verbena halei	Hall's vervain	B	*Verbenaceae*	
Arceuthobium sp.	Mistletoe	U	*Viscaceae*	
Ampelopsis arborea	Peppervine	B	*Vitaceae*	No herbarium records west of Laredo, so possibly a misidentification. It was in the moist shade and is a pretty tough plant, however. (Also, recorded it at Seminole Canyon)
Cissus trifoliata	Cow itch vine	B	*Vitaceae*	
Vitis sp.	Grape	B	*Vitaceae*	Reported *V. rupestris* in Seminole Canyon
Larrea tridentata	Creosote	U, S, MS	*Zygophyllaceae*	

Table App A.3. Unknown plants observed in Eagle Nest Canyon by Leslie Bush 5/13/2014.

Taxon	**Common Name**	**Location**	**Family**	**Notes**
Unknown L. Bush, photographed	Unknown bush, photographed	B		
Unknown purple-flowered herb	Unknown purple	B	*Nyctaginaceae*?	5-part flower Mirabilis?.Boerhavia? ASWT 2014 photographed
Yellow composit	Yellow composit	B	*Asteraceae*	
Unknown Fern	Unknown Fern	B	*Polypodiaceae*	
Unknown yellow compsit (collected)	Unknown yellow compsit (collected)	U	*Asteraceae*	
Purple aster/fleabane type flower	Purple aster/fleabane type flower	U	*Asteraceae*	

Table App A.4. Plants noted in the area but not at Eagle Nest Canyon, Leslie Bush 5/13/2014.

Taxon	**Common Name**	**Location**	**Family**	**Notes**
Psilostrophe sp. (cf. *tagetina* but poss. *gnaphalioides*)	Paperflower		*Asteraceae*	Abundant on roadsides
Glandularia bipinnatifida	Prairie verbena		*Verbenaceae*	Abundant in Seminole Canyon uplands
Parkinsonia sp.	Paloverde		*Fabaceae*	Seminole Canyon SP
Ephedra sp.	Jointfir		*Ephedraceae*	At Shumla in February
Allium drummondii	Drummond's onion		*Liliaceae*	At Shumla in February
Senna lindheimeriana	Lindheimer senna		*Fabaceae*	At Shumla in February
Nothoscordum bivalve	Crow poison		*Liliaceae*	At Shumla in February

Table App A.5. Plants expected to be at Eagle Nest Canyon but were not observed, Leslie Bush 5/13/2014.

Taxon	Common Name	Location	Family	Notes
Atriplex canescens	Four-wing saltbush, aka shadscale		*Chenopodiaceae*	*Possibly "weeping" unknown outside
Forestiera angustifolia	Desert olive		*Olaceae*	*Possibly "weeping" unknown outside
Tiquilia canescens	Oreja de perro		*Boraginaceae*	
Castela erecta	Amargosa, allthorn goat-bush		*Simaroubaceae*	
Lycium berlandieri	Wolfberry, cilindrillo		*Solanaceae*	*Possibly "weeping" unknown outside

APPENDIX B: KELLEY CAVE GROUND PENETRATING RADAR RESULTS

In early June before we began our excavations, Tiffany Osburn and Bill Pierson, of the Texas Historical Commission, conducted Ground Penetrating Radar (GPR) across a large swath of the shelter floor. By conducting a GPR survey of the shelter floor prior to excavation I wanted to avoid previous excavations and well as any large subsurface disturbances or obstacles, such as roof blocks. The results of this survey indicated no shallow disturbances or roof blocks where I intended to conduct my excavations.

Figure App B.1. The white box denotes grid area and orientation of the Ground Penetrating Radar (GPR) survey in Kelley Cave.

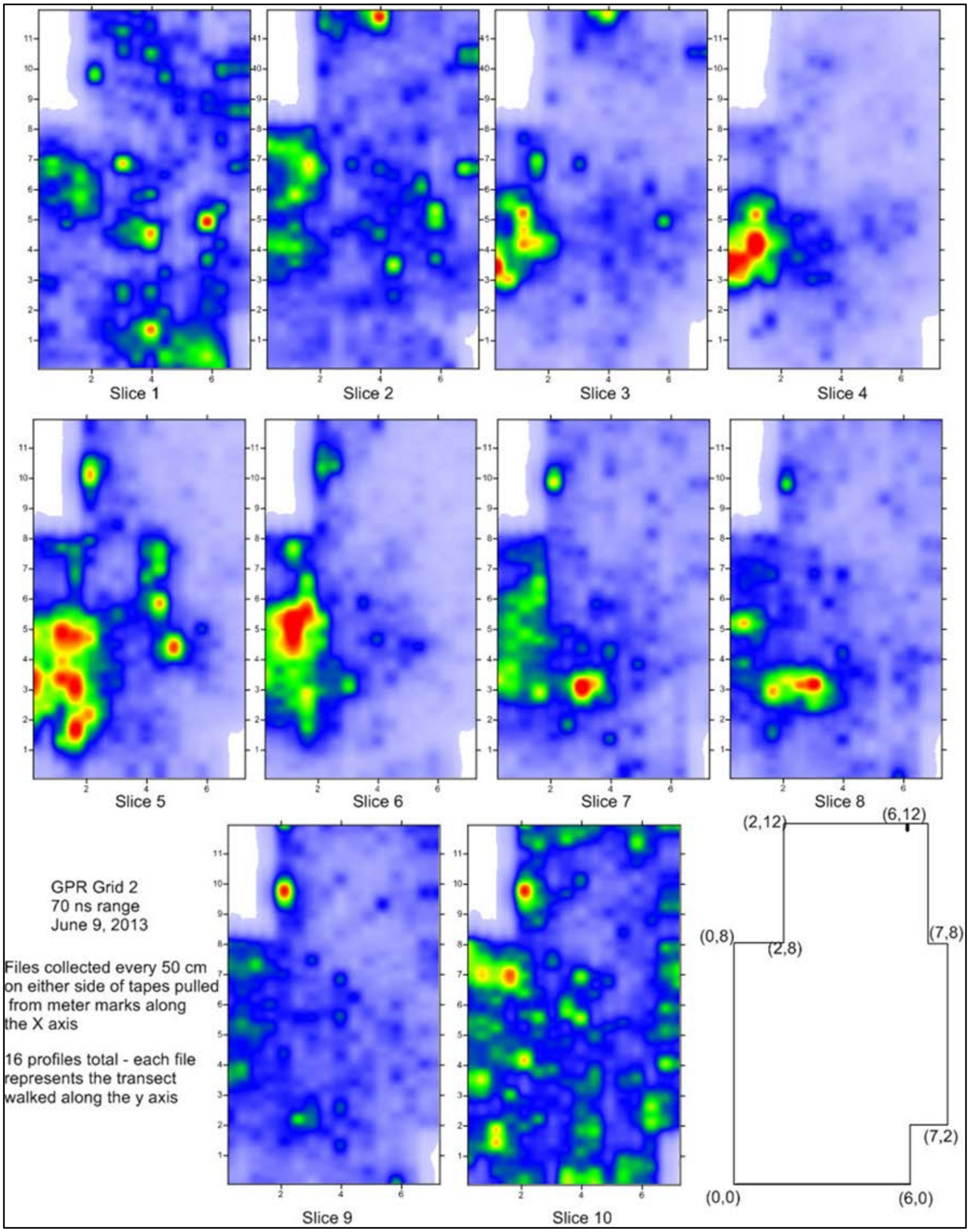


Figure App B.2. GPR depth slices from 70 ns range illustrated in plan view, by Tiffany Osburn and Bill Pierson. Slice 1 is the top and Slice 10 is lowest. Red indicates subsurface anomalies.

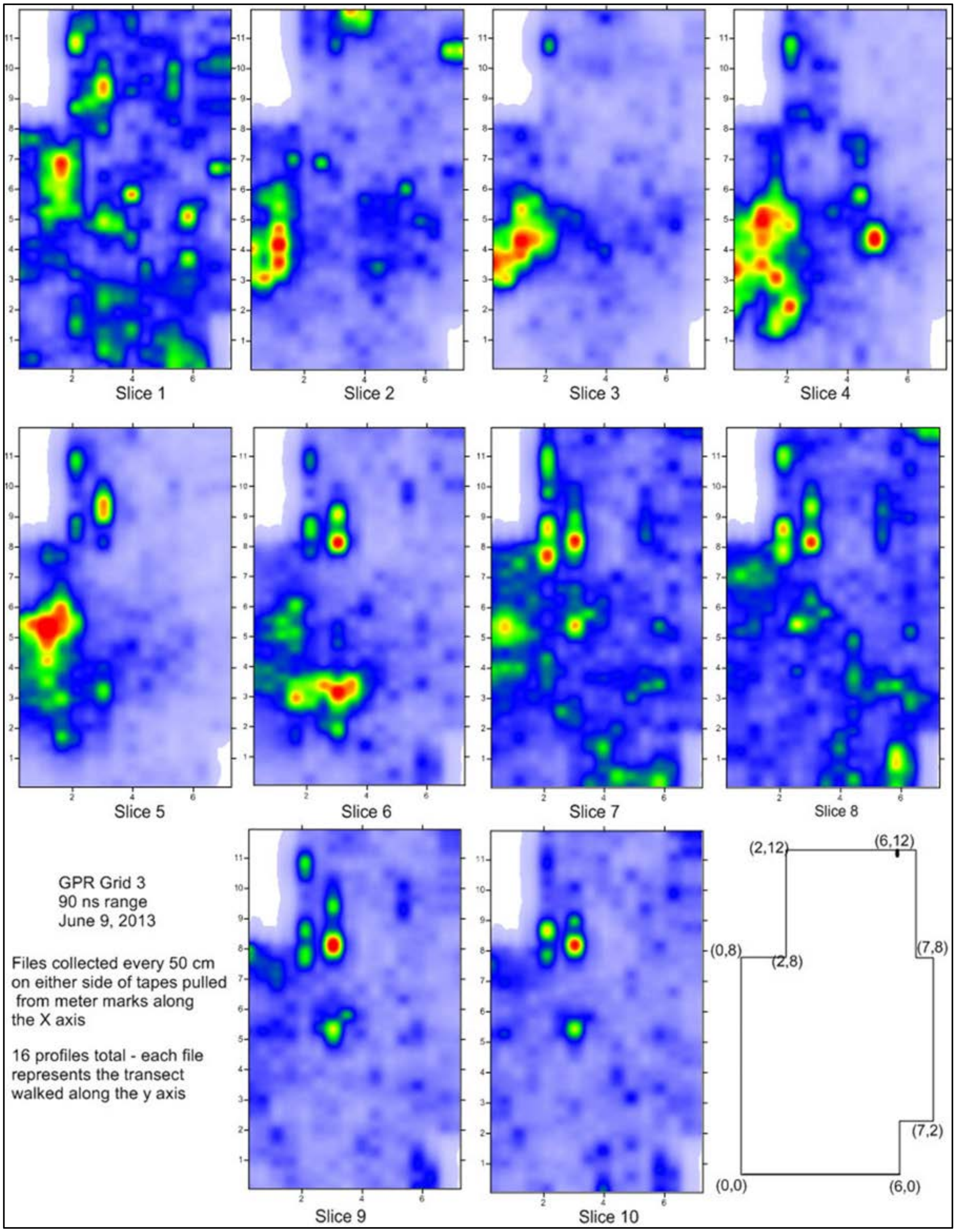


Figure App B.3. GPR depth slices from 90 ns range illustrated in plan view, by Tiffany Osburn and Bill Pierson. Slice 1 is the top and Slice 10 is lowest. Red indicates subsurface anomalies.

APPENDIX C: EXCAVATION FORMS

Excavations conducted in Skiles Shelter and Kelley Cave during the summer of 2013 utilized modified ASWT field forms from previous excavations. During the December and January excavations of Kelley Cave, the field crews used the new 2014 ASWT Eagle Nest Canyon field form. The new form presented here, contains all of the data of the old template, simply reorganized, with added lines for FN#, Layer Dimensions, and SfM Data.

Eagle Nest Canyon Expedition 2014: **Unit-Layer Form**

ASWT
Texas State University

Site: ______________________

Excavation Area: ______________________

Excav. Unit: __________ Layer: __________

Strats: ______________________

Field Number: ______________________

Recorder 1: ______________

Recorder 2: ______________

Date Started: ______________

Date Completed: ______________

Layer Measurements

Mapping Datum: ______________

Datum Elevation: ______________

Opening Elevations

NW________ NE________

Cntr________

SW________ SE________

Closing Elevations

NW________ NE________

Cntr________

SW________ SE________

Opening Dimensions

North_______ East_______

South_______ West_______

Closing Dimensions

North_______ East_______

South_______ West_______

SfM Data

SfM Photo Range: ______________

4 Required GCPs

1st GCP: ______________

2nd GCP: ______________

3rd GCP: ______________

4th GCP: ______________

2 Optional GCPs

5th GCP: ______________

6th GCP: ______________

Excavation Tools (check all that apply):

Trowels Brushes

Ice Picks Splints

Shovels Picks

Garden Claw

Other

Screen Size(s) used: **1/8”** **1/4”** **1/2”**

What to collect from 1/4” screen:

No Snails

No Charcoal unless it appears to be an artifact

No fragments of mussel shell—only umbos or visibly modified pieces

Collect all un-charred botanicals

Collect all faunal

Collect all lithics

Count and weigh FCR and unburned rock >1/2”, but discard once finished

Page 1 of 6

Figure App C.1. ASWT 2014 Excavation form sans Rock Sort page (pages 1-6).

Unit-Layer Form **EU_______ L_________ page 2 of 6**

Describe excavation methods, sequence, and problems. If this form is for a column unit, describe which side of the column was bulk collected versus screened (also provide a sketch on the last page): ________________________________

Describe any visible stratification (including intrusions): ________________________________

Other Remarks: ________________________________

Figure App C.1. Continued.

Unit-Layer Form EU______ L_______ page 3 of 6

Features

FN#s: __________________________

Notes: ____

Special Samples

Matrix Samples

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Charcoal Samples

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Other Samples

Present: ________ # Bags Collected: _________

FN#s: ____

Notes Describe "Other": ______________

Figure App C.1. Continued.

Unit-Layer Form EU______ L________ page 4 of 6

Chipped Stone Artifacts

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Non-Chipped Stone Lithic Artifacts

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Fiber, Wood, and Bone Artifacts

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Botanical Remains

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Faunal Remains

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

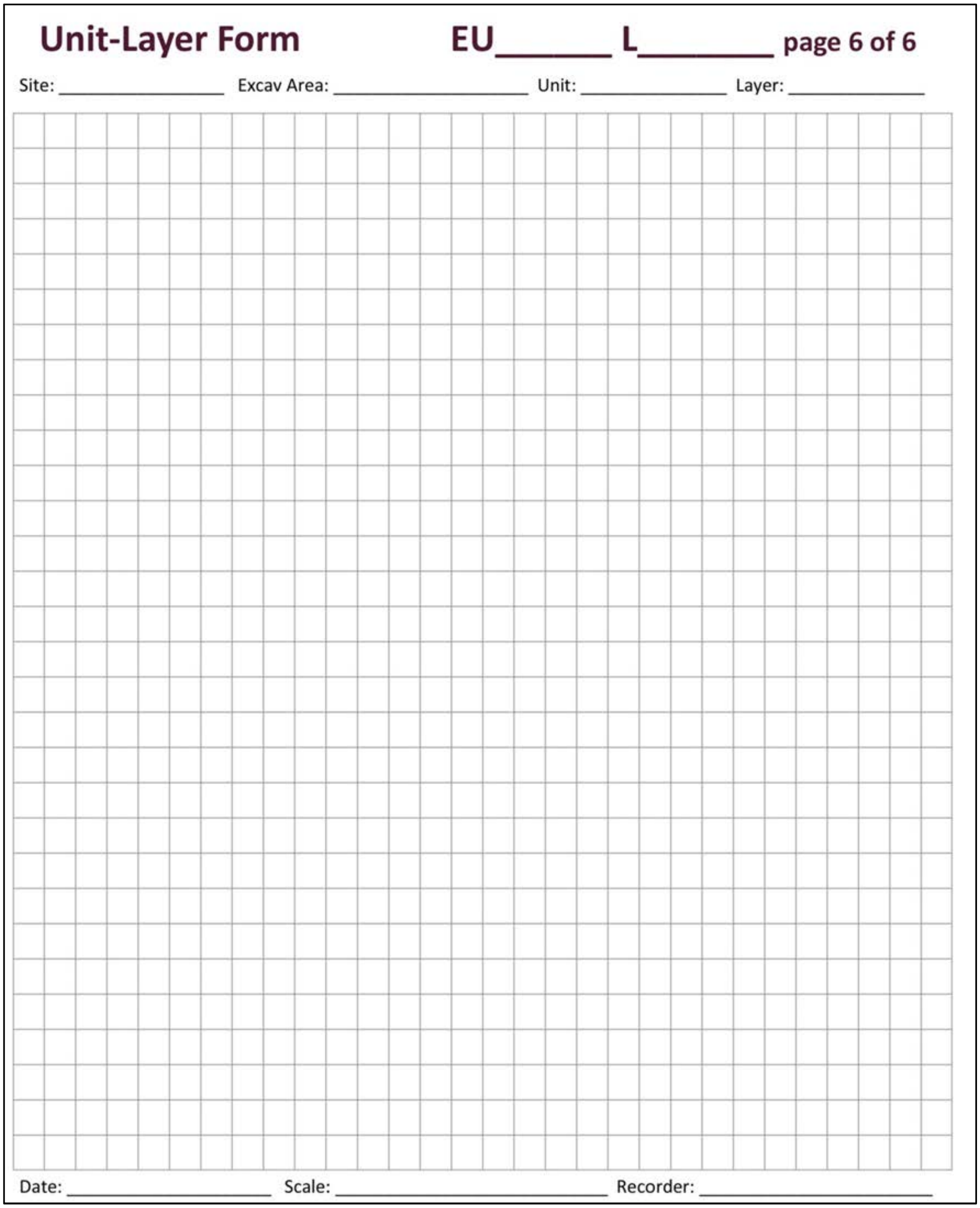
1/8” Screen Material

Present: ________ # Bags Collected: _________

FN#s: ____

Notes: ________________________

Figure App C.1. Continued.



Unit-Layer Form EU______ L________ page 6 of 6

Site: ________________ Excav Area: ____________________ Unit: _______________ Layer: ______________

Date: _____________________ Scale: ____________________________ Recorder: ________________________

Figure App C.1. Continued.

APPENDIX D: ROCK SORT BURNED ROCK QUANTIFICATION FORMS

The 2013 excavations of Skiles Shelter and Kelley Cave used a modified version of the previous Rock Sort forms created by the ASWT (Figure App D.1). The 2013 form contained three rock size classes with no count on the small rock (<7.5 cm) which was written in during Rock Sort. Later excavations in December used a new version created for the ASWT 2014 excavations which divided the Rock Sort into four size classes, however field excavators continued to follow the three size class measurement system previously established (Figure App D.2).

Ancient Southwest Texas
Texas State University
ROCK SORT

Project: **ENC 2013** Site: **Skiles Shelter – 41VV165**
Recorder(s):______________________________ Date:_________________

Area:_______________ Unit:_______________ Layer:________________

Small (<7.5 cm)

Weight (kg): _____ _____ _____ _____ Total: _____

Medium (7.5-15 cm)

Weight (kg): _____ _____ _____ _____ Total: _____

Count: _____ _____ _____ _____ Total: _____

Large (>15 cm)

Weight (kg): _____ _____ _____ _____ Total: _____

Count: _____ _____ _____ _____ Total: _____

Morphology:

Pitted: _____ _____ _____ _____ Total: _____

Rounded: _____ _____ _____ _____ Total: _____

Other: _____ _____ _____ _____ Total: _____

________: _____ _____ _____ _____ Total: _____

________: _____ _____ _____ _____ Total: _____

Remarks:

Revised 6/4/2013

Figure App D.1. The "Rock Sort" form used during the 2013 fieldwork.

Unit-Layer Form **EU________ L__________ page 5 of 6**

FCR Data

	<7.5 cm	7.5 - 11 cm		11 - 15 cm		15> cm	
	Mass (kg)	Count	Mass (kg)	Count	Mass (kg)	Count	Mass (kg)
Pitted Limestone							
Round Limestone							
Spall Limestone							
Other Limestone							
Igneous or Metamorphic							

Unburned Limestone Data

	<7.5 cm	7.5 - 11 cm		11 - 15 cm		15> cm	
	Mass (kg)	Count	Mass (kg)	Count	Mass (kg)	Count	Mass (kg)
Pitted Limestone							
Round Limestone							
Spall Limestone							
Other Limestone							

Rock Sort Photos taken? **Photo Range: __________________________**

Rock Sort Notes: ____

Figure App D.2. ASWT 2014 “Rock Sort” forms used during the December and January fieldwork (page 5 of Excavation form).

APPENDIX E: CALCULATED EXCAVATED VOLUMES FOR SKILES SHELTER AND KELLEY CAVE

Unit Layer volumes were calculated using the Cut/Fill function in ArcGIS (10.2) to measure the volume change between two spatially referenced Digital Elevation Models (DEMs). These DEMs were created from Agisoft Photoscan Structure-from-motion models (SfM). The accuracy of the DEM's depended on the accurate model construction and spatial reference of the SfM. Because of low quality models the measured volumes of some of the Unit Layers was noticeably incorrect. In such cases, an estimated volume from the field measurements was used.

Estimated volumes were produced by averaging the five string line depths (four corners and center) to produce an estimated thickness of the Unit Layer. This number was then multiplied by the measured unit area (e.g. 95-by-60 cm) to make an estimated excavated volume which was then converted to meters cubed.

Table App E.1. Excavation layer volumes for Skiles Shelter based on GIS (left) and estimated from field measurements (right). The * denotes measurements that are considered to be inaccurate.

Excavation	Layer	GIS Measured Vol. m^3	Estimated Vol. m^3
A	1	0.059	
A	2	0.123*	0.095
A	3	0.064	
A	4	0.054	
A	5	0.031	
A	6	0.044	
A	7	0.264	
A	8	0.057	
A	9	0.045	
A	10	0.077	
A	11	0.018	
A	12	0.131	
A	13	0.034	
B	1	0.086	
B	2	0.037	
B	3	0.014	
B	4	0.009*	0.005
B	5	0.009	
B-east	8	0.403*	0.024
B-east	9	0.125	
B-east	10	0.123	
B-east	11	0.015	
B-east	12	0.006*	0.045
B-east	13	0.007	
C	1	0.096	
C	2	0.046	
C	3	0.070	
C	4	0.039	
C	5	0.071	

Table App E.2. Excavation layer volumes for Kelley Cave Unit A based on GIS (left) and estimated from field measurements (right). The * denotes measurements that are considered to be inaccurate.

Excavation	Layer	GIS Measured Vol. m^3	Estimated Vol. m^3
A	1	0.036	
A	2	0.017	
A	3	0.016	
A	4	0.031	
Feature 1		0.127	
A	6	0.053	
A	7	0.066	
A	8	0.066	
A	9	0.032	
A	10	0.023	
A	11	0.041	
A	12	0.014	
A	13	0.078*	
Feature 3		0.043*	0.168
A	14	0.024	
A	15	0.032	
A	16	0.036	
A	17	0.031	
A	18	0.034	
A	19	0.005	
A	20	0.021	
A	21	0.010	
A	22	0.028	
A	23	0.020	
A	24	0.020	
A	25	0.062	
A	26		0.013
A	27	0.024	
A	28	0.017	
A	29	0.021	
A	30	0.023	
A	31	0.033	
A	32	0.060	
A	33	0.027	
A	34	0.030	
A	35	0.016	
A	36	0.003	

Table App E.3. Excavation layer volumes for Kelley Cave Unit B based on GIS (left) and estimated from field measurements (right). The * denotes measurements that are considered to be inaccurate.

Excavation	Layer	GIS Measured Vol. m^3	Estimated Vol. m^3
B	1	0.056	
B	2	0.073	
B	3	0.010	
B	4		0.042
B	5	0.069	
Feature 1			0.020
B	6	0.048	
B	7	0.033	
B	8	0.020	
B	9		0.033
B	10	0.004*	0.002
B	11	0.007*	0.021
B	12	0.024	
B	13	0.034	
B	14	0.050	
B	15	0.016	
Feature 3		0.217*	0.196
B	16	0.149*	0.055
B	17	0.037	
B	18	0.035	
B	19	0.035	
B	20	0.049	
B	21	0.073	
B	22	0.053	
B	23	0.034	
B	24	0.024	
B	25	0.069	
B	26	0.056	
B	27	0.017	
B	28	0.009	
B	29	0.016	
B	30	0.012	
B	31	0.008	
B	32	0.016	

Table App E.4. Excavation layer volumes for Kelley Cave Unit AB based on GIS (left) and estimated from field measurements (right). The * denotes measurements that are considered to be inaccurate.

Excavation	Layer	GIS Measured Vol. m^3	Estimated Vol. m^3
AB	37	0.033	0.139
AB	38	0.015	0.034
AB	39	0.004*	0.041
AB	40		0.039
AB	41		0.029
AB	42		0.044
AB	43		0.023
AB	44		0.021
AB	45		0.031
AB	46	0.005*	0.029
AB	47		0.004
AB	48		0.032
AB	49	0.072	0.021
AB	50		0.028
AB	51	0.026	0.011
AB	52	0.022157	0.0258048
AB	53	0.022257	0.026125
AB	54	0.035021	0.00693
AB	55	0.048622	0.033488
AB	56	0.027699	0.0108438
AB	57	0.070386	0.00477

Table App E.5. Excavation layer volumes for Kelley Cave Unit 4A based on GIS (left) and estimated from field measurements (right). The * denotes measurements that are considered to be inaccurate.

Excavation	Layer	GIS Measured Vol. m^3	Estimated Vol. m^3
4A	1	0.025	0.047
4A	2	0.042	0.062
4A	3	0.076	0.043
4A	4	0.042	0.041
4A	5	0.006*	0.018
4A	6	0.052	0.014
4A	7	0.039	
4A	8	0.039	
4A	9	0.020	0.048
4A	10	0.026	0.037
4A	11	0.023	0.006
4A	12	0.013	0.053
4A	13	0.025	0.036

APPENDIX F: SOIL PROFILE DESCRIPTIONS FOR SKILES SHELTER AND KELLEY CAVE

The Stratigraphic Layers were defined, described and sampled in Skiles Shelter and Kelley Cave with the help of Charles Frederick, Ken Lawrence, Brittney Gregory, and Dan Rodriguez. The soil profile descriptions in the tables below are based on soil profile forms used by Frederick.

Table App F.1. Stratigraphic Layers A through H profile descriptions for Skiles Shelter.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
A	0-55 cmbs	Silty Clay	Loose	Abrupt, Sloping	Structureless	10YR 5/1	10YR 7/1	2	Numerous rabdotus shell present in layer. Some very small spalls in matrix with many charcoal. Layer slopes from north to south. Appears to have been screened with a 1/4 inch screen. Intrusive into Layer B.
FN 1167	12-15 cmbs	Burned Fiber	Compact	Abrupt, Sloping	Structureless	N/A	N/A	N/A	Burned layer of cut leaf bases. In center of north wall Unit A. Measures 37 cm N-S, 23 cm W-E, and 1 cm thick. Slopes down from north to south directly atop the alluvial Layer B.
B	12-73 cmbs	Fine Sandy Loam	Compact	Abrupt, Sloping	Strong	10 YR 6/3	10YR 6/9	<1	Alluvial layer with lighter laminae approx. 30 cmbs. Top of layer slopes from north to south, but bottom of layer slopes from south to north. Very fine sand with rare to no inclusions.
C	73-75 cmbs	Fine Sandy Loam	Very Compact	Abrupt, Wavy	Strong	10YR 6/2	10YR 6/9	2	Bottom of alluvial layer. Very compact and blocky. Lower horizon is wavy to irregular but abrupt. Inclusions the result of forming over lower Layer D.
D	75-111 cmbs	Silt Loam	Loose	Abrupt, Irregular	Structureless	10YR 4/3	10YR 5/3	2	Lower cultural layer with moderate charcoal and burned rock inclusions. Few bone or botanical inclusions within. Capped cultural layer.
E	111-114 cmbs	Fine Sand	Compact	Abrupt, Irregular	Strong	10 YR 6/3	10YR 6/9	1	Very irregular and broken alluvial layer. Spans most, but not entire, Unit A. Likely small flood event trampled by subsequent reoccupation of shelter. Thickness is variable, between 1-3 cm, but no distinctive slope or shape.

Table App F.1. Continued.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
F	114-125	Silt Loam	Loose	Abrupt, Horizontal	Structureless	10YR 4/2	10YR 5/2	2	Cultural layer with some small charcoal (1cm or less) and few bone and botanical. Layer sits on lower travertine Layer G.
G	125-150+	Sandy Gravel	Very Compact	N/A	N/A	7.5YR 5/5	7.5YR 7/6	30	Layer of travertine gravel plates 10-30cm in diameter. Not matrix supported, however fine sand found in small cracks between plates. Travertine looks slightly crystalline and has a sulfur smell when cracked. Rare small flecks (~2 mm diameter) found in cracks between and under the top few plates. Some round hematite concretions (1 cm diameter) observed at approx. 140 cmbs. No cultural material encountered.
FN 1168	9-20 cmbs	Burned Fiber	Loose	Abrupt, Sloping	Structureless	N/A	N/A	N/A	Layer of burned fiber and cut leaf bases. Some rabdotus shell inclusions, both burned and unburned, with holes punctured through shell; as well as medium sized burned rocks. Layer located in south east corner of unit, the exposed portion measuring 50 cm by 50 cm.
H	0-45 cmbs	Silt Loam	Loose	Abrupt, Sloping	Structureless	10YR 4/3	10YR 5/3	2%	Cultural layer with moderate charcoal and burned rock inclusions. Few bone or botanical inclusions within. Appears to be a deflating cultural layer on top of travertine floor.

Table App F.2. Stratigraphic Layers A through M profile descriptions for Kelley Cave.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
A	0-23 cmbs	Silty Clay with ash	Loose	Abrupt, Wavy	Structureless	10YR 5/1	10YR 7/1	2%	Numerous rabdotus shell present in layer (mostly burned). Some very small spalls present in matrix; little charcoal.
AA	12-15 cmbs	Sandy Clay Loam	Loose	Abrupt, Horizontal	Structureless	10YR 3/1	10YR 5/3	2%	Numerous rabdotus shell present in layer (mostly burned). Some very small spalls present in matrix; increase in charcoal (small size)
AB	15-18 cmbs	Sandy Clay Loam	Friable	Abrupt, Horizontal	Weak	10YR 6/3	10YR 7/2	2%	More firm than above. No observable charcoal; Numerous rabdotus shell present in layer (mostly burned). Some very small spalls present in matrix.
B	9-69 cmbs	Loam to Fine Sandy Loam	Loose	Clear, Wavy	Weak	10YR 3/2	10YR 5/2	2%	Few burned rabdotus, many burned rock medium size, large charcoal inclusions, basin shaped, mottled with 10YR 4/3 and 10YR 7/1, numerous burrows ~5cm in diameter (average).
BA	28-29 cmbs	Silty Clay with ash	Loose	Abrupt, Wavy	Structureless	10YR 4/3	10YR 6/3	<1%	ash lens
BB	31-32 cmbs	Sandy Clay Loam	Firm	Abrupt, Wavy	Weak to Moderate	10YR 4/3	10YR 7/3	1%	Possible ash, small rocks (limestone) on upper and lower contact (sparse).
BC	42-44 cmbs	Silty Clay with ash	Loose	Abrupt, Wavy	Structureless	10YR 4/3	10YR 6/3	<1%	ash lens
BD	59-61 cmbs	Silty Clay with ash	Loose	Abrupt, Wavy	Structureless	10YR 4/3	10YR 6/3	<1%	ash lens
C	51-122	Sandy Loam	Loose	Diffuse, Irregular	Structureless	10YR 4/3	10YR 6/3	20%	Large mottles of charcoal laden deposits, burrows ~10-15cm in

Table App F.2. Continued.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
	cmbs								diameter, some have coating of river alluvium.
D	88-112 cmbs	Sandy Silty Loam	Loose	Diffuse, Irregular	Structureless	10YR 3/2	10YR 5/2	20%	Small ash lenses, ~15% charcoal 1cm to average ~5mm. Mostly on the small side. Possibly some thermal alteration of deposit. Coarse fragments are angular cobbles with horizontal orientation.
DA	103-105 cmbs	Silty Clay with ash	Friable	Abrupt, Smooth	Structureless	7.5YR 5/5	7.5YR 7/6	1%	Thin orangish brown, 1.2cm to 0.6cm, contains lots of charcoal (~20%) of average size of 0.5cm, base may slope slightly to south. Few Tabular cobbles under this rock
F5	105-112 cmbs	Silt Loam	Loose to slightly friable	Abrupt, Smooth	Structureless	10YR 5/1	10YR 6/2	1%	brownish gray, also seen in north wall, ~5cm thick, coarse fragments are subrounded pebbles, south end abruptly terminates. ~1% charcoal, <1mm
DB	112-118 cmbs	Silt	Loose	Abrupt, Smooth	Structureless	10YR 4/2	10YR 5/2	3%	grayish brown, coarse fragments mostly angular pebbles, few possible 1-2mm in few burrows ~1%, ~3 angular gravels fragments
DC	114-132 cmbs	Silt	Loose	Abrupt, Smooth	Structureless	10YR 5/3	10YR 6/3	2%	Angular pebbles, ~20% angular cobbles/gravels, some charcoal in matrix from 3mm, most are 2mm, boundary slopes north; some parts horizontal pitting, possibly thermodynamic alteration.
DD	111-112, 133-	Charcoal	Loose	Abrupt, Irregular	Strong	10YR 2/1	10YR 2/0	1%	Black, DC above and below, ~1 to 1.5cm thick, <1mm fragments of coarse cobbles, few angular

Table App F.2. Continued.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
	134 cmbs								cobbles.
DE	122-131 cmbs	Silt to Silty Loam	Loose	Abrupt, Smooth	Strong	10YR 3/2	10YR 5/2	1%	Grayish brown, 2.5 - 3cm thick slopes down to south, very rare rounded pebbles <1%, very small bone fragments, mixed (<2%) charcoal, 2mm tabular pieces.
E	122-147 cmbs	Silt to Silty Loam	Loose	Clear, Smooth	Strong	10YR 3/1	10YR 5/1	2%	Gray, rare burned bone fragments, slopes down to north, ~2% subrounded pebbles, very rare angular gravels - diffuse scatters of charcoal <1mm, zone has many burrows
F	134-166 cmbs	Silt	Loose	Abrupt, Irregular	Strong	10YR 6/3	10YR 6/4	1%	Yellowish brown, rests upon large roof spall, burrows, with 1% small angular gravels, some charcoal <1% up to 2mm
G	115-171 cmbs	Silt Loam	Loose	Clear, Smooth	Strong	10YR 5/2	10YR 6/1	30%	Angular cobbles approaching boulders, horizontally oriented, pockets of charcoal within matrix ~10% most in 1cm; 1-2% angular pebbles, few small bone fragments
H	171-262 cmbs	Fine Sand	Loose	None	Strong	10YR 6/3	10YR 6/9	2%	Yellowish brown, few subangular pebbles diffuse with scatters of artifacts ~1-2%, 2% subangular pebbles, 2 angular cobbles.
2A	149-151 cmbs	Clay Loam	Friable	Abrupt, Smooth	Fine, blocky	10YR 7/1	10YR 7/2	0%	Light gray, mud drape, slopes down to north
I	0-17 cmbs	Silt Loam	Extremely Firm	Clear, Sloping	Strong	10YR 6/3	10YR 7/2	30%	Extremely compact, possibly baked matrix. Contains many small burned rock fragments, angular- subangular. Large

Table App F.2. Continued.

Zone	Depth	Texture	Consistence	Lower Boundary	Structure	Color Moist	Color Dry	Coarse Frags (%)	Comments
									amounts of ash, few organics concreted into hard matrix.
J	0-35 cmbs	Silt Loam	Firm	Cleary, Wavy	Strong	10YR 5/2	10YR 6/1	<5%	Formerly labeled Strat 0002, mixed with course angular and subangular gravels, some fibers present, a rodent walnut cache was observed. Hummocky/ irregular upper and lower boundaries.
K	35-45 cmbs	Silt Loam	Friable	Clear, Sloping	Structureless	7.5YR 6/1	7.5YR 7/1	25%	Formerly labeled Strat 0003. Ash and charcoal layer, small angular and subangular burned rock 10%, charcoal small 2%. Clear slope towards dripline of shelter.
L	35-50 cmbs	Sandy Clay Loam	Loose	Abrupt, Sloping	Structureless	10YR 3/1	10YR 5/3	2%	Large amounts of ash and burned rocks 5-10 cm in diameter. Still signs of rodent burrowing through this layer. Some clusters of charcoal found on eastern side.
M	50-60 cmbs	Silt	Loose	N/A	Structureless	10YR 5/1	10YR 6/2	10%	Decrease in ash content, still clusters of charcoal, larger burned rocks in this matrix, possible alluvial filled rodent burrow observed in southeast corner of unit.

APPENDIX G: GEOARCHAEOLOGICAL ANALYSIS RESULTS

Geoarchaeological results reported below were provided by laboratory analysis conducted by Charles Frederick, Ken Lawrence, and Brittney Gregory, with the assistance of Jacob Sullivan. The X-Ray Diffraction analysis reported below was conducted by James Talbot, see Chapter 3 Geoarchaeological methods.

Table App G.1. Loss-On-Ignition (LOI), Magnetic Susceptibility (MS), and Phosphorus (P) results from the North Wall of Unit A in Kelley Cave. PK samples are batch 1 taken August 2013.

Sample	**Depth** **Elevation (m)**	**Calcium Carbonate** **Equivalent (%)**	**LOI** **(%)**	**MS Xlf** **10^{-8}kg m^3**	**MS Xfd** **(%)**	**Total P**
PK68	972.74	37.1	4.04	373.5	3.4	9.7
PK67	972.71	37	4.05	352.7	3.4	11.5
PK66	972.69	40	2.50	449.7	3.6	0
PK65	972.67	40.7	2.35	454.3	3.8	0
PK64	972.65	42.5	2.56	386.7	4.5	0
PK63	972.63	41.3	2.11	364.5	4.1	0
PK62	972.61	41.9	1.71	355.7	3.3	0
PK61	972.60	40.7	1.82	351.1	3.5	0
PK60	972.58	35.8	3.16	337	3.3	9
PK59	972.56	40.7	3.84	313.8	3.2	18.5
PK58	972.55	44.4	4.44	317.2	3.5	13.6
PK57	972.53	40.7	5.07	290.8	3.5	21
PK56	972.52	43.8	4.77	294.4	3.1	15.9
PK55	972.50	44.4	4.99	298.3	3.8	12.9
PK54	972.48	48	6.08	297.9	3.3	9.2
PK53	972.45	51	5.61	300.1	3.3	0
PK52	972.43	54.6	6.73	315.2	3.7	1.6
PK51	972.42	43.1	5.57	315.9	3.8	0
PK50	972.41	43.7	5.05	328.4	4	0
PK49	972.39	42.5	4.03	380.8	4.4	0
PK48	972.38	43.7	2.86	403.3	4.7	7.3
PK47	972.37	48.5	2.62	395.8	5.1	5.5
PK46	972.35	49.1	2.79	384.2	5.1	0.7
PK45	972.34	49.1	3.37	318.3	4.8	8.9
PK44	972.32	51.6	5.67	311.2	4.5	11.5
PK43	972.30	51.6	7.83	318.9	4.2	7
PK42	972.29	52.9	11.05	317.6	3.8	21
PK41	972.27	51.6	11.10	304.6	4.3	23
PK40	972.26	50.9	10.82	313.6	4.3	15
PK39	972.24	47.3	11.12	289.9	4	17.3
PK38	972.23	46.7	8.98	292.9	3.8	21.1
PK37	972.21	42.5	8.11	297.6	3.7	21.3
PK36	972.20	43.1	11.45	274.7	3.2	24
PK35	972.18	39.4	10.77	259.6	3.6	43.7
PK34	972.17	41.8	9.29	255.8	3.4	3.5
PK33	972.15	46.7	11.51	251.1	3.3	1.8
PK32	972.12	52.7	12.04	248.5	3.9	26.5
PK31	972.10	50.3	8.67	217.2	3.3	2.4

Table App G.1. Continued

Sample	**Depth** **Elevation (m)**	**Calcium Carbonate** **Equivalent (%)**	**LOI** **(%)**	**MS Xlf** **10^{-8}kg m^3**	**MS Xfd** **(%)**	**Total P**
PK30	972.08	49.1	9.53	252	3.1	4.9
PK29	972.06	49.1	9.21	271.4	3.9	0
PK28	972.04	52.2	7.94	267.1	2.6	0
PK27	972.02	61.2	7.73	270.4	3.6	0
PK26	972.01	66	8.68	261.1	3.3	0
PK25	971.99	70.3	10.26	260.8	3.2	0
PK24	971.97	68.4	8.44	239.5	3.2	0
PK23	971.96	66.7	8.24	264.2	3.5	0
PK22	971.93	62.4	10.65	251.2	3.4	23.1
PK21	971.91	62.9	8.94	245.9	3.2	24.1
PK20	971.89	64.2	8.47	204.7	2.7	46.8
PK19	971.87	60.6	7.39	284.9	3.1	28.7
PK18	971.86	61.2	5.73	351.2	3	28.4
PK17	971.85	58.1	6.49	311.6	3.9	12.8
PK16	971.84	58.2	5.64	420.1	3.3	10.9
PK15	971.82	47.8	7.63	296.4	3.1	3.7
PK14	971.81	56.3	7.22	275.5	2.7	2.5
PK13	971.79	56.9	7.63	252.1	2.5	7.8
PK12	971.78	52.6	10.59	253.1	1.6	1.8
PK11	971.76	50.8	9.83	239.1	1.3	0.1
PK10	971.74	47.2	12.36	241.9	2.8	5.7
PK09	971.72	46.8	25.29	173.7	2.8	0
PK08	971.70	50.9	9.10	237.9	3	0
PK07	971.69	53.3	14.22	209.2	3.1	2.5
PK06	971.66	58.7	9.50	206.9	2.9	0
PK05	971.64	54.4	9.58	236	3.2	0
PK04	971.62	52.6	10.70	212.6	2.1	0
PK03	971.60	49	10.78	221.7	2.3	1.6
PK02	971.58	54	16.41	194.1	2.2	3.1
PK01	971.56	55.8	11.62	246.4	1.9	7

Table App G.2. Loss-On-Ignition (LOI), Magnetic Susceptibility (MS), and Phosphorus (P) and additional grain size analysis results from the North Wall of Unit A in Kelley Cave. K samples are batch 2 taken January 2014.

Sample	**Depth** **Elev.**	**Calcium Carbonate** **Equivalent (%)**	**LOI** **(%)**	**MS Xlf** **10^{-8}kg m^3**	**MS Xfd** **(%)**	**Total P**	**Sand** **(%)**	**Silt** **(%)**	**Clay (2micron)** **(%)**
K50	971.67	42.6	9.82	235.5	2.6	6.7	39.6	50.58	9.82
K49	971.64	41.1	9.32	223.5	2.9	8.3	40.1	49.4	10.5
K48	971.61	42.3	8.26	202.8	2.6	4.6	45.7	45.4	8.9
K47	971.59	40.5	8.59	236.1	2.5	2.9	43.5	47.76	8.74
K46	971.56	37.1	6.09	235.5	2.2	3.1	47.6	44.03	8.37
K45	971.53	36.5	5.61	350.9	2.1	3.7	46.2	45.39	8.41
K44	971.50	40.5	6.2	248.6	2.6	3.8	42.8	47.44	9.76
K43	971.48	36.2	7.63	219.4	2.1	21.8	46.8	46.8	6.4
K42	971.36	58.9	2.97	53.6	0.6	30.7	2.67	64.03	33.3
K41	971.45	33.5	4.65	228.5	2.2	3.9	53.6	40.01	6.39
K40	971.42	34.1	5.47	226.8	1.2	5	50.6	42.42	6.98
K39	971.40	35.6	4.4	234	2	7.7	51.7	41.47	6.83
K38	971.37	33.1	5.22	228.4	2.1	30	54.7	39.41	5.89
K37	971.36	31.3	4.55	277	3.1	22.3	59.6	35.38	5.02
K36	971.34	33.8	4.21	234.4	1.8	48.1	55.5	38.56	5.94
K35	971.31	34.4	3.9	207.2	2.8	47.6	52.4	40.39	7.21
K34	971.27	33.1	3.93	215.3	1.8	38.7	57.9	36.58	5.52
K33	971.25	33.8	2.75	233	1.8	48.1	59	35.72	5.28
K32	971.22	32.5	1.89	231.1	1.6	51	63.9	31.31	4.79
K31	971.20	32.5	3.07	227.6	1.6	48.4	60.6	34.78	4.62
K30	971.18	32.5	2.62	223.7	1.5	39.8	60.9	34.09	5.01
K29	971.15	30.1	2.59	185.8	1.6	37.4	60.4	34.74	4.86
K28	971.13	25.5	1.83	200.3	1.2	34.5	63.3	32.71	3.99
K27	971.10	27.3	2.24	216.2	2.3	34.5	63.6	32.34	4.06
K26	971.08	28.5	1.65	231.8	2	32.3	66.5	29.57	3.93
K25	971.06	25.2	1.32	223.4	2.1	32.3	63.2	32.43	4.37
K24	971.03	27.9	0.68	229.5	0.6	29.3	65.2	30.48	4.32
K23	971.01	24.2	0.89	220.7	0.9	33.4	65.4	30.29	4.31
K22	970.97	17.9	0.45	192.4	0.7	16.1	63.3	31.67	5.03
K21	970.95	18.8	0.99	215.3	1.7	28.5	62	33.45	4.55
K20	970.91	15.5	0.66	222.4	1.4	16.7	63.4	32.71	3.89
K19	970.89	18.2	0.62	217.3	1.4	16.8	62.8	32.31	4.89
K18	970.89	21.5	1.26	208.5	1.8	26.7	61.3	33.77	4.93
K17	970.87	24.9	2.03	213.6	2.2	27	59.7	35.31	4.99
K16	970.84	24.3	1.99	210.3	2.1	27.2	59.8	34.93	5.27
K15	970.82	24	1.61	219.7	2.2	27.9	63.3	32.74	3.96
K14	970.80	25.5	1.2	225.6	1.1	24.8	62.7	32.91	4.39

Table App G.2. Continued

Sample	**Depth** **Elev.**	**Calcium Carbonate** **Equivalent (%)**	**LOI** **(%)**	**MS Xlf** **10^{-8}kg m^3**	**MS Xfd** **(%)**	**Total P**	**Sand** **(%)**	**Silt** **(%)**	**Clay (2micron)** **(%)**
K13	970.77	21	0.86	224.8	1.7	25.9	62.5	33.03	4.47
K12	970.76	19.4	0.89	211.4	0.2	21.5	64.4	31.67	3.93
K11	970.73	20.7	0.89	188	0.6	21.6	66.7	28.82	4.48
K10	970.71	26.2	1.42	212.5	1.8	25	71.9	25.12	2.98
K09	970.68	18.3	0.84	229.6	0.6	21.2	71.5	25.53	2.97
K08	970.65	20.1	0.85	223.8	1.3	20.9	71.3	25.62	3.08
K07	970.62	21.3	0.89	226.1	1.7	20.4	71.5	25.22	3.28
K06	970.57	13.4	0.59	236.8	0.6	14.7	80.5	17.32	2.18
K05	970.55	15.8	0.49	244.3	1.4	14.5	77.2	20.3	2.5
K04	970.52	11.9	0.39	238	1	10.4	68	28.37	3.63
K03	970.49	11.6	0.44	240.9	1.2	9.6	70.7	26.04	3.26
K02	970.46	15.3	0.47	201	1.7	6.9	69.6	27	3.4
K01	970.43	18	0.58	216.5	0.6	13.2	81.9	16.11	1.99
	966.02	30.4	1.89	130.8	1.7	12	41.5	50.01	8.49
	966.84	31.3	2	135.7	0.9	10.1	37.7	52.96	9.34

Table App G.3. Skiles Shelter Magnetic Susceptibility and grain size by B. Gregory and K. Lawrence.

Sample	**Depth (cm)**	**CaCO3 (%)**	**Mag Xlf**	**Sand (%)**	**Silt (%)**	**Clay (%)**	**Gravel (%)**
1	0.75	32.82	157.74	45.1	22	30.1	2.9
2	6.5	37.59	162.15	33.5	35.9	27.6	3
3	12.5	33.82	167.33	30.7	37.3	30.3	1.7
4	17	38.27	144.35	28	56.4	15.6	0
5	20	36.62	149	31.4	51.7	16.9	0
6	22.5	38.84	144.74	27.9	55.6	16.5	0
7	25.5	36.32	151.11	30.9	51	18.1	0
8	27.5	39.53	140.46	25.4	57.8	16.8	0
9	30	37.65	150.01	30.2	53.9	15.9	0
10	32	41.46	118.73	17.8	63.8	18.4	0
11	35.5	40.83	127.78	18.7	63.4	17.9	0
12	37	39.23	123.55	18.4	64.7	16.9	0
13	39	38.91	135.65	23.1	58.4	18.5	0
14	42	37.32	143.23	30	54.2	15.8	0
15	45	35.42	139.49	38.2	46.1	15.7	0
16	48	31.27	138.86	42.7	42.4	14.9	0
17	51	32.86	134.52	43	43	14	0
18	53	33.18	138.07	45.9	40.2	13.9	0
19	56	31.92	149.72	47	40.6	12.4	0
20	58.5	33.49	147.8	45.2	38.2	16.6	0
21	60	30.94	144.83	47.1	40	12.9	0
22	63	32.85	147.79	44.6	41.8	13.6	0
23	65	33.17	153.81	41.3	42.6	16.1	0
24	67	34.46	156.74	42.1	42	15.9	0
25	68.5	36.37	128.31	39.1	44.7	16.2	0
26	71	41.77	124.62	28.8	49.5	21.7	0
27	73	43.68	110.08	14.4	57.9	27.7	0
28	78	53.58	157.63	31.1	35.1	22.7	11.1
29	82.5	57.07	177.24	29.9	23.8	28.6	17.7
30	87.5	63.06	174.08	34.3	24.6	33.7	7.3
31	92.5	60.88	165.71	32.4	21.3	35.6	10.7
32	97.5	60.08	194.97	38.5	25.7	27.4	8.4
33	102.5	56.61	207.57	34.5	21.3	35.2	9
34	107.5	59.45	196.2	40.7	17.9	26.2	15.3
35	112.5	57.54	194.31	43	10.5	34.8	11.7
36	117.5	56.4	198.45	46.1	11	35.6	7.4

(shaded) completed with hydrometer

Table App G.4. Skiles Shelter Loss-On-Ignition (LOI) and Phosphorus (P) results by Ken Lawrence and Brittney Gregory.

Sample	Depth cmbD	Avg. Total P (LOI) Colorimeter (mg/L)	LOI%
PS 69	2	34.2	7.6
PS 68	7	50.4	5.18
PS 67	10	16.2	3.9
PS 66	12	14.4	3.63
PS 65	14	12.3	3.49
PS 64	16	5.1	3.67
PS 63	17.5	6.9	3.66
PS 62	19	4.2	3.71
PS 61	21	4.7	3.55
PS 60	23	10.6	3.52
PS 59	25	11.8	3.7
PS 58	27	6.3	3.86
PS 57	29	4.2	4.03
PS 56	31	15.7	3.91
PS 55	32.5	13.4	4.03
PS 54	35	12.1	4.04
PS 53	37.5	8.3	4.73
PS 52	39.5	13.8	3.95
PS 51	41.5	11.2	3.78
PS 50	43.5	12.4	3.45
PS 49	45	10.4	3.36
PS 48	46.5	4.8	3.39
PS 47	48	4.0	3.35
PS 46	50.5	2.3	3.45
PS 45	52	1.1	3.54
PS 44	53.5	0.0	3.6
PS 43	55	0.0	3.67
PS 42	56.5	0.0	3.67
PS 41	57.5	0.0	3.61
PS 40	59	7.3	2.84
PS 39	59.5	6.1	3.03
PS 38	61	5.6	3
PS 37	62.5	5.2	3.01
PS 36	64	4.0	3.21
PS 35	65.5	3.6	3.44
PS 34	67	2.0	3.67
PS 33	68	1.8	4.41
PS 32	70	7.1	3.79
PS 31	72	6.0	4
PS 30	74	0.2	7.65

Table App G.4. Continued

Sample	Depth cmbD	Avg. Total P (LOI) Colorimeter (mg/L)	LOI%
PS 29	76	0.0	8.06
PS 28	78	0.0	7.51
PS 27	79	5.0	17.4
PS 26	81	7.2	13.92
PS 25	83	7.3	14.85
PS 24	85	23.8	14.21
PS 23	87	36.1	15.04
PS 22	89	32.6	15.65
PS 21	90.5	29.4	16.86
PS 20	92	42.1	17.6
PS 19	94	47.4	22.3
PS 18	95	37.5	19.91
PS 17	96	41.1	20.86
PS 16	98	13.4	19.15
PS 15	100	11.2	19.56
PS 14	102	14.5	19.17
PS 13	103	13.2	20.92
PS 12	105	16.2	20.41
PS 11	107	16.2	18.81
PS 10	108	12.2	14.45
PS 09	110	15.6	15.42
PS 08	113	1.0	16.23
PS 07	114	0.3	11.06
PS 06	116	0.4	10.54
PS 05	118	0.6	9.93
PS 04	121	0.9	9.73
PS 03	123	1.6	9.19
PS 02	125	5.6	7.95
PS 01	127	5.7	7.91

Table App G.5. X-Ray Diffraction results from Skiles Shelter and Kelley Cave, by James Talbot and Charles Frederick.

XRD #	Location	Depth (cm)	Description	Sample/Zone	Quartz	K-Feldspar	Plagioclase	Calcite	Dolomite	Gypsum	Hematite	R0 M-L I/S (90%S)*	Illite&Mica	Kaolinite	Chlorite	TOTAL
CF101	Kelley Cave,	24	Feature 1	pk61	29.7	5.8	11.6	47.3	1.2	0	0.3	0	4.1	0	0	100
CF102	Kelley Cave,	32	Layer 2	pk56	19.8	6.8	14.2	51.7	1.1	0	0.7	0	5.7	0	0	100
CF103	Kelley Cave,	36	Layer 3	pk54	32.8	3.1	15.5	42.4	1.6	0	0.5	0	4.1	0	0	100
CF104	Kelley Cave,	47	Layer 4	pk47	20.1	5.1	19.8	49.1	0.8	1.1	0.6	0	3.4	0	0	100
CF105	Kelley Cave,	58	Feature 3	pk40	21.6	4	13.4	54.8	1.3	1.3	0.2	0	3.4	0	0	100
CF106	Kelley Cave,	63.6	Feature 3	pk36	27.9	4.7	13.5	48.8	0.6	0.7	0.3	0	3.5	0	0	100
CF107	Kelley Cave,	73.5	Feature 3	pk31	34.8	3.6	14.9	43.2	0.6	0.5	0	0	2.4	0	0	100
CF108	Kelley Cave,	83	Layer 5	pk26	27.4	4.2	17.9	45.5	0	1.4	0	0	3.6	0	0	100
CF109	Kelley Cave,	93	Layer 7	pk21	33.1	4.6	12.7	43.9	1.4	0.8	0	0	3.5	0	0	100
CF110	Kelley Cave,	98.5	Feature 5	pk17	22.8	3.8	8.9	58.4	2.2	1	0.4	0	2.5	0	0	100
CF111	Kelley Cave,	109.5	Feature 5	pk10	35.3	4.7	12.4	40.7	0	0.8	0.4	0	3.5	1.3	0.9	100
CF112	Kelley Cave,	121.5-	Feature 5	pk3-4	25.9	5.8	15.2	43.6	2	1.2	0	0	4.1	1.3	0.9	100
CF113	Skiles Shelter,	7	cube 3	zone 2	40.3	3.3	22.5	22.9	1.4	0.8	0	3.3	3.7	1.1	0.7	100
CF114	Skiles Shelter,	25.5	cube 10	zone 4	45.4	4.5	15.1	22.2	1.7	0.6	0.2	5.6	2.6	1.5	0.6	100
CF115	Skiles Shelter,	35.5	cube 14	zone 5	28.9	8.2	20.5	29.4	1.2	0	0.3	5	4.9	1.2	0.4	100
CF116	Skiles Shelter,	58.5	cube 23	zone 7	34.8	3.9	22.2	24.6	1	0	0	4	7.4	1.8	0.3	100
CF117	Skiles Shelter,	83	cube 33	zone 9	27	3.2	17.2	44.2	1.1	0.6	0.6	0	4.8	1.3	0	100
CF118	Skiles Shelter,	94.5	cube 37	zone 9	24.1	2.9	8.6	55.3	0	0.5	0	0	7.2	1.4	0	100
CF119	Skiles Shelter,	105	cube 41	zone 9	24.6	3.9	14.3	51.3	0	0.3	0	0	4.6	1	0	100
CF120	Skiles Shelter,	116	cube 45	zone 9	35.2	2.5	10.5	42.4	1.9	0.3	0.3	0	6.2	0.7	0	100

APPENDIX H: ARTIFACT INVENTORY FROM THE 2013 EXCAVATIONS AT SKILES SHELTER

Attached below is a summary of the artifact inventory from Skiles Shelter; the full artifact inventory is on file with the ASWT at Texas State University. This inventory does not include material identified in the 1/8th inch screen sort or faunal analysis. The charcoal samples in the inventory are given in grams.

Table App H.1. Skiles Shelter Artifact Inventory from the 2013 investigation.

Unit Layer	Unifacial Tools	Bifacial Tools	Expedient Tools	Projectile Points	Point Fragments	Ground Stone	Debitage	Bone	Rabdotus	Charcoal (g)	Clear Glass
A1						1	21	8	30	41.9	
A2					1		3	49	89	2.9	
A3						Grinding Slab	5	56	30		
A4							1	8	10		
A5							5	10	9		
A6							9	8	12		
A7								3			
A8	2	1	1	Perdiz			36	21	9	2.8	
A9		2					58	13	19	4.1	
A10							115	38	44	14.2	
A11							41	15	29	5.3	
A12							110	2	7	2.1	
A13					1		47	3		1.6	
B1							50	28	41		
B2							13	19	16		
B3							1	4	1		
B4							2				
B5											
B6											
B-east8				Ensor			12	39	42	2.4	
B-east9	1				1		41	14			
B-east10				Langtry				17	7		
B-east11			1				26	6	8	3.4	
B-east12	1						38	10	6		
B-east13	1						7				

Table App H.1. Continued.

Unit Layer	Unifacial Tools	Bifacial Tools	Expedient Tools	Projectile Points	Point Fragments	Ground Stone	Debitage	Bone	Rabdotus	Charcoal (g)	Clear Glass
C1		2					100	95	21		2
C2	1						67	43	46		
C3		3	1				73	13	3		
C4							38	9	5		
C5							12		1	0.4	
Totals	**6**	**8**	**3**	**3**	**3**	**2**	**931**	**531**	**485**	**81.1**	**2**

APPENDIX I: FAUNAL ANALYSIS RESULTS FROM SKILES SHELTER AND KELLEY CAVE

Faunal analysis was conducted by Christopher Jurgens after fieldwork was concluded. Below is a summary of the faunal analysis inventory from both Skiles Shelter and Kelley Cave. The full faunal inventory is on file with the ASWT at Texas State University.

Faunal identification was made using his previous experience identifying bones at Arenosa Shelter as well as osteological books listed in Chapter 3. The faunal inventory below was created by the author with help from Jurgens. The majority of bones analyzed during the faunal analysis were fragmentary: in Kelley Cave 17 of the 928 analyzed and 2 of the 68 bones in Skiles Shelter were whole.

Cut marks on the bone fragments are a conclusive indicator of human processing of the animal, such as butchering and skinning. Burned or calcined bone fragments are not directly indicative of human consumption. Thermally altered bone fragments may be due to human cooking, if partially burned or discarded into the fire afterward. Alternatively, burned bone may have initially been introduced into the shelter by the death of a small animal, say a rodent in a burrow, which was then burned due to the proximity of the fire.

Table App I.1. Taxa identified during faunal analysis in both shelters.

Class	**Order**	**Family**	**Genus**	**Species**	**Common Name**
Aves					Bird (undetermined species)
	Anseriformes				Web-footed birds (undetermined species)
		Anatidae			Duck (undetermined species)
	Accipitriformes	Accipitridae			Hawk (undetermined species)
	Cuculiformes	Cuculidae	*Geococcyx*	*californianus*	Roadrunner
Reptillia					Reptile (undetermined species)
	Testudinae/Chelonia				Terrapin (undetermined species)
	Testudinae	Trionychidae	*Apalone*	*spinifera*	Spiny softshell turtle
			Apalone	*spinifera* cf. *emoryi*	Texas spiny softshell turtle
			Apalone	*spiniferus*	Spiny softshell turtle
	Squamata				Scaled Reptiles (undetermined species)
	Suborder: Serpentes				Legless lizards (undetermined species)
Actinopterygii	Cypriniformes	Catostomidae			Sucker (undetermined species)
	Siluriformes	Ictaluridae			Catfish (undetermined species)
			Ictalurus	*furcatus*	Blue Catfish
			Ictalurus	*punctarus*	Channel Catfish
			Ictalurus	*sp.*	Catfish (undetermined species)
Infraclass: Teleostei					Boney fish (undetermined species)
Mammalia					Mammal (undetermined species)
	Rodentia				Rodent (undetermined species)
		Cricetidae	*Neotoma*	*sp.*	Woodrat
		Cricetidae	*Sigmodon*	*sp.*	Cotton Rat
		Sciuridae	*Otospermophilus*	*variegatus*	Rock Squirrel
	Lagomorpha	Leporidae			Rabbit (undetermined species)
			Lepus	*californicus*	Blacktail Jackrabbit
			Sylvilagus	*floridanus*	Eastern Cottontail
			Sylvilagus	*sp.*	Cottontail Rabbit (undetermined species)

Table App I.1. Continued.

Class	**Order**	**Family**	**Genus**	**Species**	**Common Name**
	Carnivora				Carnivore (undetermined species)
		Canidae			Small Canid (undetermined species)
			Urocyon	*cinereoargenteus*	Gray Fox
			Canis	*sp.*	Canine
	Artiodactyla				Even-toed ungulates (undetermined
		Cervidae	*Odocoileus*	*virginianus*	White-tailed Deer
			Odocoileus	*sp.*	Deer (undetermined species)

Table App I.2. Faunal analysis results for Skiles Shelter, by Christopher Jurgens.

Radiocarbon Dates cal B.P.	**Stratigraphic Layer**	**Horizontal Provenience**	**Taxon**	**NISP**	**MNI**	**MNE**
667±18	Layer D	Unit A	Aves	3	1	3
669±26			Canidae	1	1	1
			Geococcyx califorianus	1	1	1
			Ictaluridae	1	1	1
			Leporidae	2	2	2
			Lepus californicus	7	2	7
			Neotoma sp.	2	2	1
			Odocoileus sp.	1	1	1
			Otospermophilus variegatus	1	1	1
			Sigmodon sp.	2	1	2
			Sylvilagus sp.	18	3	17
602±31	Layer F	Unit A	*Sylvilagus sp.*	1	1	1

Table App I.3. Faunal analysis results for Kelley Cave, by Christopher Jurgens.

Radiocarbon Dates cal B.P.	**Stratigraphic Layer**	**Horizontal Provenience**	**Taxon**	**NISP**	**MNI**	**MNE**
	Feature 1	Units A & B	Accipitridae	1	1	1
			Apalone spinifera	4	1	2
			Apalone spiniferus	2	1	1
			Aves	6	1	1
			Canis sp.	1	1	1
			Carnivora	2	1	2
			Lepus californicus	14	3	8
			Odocoileus sp.	11	1	7
			Osteichthyes	2	1	2
			Squamata	1	1	1
			Sylvilagus sp.	29	3	15
	Prehistoric Pit	Unit B	Artiodactyla	2	1	1
			Aves	3	1	1
			Canidae	2	2	1
			Catostomidae	1	1	1
			Chelonia	1	1	1
			Lepus californicus	7	3	7
			Odocoileus virginianus	7	3	6
			Reptilia	1	1	1

Table App I.3. Continued.

Radiocarbon Dates cal B.P.	**Stratigraphic Layer**	**Horizontal Provenience**	**Taxon**	**NISP**	**MNI**	**MNE**
	Prehistoric Pit	Unit B	Rodentia	5	4	4
			Serpentes	1	1	1
			Sylvilagus sp.	15	7	12
			Teleostei	1	1	1
3557±42	Feature 3		*Apalone spiniferus*	1	1	1
5414±57			*Aves*	1	1	1
			Canidae	2	1	1
			Carnivora	2	1	2
			Ictaluridae	5	1	1
			Ictalurus sp.	1	1	1
			Lepus californicus	16	3	12
			Neotoma sp.	2	2	2
			Odocoileus sp.	12	3	6
			Rodentia	3	1	3
			Sylvilagus sp.	30	4	11
			Teleostei	4	1	3
			Testudinae	2	1	1
	Layer C	Unit A	Catastomidae	1	1	1
			Rodentia	2	1	2
			Sylvilagus sp.	3	2	2
	Layer D	Unit A	*Lepus californicus*	5	3	5
			Ictalurus furcatus	1	1	1
			Ictalurus sp.	2	1	1
			Sylvilagus sp.	3	2	3
			Neotoma sp.	2	1	1
			Reptilia	2	1	2
			Aves	1	1	1
7374±34	Feature 5; Layers DA, DB, DC, DD	Unit A	Canidae	1	1	1
7356±41			*Canis sp.*	1	1	1
			Carnivora	2	1	1
			Catastomidae	1	1	1
			Ictalurus furcatus	1	1	1
			Ictalurus punctarus	1	1	1
			Ictalurus sp.	2	1	1
			Lepus californicus	13	4	12
			Neotoma sp.	5	3	3
			Reptilia	2	1	2
			Rodentia	7	1	3
			Sylvilagus floridanus	1	1	1

Table App I.3. Continued.

Radiocarbon Dates cal B.P.	**Stratigraphic Layer**	**Horizontal Provenience**	**Taxon**	**NISP**	**MNI**	**MNE**
	Feature 5;	Unit A	*Sylvilagus sp.*	11	3	7
	Layers DA…		Teleostei	4	1	2
7490±35	Layer G	Unit AB	*Apalone spinifera* cf. *emoryi*	1	1	1
7530±28			*Aves*	1	1	1
			Canidae	2	2	2
			Canis sp.	5	1	5
			Ictaluridae	1	1	1
			Lepus californicus	8	3	8
			Neotoma sp.	2	2	2
			Rodentia	1	1	1
			Sylvilagus floridanus	5	1	3
			Sylvilagus sp.	2	1	2
			Teleostei	6	2	4
	Feature 6	Unit AB	*Ictalurus sp.*	1	1	1
			Osteichthyes	1	1	1
			Rodentia	1	1	1
			Lepus californicus	4	1	4
			Sylvilagus sp.	13	2	7
7366±35	Layer H	Unit AB	Anatidae	1	1	1
7449±22			*Apalone spiniferus*	1	1	1
			Canidae	1	1	1
			Catastomidae	3	1	1
			Ictaluridae	3	3	3
			Leporidae	1	1	1
			Lepus californicus	11	6	11
			Neotoma sp.	1	1	1
			Odocoileus virginianus	5	5	4
			Rodentia	2	2	2
			Serpentes	2	2	2
			Sylvilagus sp.	10	4	10
			Teleostei	2	1	1
			Testudinae	1	1	1
642±40	Layer I	Unit 4A	*Aves*	3	1	1
			Canidae	7	6	2
			Catastomidae	1	1	1
			Ictalurus sp.	5	1	2
			Leporidae	1	1	1
			Lepus californicus	10	1	8
			Neotoma sp.	1	1	1

Table App I.3. Continued.

Radiocarbon Dates cal B.P.	Stratigraphic Layer	Horizontal Provenience	Taxon	NISP	MNI	MNE
	Layer I	Unit 4A	*Odocoileus virginianus*	3	1	2
			Rodentia	3	1	3
			Sylvilagus sp.	7	1	6
	Layer J	Unit 4A	Anseriformes	1	1	1
			Aves	1	1	1
			Carnivora	1	1	1
			Ictaluridae	1	1	1
			Leporidae	1	1	1
			Lepus californicus	1	1	1
			Odocoileus virginianus	3	1	2
			Osteichthyes	2	1	1
			Sylvilagus sp.	9	3	4
			Urocyon cinereoargenteus	1	1	1
	Layers K, L	Unit 4A	*Odocoileus sp.*	3	1	2
			Sylvilagus sp.	1	1	1
			Testudinae	1	1	1
2586±71	Layer M	Unit 4A	Accipitridae	1	1	1
			Aves	3	2	3
			Ictalurus sp.	4	1	3
			Odocoileus sp.	1	1	1
			Rodentia	1	1	1
			Sylvilagus sp.	7	2	5

Table App I.4. Modified bone fragment results for Kelley Cave, by Christopher Jurgens.

Radiocarbon Date cal B.P.	Stratigraphic Layer	Unit Layers	Modified Bone	Count
	Prehistoric Pit	B1, B4	Bone Tool Frag.	2
			Bone Manufacturing Debris	3
	Feature 1		Bone Bead	2
			Spatulate Tool	1
			Bone Manufacturing Debris	1
3557±42	Feature 3		Bone Bead	2
5414±57			Bone Manufacturing Debris	1
	Layer D	A22	Mandible Scarifier	1
2586±71	Layer M	4A13	Bone Manufacturing Debris	1

APPENDIX J: KELLEY CAVE BOTANICAL RESULTS

Leslie Bush conducted the macrobotanical analysis for flotation samples from Feature 1 and Feature 6. The Feature 1 ash matrix had been previously floated during the 2013 field school using the method outlined in Chapter 3. One liter of the bulk matrix sample from Feature 6 was measured and sent to Leslie Bush who conducted both the flotation and macrobotanical analysis.

Table App J.1. Botanical results from Feature 1 floated matrix (FN 10144B), by Leslie Bush.

Flotation matrix: 2.5 cubic decimeters	**State**	**Part**	**Botanical Name**	**Common Name**	**Number**	**Weight (g)**	**Comments**
Wood	Carbonized	Wood	*Prosopis sp.*	Mesquite	1	0.03	
	Carbonized	Wood	*Acacia/Prosopis*	Acacia/Mesquite	5	0.12	LW not developed
	Carbonized	Wood	*Hardwood*	Hardwood	3	0.04	young or inconsistent ring to ring
	Carbonized	Wood	*Condalia spp.*	Condalia	3	0.07	
	Carbonized	Wood	*Diffuse-porous hardwood*	Diffuse-porous hardwood	1	0.03	Acer group, with bark
	Carbonized	Wood	*Acacia sp.*	Acacia	1	0.01	
	Carbonized	Wood	*Diospyros texana*	Texas persimmon	2	0.01	
	Carbonized	Wood	*Fabaceae 3*	Legume	1	0.01	ring-porous, rays 3-4 seriate, parenchyma in narrow bands
	Carbonized	Wood	*Quercus subg. Quercus*	White group oak	2	0.01	
	Carbonized	Wood	*Fraxinus sp.*	Ash	1	0.01	
	Carbonized	Wood	*Not examined*	Not examined	37	0.14	
Agavaceae vegetative parts	Uncarbonized	Fiber	*Agavaceae*	Agave family	1	0.01	
Bulb parts	Carbonized	Bulb base			2	0.01	fragments of base just above roots. prob. onion based on size
	Carbonized	Bulb scale			1	0.01	Prob. onion based on thickness
	Uncarbonized	Bulb cloak	*Allium drummondii*	Drummond's onion	2	0.01	
Seeds and related	Carbonized	Seed	*Celtis sp.*	Hackberry	10	0.02	1 whole, 9 fragments
Seeds and related	Uncarbonized	Seed	*Poaceae*	Grass family	1	0.01	glumes
	Uncarbonized	Seed	*Unknown*	Unknown	1	0.01	fragment, C-shaped
	Uncarbonized	Seed	*Verbenaceae*	Verbena family	1	0.01	small fragment
	Uncarbonized	Seed	*Opuntia sp.*	Prickly pear	1	0.01	small fragment

Table App J.1. Continued.

Flotation matrix: 2.5 cubic decimeters	**State**	**Part**	**Botanical Name**	**Common Name**	**Number**	**Weight (g)**	**Comments**
Grass vegetative parts	Uncarbonized	Leaf	*Poaceae*	Grass family	2	0.01	
	Uncarbonized	Stem	*Poaceae*	Grass family	2	0.01	
	Carbonized	Stem	*Poaceae*	Grass family	1	0.01	interior faintly reddish-brown
Miscellaneous botanical	Uncarbonized	Indeterminable				0.01	
Non-botanical	Modern	White plastic				0.01	
	Examined residue < 2 mm					0.21	

Table App J.2. Preliminary botanical results from Feature 6 floated matrix (FN 10013), by Leslie Bush.

Flotation matrix: 1.0 cubic decimeters	**State**	**Part**	**Botanical Name**	**Common Name**	**Number**	**Weight (g)**	**Comments**
Wood	Carbonized	Wood	*Fabaceae 1*	Legume family	2	0.32	ring-porous, rays 5-7 seriate, with thick parenchyma
	Carbonized	Wood	*Acacia sp.*	Acacia	4	0.13	
	Carbonized	Wood	*Fabaceae 2*	Legume family	1	0.21	diffuse-porous, rays 5-7 seriate, little parenchyma
	Carbonized	Wood	*Rhamnaceae*	Buckthorn family	1	0.03	cf. Karwinskia, needs comparative
	Carbonized	Wood	*Acacia/Prosopis*	Acacia/Mesquite	6	0.11	some evidence of high-temp burning
Wood	Carbonized	Wood	*Diospyros texana*	Texas persimmon	1	0.03	
	Carbonized	Wood	*cf. Prosopis sp.*	cf. Mesquite	1	0.05	LW clusters 5-7 as *Prosopis* but parenchyma paratracheal and < 1/2 x-sect
	Carbonized	Wood	Hardwood	Hardwood	2	0.02	young wood
	Carbonized	Wood	*Fabaceae 3*	Legume family	2	0.03	ring-porous, rays 3-4 seriate, parenchyma in narrow bands
	Carbonized	Wood	Not examined	Not examined	806	9.67	
Agavaceae vegetative parts	Uncarbonized	Leaf epidermis	*Agavaceae*	Agave family	32	0.01	
	Carbonized	Leaf base	*cf. Agavaceae*	cf. Agave family	3	0.01	id based on thickness not visible cell structure
	Uncarbonized	Fiber	*Agavaceae*	Agave family	11	0.01	

Table App J.2. Continued.

Flotation matrix: 1.0 cubic decimeters	State	Part	Botanical Name	Common Name	Number	Weight (g)	Comments
Agavaceae vegetative parts	Carbonized	Indeterminable	*Indeterminable*	Starchy fragments	65	0.61	probably carbonized sotol/lechuguilla heart sugars
Bulb parts	Uncarbonized	Bulb cloak	*Allium drummondii*	Drummond's onion	20	0.01	
Seeds and related	Uncarbonized	Seed	*Setaria sp.*	Bristlegrass	1150	0.23	paleas and lemmas; grains absent
	Uncarbonized	Seed	*Poaceae*	Grass family	17	0.01	
	Uncarbonized	Seed	*Setaria sp.*	Bristlegrass	3	0.01	larger and paler than other *Setaria* in feature
	Carbonized	Seed	*Chenopodium sp.*	Chenopodium	10	0.01	thick seed coats
	Uncarbonized	Seed	*Poaceae*	Grass family	7	0.01	
	Carbonized	Seed	*Opuntia sp.*	Prickly pear	7	0.01	
	Uncarbonized	Seed	*Opuntia sp.*	Prickly pear	79	0.17	
	Uncarbonized	Seed	*Fabaceae*	Legume	6	0.04	
	Carbonized	Seed	Indeterminable	Indeterminable	1	0.01	
	Uncarbonized	Seed	*Celtis sp.*	Hackberry	2	0.02	1 whole
	Carbonized	Seed	*Poaceae*	Grass family	1	0.01	
	Uncarbonized	Seed	*Asteraceae*	Daisy family	1	0.01	tiny, id based on pappus
	Uncarbonized	Seed	*Sida sp.*	Sida	1	0.01	
	Uncarbonized	Seed	*Asteraceae*	Daisy family	3	0.01	
	Uncarbonized	Pericarp	*Chenopodium sp.*	Chenopodium	1	0.01	
	Uncarbonized	Pericarp	*Prosopis sp.*	Mesquite	1	0.03	
Seeds and related	Uncarbonized	Fruit	Unknown	Unknown	7	0.01	flattened. Likely achene, poss. Ambrosia but with bifurcate central spike
	Uncarbonized	Pod epidermis fragment	*Fabaceae*	Legume	3	0.01	

Table App J.2. Continued.

Flotation matrix: 1.0 cubic decimeters	**State**	**Part**	**Botanical Name**	**Common Name**	**Number**	**Weight (g)**	**Comments**
		s					
Nutshell	Carbonized	Nutshell	*Juglans sp.*	Walnut/butternut	3	0.02	
Miscellaneous botanical	Carbonized	Peduncle			1	0.01	
	Uncarbonized	Indeterminable/Undetermined				0.14	
Non-botanical	Rocks					0.08	
	Fauna , bone				1	0.01	
	Uncarbonized	Frass	Termite		2	0.01	
	Carbonized	Frass	(2 different sized, both larger than termite)			0.01	
	Examined residue < 2 mm					31.9	

APPENDIX K: ARTIFACT INVENTORY FROM THE 2013 EXCAVATIONS AT KELLEY CAVE

Attached below is a summary of the artifact inventory from Kelley Cave; the full artifact inventory is on file with the ASWT at Texas State University. This inventory does not include material identified in the 1/8th inch screen sort or faunal analysis. The charcoal and burned exudate samples in the inventory are given in grams.

Table App K.1. Kelley Cave artifact inventory from the 2013-2014 investigations, part 1.

Unit Layer	**Projectile Points**	**Manos**	**Ground Stone Fragments**	**Cores**	**Core Tools**	**Scrapers**	**Graver/ Perforators**	**Spokshavers**	**Unifacial Tools**	**Bifacial Tools**	**Expedient Tool s/ Utilized Flakes**	**Lithic Tool Residue Samples**	**Debitage**
Surface	Shumla (2), Conejo, Ensor, Langtry (2), Val Verde, Pedernales, Marshall	1							1				
Feature 1	Marshall, Desmuke, Langtry		3			2	1				1		496
A1	Sabinal		2	1							6		287
A2										2	5	Scrape r	253
A3													65
A4													73
A6							Distal frag.						203
A7			1			Unifacial							72
A8			1										73
A9													130
A10	Val Verde (2)							1		1			86
A11			1			1							235
A12	Pandale												197
Feature 3	Palmillas (2), Marshall, Unknown		3			2	1			3	6	Utilize d Flake	1060
A13													79
A14					2					1			121
A15	Val Verde										1	Scrape	126

Table App K.1. Continued.

Unit Layer	Projectile Points	Manos	Ground Stone Fragments	Cores	Core Tools	Scrapers	Graver/ Perforators	Spokshavers	Unifacial Tools	Bifacial Tools	Expedient Tool s/ Utilized Flakes	Lithic Tool Residue Samples	Debitage
												r	
A16													47
A17						Unifacial							75
A18													38
A19													8
A20													19
A21													28
A22													41
A23													40
A24												Biface	100
A25													57
A26										1			28
A27	Langtry?		2				Distal frag.			1			
Feature 5		1											
A28													87
A29													122
A30													48
A31													43
A32													19
A33													120
A34													37
A35													33

Table App K.1. Continued.

Unit Layer	Projectile Points	Manos	Ground Stone Fragments	Cores	Core Tools	Scrapers	Graver/ Perforators	Spokshavers	Unifacial Tools	Bifacial Tools	Expedient Tool s/ Utilized Flakes	Lithic Tool Residue Samples	Debitage
A36													20
B1	Val Verde		2			2	1			2		Scraper	460
B2													159
B3													48
B4												Scraper	37
Feature 2													
B5	Lange/Palmillas, Langtry/Val Verde			1									83
B6	Val Verde/Langtry					1				1			125
B7				1						2			108
B8													40
B10										1			45
B11													34
B12													91
B13	Ensor												119
B14						1						Biface	51
B15										1	1		82
B16	Langtry, Arenosa												91
B17			1	1									264
B18							1				1		114
B19	Val Verde												89
B20						1					1		90

Table App K.1. Continued.

Unit Layer	Projectile Points	Manos	Ground Stone Fragments	Cores	Core Tools	Scrapers	Graver/ Perforators	Spokshavers	Unifacial Tools	Bifacial Tools	Expedient Tool s/ Utilized Flakes	Lithic Tool Residue Samples	Debitage
B21										1	2		61
B22													75
B23										1	1		85
B24											2	Biface	64
B25													36
B26										2			70
B27			1										
B28													50
B29													18
B30													15
B31													12
B32													27
C1	Frio, Langtry, Pandale								1	1			330
C2											1		193
C3										1	2		174
C4													48
C5											2		73
C6													47
C7											1		35
C8	Langtry		1								1		116
C9	Montell, Pandale						1				1		158
4A1													74
4A2						1				1			132

Table App K.1. Continued.

Unit Layer	Projectile Points	Manos	Ground Stone Fragments	Cores	Core Tools	Scrapers	Graver/ Perforators	Spokshavers	Unifacial Tools	Bifacial Tools	Expedient Tool s/ Utilized Flakes	Lithic Tool Residue Samples	Debitage
4A3		1	2								1		199
4A4			1										64
4A5													17
4A6											2		22
4A7													29
4A8													84
4A9													18
4A10													34
4A11										1	1		24
4A12													10
4A13													23
AB37			1										41
AB38													9
AB39													20
AB40													35
AB41			1										11
Feature 6													11
AB42													17
Feature 7													
Feature 8													
AB43			2										7
AB44													1

Table App K.1. Continued.

Unit Layer	**Projectile Points**	**Manos**	**Ground Stone Fragments**	**Cores**	**Core Tools**	**Scrapers**	**Graver/ Perforators**	**Spokshavers**	**Unifacial Tools**	**Bifacial Tools**	**Expedient Tool s/ Utilized Flakes**	**Lithic Tool Residue Samples**	**Debitage**
AB45													13
AB46													2
AB47													7
AB48													6
AB49													5
AB50	Bulverde stem frag. ?												10
AB51													1
AB52													9
AB53													4
AB54													2
AB55													
AB56													1
AB57													3
Totals	**37**	**3**	**25**	**4**	**2**	**13**	**7**	**1**	**2**	**24**	**39**	**8**	**9328**

Table App K.2. Kelley Cave artifact inventory from the 2013-2014 investigations, part 2.

Unit Layer	Point Fragments	Bone Bead	Bone Tools	Rabdotus	Historic Artifacts	Burned Exudate (g)	Clay Artifact	Charcoal (g)	Bone
Surface									
Feature 1		1		46		0.1		16.7	100
A1				4					50
A2				16					68
A3				5					19
A4				2					13
A6	Serrated distal frag.			8		0.1		0.1	40
A7				3				<0.1	15
A8	Distal			1					6
A9				4					21
A10				6		0.8		11.9	2
A11				9				12.6	26
A12	Distal frag. (2)			3				10.9	30
Feature 3	Shoulder frag.		1	24			1	47	128
A13				2				3.7	12
A14	Distal frag.			1					17
A15				4				12.9	32
A16				1				7.1	8
A17				1					23
A18				2					18
A19								12.6	5
A20								11	39
A21	Shoulder frag.			1					14

Table App K.2. Continued.

Unit Layer	Point Fragments	Bone Bead	Bone Tools	Rabdotus	Historic Artifacts	Burned Exudate (g)	Clay Artifact	Charcoal (g)	Bone
A22				2					26
A23								17.1	22
A24				1				2.2	
A25				2		1		2.5	43
A26								11.4	12
A27				1					61
Feature 5								4.7	
A28									71
A29						2.8			80
A30				2					27
A31						1		1.4	32
A32				2					24
A33				2		0.1			33
A34				2		0.2		1.7	80
A35						0.5		2.2	53
A36						0.2			7
B1				22	Bullet fragment				59
B2				30				0.4	47
B3				13				7.1	11
B4				14					8
Feature 2				7				2.3	2
B5				1				12.1	12
B6	Distal fragment							27.3	6
B7				12				15.4	8
B8				7				10.4	8

Table App K.2. Continued.

Unit Layer	Point Fragments	Bone Bead	Bone Tools	Rabdotus	Historic Artifacts	Burned Exudate (g)	Clay Artifact	Charcoal (g)	Bone
B10				5					8
B11				4			1	0.6	4
B12									14
B13								7.6	27
B14				8					7
B15				6				2.1	15
B16	Distal fragment			5				16.4	17
B17									36
B18				5					28
B19	Distal fragment			4				2.9	31
B20				1					48
B21				2		1.6		15.2	28
B22				1					21
B23									28
B24				1					47
B25				4					31
B26				1					25
B27				7				1	43
B28									5
B29						0.4			32
B30									23
B31						0.3		0.7	12
B32								1.6	7
C1		1		12					54
C2									31

Table App K.2. Continued.

Unit Layer	Point Fragments	Bone Bead	Bone Tools	Rabdotus	Historic Artifacts	Burned Exudate (g)	Clay Artifact	Charcoal (g)	Bone
C3	Basal fragment of unknown style			6					47
C4				4					9
C5				3				27.2	17
C6						0.7		14.8	6
C7				1				5.4	6
C8				6				8.2	63
C9	Medial fragment	1		5				89.1	2
4A1									44
4A2	Distal fragment			6				2.3	22
4A3				21				11.3	120
4A4				11		0.5		20.8	44
4A5				1				8.3	17
4A6				6				22.2	2
4A7								8.6	9
4A8				3					28
4A9				9				23.8	20
4A10				2				45.3	14
4A11								8.3	15
4A12						0.1		17	8
4A13				2				48.9	22
AB37						2			37
AB38						1.7		16.6	15
AB39				3		4.2		26	23
AB40								13.4	16

Table App K.2. Continued.

Unit Layer	Point Fragments	Bone Bead	Bone Tools	Rabdotus	Historic Artifacts	Burned Exudate (g)	Clay Artifact	Charcoal (g)	Bone
AB41	Distal fragment							22.4	20
Feature 6				5		1.7		40.3	25
AB42				1		0.6		27.2	25
Feature 7								1.4	
Feature 8								3.4	
AB43				1				4	3
AB44								10.1	2
AB45				1				9.9	11
AB46								4.5	5
AB47						0.1		10.3	5
AB48								6.4	4
AB49								13	9
AB50						0.9		16.4	17
AB51								3.8	4
AB52						0.2		3.3	17
AB53						0.3		7.2	14
AB54								2.8	21
AB55				1				16.6	13
AB56								4.5	2
AB57						0.4		1.1	6
Totals	**14**	**3**	**1**	**427**	**1**	**22.5**	**2**	**938.9**	**2849**

APPENDIX L: KELLEY CAVE QUANTIFIED BURNED ROCK

In both Skiles Shelter and Kelley Cave, thermally altered rock recovered from each layer and feature was set aside for quantification, an ASWT protocol known as Rock Sort. Fire-cracked rock was pulled out from within the unit as well as from the 1/2 inch screen. All burned rock collected off the screen that was approximately one inch (ca. 3 cm) or greater in diameter was quantified. The >3 cm rock from each unit layer were then sorted on a sheet of plywood gridded into 7.5 cm squares to allow for effective sorting and quick photography with a scale. Rocks were sorted into three size classes: 0-7.5 cm, 7.5-15 cm, and 15 cm plus. These rocks were counted and weighed across each of these size classes to allow for comparability with previous data conducted by the ASWT in the LPC. During the last month of fieldwork at Kelley Cave, recovered burned rock was counted and weighed based on rock morphology, e.g., tabular, spall, pitted, irregular following the ASWT ENC 2014 procedure.

Table App L.1. Quantified burned rock from Unit A and AB.

		Count			Weight (kg)		
Strat Layer	**Unit Layer**	**Small (<7.5 cm)**	**Medium (7.5-15 cm)**	**Large (>15 cm)**	**Small (<7.5 cm)**	**Medium (7.5-15 cm)**	**Large (>15 cm)**
Trench	A01	0	0	0	0	0	0
Trench	A02	23	5	1	1.56	0.63	0.85
Trench	A03	5	2	0	0.12	0.9	0
Trench	A04	10	0	0	0.23	0	0
A	Feature 1	75	10	0	1.57	1.44	0
Trench	A06	23	4	0	0.64	0.82	0
Trench	A07	16	1	0	1.97	0.15	0
Trench	A08	7	1	0	0.21	0.15	0
Trench	A09	24	0	0	0.87	0	0
Trench	A10	45	17	2	4.1	4.4	1.56
Trench	A11	12	7	0	0.9	1.53	0
Trench	A12	23	5	0	0.66	1.07	0
B	A13	23	7	0	1.14	1.1	0
B	Feature 3	55	12	0	2.49	2.06	0
C	A14	36	2	0	0.84	0.28	0
C	A15	50	0	0	1.28	0	0
C	A16	42	12	0	1.29	2.14	0
C	A17	12	1	0	0.39	0.15	0
C	A18	86	8	13	3.28	1.79	7.2
D	A19	37	7	3	1.68	4.09	7.76
D	A20	49	17	1	2.01	4.12	1.58
D	A21	58	21	2	2.89	6.86	1.64
D	A22	51	19	2	2.16	6.11	2.92
D	A23	76	32	1	3.83	7.66	1.11
D	A24	56	5	0	1.98	0.98	0
D,DA	A25	55	14	3	1.85	4.24	3.38
D,DA	A26	66	4	6	1.53	0.76	3.62
F5	A27	57	5	8	3.24	1.53	3.99
F5	Feature 5	3	8	8	0.26	3.46	13.1
DB	A28	88	5	0	3.11	2.54	0
DC,DD	A29	62	7	0	2.87	2.19	0
DC,G	A30	102	6	1		0.93	1.82
G	A31	128	4	1	2.28	1.31	1.05
G, 2A	A32	102	12	1	3.15	2.88	0.53
G	A33	206	29	5	5.34	7.63	6
G	A34	142	5	1	2.8	7.06	1.25

Table App L.1. Continued.

		Count			Weight (kg)		
Strat Layer	Unit Layer	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)
G	A35	6	4	1	0.19	0.66	0.57
G	A36	19	7	1	0.79	0.99	0.27
F6	Feature 6	49	6	0	1.38	2.11	0
H	AB37	23	0	0	0.33	0	0
H	AB38	55	6	0	0.92	0.42	0
H	AB39	47	12	0	1.73	1.99	0
H	AB40	45	10	1	0.87	1.45	1.4
F7	Feature 7	0	5	1	0	1.26	1.26
H	AB41	29	0	0	0.54	0	0
F8	Feature 8	0	1	0	0	0.11	0
H	AB42	38	4	1	0.71	0.86	0.21
H	AB43	23	1	1	0.18	0.09	0.4
H	AB44	18	0	0	0.13	0	0
H	AB45	30	1	0	0.1	0.26	0
H	AB46	30	0	0	0.25	0	0
H	AB47	0	0	0	0	0	0
H	AB48	30	0	0	0.28	0	0
H	AB49	33	0	0	0.23	0	0
H	AB50	20	0	0	0.15	0	0
H	AB51	7	0	0	0.15	0	0
H	AB52	0	0	0	0	0	0
H	AB53	11	0	0	0.14	0	0
H	AB54	13	0	0	0.2	0	0
H	AB55	4	0	0	0.04	0	0
H	AB56	1	0	0	0	0	0
H	AB57	1	0	0	0	0	0

Table App L.2. Quantified burned rock from Unit B.

		Count			Weight (kg)		
Strat Layer	Unit Layer	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)
A	B01	39	4	0	1.44	0.49	0
A	B02	7	2	0	0.46	0.74	0
F2	Feature 2	3	3	0	0.2	0.56	0
A	B04	16	0	0	0.78	0	0
A	B06	7	0	0	0.52	0	0
A	B07	9	2	0	0.69	0.29	0
B	B11	21	15	0	1.02	2.89	0
B	B12	19	2	0	0.59	0.22	0
B	B13	40	2	0	0.87	0.49	0
B	B14	9	6	0	0.53	0.82	0
B	B15	18	11	1	0.86	2.25	1.25
B	Feature 3	258	34	0	9.41	6.4	0
C	B16	85	2	0	3.88	5.36	0
C	B17	94	16	0	5.18	10.01	0
C	B18	108	2	0	3.99	0.82	0
C	B19	130	19	0	5.75	3.62	0
C	B20	165	5	0	4.53	0.84	0
E, G	B21	110	10	0	3.41	2.18	0
E,G	B22	156	6	0	1.7	0.26	0
E,G	B23	87	9	2	2.17	2.5	2.52
E,G	B24	86	20	1	2.73	4.76	1.08
E,F,G	B25	6	5	2	0.2	1.92	2.52
E,F,G	B26	48	36	0	3.12	5.49	0
E,F,G	B27	92	19	2	4.48	4.25	1.73
E,F,G	B28	15	2	0	0.34	0.45	0
E,F,G	B29	118	18	2	2.84	4.2	1.5
E,G	B30	46	5	1	0.61	1.45	0.81
G	B31	54	11	3	0.6	2.81	4.36
G	B32	9	2	1	0.34	0.33	1

Table App L.3. Quantified burned rock from Unit C.

		Count			Weight (kg)		
Strat Layer	Unit Layer	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)
A	C1	107	5	3	2.88	0.52	1.36
A	C2	45	6	0	1.31	1.01	0
A	C4	28	6	0	0.69	2.02	0
B	C5	36	6	1	1.21	0.65	1.87
B	C6	29	2	0	0.56	0.42	0
B	C7	10	0	0	0.13	0	0
B	C8	53	8	0	2.63	1.36	0
B	C9	44	6	0	2.83	0.89	0

Table App L.4. Quantified burned rock from Unit 4A.

		Count			Weight (kg)		
Strat Layer	Unit Layer	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)	Small (<7.5 cm)	Medium (7.5-15 cm)	Large (>15 cm)
I	4A1	16	2	0	0.31	0.36	0
I	4A2	122	33	13	4.04	3.78	3.58
I,J	4A3	280	141	0	7.25	25.22	0
J	4A4	64	14	0	1.24	1.65	0
J.K	4A5	15	3	0	0.3	0.31	0
K,L	4A6	120	14	3	3.32	1.99	0.75
K,L	4A7	47	3	2	1.84	0.54	0.81
K,L	4A8	76	8	3	3.23	1.18	2.13
M	4A9	43	3	0	2.17	0.37	0
M	4A10	99	9	1	3.2	2.12	0.91
M	4A11	34	17	1	1.41	3.7	0.85
M	4A12	107	13	0	3.66	2.34	0
M	4A13	57	6	0	5.64	2.58	0

APPENDIX M: KELLEY CAVE 1/8TH INCH SCREEN SORT RESULTS

The 1/8th inch screen sort method consisted of sorting a measured volume of 0.5 L for debitage, fauna, seeds and other unburned organics, apex of rabdotus shells, and when identified, a shiny black substance which may be a burned plant carbohydrate (exudate). Samples were sorted by hand using a large flat tray and utensils to separate out the different classes (e.g. debitage, botanical, dung, burned exudate, leather, etc.). All material came from 0.5 liter samples except UL AB57 which was a 0.3 liters.

Table App M.1. Kelley Cave 1/8th inch screen sort results for all sampled Unit Layers. All material came from 0.5L samples except AB57 which was a 0.3L sample.

Strat.	Unit Layers	Description	Quantity	Weight (g)
A	B1	bone		14
A	B1	botanical		2.9
A	B1	burned exudate	7	0.3
A	B1	debitage	234	10.4
A	B1	dung pellet remnants		75.5
A	B1	rabdotus shell	37	1.5
A,AA,AB	Feat. 1	bone	109	5.5
A,AA,AB	Feat. 1	botanical		3.7
A,AA,AB	Feat. 1	burned exudate		0.1
A,AA,AB	Feat. 1	debitage	125	5.4
A,AA,AB	Feat. 1	dung pellet remnants		6.3
A,AA,AB	Feat. 1	rabdotus shell	31	1.1
A	B4	bone		5.1
A	B4	botanical		1.8
A	B4	burned exudate		0.4
A	B4	debitage	121	5.2
A	B4	dung pellet remnants		5.3
A	B4	possible ochre	1	<0.1
A	B4	rabdotus shell	37	1.5
A	B7	bone		5.3
A	B7	botanical		1.6
A	B7	burned exudate		0.5
A	B7	debitage	126	5.2
A	B7	dung pellet remnants		2.6
A	B7	rabdotus shell	24	0.7
A	B10	bone	113	4.1
A	B10	botanical		2.3
A	B10	burned exudate		0.1
A	B10	debitage	111	5
A	B10	dung pellet remnants		5
A	B10	possible ochre	2	<0.1
A	B10	rabdotus shell	29	1.4
B	B13	bone	81	3.9
B	B13	botanical		1.2
B	B13	burned exudate		0.4
B	B13	debitage	88	3.9
B	B13	dung pellet remnants		3.5
B	B13	rabdotus shell	6	0.3

Table App M.1. Continued.

Strat.	**Unit Layers**	**Description**	**Quantity**	**Weight (g)**
B	Feat. 3	bone		4.8
B	Feat. 3	botanical		0.5
B	Feat. 3	burned exudate		0.2
B	Feat. 3	debitage	196	8.4
B	Feat. 3	dung pellet remnants		0.5
B	Feat. 3	rabdotus shell	7	
B	Feat. 3	red ochre	1	>0.1
C	B16	bone	120	4.2
C	B16	botanical		1.5
C	B16	burned exudate		2.9
C	B16	debitage	50	2.4
C	B16	dung pellet remnants		2.7
C	B16	rabdotus shell	6	0.3
C	A16	bone	102	3.3
C	A16	botanical		0.5
C	A16	burned exudate		0.5
C	A16	debitage	105	4.6
C	A16	dung pellet remnants		0.5
C	A16	projectile point distal tip	1	
C	A16	rabdotus shell	1	
D	A19	bone	77	2.1
D	A19	botanical		0.8
D	A19	burned exudate		1
D	A19	debitage	57	2.1
D	A19	dung pellet remnants		0.2
D	A19	rabdotus shell	2	
D	A22	bone	168	5.2
D	A22	botanical		1.2
D	A22	burned exudate		
D	A22	debitage	77	2.9
D	A22	dung pellet remnants		2.3
D	A22	rabdotus shell	4	
D,DA	A25	bone		7.8
D,DA	A25	botanical		1.7
D,DA	A25	burned exudate	1	
D,DA	A25	debitage	90	3.3
D,DA	A25	dung pellet remnants		3.6
D,DA	A25	rabdotus shell	1	
DC,DD	A29	bone		9

Table App M.1. Continued.

Strat.	**Unit Layers**	**Description**	**Quantity**	**Weight (g)**
DC,DD	A29	botanical		1.1
DC,DD	A29	burned exudate		1.5
DC,DD	A29	debitage	134	6.4
DC,DD	A29	dung pellet remnants		0.6
DC,DD	A29	red ochre		>0.1
G	A31	bone	163	4.5
G	A31	botanical		0.9
G	A31	burned exudate	41	1
G	A31	debitage	51	1.8
G	A31	dung pellet remnants		0.1
G	A33	bone	135	4.1
G	A33	botanical		2
G	A33	burned exudate	56	1.3
G	A33	debitage	55	1.9
G	A33	dung pellet remnants	56	0.8
G	A33	rabdotus shell	5	0.2
G	A36	bone		5.9
G	A36	botanical		2.9
G	A36	burned exudate		1.9
G	A36	*Celtis sp*. (-*laevigata*, -*laevigata* var. *reticulata*, -*ehreubergiana*) seeds	48	
G	A36	*Colubrina texensis* leaf	1	
G	A36	debitage	81	3.2
G	A36	*Diospyros texana*, persimmon leaf	2	
G	A36	*Diospyros texana*, persimmon seeds	1	
G	A36	dung pellet remnants		2.5
G	A36	*Euphorbia Karwinskia* seeds	5	
G	A36	*Euphoriba Croton* seed	1	
G	A36	*Fabaceae* seed skin	1	
G	A36	Indeterminate seed fragments	2	
G	A36	*Juglans* microcarpa, shell fragments	3	
G	A36	*Optunia sp*. Seeds	76	
G	A36	*Poaceae* seeds	3	
G	A36	*Prosopis sp*. Leaf	1	
G	A36	*Prosopis sp*. Seeds	11	
G	A36	rabdotus shell	5	
G	A36	red ochre	3	0.3
G	A36	*Rhus virens*, Sumac, seed	1	
G	A36	*Ungnadia speciosa*, Mexican buckeye -skins	4	
G	A36	Unknown seed #1	1	

Table App M.1. Continued.

Strat.	Unit Layers	Description	Quantity	Weight (g)
G	A36	Unknown seed #2	1	
G	A36	unknown spatulate leaf	1	
G	A36	*Vitis sp.*	1	
H	AB38	bone	86	3.9
H	AB38	botanical		4.8
H	AB38	burned exudate	59	1.7
H	AB38	debitage	32	1
H	AB38	dung pellet remnants		1.5
H	AB38	possible ochre	4	0.1
H	AB38	rabdotus shell	6	0.2
H	AB40	bone	132	4.5
H	AB40	botanical		4.5
H	AB40	burned exudate		0.9
H	AB40	debitage	43	1.8
H	AB40	dung pellet remnants		3.1
H	AB40	heliodiscus shell	2	<0.1
H	AB40	rabdotus shell	1	<0.1
F6	Feat. 6	bone	72	3.3
F6	Feat. 6	botanical		0.7
F6	Feat. 6	burned exudate		1
F6	Feat. 6	debitage	24	1
F6	Feat. 6	dung pellet remnants		0.1
F6	Feat. 6	rabdotus shell	1	
F6	Feat. 6	red ochre	1	0.2
F6	Feat. 6	shaped mussel shell	1	
H	AB42	bone	96	3.5
H	AB42	botanical		2.8
H	AB42	burned exudate	35	1.3
H	AB42	debitage	30	1.4
H	AB42	dung pellet remnants		3
H	AB42	rabdotus shell	4	0.1
H	AB46	bone	69	2
H	AB46	botanical		1.6
H	AB46	burned exudate	11	0.2
H	AB46	debitage	22	1.1
H	AB46	dung pellet remnants	16	0.3
H	AB46	rabdotus shell	2	<0.1
H	AB48	bone	68	2
H	AB48	botanical		1.2

Table App M.1. Continued.

Strat.	**Unit Layers**	**Description**	**Quantity**	**Weight (g)**
H	AB48	burned exudate	11	0.3
H	AB48	debitage	19	1.1
H	AB48	dung pellet remnants	27	0.3
H	AB48	rabdotus shell	1	<0.1
H	AB50	bone	48	2.8
H	AB50	botanical		2.5
H	AB50	burned exudate	10	0.2
H	AB50	debitage	13	0.3
H	AB50	dung pellet remnants	55	0.6
H	AB50	Possible Ochre	3	0.1
H	AB50	rabdotus shell	1	<0.1
H	AB53	bone	76	2.1
H	AB53	botanical		1.5
H	AB53	burned exudate	1	<0.1
H	AB53	debitage	14	0.7
H	AB53	dung pellet remnants	11	0.1
H	AB53	Possible Ochre	1	<0.1
H	AB55	bone	71	2.3
H	AB55	botanical		1.8
H	AB55	burned exudate	5	0.1
H	AB55	debitage	6	0.3
H	AB55	dung pellet remnants	5	0.2
H	AB57	Bone	41	1.5
H	AB57	burned exudate	2	<0.1
H	AB57	debitage	4	0.2
H	AB57	dung pellet remnants	8	0.1
H	AB57	botanical		3.4
H	AB57	Possible Ochre	1	<0.1
I	4A1	bone	48	1.6
I	4A1	botanical		5.8
I	4A1	burned exudate	56	2.9
I	4A1	debitage	49	1.8
I	4A1	rabdotus shell	3	0.1
J	4A4	bone	140	4.4
J	4A4	botanical		2.5
J	4A4	burned exudate	10	0.2
J	4A4	debitage	88	3.7
J	4A4	possible ochre	1	<0.1g
J	4A4	rabdotus shell	7	0.3

Table App M.1. Continued.

Strat.	Unit Layers	Description	Quantity	Weight (g)
K,L	4A7	bone		5.5
K,L	4A7	botanical		1.7
K,L	4A7	burned exudate		0.2
K,L	4A7	debitage	83	3.4
K,L	4A7	leather	4	
K,L	4A7	rabdotus shell	3	
M	4A10	bone	76	2.5
M	4A10	botanical		5.3
M	4A10	burned exudate		>0.1
M	4A10	debitage	36	1.4
M	4A10	rabdotus shell	1	
M	4A13	bone	52	1.8
M	4A13	botanical		1.9
M	4A13	debitage	20	0.8
M	4A13	rabdotus shell	3	

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