# STORIES IN THE SAND: EXCAVATION AND ANALYSIS OF THE SAYLES ADOBE TERRACE (41VV2239) IN EAGLE NEST CANYON, LANGTRY, TEXAS

by

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## DEDICATION

To Bud, nothing I have accomplished would have been possible if you had not come into our lives. I wish you could see us all now.

## ACKNOWLEDGEMENTS

I first must thank the Skiles family for being such great stewards of the land and allowing us to work there – we quite literally could not do it without you all. Secondly, my many thanks to my committee chair, Dr. Stephen Black, for giving me a chance to be part of the Ancient Southwest Texas Project. Thank you for being so very patient with me during this process and for the endless support from ASWT. To the two other folks who took a chance on me, Charles Koenig and Amanda Castaneda. Your mentorship and friendship have helped me become a better archaeologist and person. I must also extend my deepest gratitude to Dr. Charles Frederick for allowing me to use his lab and bunkhouse to complete my analysis, and for mentoring me along the way.

My thanks to Spencer Lodge, Kelton Meyer, Justin Ayers, Stephanie Mueller, Emily McCuiston, Bryan Heisenger, Amelia Dall, Emily Teague, Chris Lintz, Adam Pagano, and so many other volunteers that were a wonderful and tireless field crew. My thanks to Ken Lawrence, Ken Brown, and Arlo McKee, who were tireless in their help editing and mentoring. To the other wonderful ASWT collaborators -- including but not limited to: Dr. Leslie Bush, Dr. Kevin Hanselka, and the SHUMLA team – who have continually held an interest in the project: Thank you, I hope the final product does not (completely) disappoint. My thanks also to the Council of Texas Archaeologists who helped fund some of the analysis through a research grant.

And finally (here comes the cheesy bit), I must thank my family who didn't even blink or doubt me when I told them I planned to become an archaeologist. I love you all.

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## LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| ASWT | Ancient Southwest Texas Project |
| BP | Borrow Pit |
| CCE | Calcium Carbonate Equivalent |
| CE | Compound Episode |
| CU | Cultural Unit |
| DU | Depositional Unit |
| E | Episode |
| F | Feature |
| FD | Flood Drape |
| ENC | Eagle Nest Canyon |
| LPC | Lower Pecos Canyonlands |
| MS | Magnetic Susceptibility |
| PE | Potential Episode |
| PS | Profile Section |
| SB | Sand Box |
| TOC | Total Organic Carbon |
| XRD | X-Ray Diffraction |

# I. SAYLES ADOBE (41VV2239)

Sayles Adobe (41VV2239) is a deeply stratified, multi-component alluvial terrace site located in Eagle Nest Canyon (ENC; also known as Mile Canyon) near Langtry, Texas. The site is perched above the canyon bottom, 260 meters upstream from the current bank of the Rio Grande and Eagle Nest Canyon confluence (Figure 1.1). The terrace sits below and less than 50 meters downstream from previously excavated rockshelter sites, Kelley Cave (41VV164) and Skiles Shelter (41VV0165), which are noted for their rock art panels and immense quantities of discarded burned rock.

Figure 1.1: Sayles Adobe, Kelley Cave, and Skiles Shelt as seen from the southwest rim of the canyon. Along with the extent of the Rio Grande floodplain in the background with an arrow pointing to the location fo Sayles Adobe.

This thesis focuses on understanding the natural and cultural formation of the site, detailing the chronology and intensity of flood events as climatic events that would have impacted human behavior at the site and in the canyon. The deep, stratified deposits and ten radiocarbon dates spanning the Late Paleoindian to Late Prehistoric periods suggest Sayles was occupied at times not documented in the archaeology of the two nearby shelters. Low velocity flood events in the canyon sealed and preserved Sayles Adobe deposits, often as low-density occupation surfaces. So, while the deposits offer relatively poor organic preservation, they represent a better opportunity for understanding the paleoenvironment and flood regime in the canyon than the rockshelters.

Flood event chronology can be used to correlate prehistoric behavioral patterns and subsistence techniques with climatic and environmental changes (Baker 2008; Patton & Dibble 1982). The topography and nature of rain-flood events in the Lower Pecos indicates a region prime for the study of terrace formation and preservation of anthropogenic surfaces (Gustavson and Collins 1998:81). These flood deposits in combination with the rich cultural record, open pathways of reconstructing paleoclimate and settlement patterns.

*Site Discovery and Initial Observations*

Skiles Shelter and Kelley Cave were excavated by the Ancient Southwest Texas project (ASWT) from 2013-2014. During backfilling of Skiles Shelter in June, 2014, the ASWT crew began to use alluvium from a terrace below the site after a summer flood impacted their original back dirt; it was here that burned rock and charcoal flecked matrix was discovered. In December 2015, a crew of five: Dr. Steve Black, Dr. Charles Frederick, Charles Koenig, Amanda Castaneda, and I, carried out a three-day reconnaissance of the alluvial terrace and the 2014 borrow pit. Surface survey and removal of vegetation revealed scattered fire-cracked rock eroding from the slopes at several locations across the terrace. Frederick and I cleaned and squared off two exposed faces of the borrow pit to examine the stratigraphy of the massive alluvial deposit above the burned rock seen in 2014.

During this task, I discovered a compact layer of very fine silt, directly above carbon-stained matrix and several burned rocks (Figure 1.2). Frederick recognized the layer as a “mud drape,” a thin layer of fine silt and clay that is deposited by slow-moving floods. These characteristically upward-fining silt and clay deposits are notable indicators of slow-moving, slack-water flood events (Kochel and Baker 1982; Patton and Dibble 1982:102). The extent of the mud drape above the burned rock was established within the bounds of the 2014 pit which, after documenting the profiles and mud drape, was partially backfilled to preserve the integrity of the exposure until January 2016, when excavations would begin.

Figure 1.2: Reconnaissance for the extent and completeness of the flood drape. Close up of the flood drape interfaces with burned rock and grey, charcoal-flecked matrix.

Today floodplain terrace sites are known to be great settings for the preservation of anthropogenic activity and environmental data (Ferring 1986; Schiffer 1983; Waters 1998). The role of site formation processes in understanding archaeological deposits has greatly increased the amount of information gleaned from ephemeral sites that may represent short stays on a single occupation surface (Frederick 2009:4). Frederick posits the interpretive value in considering factors like time averaging, where site deposits may undergo gradation, overprinting, or in obrution[1] events where deposits retain clear stratigraphic breaks and preserved surfaces due to a quick, sudden burial. With this in mind, a geoarchaeologically focused excavation and analysis was undertaken; with a goal of identifying flood events and discrete, otherwise missed (or unidentified) periods of human activity.

Beginning in January 2016, I directed excavations at Sayles Adobe with ASWT staff and volunteers which included ground-penetrating radar, auger testing, two major excavation units (~3x3 m), and small test unit. My approach was designed to produce a detailed understanding of profile stratigraphy that can be correlated across the terrace. The analysis of the deeply stratified flood and cultural deposits seen at Sayles Adobe, provide a large, high resolution dataset that are used to correlate natural processes and cultural behavior (i.e., site use) with nearby sites.

## RESEARCH FRAMEWORK

A contextual framework, as defined by Waters (1998:6)[2], was followed when planning the excavation and analysis of the Sayles Adobe deposits. This contextual approach calls for a combined specialized approach including archaeology, geology, zooarchaeology, archaeobotany, and other forms of analysis to reconstruct and understand the prehistoric uses of Sayles Adobe.

There were three stages of work for this thesis: 1) testing; 2) excavation and sampling; and 3) laboratory analysis. Field data collection (testing and excavation stages)

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[1] Frederick (Carpenter et.al.2013: 116-119) defines an obrution event as, "…burial of a surface by a single sudden depositional event…". This term originally hails from a paleontological deposit in reference to fossil assemblages that have exceptional preservation due to their rapid burial.

[2] *Contextual archaeology is a systems approach in which the contextual components of the human ecosystem (flora, fauna, climate, landscape, and human culture) reconstructed and the interactions between them are used to explain the cultural stability and change. (Waters 1998: 4)*

took place in multi-week work sessions over several periods: December 2015-June 2016, December 2016, and March 2017. Lab analysis beginning in September of 2016 was accomplished in multiple sessions at Dr. Frederick's Geoarchaeology Lab and at the Texas State University Upper Pecos Lab.

The analysis phase centered on chemical and physical analyses of sediments to understand the periodicity and intensity of flood events that resulted in the formation of the terrace. Other archaeological materials collected were also analyzed during this phase to contribute to the anthropogenic aspects of the site.

Specific focus on the stratigraphy of the terrace will help in the evaluation and modeling periods of prehistoric environmental stability and change. Establishing stratigraphic and cultural sequences at Sayles Adobe allowing the correlation of flood events and human behaviors within the canyon; these combined datasets were aimed towards answering my four main research questions:

1) What is the nature and timing of flood events that formed the terrace?
2) What can the Sayles Adobe terrace deposits tell us about the climatic and environmental conditions at the time the site formed?
3) Do the alluvial deposits at Sayles Adobe correlate to other flood deposits seen in sites in the canyon and/or the region?
4) How do site use behaviors seen at Sayles Adobe relate to other sites in the canyon?

## SETTING: LOWER PECOS CANYONLANDS AND EAGLE NEST CANYON

Archaeological research in the Lower Pecos region has focused on the sheltered sites because of their excellent preservation and rock art panels (Bement 1989; Black 2013; Collins 1969: 1). Prior to the Sayles Adobe investigations only three alluvial terrace sites had been excavated in the region: Arenosa Shelter, Devils Mouth site, and Nopal Terrace, each of which was investigated in the 1960s during the Amistad Reservoir Salvage Project (Black 2008; Dibble 1967; Johnson 1961). Sayles Adobe is the first terrace site to be excavated in the region in nearly 60 years, and only the second terrace site excavated with a geoarchaeological focus (the other being Arenosa Shelter).

### *E.B. Sayles 1932 Expedition*

Research in Eagle Nest Canyon began eighty-five years ago with E.B. Sayles who was tasked by the Gila Pueblo Archaeological Foundation to identify and define the cultures of Texas to determine relations between them and those in the adjacent regions (Sayles 1935: iii). This led Sayles to the Lower Pecos region, known to locals as a rich historic and prehistoric area, with rock art panels and dry rockshelters that preserved delicate, organic artifacts. Along with a young J. Charles Kelley, Sayles focused on documenting deposits and rock art in what are now known as Eagle Cave (41VV167) and Kelley Cave (41VV164). It is from field notes by Sayles and Kelley of their work in Kelley Cave, that the earliest descriptions of flood deposits and discussion over the potential for paleoflood reconstruction in Eagle Nest Canyon was documented (Sayles 1935).

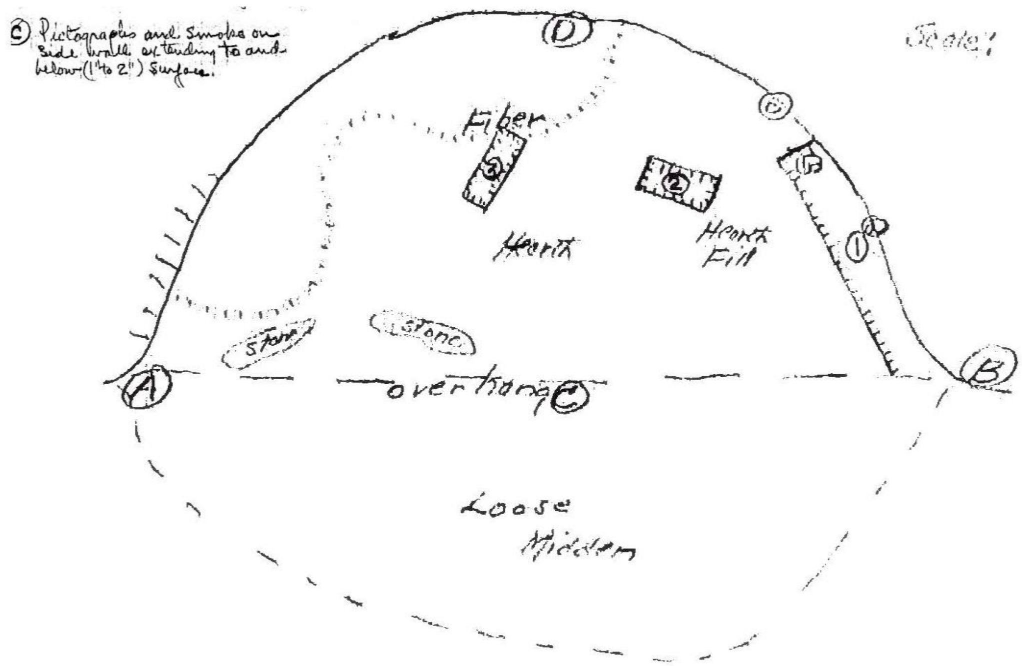



Figure 1.3: Sketched plan map by E.B.Sayles (1935) of the Kelley Cave excavations.
Courtesy of TARL.

Sayles and Kelley excavated in three areas within Kelley Cave (Figure 1.3), from which all "adobe" deposits (Sayles 1935) were described at multiple levels. These deposits are frequently noted as "sterile clay" that capped, fiber and/or ash deposits, which were associated with cultural materials. These early stratigraphic descriptions of the deposits indicated that large floods had taken place in the canyon, sealing and impacting deposits at various times throughout prehistory.

Inhabitants of nearby Langtry told Sayles that many floods had occurred since the town was established in 1882, but no heights had been documented. Sayles speculated that flood deposits seen in Kelley Cave were due to the narrowing of the mouth of Eagle Nest Canyon (Figure 1.4), and from the formation of a water dam by the Rio Grande, flood waters would back up into the shelters. Sayles attributed the "adobe" deposits in Kelley Cave to these back-flood events, that would have impacted the use of the site.

Noted on Sayles's map (Figure 1.4) is a terrace formation labelled as "sandy adobe". He did not, however, explain what he meant by the notation. Today, this location is recognized as the site of Sayles Adobe, its name pays homage to E.B. Sayles pioneering work and his curious notation on his sketch map. Archaeologist Elton Prewitt recalls visiting Kelley Cave and Skiles Shelter (Figure 1.5) in the early 1960s with no mention of a site at Sayles's location.

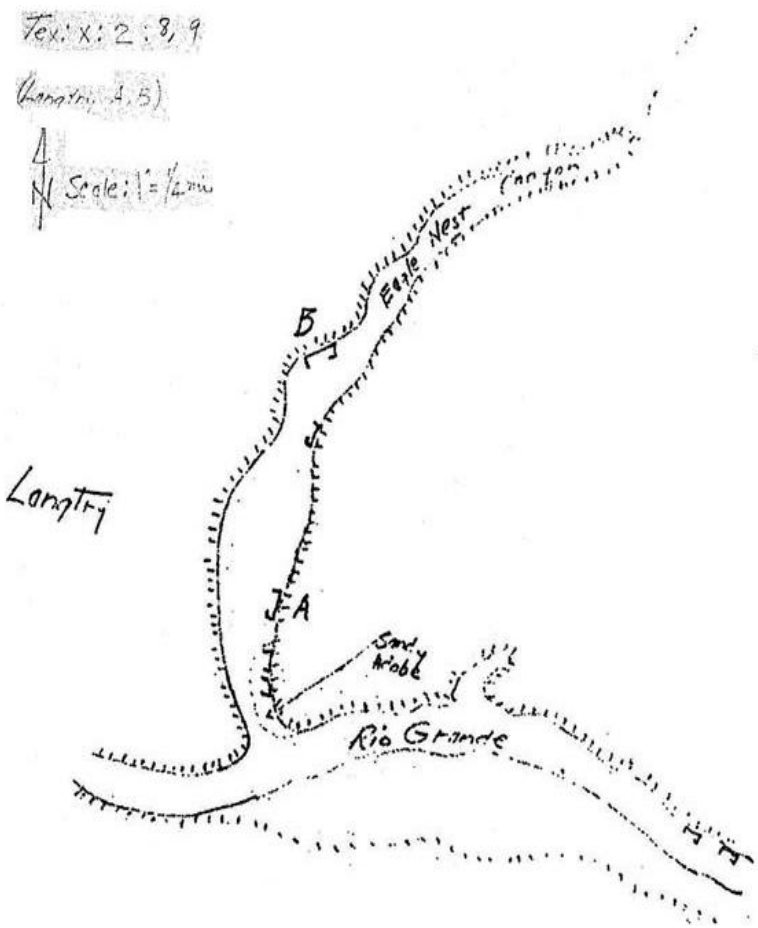



Figure 1.4: Sketch of Eagle Nest Canyon from E.B. Sayles 1932 expedition, where he notes site locations. Site "B" is now Eagle Cave, and Site "A" is what is now Kelley Cave. The area Sayles denoted as "sandy adobe" is now identified as the Sayles Adobe site. Courtesy of TARL.

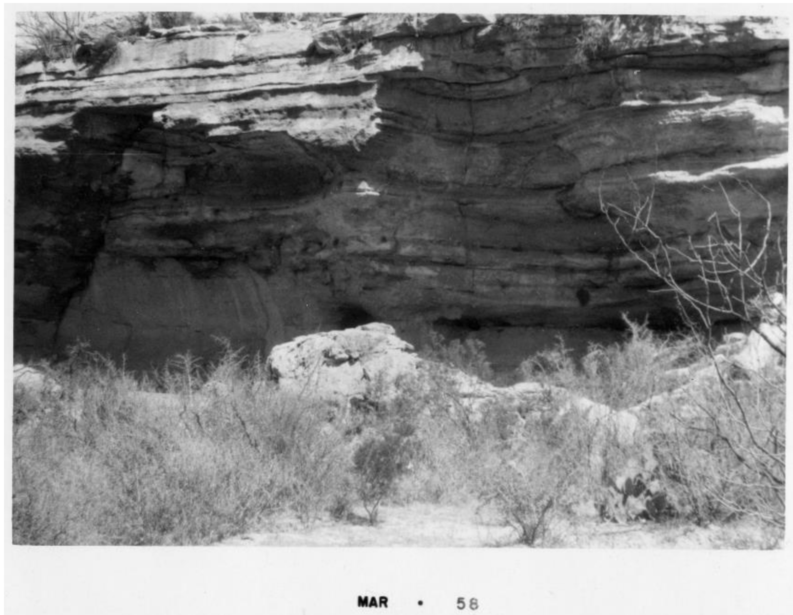



Figure 1.5: Photo taken by Graham and Davis (1958), looking north into Skiles Shelter, and standing (presumably) on the Sayles Adobe terrace. Note the lower density of vegetation than is present today.

*2013-2017: Ancient Southwest Texas Project in ENC*

Archaeologists from several institutions were drawn to Eagle Nest Canyon from the 1930s to the 1980s because of the rock art and notable cultural deposits and preservation in the shelters (Bement 1986; Davenport 1938; Ross 1965; Rodriguez 2015). In 2013, the Ancient Southwest Texas (ASWT) Project of Texas State University began work in the canyon focusing on documenting and preserving the archaeological record by taking an interdisciplinary data collection approach and archiving samples of the excavated archaeological record for ongoing and future research.

With this goal of preserving the data for the future, the project adopted a photogrammetry technique, Structure from Motion (SfM), for recording and modeling excavations (see Koenig et al. 2017). This approach allowed the project to capture excavation exposures and contexts digitally that are available to analyze in GIS and other platforms. Site by site a massive collection of digital data was built that can now be curated and analyzed well after the project has concluded. To accompany the digital data, the material collections from ASWT excavations — sediment samples, artifacts, C14 samples, and much more— are being curated at the Center for Archaeological Studies at Texas State University.

Of the six rockshelter sites within Eagle Nest Canyon (Figure 1.6), ASWT has conducted excavations at five, with completed master's theses detailing excavations at Kelley Cave (41VV164) and Skiles Shelter (Rodriguez 2015), as well as Eagle Cave (Nielsen 2017). Rodriguez's and Nielsen's projects have focused on site use and microstratigraphic deposits from ENC rockshelters. A 2015 field school and later excavations at Horse Trail Shelter (41VV166), although not yet reported, are also particularly relevant to the interpretation of Sayles Adobe due to the flood deposits preserved there.

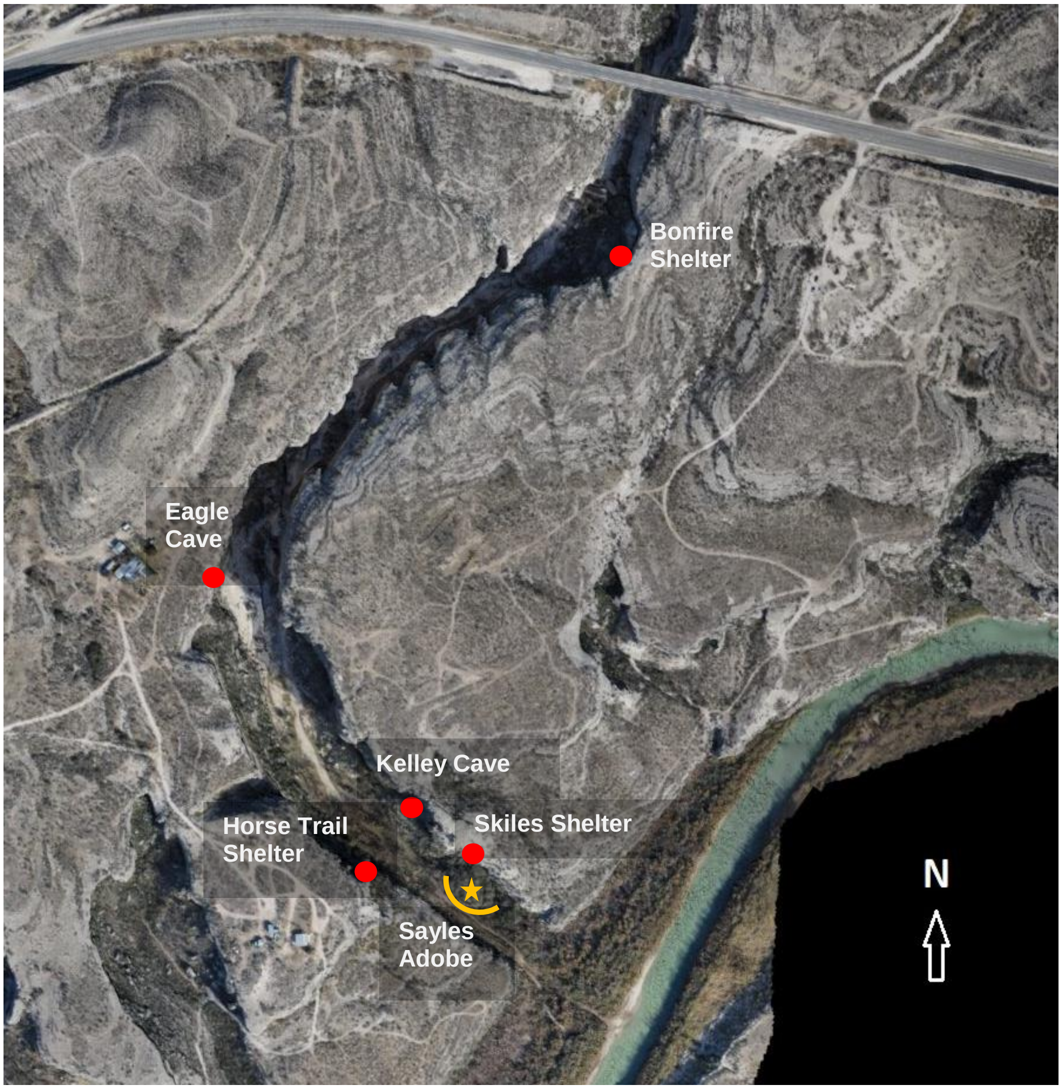


Figure 1.6: Aerial photo annotated to show the locations of the sites ASWT has worked in.

The investigations at each of these sites were critical in the early stages of research design for the excavation of Sayles Adobe, aiding in the logistics of sampling, documentation, and analysis. They also served as referential sources on paleofloods that helped in the identification and description of the flood deposits, depositional, and post-depositional characteristics seen at Sayles Adobe. My research has benefitted greatly from the current frameworks of contextual, high-resolution geoarchaeology that is a focus of the Ancient Southwest Texas collaborators.

*Kelley Cave (41VV164) & Skiles Shelter (41VV165)*

First excavated in May 1932 by E.B. Sayles and J. Charles Kelley, Kelley Cave (41VV164) sits 300-meters from current bank of the Rio Grande (Figure 1.7). A faded Lower Pecos style pictograph panel is present along the rockshelter's southern wall, and multiple bedrock grinding features and grinding slabs were documented around and on the surface of the shelter (Castaneda 2015; Rodriguez 2015). Kelley Cave bespeaks extensive use by humans, characterized by a massive burned rock talus, perishable and non-perishable artifacts, and numerous thermal features that have dated from 11,500 to 600 cal. BP (LPC Guidebook 2017: 61).

Figure 1.7: Kelley Cave (left) and Skiles Shelter (right) as seen from the south canyon edge of ENC. The arrow points to the location of Sayles Adobe. This photo was taken in 2014, showing the proximity of Sayles Adobe to the shelters and the meander of the Rio Grande, which can be seen in the background.

Immediately adjacent to Kelley Cave is Skiles Shelter (Figure 1.7) a south-facing shelter that sits 30-meters northwest of the Sayles Adobe terrace and has two alcoves separated by a large tufa mound (Rodriguez 2015). Numerous bedrock features, Pecos River style pictographs, polished surfaces, and surface artifacts have attracted the attention of researchers. The site is sectioned by a tufa mound, which has been worn slick and has multiple bedrock mortar and deep, long striations from use (Castaneda 2015; Gershtein et al. 2017). One of the more dramatic and obvious features of Skiles Shelter is the massive fire-cracked rock (FCR) talus (commonly termed a burned rock midden) that spills down the slope in front of this site.

Site elevation and flood height are key when trying to understand the frequency of deposition, particularly when looking at elevation differences like that between Kelley and Skiles (Figure 1.8). The floor of Kelley Cave slopes, with a 5-meter difference in elevation at points, making parts of the shelter more susceptible to flooding during very high magnitude floods. These larger, rarer flood events are evidenced in the stratigraphy of the site, noted as "adobe" deposits in Sayles 1935 trench descriptions, and as "mud-drape" deposits by Rodriguez (2015). During Rodriguez's 2013 excavations, a 3-cm thick mud drape layer was encountered just beneath the surface in the central part of Kelley Cave, a top a thick lens of unburned fiber, from which radiocarbon dates above and below dated the flood event to ca.AD 1340 (Black and Rodriguez 2015; LPC Guidebook 2017: 63).

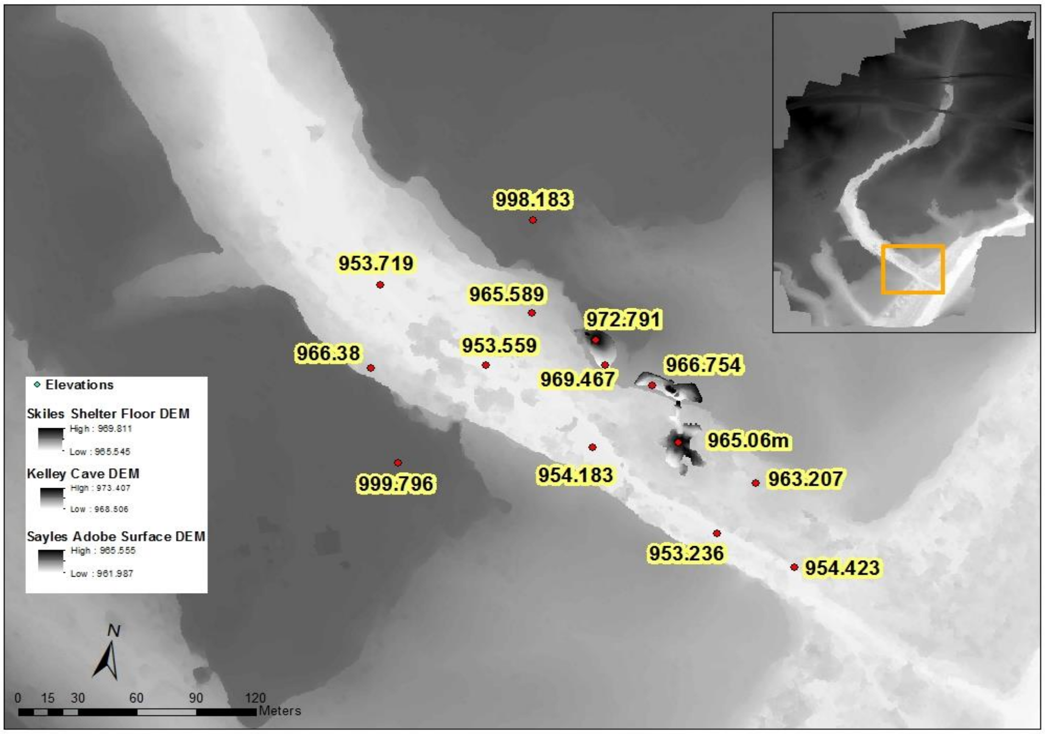



Figure 1.8: Digital Elevation Model (DEM) of ENC and surface DEMs of Skiles, Kelley, and Sayles.

This dated mud drape is correlated with a thicker, but likely contemporaneous deposit found in the adjacent Skiles Shelter (Figure 1.9). Unlike Kelley, Skiles is associated with a (presently) inactive spring-vent that sits along the back wall of the shelter behind the tufa mound that separates the two sections of the site. This spring vent, along with more frequent flooding at the site and extensive earth oven activities, contribute to the disturbed stratigraphy seen in the Skiles profiles. Intensive earth oven activity at the site has worked to churn up and disrupt the deposits and features, whereas the preserved stratigraphy of Sayles Adobe provides a finer look at the flood sequence and periods of use unseen at Skiles Shelter or Kelley Cave.

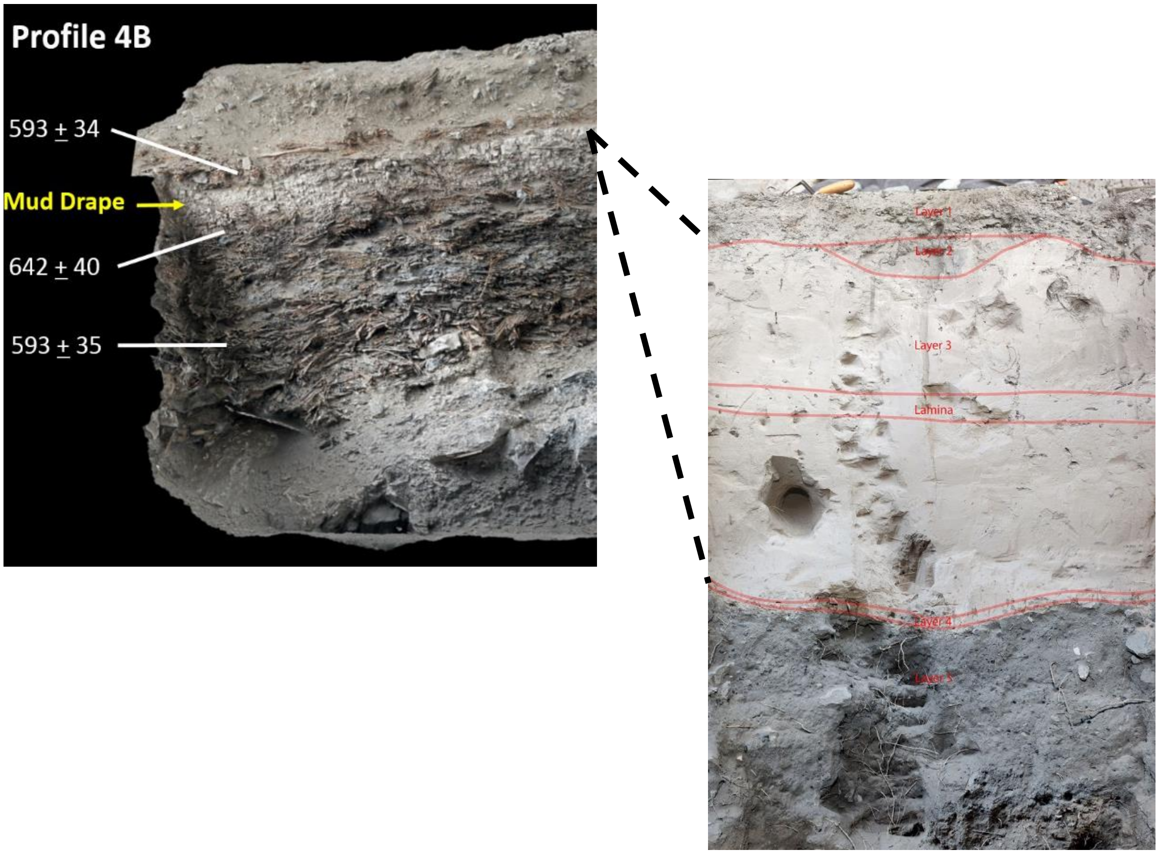



Figure 1.9: (Right) Excavated profile from Skiles Shelter (Rodiguez 2015: Figure 4.13), with clearly identifiable mud drape deposit. (Left) Kelley Cave profile, showing the same mud drape from Skiles Shelter (Rodriguez and Black 2017: Figure Kelley 7).

Together Kelley, Skiles, and Sayles present a unique situation in the canyon where we can see the natural and human history of the canyon in a new way. All three sites are within 30 to 50 meters of each other; and, due to the differences in elevation and orientation of the sites, each provides a piece of the ENC puzzle.

*Horse Trail Shelter (41VV166)*

Horse Trail Shelter (41VV166), is a long shelter with a shallow overhang that sits along the western canyon wall of Eagle Nest Canyon, serving as a trail leading down the canyon since historic times (LPC Guidebook 2017: 67). Multiple bedrock grinding features and a small burned rock midden indicate the area was used in prehistoric times. However, the lack of rock art and significant anthropogenic deposits seen in the other shelters resulted in the site being left unexcavated until it was tested by ASWT in 2014. The 2014 testing consisted of multiple shovel tests to identify the extent of deposits and pinpoint locations for future work. The shovel tests and several small test units (Figure 1.10) revealed that AD 1340 flood deposits previously identified in Skiles Shelter and Kelley Cave were also present at Horse Trail.

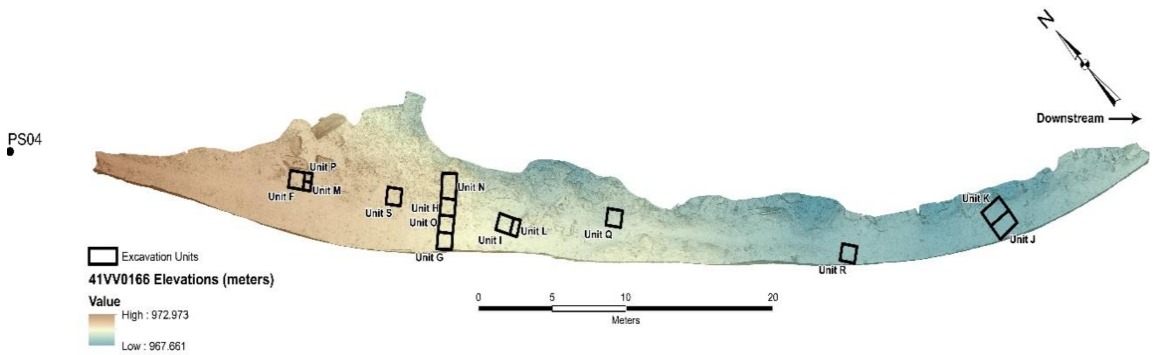



Figure 1.10: Horse Trail Shelter site map created from a SfM model of the site, which shows the location of excavations.

In 2015, a Texas State University archaeological field school was held at Horse Trail Shelter to follow up the 2014 testing. The students excavated several units in what had been identified as “activity” areas, resulting in the excavation of multiple earth oven feature areas. Excavations and geoarchaeological analyses at Horse Trail Shelter documented high-magnitude, high-volume flood events that deposited fine-grained flood sediments, like those seen in other sites.

The deepest unit was over 2-meters below surface (Figure 1.11a), with at least 20 individual flood deposits identified. Documented as Profile Section 3 (PS03), this stratified sequence of Rio Grande alluvium is dated with a single-grain OSL date to around 22,000 years old. A second OSL date was recovered from PS04 (Figure 1.11b) deposits that leads ASWT geoarchaeologists to believe these are remnant wedges of flood alluvium that have been eroded with new deposits laid down over time.

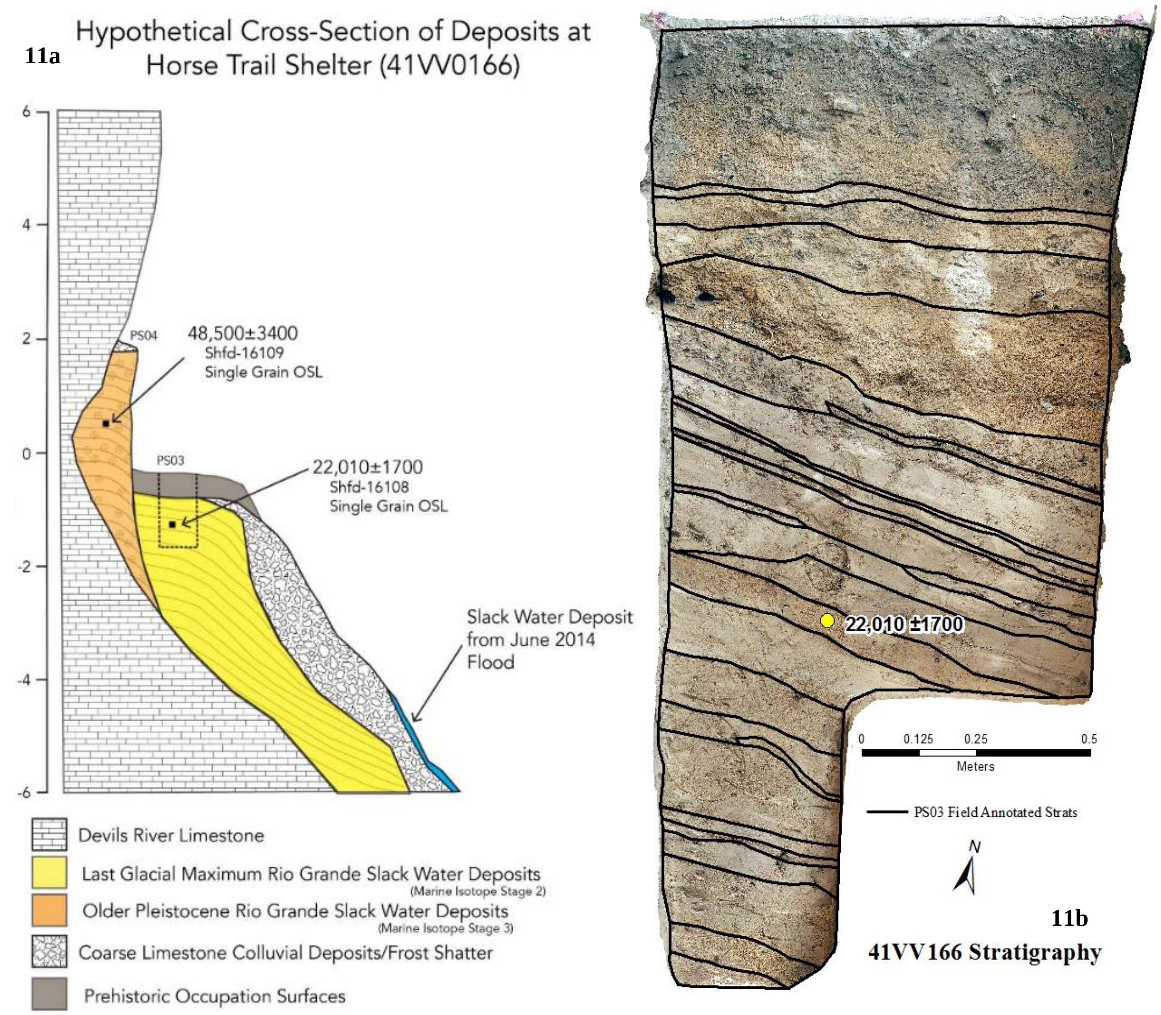



Figure 1.11: (Left: 1.11a) Hypothetical cross-section of Horse Trail shelter (not to scale) with the annotated locations of profile sections, dates, and notable deposits. (Right: 1.11b) Profile Section 3 (PS03) was the deepest profile excavated in Horse Trail. A single OSL age from near the center of the profile, plotted with the yellow circle. Annotated stratigraphy of the flood deposits completed by ASWT geoarchaeologists. From the LPC Academy Guidebook 2017.

### *Flooding in the Canyon*

> *The canyon bottom has been completely transformed. There are massive gravel bars and dunes extending downstream from Eagle Cave, and they have covered the previous floor of the canyon with several meters of gravel. The old water pump the Skiles family installed in the bottom of the canyon in the 1950s is either covered up by gravel or washed down into the Rio Grande.* (Koenig and Black 2014 ASWT Blog; Figure 1.12)

Figure 1.12 (Left) ENC and Eagle Cave in 1932, note lack of vegetation and exposed bedrock. Courtesy of TARL. (Right) ENC and Eagle Cave pre-flood 2014; note the increased vegetation and sediment deposits.

The 1982 Val Verde County Soil Survey reports an annual rainfall variation from 37.75-inches in 1914 to 4.34-inches in 1956, with the highest average rainfall in a day of 13.71-inches in 1935. Patterson (1963: B-140), reports historic peak flood stage discharge records of the Rio Grande at Langtry from 1900-1960 (Table 1.1). With the lowest peak discharge reported in June 1924 at 5,000-cubic feet per second (cfs) and the highest reported in June 1922 at 204,000cfs. *Texas Greatest Rainstorms*: *1891-1938* from the Texas Almanac (1939: 121), reported an exceptional storm that moved in from Mexico into Texas from the Big Bend region across Texas east-northeast from August 29 to September 7, 1932. While the storm was north of Val Verde County, the rainfall affected the headwaters of the Devil’s and Pecos rivers, as well as the Rio Grande, taking 11 lives and causing $2,500,000 in damages.

Table 1.1: Highest discharges recorded from Rio Grande at Langtry, TX station. Adapted from Patterson 1963: B-140; only annual peak discharges reported.

| Water Year | Date | Gage Height (feet) | Discharge (cfa) |
|---|---|---|---|
| 1904 | September 13, 1904 | -- | 138,000 |
| 1919 | September 16, 1919 | 46.9 | 152,000 |
| 1922 | June 18, 1922 | 56.9 | 204,000 |
| 1935 | September 4, 1935 | 46.70 | 149,000 |
| 1954 | June 27, 1954 | 49.87 | 169,000 |

Perhaps the most memorable flood in the region and Eagle Nest Canyon occurred on June 27, 1954 as Hurricane Alice stalled in the Gulf of Mexico, which created floodwaters across all three major rivers in the region (Dibble and Patton 1982: 97; Patton 1977: 122). This resulted in a massive amount of rain travelling down the Rio Grande, and backing up in the canyon, with ENC landowners Jack and Wilmuth Skiles recalling floodwaters that covered both Skiles Shelter and Kelley Cave.

More recently, two summer floods (2010 and 2014) have come through the canyon and were witnessed by ASWT crews (Figure 1.13). The June 20$^{th}$, 2010 flood, a product of Hurricane Alex and Tropical Depression Two (a secondary storm), is the largest flood since 1954. Flood waters briefly flowed above Sayles Adobe and into Skiles Shelter; however, there is little visible evidence around Sayles that there was any major deposition at the sites. In both events, crewmembers were able to watch the canyon fill as high-velocity run-off from the canyon uplands flowed down into the canyon then in the afternoon when low-velocity water from the Rio Grande flooded up into the canyon. Prior to the construction of the Amistad Dam, hydrologic damming would have occurred naturally at the mouth of the canyon.

Figure 1.13: Photo highlighting the height of floodwater during the morning of the 2014 flood event. Note Kelley Cave on the far left, with the arrow pointing to Sayles Adobe.

## THESIS OVERVIEW

It is a goal of this thesis to document in detail the natural and cultural processes at work at Sayles Adobe and compare site use between the rockshelters and open sites in Eagle Nest Canyon. To accomplish this, I considered the many processes that have created and impacted the deposits throughout the site's formation. Remaining chapters cover the following: Chapter 2 focuses on the geomorphology, hydrology, and relevant archaeology. Field methods and laboratory analyses are discussed in Chapters 3and 4. Chapter 5 describes the geoarchaeological sampling and analyses. Chapter 6 presents the geoarchaeological dataset with the delineation of depositional and cultural units, and the use of the R statistical package to create an Age-Depth model for the site. The interpretation of the combined geoarchaeological data and material archaeological assemblages – features, lithic, faunal, and botanical are discussed in Chapter 7. Chapter 8 is the conclusion of this thesisand presents the final interpretations of the site formation processes, material culture, and site use. Additionally, this chapter will relate Sayles Adobe to shelter sites within ENC and Texas, closing with a discussion of the relevance of the contextual approach of geoarchaeology and further work that could be done with the collected data.

Raw datasets and analyses are presented in the appendices that follow the main body of this text. Appendix A consists of the field forms used to record data and notes during excavation. Appendix B contains the data from auger testing and GPR conducted across the site, which was used to create stratigraphic windows (at depths from ~.5-meter to 2.81-meters) across the site. Appendix C includes the illustrated and described profile sections for the site. Appendix D provides the geoarchaeological datasets that support the discussions of Chapters 6, 7, and 8. Appendices E, F, G and H, respectively, present material assemblage data: macrobotanical, macro faunal, malacological, and a general site inventory.

# II. GEOMORPHOLOGY AND ARCHAEOLOGY

The Lower Pecos Canyonlands (LPC) is a semi-arid region of southwest Texas where the confluence of different geologic, ecologic, and climatic zones creates a unique landscape. Archaeologically, the region is best known for its dry rockshelters (Figure 2.1) housing rock art and perishable artifacts reflecting an unbroken record of over 10,000 years of hunter-gatherer occupation (Turpin 2004). The region's arid climate fluctuates between prolonged drought and occasional intense floods; the region has been climatically variable and sensitive to the drought-flood cycles throughout the Holocene and Pleistocene (Brown 1991; COHMAP 1988; Ely 1992; Ely et.al. 1993).

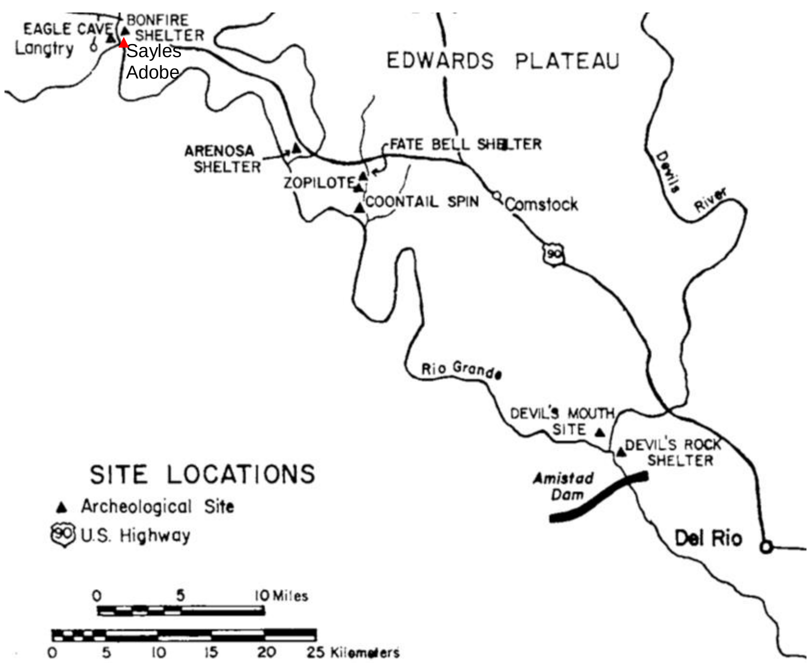



Figure 2.1: Map showing the locales of LPC sites, adapted from Patton and Dibble (1982: 100)

The physiography and geology of the region in combination with the high relief of the limestone canyon plateaus, poorly developed soils, sparse vegetation, and intense storm frequencies, result in high flood discharges along drainages (Patton 1977; Patton and Dibble 1982). These flood waters can often carry suspended loads that are deposited in tributary mouths and up tributary canyons in back flooding events (Kochel 2008; Waters 1998). Understanding these cycles and their impact on cultural and natural site formation processes is essential to understanding the mobility of prehistoric foraging societies that inhabited the Canyonlands.

## ALLUVIAL DEPOSITION AND TERRACE FORMATION

Natural terraces are stratified deposits of sediment along the pathway of a river or drainage, often defined as alluvial or floodplain features. Vandenberghe (2014: 3) and Waters (1998: 149) have defined two major categories of terrace structures: erosional terraces and fill terraces, both dependent on the nature of the river or floodplain that they form in. Erosional terraces form in the creation, or abandonment of a floodplain, with unconsolidated sediments that have been deposited from receding waters. Fill terraces form as sediment accumulates settling as stacked deposits of bedded sediment resulting from standing water—like those seen after flood events. Terraces that form along the pathways of rivers or streams can be good indicators of climatic change: relics of where, when, and what water once carried.

Fluvial geomorphology is essential in the study of terrace formations; this includes studying the mechanics of sediment transport, the mechanics of water flow, and the forms of the channels (Richards 1987). Understanding hydrological processes that result in these formations aids in the interpretation and in distinguishing cultural and natural features; particle size, carbon content, and sediment structure are all key factors in this analysis. These depositional indicators can be used to model the intensity and duration of a flood event (Vandenberghe 2014; Waters 1998), as well as help identify the post-depositional processes.

Victor Baker, R. Craig Kochel, and Peter C. Patton, the first team to do intensive studies into the nature of formation and preservation of flood deposits in the region, pioneered Paleoflood hydrology and geomorphology in the Lower Pecos region. There are four characteristics of bedrock canyons, which favor terrace formation, as Kochel and Baker (1982: 354-355) have explained:

1) Drainage morphology should have low stream density, low channel gradient.

2) Meanders in the bedrock of the canyon protect deposits and promote accumulation of sediment along the walls, shallow caves, or on the downstream sides of protrusions and talus blocks.

3) River-canyon junction angles that permit easy access to reverse surges without excessive velocity, allowing for back flooding into the canyon.

4) Minimal vegetative cover on the deposits, to limit bioturbation of the stratigraphy; vegetative cover is also useful in characterizing the stability of the terrace.

The nature of rainfall in the Lower Pecos Canyonlands meets many of these characteristics; it is this combination, rainfall and topography, that make the LPC a prime region for studying rainfall-runoff regimes and the nature of sedimentation within the canyons (Patton 1977). Remnant terraces that form within the narrow, deep bedrock canyons region are particularly good for studying slack-water deposits (Patton and Dibble 1982). Sediment accumulates along canyon walls during massive flood events, creating terraces, which are not likely to be disturbed by lesser flood events (Kochel and Baker 1982: 353-354).

Terrace deposits characteristic of tributary canyons in the region are commonly formed through slack-water and back flooding during intense, slow-moving flood events (Baker et al. 1979:4; Kochel and Baker 1982: 354). Slack-water deposits accumulate during a flood event where water has backed-up into the tributary canyons, floodplains, and shelters. These deposits typically present as well stratified horizontally bedded silts, sands, and clays depending on the origins of the sediment (Baker et al. 1979; Dibble 1967). Organic material is also often found bedded within terrace structures, typically as the capping of a flood unit. This can vary from seeds, leaves, and twigs to logs and branches, and can also result in the formation of soils within terraces (Waters 1998). These organic layers are often the most reliable for radiocarbon dating. The buried soils or other organics can sometimes be dated and provide minimum time intervals between deposition periods of when the soil formed and flood deposition events (Kochel and Baker 1982).

The mouths of tributary canyons are common sites of accumulation and preservation, this is especially true in western parts of Texas because tributary drainages peak rapidly during floods and fill bedrock channels before the mainstream floods (Patton 1977). Back flooding (Figure 2.2) occurs as waters from the main river resurge up the canyons, sediment-rich and at a lower velocity than a flash-flood event, depositing thick beds of sediment that would not be seen in erosional terraces (Vandenberghe 2014).

Figure 2.2: 2014 flood waters in ENC. (Left) Water flowing down canyon at 9am. (Right) Back flooding from the Rio Grande later the same day, 2:30pm.

## TERRACE EXACAVATIONS IN THE LOWER PECOS CANYONLANDS

The Rio Grande, Pecos, and Devils rivers (along with their tributaries and run-off zones) have created deep, high-walled canyons and arroyos that are excellent for studying the sedimentation of flood events (Baker et al. 1979; Kochel and Baker 1982). It is known that open terrace deposits typically do not preserve most organic materials; however, some open terraces have sealed cultural deposits between sterile flood deposits that can provide stratigraphic detail unseen in rockshelters (Bement et al. 1989; Gustavson and Collins 1998). This is evident in work done at sites such as Arenosa Shelter along the Pecos River, Devil's Mouth site at the confluence of the Devils and Rio Grande, and Nopal Terrace not far and upstream from Devils Mouth on the Rio Grande.

From 1958-1967 the Amistad Archeological Salvage Project took place, aimed towards the documentation of sites before they were inundated after completion of the dam. Much of the fieldwork was carried out by archaeologists of the Texas Archeological Salvage Project of the University of Texas at Austin; hundreds of sites were recorded during the project, but few were thoroughly excavated. Most excavations were focused towards the definition of cultural sequences based upon stone tools (Black 2013; Collins 1969). This was a product of the times, an era of archaeology concerned with the recovery of artifacts and the development of cultural chronologies dependent on tool technologies. It was not until later stages of the project that the significance of stratified terrace sites and the stratigraphy of rockshelter deposits was recognized and led to a focused approach to understanding geomorphology and the interaction of prehistoric humans with their environment (Black 2013; Baker 2008).

Of the sites identified during the Amistad project, eight buried terrace sites and three stratified terrace sites were recorded (Gustavson and Collins 1998). Three of these sites were excavated during the project—Devil's Mouth, Nopal Terrace, and Arenosa Shelter. Interstratified natural and cultural deposits characterized all three terrace sites along and at confluences of rivers in the Lower Pecos. Each excavated site provided insight into the history and the nature of floods, sedimentation in the region, and use of open areas by prehistoric peoples.

*Arenosa Shelter (41VV99)*

First recorded in 1958, by John Graham and William Davis, Arenosa shelter lies along the Pecos River 3/4 of a mile upstream from the confluence of the Pecos and the Rio Grande (Figure 2.3). The site had two distinct components: the shelter overhang and the Pecos River terrace which partially infilled the shelter. In 1965, David Dibble described the site as deeply stratified, with distinctly alternating cultural and flood deposits (Dibble 1967: 14). Dibble directed deep trench excavations from 1965 to 1966, following the natural stratigraphy initially identified in the exposed cut-bank profile along the river. Backhoe trench and hand excavations were completed to a depth of 41 feet, defining 49 individual strata (Dibble 1967; Whelan and Black 2008). Samples from the stratified deposits included palynology and radiocarbon dating; these results combined with cultural chronology established a formation sequence of 9,500 years (Patton and Dibble 1982). The combination of overbank flooding from the Pecos River and back flood events from the Rio Grande resulted in the deposition of horizontal stratum alternating with cultural deposits from prehistoric site use (Dibble 1967: 14).

upper Arenosa Shelter deposits. Photo courtesy of ARNA-NPS archives TARL. (Right) 2007 photo by Chris Jurgens, pointing to the now-inundated Arenosa site when the lake is filled.

Arenosa Shelter was situated roughly 57 feet above the normal 1967 Pecos River level; consisting of shelter deposits and two benches of terrace deposits. Dibble (1967) describes deposits as alternating silt and sand deposited with the fluctuating level of the Pecos River, with the upper bench deposits of the site indicating higher water levels. Hand excavation was completed in natural levels “peeling” the deposits off in the units, creating a nearly continuous profile from top to bottom. It was noted that occasional dense bands of silt helped stabilize the profiles that were created and maintained by slightly sloping faces and no shoring (Dibble 1967; Figure 2.4).

Excavators of the site collected monolith sections of the profile stratigraphy and sediment samples, to aid in the geoarchaeological analysis of the sites deposits. Patton and Dibble worked to understand the flood sequences, as well as the cultural and natural chronology of the site. Stratigraphic descriptions that focused on the structure, sediment types, and other notable characteristics that could be used to understand the sites use and formation (Gustavson and Collins 1998; Patton 1977).

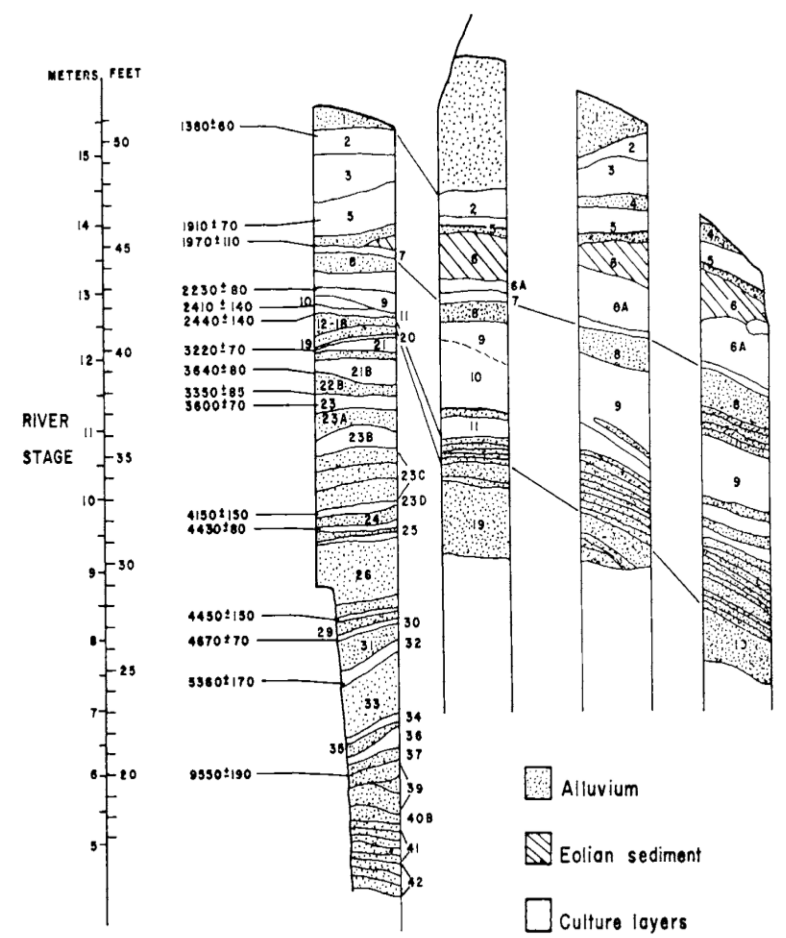



Figure 2.4 Correlated deposit stratigraphy at Arenosa Shelter. Patton and Dibble 1982: 109

*Devils Mouth Site (41VV188)*

Recorded and tested by Dibble in 1959, Devil's Mouth terrace sits at the juncture of the Devils River and the Rio Grande. Two periods of excavation took place at the site: first, by LeRoy Johnson Jr. from 1961-1962; second, by William M. Sorrow in 1967. Johnson described 24 individual strata (Figure 2.5) of cultural and fluvial deposits with the oldest, lowest level 36 feet below the terrace surface (Johnson 1961). Dating the site was mostly focused on the stone tool and projectile point sequence, which placed occupations at the site in the Late Paleoindian to the Late Prehistoric and into the Protohistoric periods.

This site is arguably one of the most important sites excavated during the Amistad work, with interstratified cultural and fluvial deposits at a thickness of ~15-meters (Gustavson and Collins 1998: 20). The deepness of the deposits provided a large window into the cultural and natural formation of the site unseen at other known sites. It was determined that the terrace was formed by periodic flood deposits from one, or both, rivers that occurred between prehistoric site use episodes, thus resulting in less mixing of the deposits, than what had been seen in most rockshelters (Black 2013:145).

Aside from correlating the stratigraphy of deposits (Figure 2.5), little attention was paid to studying the depositional nature of the site. Profile descriptions typically noted the integrity of the deposits, the type of sediment, and the color, but no geoarchaeological samples were collected. The bulk of excavations and analysis for the site was centered in describing the stone artifacts and other cultural materials that were recovered from "occupation" deposits (Johnson 1960: 260; Sorrow 1968: 42).

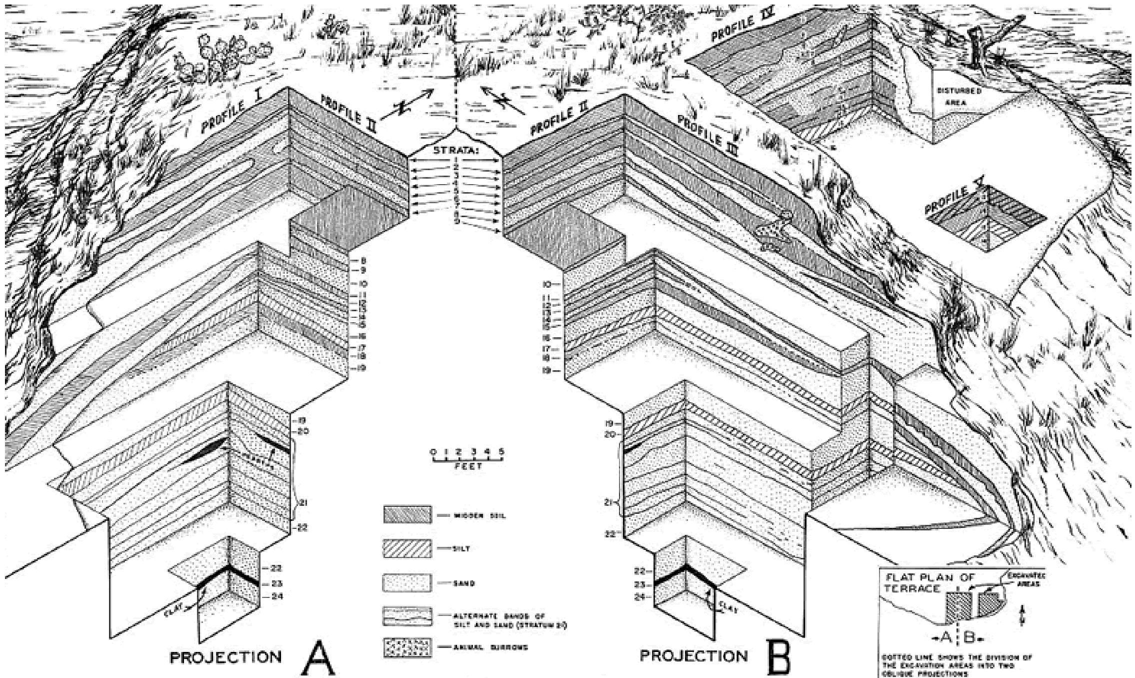


Figure 2.5: Correlated stratigraphy of Devils Mouth. Johnson 1960

*Nopal Terrace (41VV301)*

In 1967, during a return season to Devil's Mouth site, William Sorrow, conducted test excavations at Nopal Terrace, a small terrace reported in a 1964 survey. The site sat on the left bank of the Rio Grande just 2.5 miles upstream from Devil's Mouth (Sorrow 1968:1). The site's extent was estimated at 50 feet (15.2m) by 80 feet (24.4m) with an average depth reaching 18 feet (5.5m). One hand-dug test unit was excavated, and a backhoe was used to open up a long trench profile into the bank, from which ten individual strata were defined (Figure 2.6). Like other terrace sites, the stratigraphy reflected a series of the intermittent flood and occupation deposits along the bank (Black et al. 2008; Gustavson and Collins 1998; Sorrow 1968).

Several chipped stone tools and projectile points were collected in excavations, which were the basis of the cultural chronology for the site. The site was excavated in natural layers; however, stratum descriptions were brief and included little information beyond color and boundary definitions. Sorrow's distributional analysis of artifacts and stratigraphy identified strata:  2, 4, 6, 7a-c, and 8 as solidly cultural deposits, with 1, 3, 5, 9, and 10 defined as sterile. Application of the point chronology and comparison of deposit sequences to Arenosa Shelter led Sorrow (1968: 37) to believe the site was used multiple times over a roughly 3000-year period. Despite the lack of focus on the deposits themselves, the Nopal Terrace site reinforces the pattern of intense and repeated use of open sites that is seen Sayles Adobe.

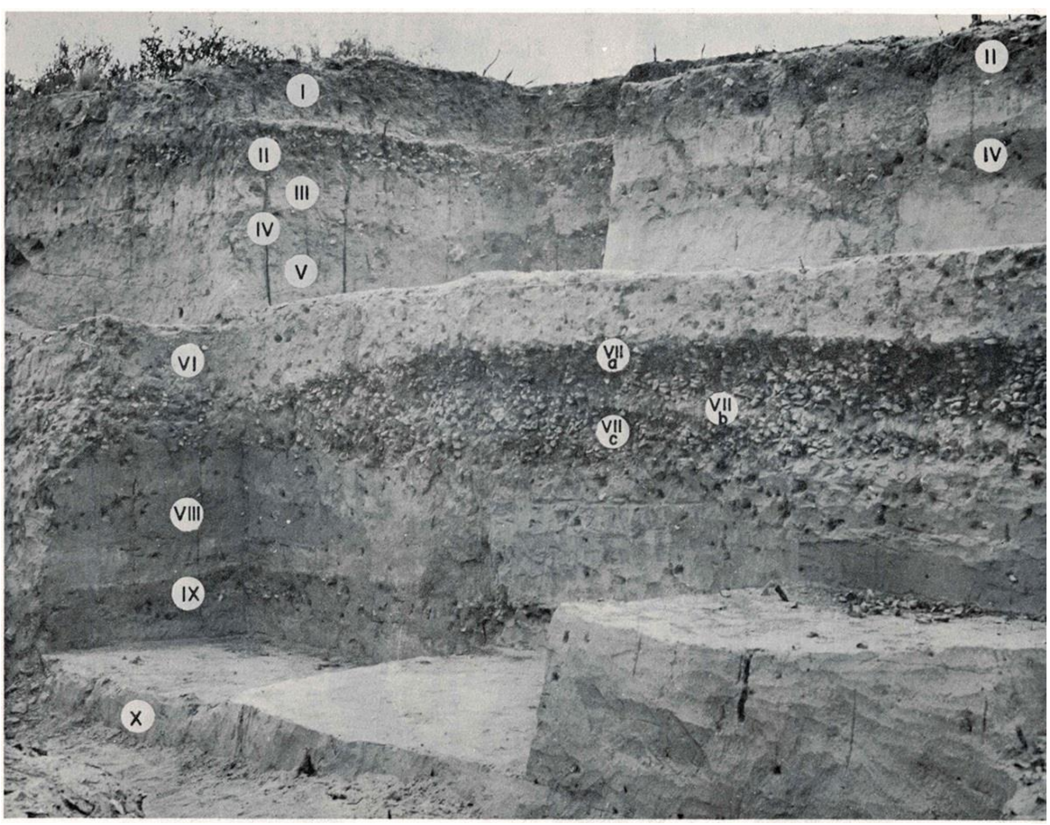



Figure 2.6: Numbered deposits of the completed excavations at Nopal Terrace. Johnson 1960: Figure7

# III. FIELD METHODS: TESTING

Testing of the site began in January 2016, and this initial work included clearing of vegetation across the site and mapping the surface of the site via SfM photogrammetry. By using a photogrammetric approach, a high resolution, accurate surface map (Figure 3.1) was created that could be manipulated and annotated in GIS. The SfM map, and all other excavation data, were georeferenced with a total data station (TDS) and tied to a previously established canyon-wide grid system to connect the work at Sayles Adobe to the other canyon sites. This chapter explains the mapping and testing methods used during the first phase of Sayles Adobe fieldwork. The methods and the results of the ground penetrating radar, auger, and test unit excavations are summarized here, with raw GPR and auger data reported in Appendix B.

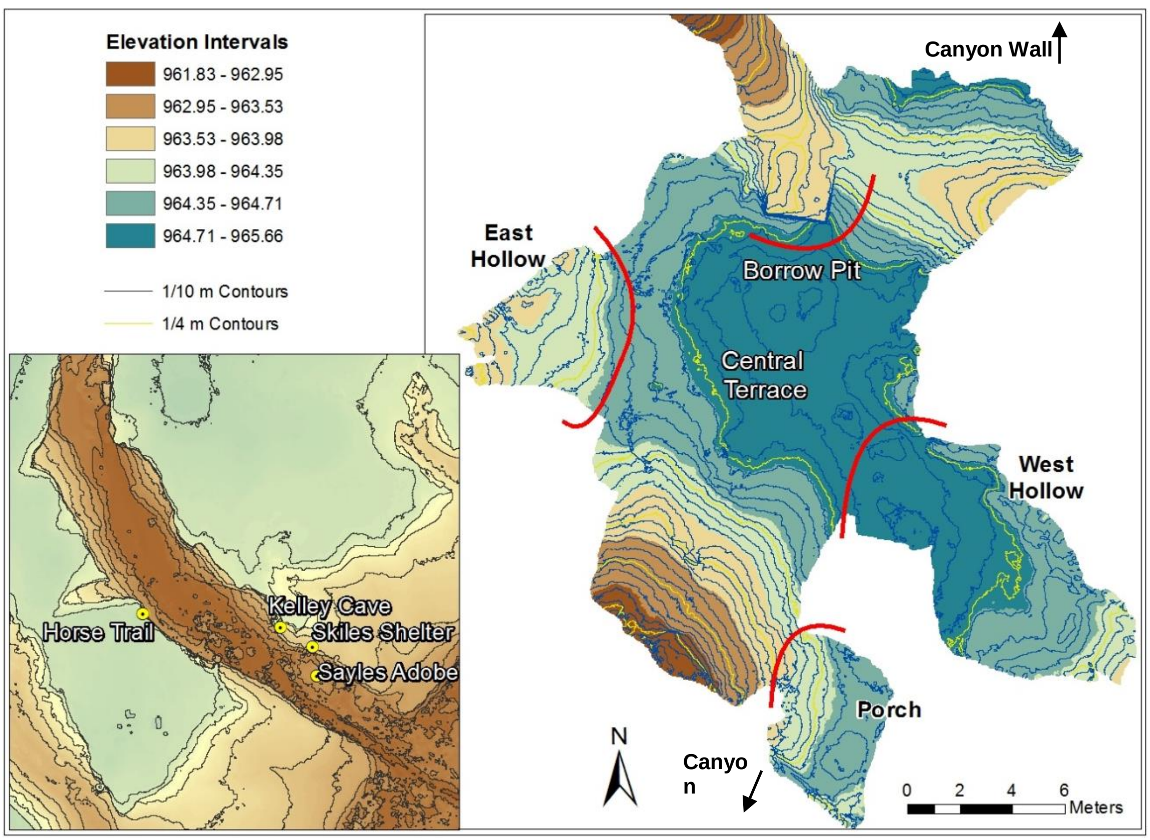



Figure 3.1: Digital elevation model created through SfM photogrammetry with initial area designations.

*Subsurface Exploration*

After clearing and mapping were completed, five potential excavation areas were identified: the Borrow Pit, Porch, East Hollow, West Hollow, and Central Terrace (see Figure 3.1). Each of these areas were investigated with subsurface survey prior to excavations. Two forms of sub-surface survey were performed: Ground Penetrating Radar (GPR) and auger testing. In general, GPR and augering were used to assess the archaeological deposits beyond the Borrow Pit and target specific features or areas for further excavation. GPR was used first to identify anomalies and map the subsurface deposits, and then augering was used to ground-truth the GPR results. An added benefit of the auger testing was the ability to recover sediment samples in long transects to piece together the stratigraphy across the site (Appendix C).

Tiffany Osburn of the Texas Historical Commission, assisted by the author, performed a GPR survey within temporary grid that was staked out across the terrace. Two antennas (270MHz and 400MHz) were towed back and forth across the surface in 1-meter transects, making note of any surface issues (e.g., rocks, roots, plants, holes, etc.) that may create artificial anomalies in the data later on. Osburn made multiple passes north-south and east-west across the grid with the GPR antennae that followed the longest and widest sections of the site (Figure 3.2). She also made a few additional small passes in the Porch and East Hollow areas to assess their potential.

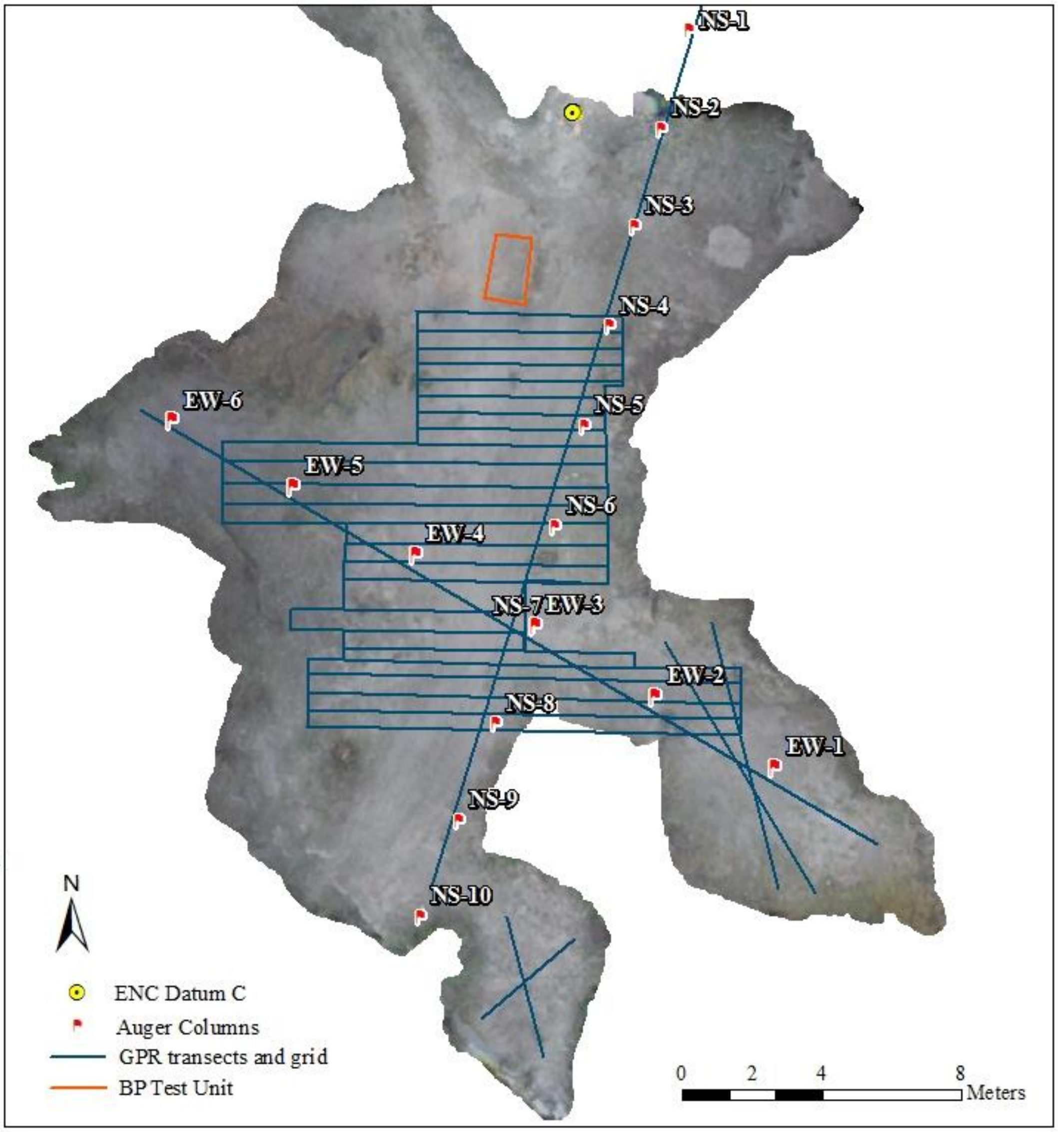
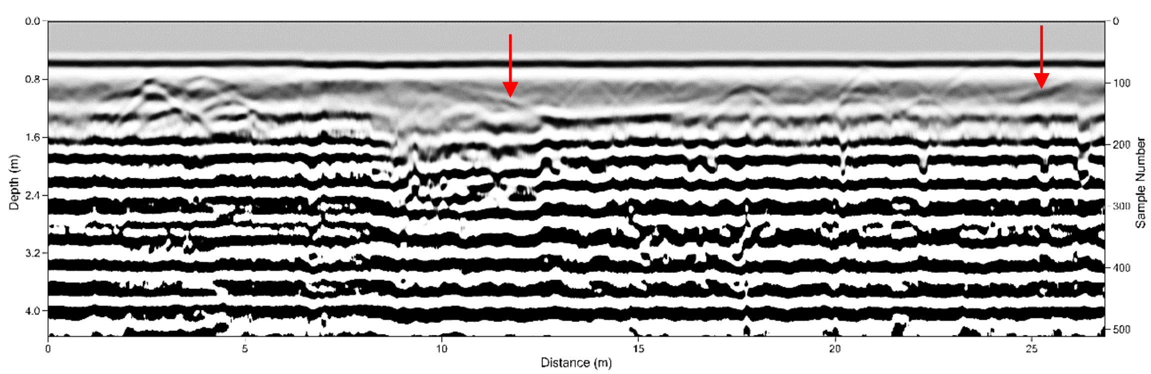



Figure 3.2: Map of the Sayles surface with the lines of the GPR passes, location of test unit A, as well as the location of the auger tests.



Almost immediately, Osburn was able to identify multiple anomalies at varying depths within the upper 1.5-meters of the deposits (Figure 3.3). At these depths there would be potential deposits in reach of the auger and at the depth of the mud drape initially encountered and Occupation 1 from the Borrow Pit. Following data recovery, Osburn used a processing software to identify anomalies she thought represented cultural features (Figure 3.4; Appendix B for all data).

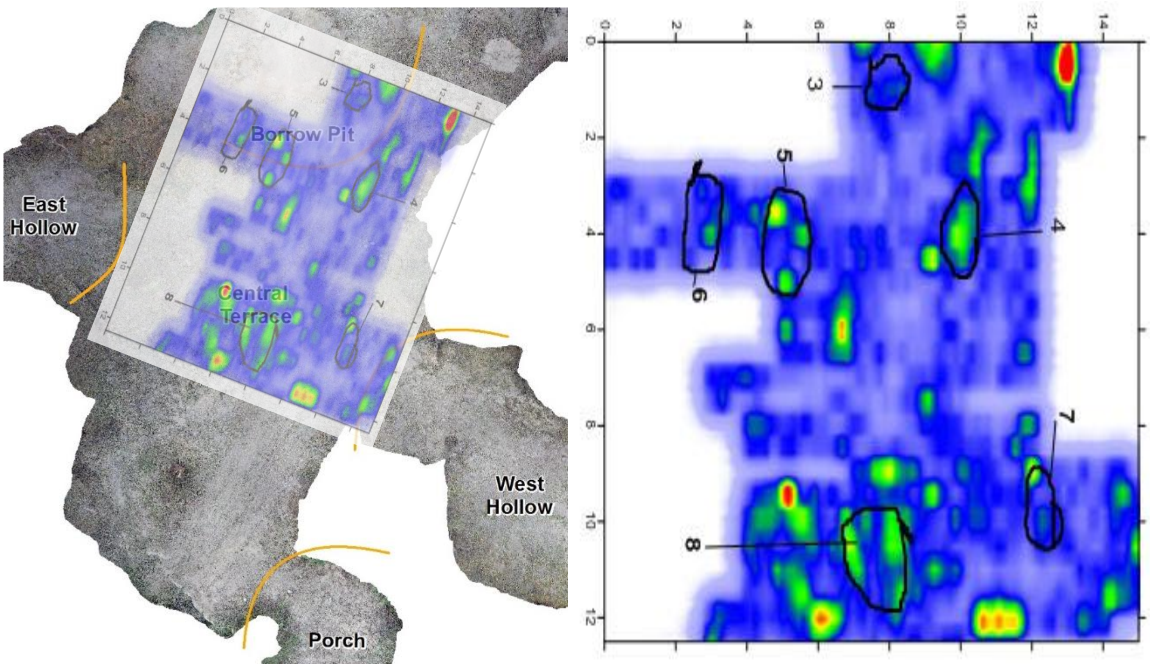



Figure 3.4: (Left) The Sayles surface with a superimposed slice from the 400 Hz antenna passes. (Right) The same slice from the left frame that shows a few of the annotations made by Osburn in post-processing.

After the GPR survey was complete, ASWT crewmember Justin Ayers and I used a 10-cm bucket auger with extensions to 3-meters, to ground-truth some of the anomalies seen by Osburn and prospect for buried cultural deposits. These auger holes were laid out across the terrace following the long GPR transects and were placed at 4- and 5-meter intervals. This resulted in 10 N-S and 6 E-W test columns creating an “X” across the terrace (Figure 3.2). An average depth of 1.55-meters was reached for the North-South transect; an average depth of 2.47-meters was reached for the East-West.

Each bucket load was screened through a 2mm geologic sieve for cultural materials and the color and texture of sediment was recorded (Figure 3.5). Prior to discarding the sediment of each load, we collected a sample of approximately 20-grams for later geoarchaeological analysis. Fully aware that the auger does result in some mixing, we tried to obtain relatively unmixed samples; admixture aside, this procedure meant we could prospect for cultural deposits and sample for geoarchaeological analyses in deposits we would not document otherwise. The physical descriptions of deposits recovered were used to create profiles correlating similar deposits across the site, paired with the profile sections created via excavation (Appendix C).

Figure 3.5: (Left) Tiffany Osburn running the GPR across the central grid at Sayles Adobe. (Right) The author and ASWT crewmember Justin Ayers augering in the East Hollow of Sayles.

TESTING RESULTS

By combining the results of the GPR and auger columns, we identified multiple locales on the terrace that we could target for excavation. When ground-truthed with the auger many of the anomalies seen in Osburn's grid (Figure 3.4; 3.6) were identified as either cultural deposits (consisting of mainly burned rock) or as flood deposits (mud drapes). Figure 3.6 was provided by Osburn after preliminary post-processing, creating slices starting from the surface with Slice 1 in the upper left frame to Slice 7 in the lower right frame. Many of the anomalies were identified by the GPR were sampled by auger tests, or by the excavations across the site.

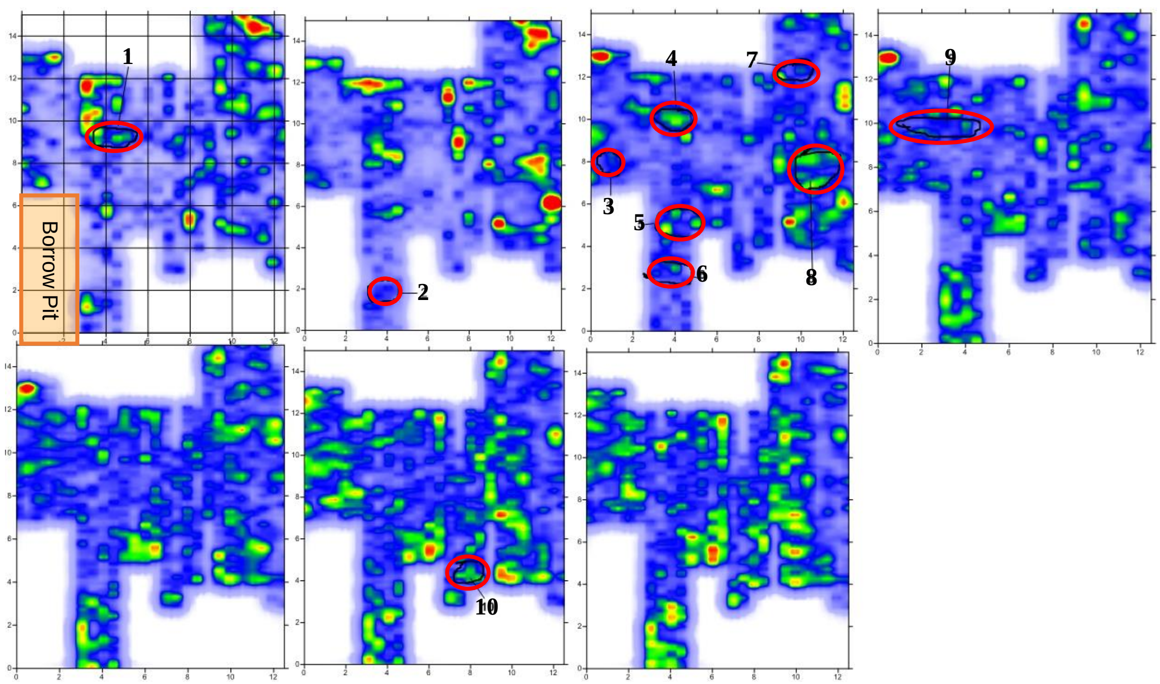


Figure 3.6: Annotated results of the 400Hz antenna. Each frame represents a progressively deeper slice below the surface.

Anomalies 2, 3, 5, and 6 were all just outside the extent of Unit A, and in the unit profiles we could see a dense level accumulation of FCR and grey, charcoal flecked matrix that seemingly extended into the walls. Therefore, we planned to investigate the anomalies with the expansion of the upper Borrow Pit excavations later in the season.

Anomalies 1, 4, and 9, were identified in approximately the same location at multiple levels just beyond the extent of Borrow Pit excavations, located between Auger Tests N-S 4 and5. While no auger tests were placed directly on the anomaly locations, the auger test NS-5 brought up cultural materials from 1.16mbs to 1.69mbs consisting of charcoal, FCR fragments, and chert debitage. Again, at NS-5 FCR fragments and flecked charcoal were recovered from 2.2 m to 2.45 mbs, indicating a second cultural deposit that apparently lies below the range of the GPR.

Anomaly 10 was targeted by Auger Test EW-4 (Figure 3.7), which encountered numerous obstacles (large roots or burned rock) that prevented the auger from reaching its full depth. We tried six times to get the auger to full depth (2.8m); all but one of the attempts was stopped by burned rock that came up as fragments in the bucket.

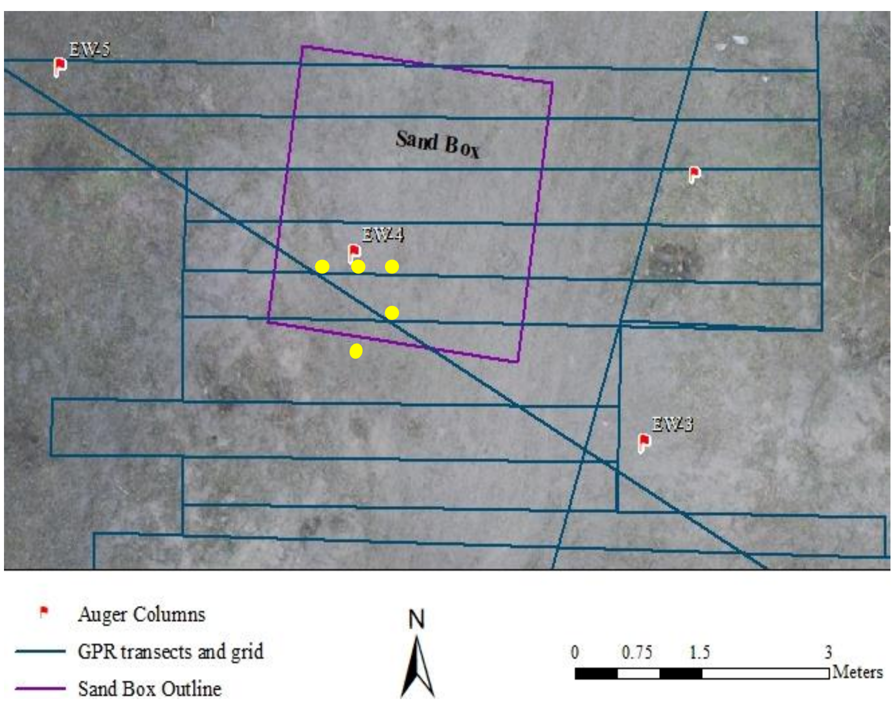


Figure 3.7: Map displaying the location of the original auger placement (EW-4), in yellow are the additional holes augered that were stopped at FCR.

After each failed attempt to penetrate the 1.2-meter level, a new auger test was placed approximately 40cm over and we restarted. It was obvious we were hitting a dense layer of fire-cracked rock that we had not encountered in the Borrow Pit test unit. To investigate the suspected cultural surface, we decided to open a large excavation area called the Sand Box.

*Initial Borrow Pit Excavations*

As discussed in Chapter 1, we initially cleaned up the 2014 borrow pit area during the December 2015 excursion to the site and named the area Unit A (Figure 3.8). It was decided that the excavations in Unit A, which would become known as simply the Borrow Pit, would be dug somewhat expediently in order to evaluate the extent of the cultural deposits and provide a glimpse into the site's stratigraphy. The first excavation unit placed in the Borrow Pit area was Unit A1, and excavations began in January 2016 prior to GPR survey and auger testing.

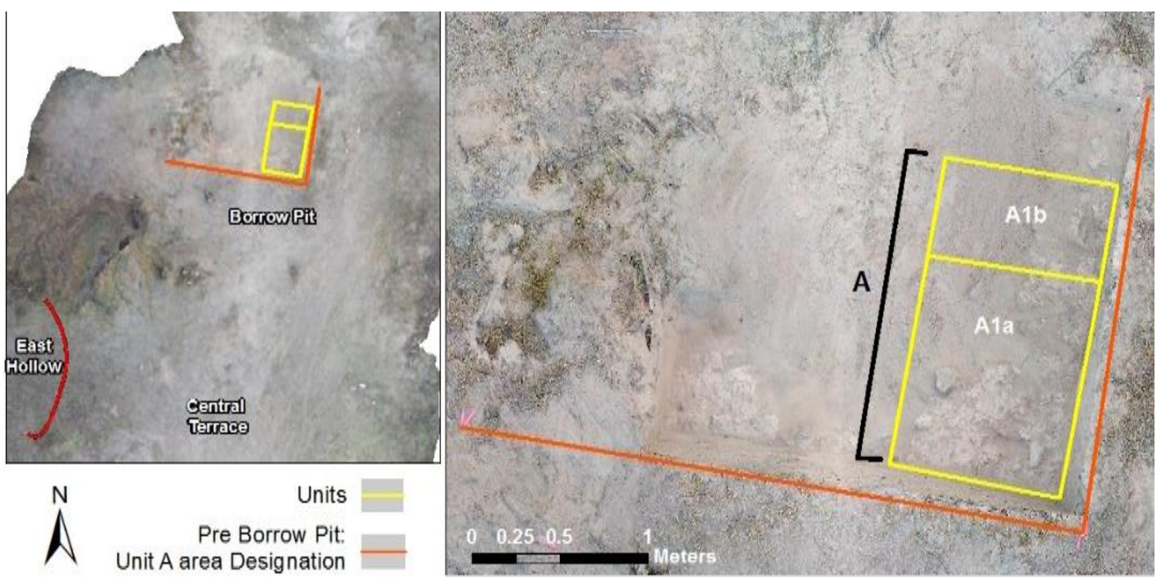


Figure 3.8: Excavation area A, with units A1, A1a, and A1b.

We first removed the flood drape across the entirety of Unit A1, carefully peeling the deposit off to expose the anthropogenic surface below (Figure 3.9). Unsure of the density and extent of the cultural deposit, excavations were done cautiously, with excavators following natural layers rather than arbitrary levels. This resulted in A1 being removed in eight thin layers, with the top of each layer documented with SfM photogrammetry. After the field we were able to use the SfM layer models look at the distribution of FCR rock in the unit. The Borrow Pit testing provided an opportunity to train the crew on SfM and nail down our excavation procedures.


Figure 3.9: Pre-excavation chalkboard photo of Unit A1, showing the extent of preserved flood drape associated with grey sediment and FCR.

The upper 35cm of the A1 excavation (Figure 3.9 and Figure 3.10) captured the mud drape interface with the carbon-stained cultural deposit (designated S004 or Occupation 1), and mottled, tan deposit (S005) below. Excavations yielded debitage, FCR, unburned *Rabdotus* shell, one manuport, a few flakes >1/2”, and a flake perforator. The lower 15cm of Occupation 1 (S005) was mottled grey-tan sandy-silt with microdebitage, gradually becoming culturally sterile sandy-silt alluvium. The interface between S005 and S004 (Figure 3.10) had an irregular boundary between the mottled, charcoal stained matrix of Occupation 1 contrasting with a tan matrix with an increase in carbonate inclusions beneath (Table 3.2).

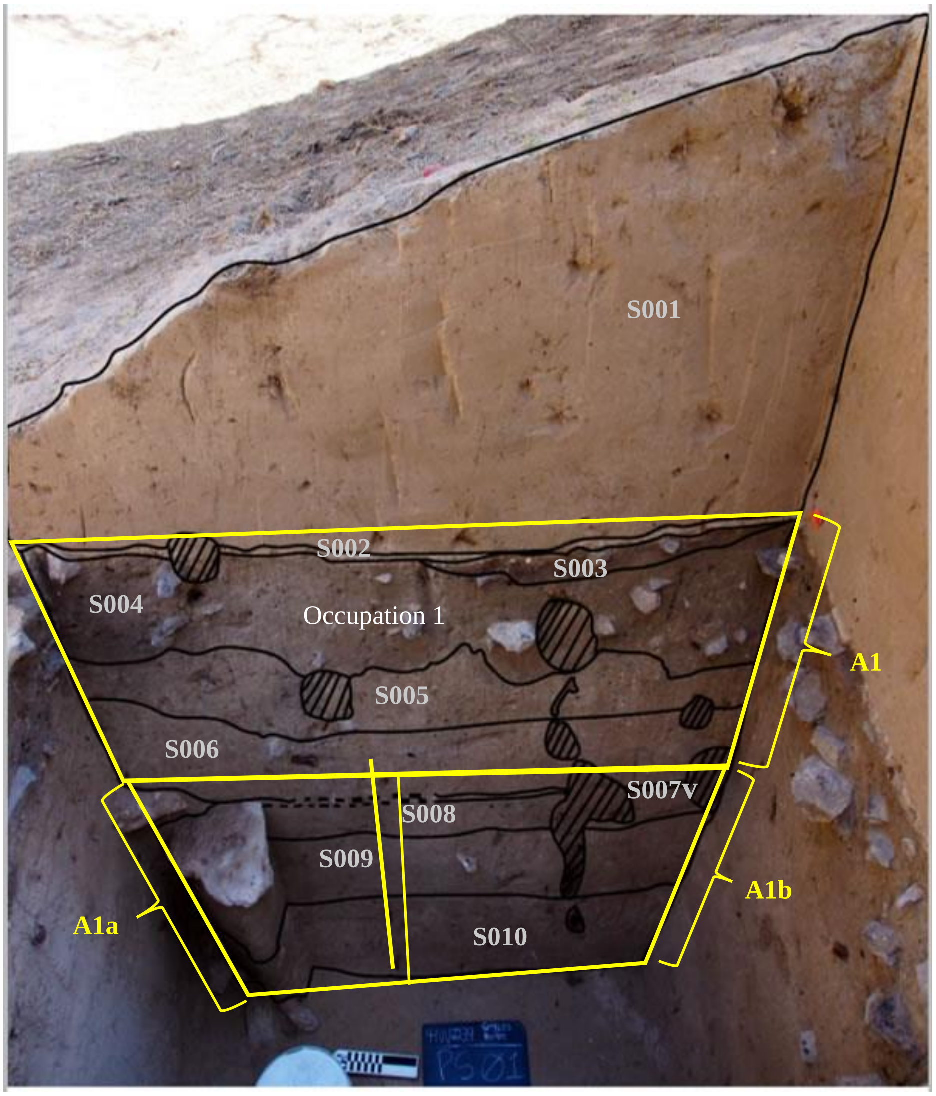


Figure 3.10: Early field annotation of Profile Section 01 in the Borrow Pit. Yellow boxes indicate the unit divisions; Upper: A1; Lower left: A1a; Lower right: A1b.

Beneath Occupation 1, Unit A1 was subdivided into two smaller units: A1a (north 40cm) and A1b (south 70cm). Each unit was removed in an alternating fashion to facilitate excavation via natural layers. First A1a was expediently excavated (shovel skimmed) 50cm beneath Occupation 1, and then A1b was excavated following the layers exposed in the profile of A1a (e.g., S006-S008). Once A1b reached the same level as A1a, we excavated another 10cm deeper in A1a before exposing a small cluster of burned and unburned limestone rocks in the northeast corner. As we excavated A1b to the same level, some additional small FCR was seen in the screen, and an increase in microdebitage was noted, but no rock cluster was apparent. We also noted that the matrix seemed to be firmer and siltier, unlike the above sediments that were sandier and less compact. Table 3.1 lists all recovered lithic and faunal cultural materials from the test unit, demonstrating the presence of cultural materials even in deposits that otherwise looked culturally sterile.

Table 3.1: Artifact types and quantities recovered from A1

| Unit | Artifact Type | Artifact Count |
|---|---|---|
| A1 | Debitage | 286 |
| | Manuports | 3 |
| | Flake Tools | 2 |
| | Biface | 1 |
| | Core | 1 |
| | Faunal Remains | 10 |
| A1a | Uniface | 1 |
| | Debitage | 58 |
| | Flake Tools | 2 |
| A1b | Ground Stone | 1 |
| | Flake Tools | 2 |
| | Debitage | 73 |
| | Faunal Remains | 1 |
| | Core | 1 |
| | Biface | 1 |

After excavating Unit A1-A1a-A1b to a depth of roughly 2.2-meters below surface, we stopped excavations and documented the stratigraphy we saw in the profile. The east wall of unit A1-A1a-A1b became Profile Section 01, which was aligned on the north-south axis of the site that would be followed with later GPR and auger tests. Profile

Section 01 (PS01) was mapped with SfM, and the natural and cultural stratigraphic boundaries (strats) were annotated and described in the field. Field descriptions included sediment texture, color, boundary type, and other notable characteristics (Table 3.2).

Table 3.2: Profile Section 01 Strat Descriptions

| **Strat** | **Color** | **Description** |
|---|---|---|
| 001 | 10YR 6/3: Pale Brown | Massive sandy deposit sloping upwards from the North to the South. No visible inclusions. Root and insect burrows visible in profile. Firm-friable. |
| 002 | 10YR 7/3; Very Pale Brown | Thin (~1-1.5cm) very fine silt-mud mud drape capping burned rocks. In profile, it slopes very slightly south and dips slightly in the center. Extremely firm. |
| 003 | 10YR 4/2: Dark Greyish Brown | Thin lens (~2cm) of charcoal flecked silty-sand matrix under the drape in south 40cm of profile. Firm. |
| 004 | 10YR 5/2: Greyish Brown | Thick (~30cm) horizontally bedded carbon stained under drape with >7.5cm FCR, burrows, charcoal, snails, and roots in profile. Silty, slightly gritty. Firm-friable. Strat dubbed Occupation 1. |
| 005 | 10YR 6/3 & 10YR 5/2 | Mottled gray-tan silty, gritty loam. Heterogeneous mixing of the cultural deposit above and alluvium below. Burrows and FCR visible in profile. |
| 006 | 10YR 6/3: Pale Brown | Essentially sterile, homogenous alluvium. White, unidentified—possibly decomposing limestone— inclusions. Firm. Sandy-silt loam. Roots and burrows in profile; two large limestone rocks (>15cm) in the north edge. |
| 007 | 10YR 6/4: Light Yellowish Brown | Thin (~1-1.5cm) compact layer that is broken across the profile, but identifiable across it at both ends. Roots and burrows in profile. Silty. Extremely firm. |
| 008-009 | 10YR 6/3-6/4: Pale Brown-Light Yellowish Brown | Two very similar strats of sandy-silt that seem to may or may not be the same. Similar matrix color range. Both have lighter, small mud-clay inclusions or laminations that seem to be horizontally bedded but are not continuous. Roots and burrows in profile. Firm. |
| 010 | 10YR 6/3: Pale Brown | Semi-compact lowest stratum of silty-sand matrix. Strat is the last 15cm of matrix from Units A1a & A1b. Rock clustered in lower north corner. |

## CONTINUING WORK ACROSS THE SITE

By the end of the January testing, it was clear Sayles Adobe had multiple areas with stratified cultural deposits, suggesting anthropogenic activity had taken place across the terrace during many different periods. This helped shape the work moving into

February, allowing us to focus excavation on areas that seemed to provide the best opportunities for interpreting the formation and use of the terrace.

The creation and documentation of the >2-meter profile section (PS01) at an early stage in the excavations was hugely important because it provided a larger window into the stratigraphy of the site against which we could compare the GPR and auger test results. This repeated stratigraphic triad of alluvium-mud drape-cultural deposit was identified in several areas of the site and helped guide how we excavated. We then knew the mud drape was a distinct stratigraphic “marker-bed” between the massive upper alluvial deposit across the terrace and the cultural deposits beneath.

# IV. FIELD METHODS: EXCAVATION

This chapter begins by laying out excavation procedures and documentation standards for the site, concluding with a discussion of the units opened. Procedures for excavation were established during survey and testing in January 2016. Previous ASWT forms and documentation techniques revolved around the rockshelters and were adapted to fit open site conditions present at Sayles Adobe.

## EXCAVATION METHODOLOGY AND COLLECTION STANDARDS

As initially discussed in Chapter 3, excavations at Sayles Adobe were generally oriented on a north-south grid across the terrace, with all unit corners shot in using a Sokkia TDS and referenced to UTMs via a canyon-wide grid system of datums. Excavations followed natural layers whenever possible, except for thick deposits (>30cm). In those cases 10-20 cm arbitrary levels were used until a change in the deposit was noted. Each unit-layer received a field number (FN) used as the "Lot" number which all artifacts and samples were linked to, allowing us to tie collected materials to their excavated provenience.

All matrix excavated was screened through 1/2", 1/4", and 1/8" screens[3]. Cultural material collected from screens included: all bone, all lithics, non-root botanic remains, and diagnostic mussel shell (with umbo). Noteworthy artifacts (projectile points, tools, modified bone, etc.) found *in situ,* were assigned individual FNs, shot in with the TDS and photographed with a scale before collection in the field. If any of these notable items were identified post-field (i.e., while cleaning and inventorying artifacts), they were assigned FNs in the lab.

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[3]A few exceptions were made to this standard, which are noted on the field forms for any unit or layer that diverged.

*Rocksort*

Rocksort is the ASWT routine for sorting, counting, and weighing burned and unburned rock larger than 1-inch. Both burned and unburned rocks were set aside and sorted at the completion of each unit-layer (Figure 4.1). Sorting categories were developed during previous ASWT work documenting rock size (<7.5 cm, 7.5-11cm, 11-15 cm, and >15 cm) and limestone type -- spall, rounded, pitted, angular, or unknown. Once sorted for size and type, a photo was taken, and each category was weighed before being discarded (See Appendix H.3 for complete rocksort data).


Figure 4.1: Rocksort was completed on all burned and unburned rock larger than 1-inch that was excavated.

This sorting process allows the quantification of rock and an estimate the number of earth ovens and baking events that occurred at a site (Knapp 2015; Nielsen 2017; Rodriguez 2015). When heated and reheated, rock begins to break down, from large rocks (>15cm) characteristic of intact heating elements to progressively smaller fragments (<7.5cm) that have been discarded. This process of quantifying discarded burned rock was developed by archaeologists who have argued for plant baking intensification (Knapp 2015; Black and Thoms 2014; Thoms 2003: 88-89).

*Structure from Motion (SfM) Photogrammetry*

An excavation standard in the Ancient Southwest Texas project has been the digital documentation of excavations with Structure from Motion (SfM) photogrammetry (e.g., Koenig et. al. 2017). SfM is a process of taking multiple, overlapping photos of a subject, and processing the photos using Agisoft Photoscan. The result is a high-resolution 3D model of units, profiles, deposits, and features.

These models are georeferenced with Ground Control Points (GCPs), stable points in a unit or area that have been marked with an “X”, numbered, and shot in with a Sokkia total-data station (TDS). Referenced 3D-models, digital elevation models (DEMs) and orthographic photos can be exported and manipulated using GIS. Models were processed almost every night and printed orthophotos were available for annotation the next day.

The SfM technique in combination with GIS provided a certain amount of flexibility with excavations allowing us to create units in any shape, size, and orientation. Photogrammetry was used to document all aspects of excavation, replacing plan and profile drawings, and other types of conventional mapping. In the field, ortho-rectified images of profiles, units, and other features were annotated (Figure 4.2). To standardize data collection, annotations were paired with forms, which directed excavators to data important to document in the field.

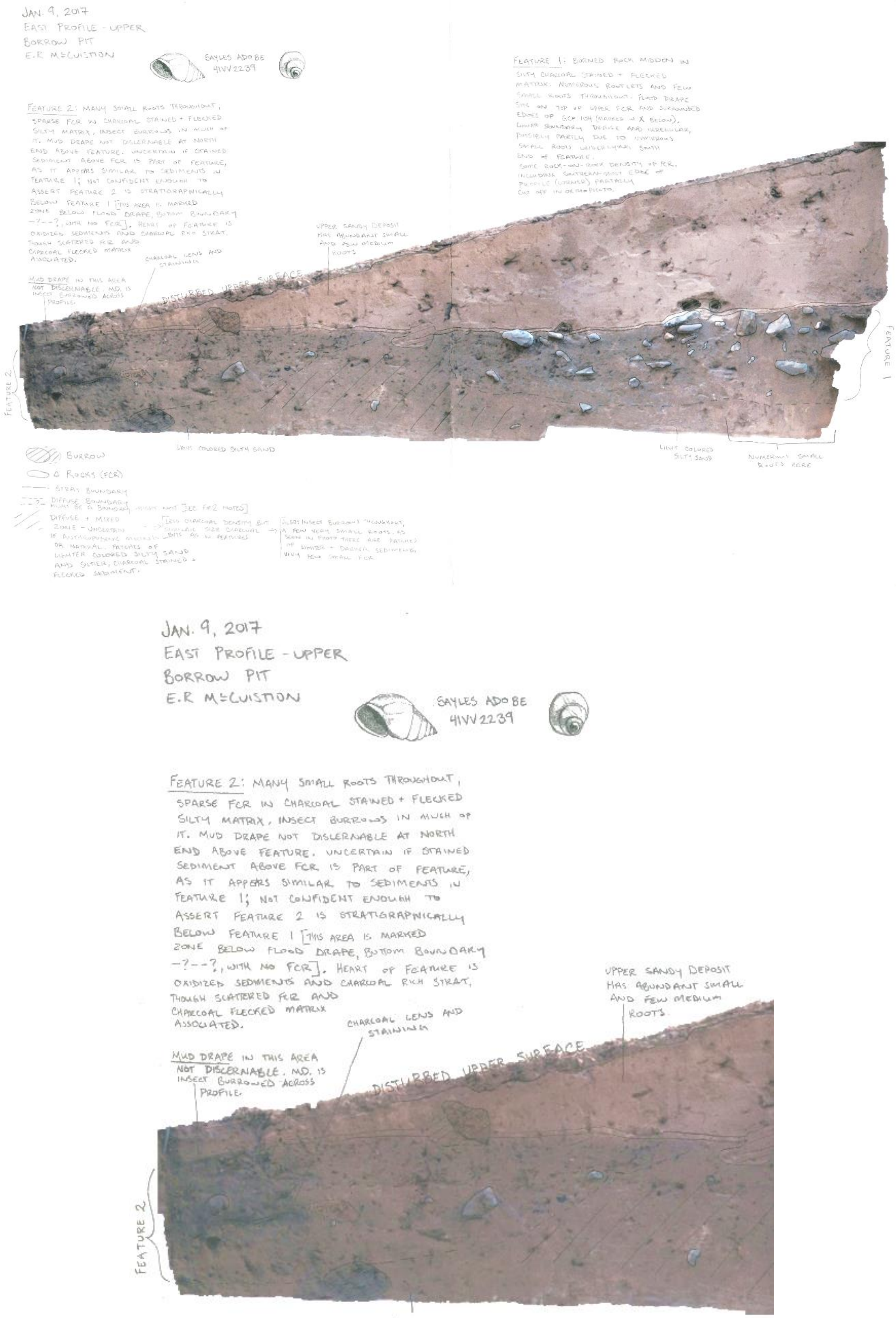



Figure 4.2: Annotated feature profile orthophoto created with SfM, and later annotated in the field.

*In-Field Documentation*

To intensively sample and correlate stratigraphy across the site, we created profile sections from unit excavations oriented on either a north to south or an east to west axis. With the use of SfM photogrammetry, conventional sketch maps done on graph paper using a datum, line level, and tape measures were unnecessary. As mentioned, paper forms were used to record unit-layer, stratigraphic, sample, profile section, and feature information. These forms were used in combination with a printed orthophoto, on which additional annotations were made and later digitized (e.g., Figures 4.2, 4.3, and 4.4).

These field annotations were also used to develop sampling strategies; they were the first run at describing stratigraphy and any notable features present. Annotations of profile sections recorded information such as bedding, color, texture, inclusions, bioturbation, and other notable characteristics identifying stratigraphic boundaries between deposits (Figure 4.3 and 4.4). As mentioned, the annotations also provided an alternative for georeferencing when the TDS was not available or when the excavations reached depths that made accurate points difficult to record.

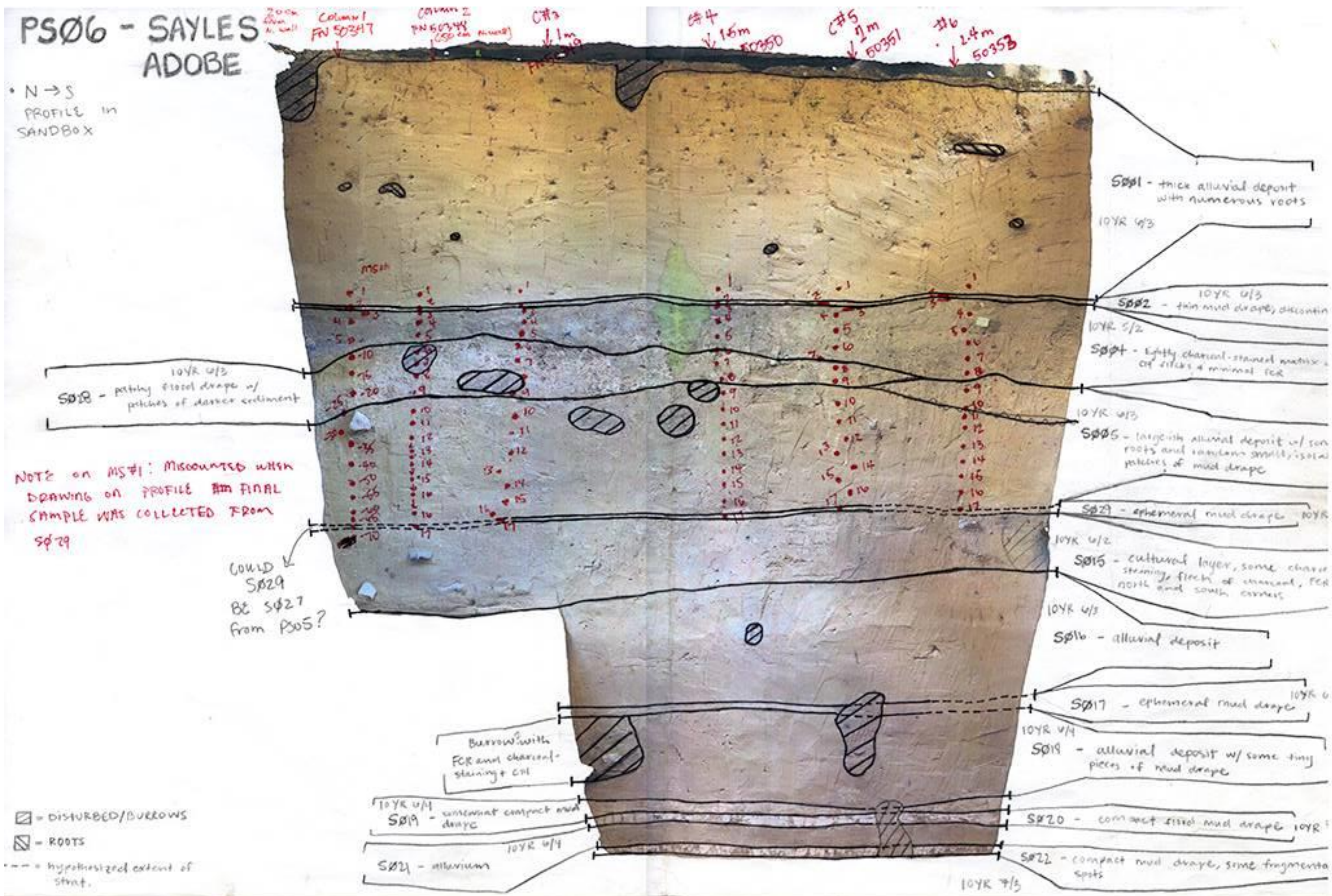



Figure 4.3: Profile Section 06 (from the Sand Box) field annotation, with stratigraphic descriptions and notes on magnetic susceptibility samples. This profile section was oriented on the north-south axis of the site and correlates stratigraphy between the Borrow Pit (PS01) and the Sand Box (PS06).

After field annotations were complete, specialized paper forms were filled out to record a more detailed description of deposits (See Appendix A). Field forms prompted excavators to document important information such as photo numbers, samples, and artifacts collected. This allowed us to standardize the information collected and provided an opportunity for us to have multiple eyes look at deposits. These annotations and their paired forms were used to illustrate and describe the deposits.

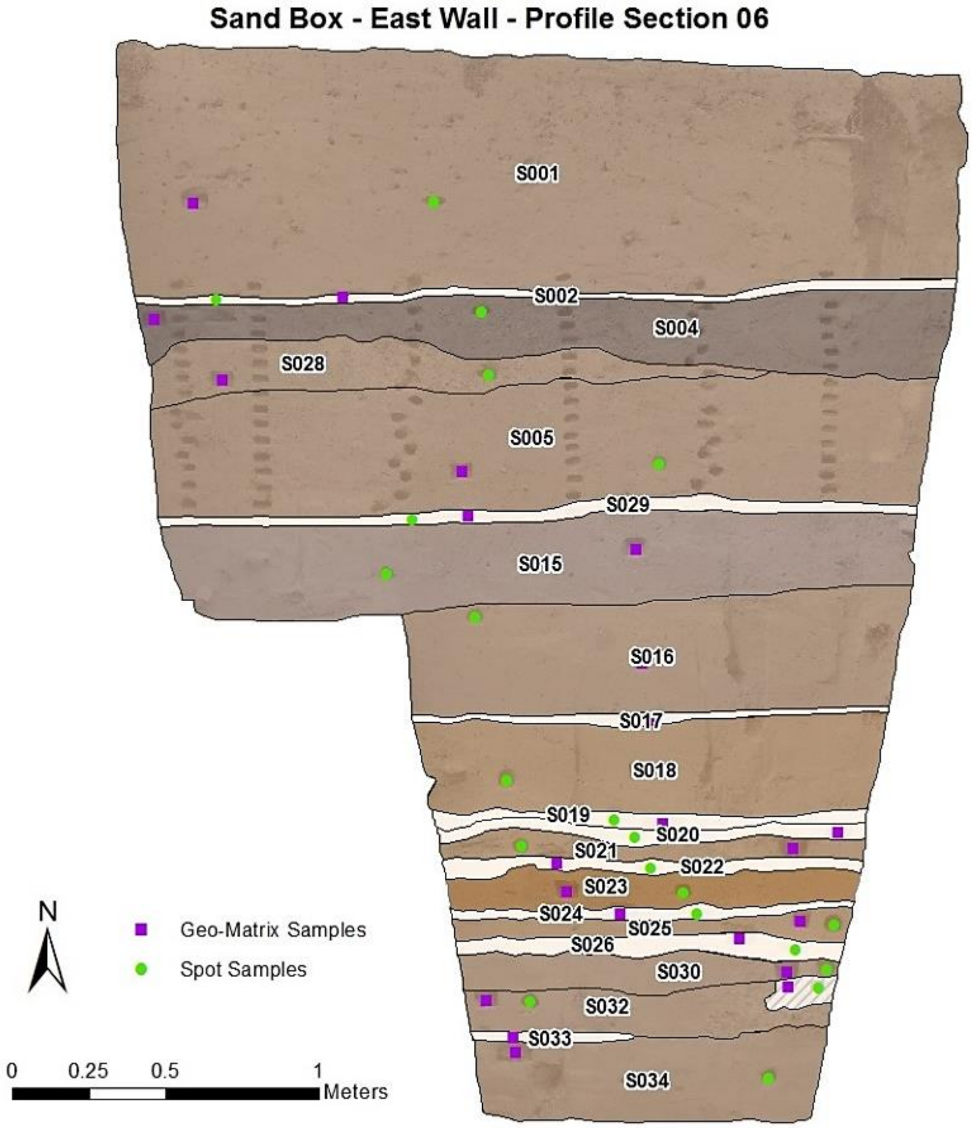



Figure 4.4: Digitized profile annotation, created with an orthorectified model that was exported from Photoscan and imported into ArcGIS..

## EXCAVATIONS[4]

As testing wrapped up we knew where we wanted to place new units and work moved quickly as we began to target the identified anomalies. This resulted in three excavation areas (Figure 4.5), one at the north end of the terrace (the Borrow Pit), one in the central area (the Sand Box), and one at its southern point (the Porch). The Porch was opened at the southernmost point of the site.  A new large excavation area was opened in the central section of the terrace, which was designated the Sand Box. Borrow Pit excavations were expanded twice from the original 1m-x-2m test unit. First, by excavating the remaining previously exposed area; second, by expediently (i.e., shoveling out and screening every fourth bucket) removing the alluvium above the mud drape on the south and east sides of the area (Figure 4.5).

The East and West Hollows which we considered as initial excavation areas (discussed in Chapter 3) were not targeted for more work and designated as screening stations for the Sand Box and Borrow Pit. The rest of the chapter will discuss the work completed in the three excavation areas: Borrow Pit, Sand Box, and Porch. From these areas six profile sections were intensively recorded and sampled.

[4] Note to the reader, the order of the excavations discussed is not necessarily the order in which they were excavated. For the most part the units were excavated simultaneously throughout the February-June work sessions, as crew size allowed.

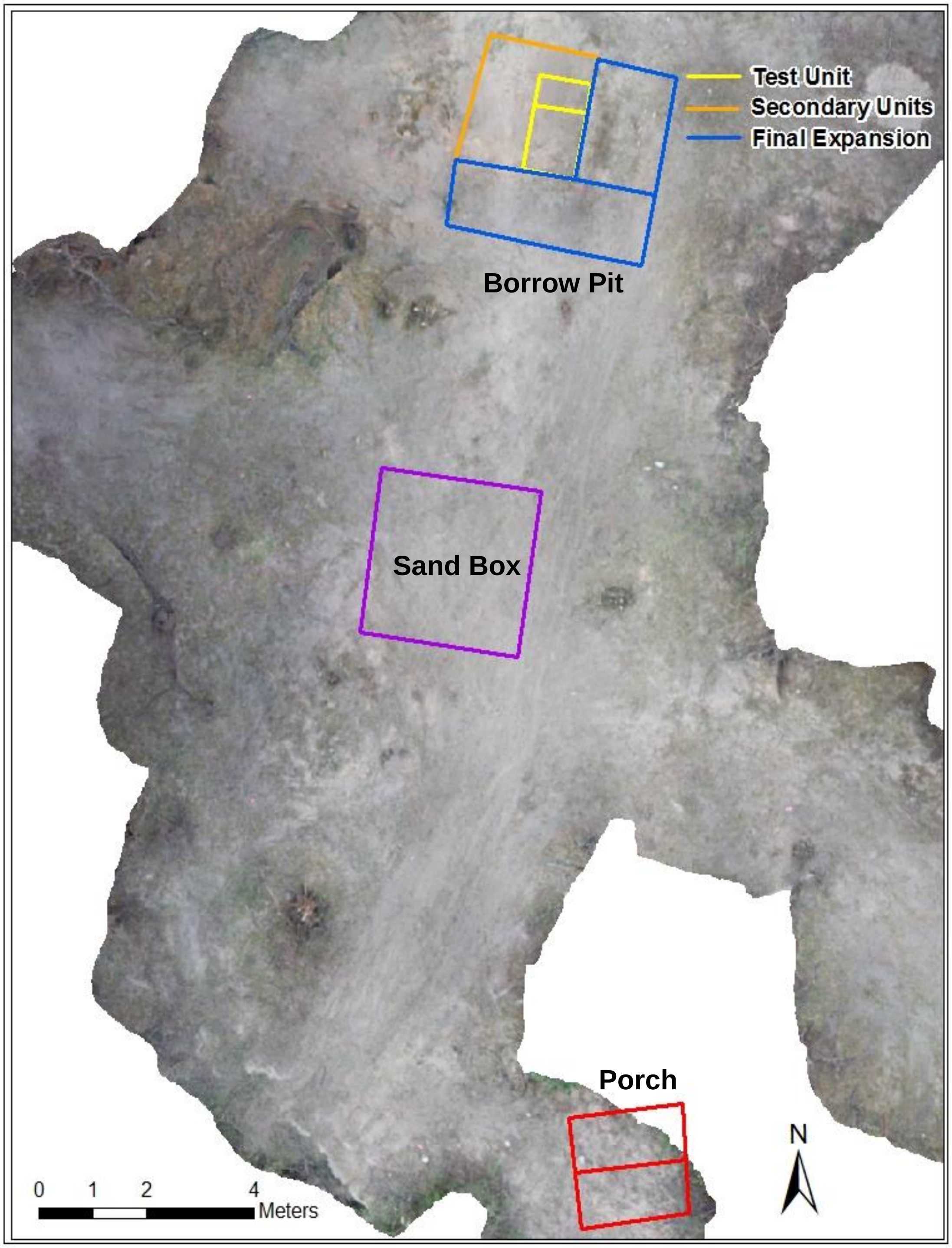



Figure 4.5: Excavation units across Sayles Adobe.

*Porch*

This excavation area was located at the southernmost point of the site immediately overlooking the channel of Eagle Nest Creek (Figure 4.5), offering a unique view from the site, down the canyon to the Rio Grande and Mexico, and across the canyon to Horse Trail shelter. We were curious if the area was used, considering the limited space and proximity to the massive limestone blocks we could see below from the canyon bottom (Figure 4.6). The Porch area had a slight downwards slope to the west towards the steep edge of the terrace. GPR survey was attempted over the area, but the limestone below interfered with the data recovered. Consequently, we decided to open a small excavation area to investigate the deposits and identify the slope of the rocks below.

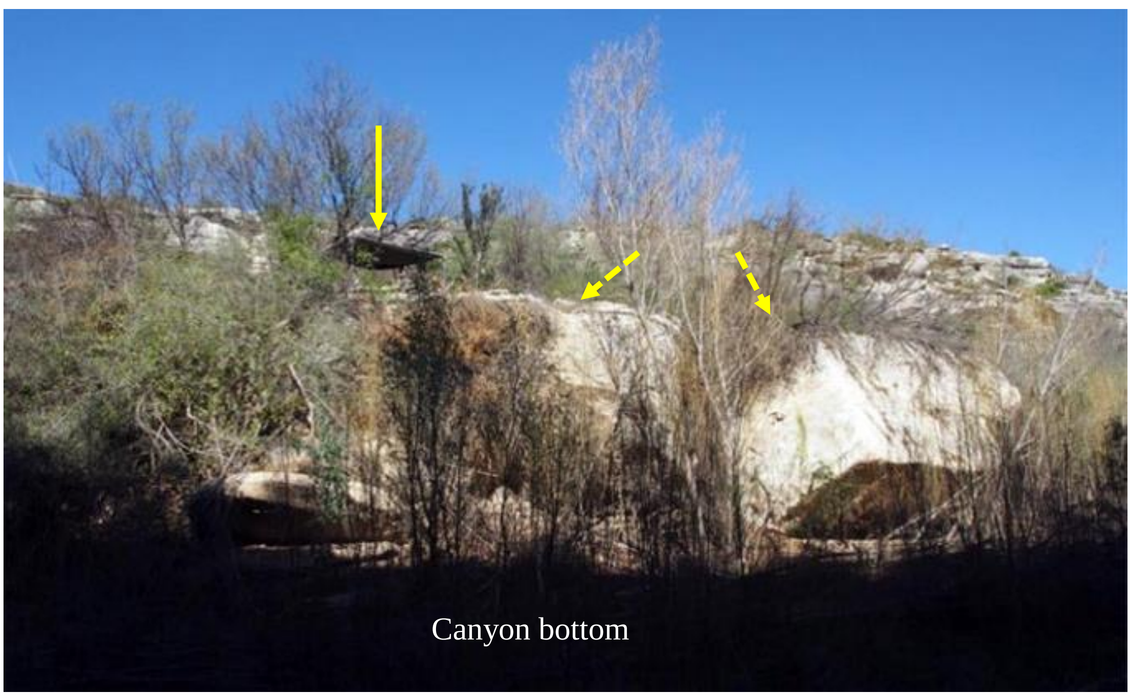



Figure 4.6: View of Sayles Adobe from the canyon bottom. The solid arrow points to the Porch excavation area, and the two dashed arrows indicate the limestone blocks that create the terrace catchment.

Excavations began in Unit C (Figure 4.7); it quickly became evident from the first two layers, that there was very little discernable change in the deposits. The sloping surface resulted in the lower boundaries of each layer having different depths below surface level. Due to the homogeneousness of deposits, excavators switched from hand excavation to shovel skimming during Layer 2. From Unit C, several large (>5cm in diameter) modified flakes, flake tools, and some debitage were collected from layers two and three (Table 4.1). However, there were no obvious signs of an anthropogenic surface; the sediments seemed mixed and contained calcium carbonate inclusions and insect casts.

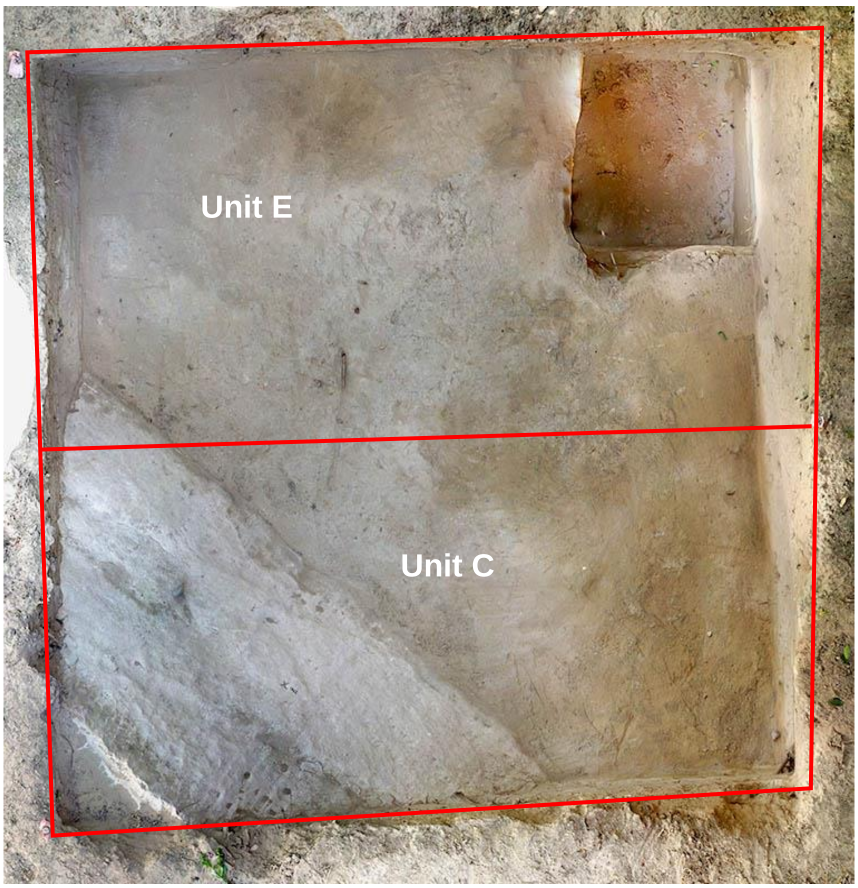


Figure 4.7: Porch area excavation units. Note the large sloping limestone slab in the lower left corner; this is the same limestone block that can be seen from the canyon bottom

Table 4.1: All cultural materials from Unit C & E excavations.

| Unit | Object Name | Artifact Material | Count |
|---|---|---|---|
| C | Debitage | Chert | 60 |
| C | Modified Flake | Chert | 2 |
| C | Flake Tool | Igneous | 1 |
| E | Painted Pebbles | Limestone | 4 |
| E | Modified Flake | Chert | 1 |
| E | Debitage | Chert & Igneous | 48 |

Excavations at the Porch continued with a second 1m-x-2m, Unit E, which lay immediately north of Unit C (Figure 4.7). Again, we saw little change in the deposits, so excavators split the unit in half, shovel skimming each side 20cm at a time, and recording the unit as a single layer. One modified flake and assorted debitage from screened materials were recovered; surprisingly, an apparent cache of three (possibly four) painted pebbles was encountered; three from roughly 30-cmbs and one 60-cmbs (Figure 4.8). However, there was no indication of a pit or any anthropogenic surface in the excavations, this led to a geoarchaeological investigation of Profile Section 03, the north wall of Unit E.

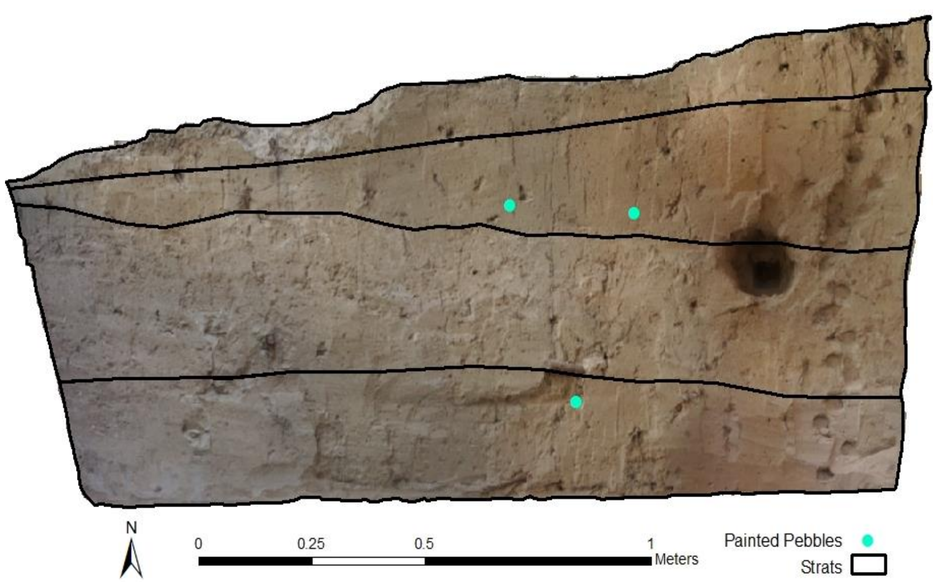



Figure 4.8: Final Porch profile (PS03), annotated with painted pebbles and geoarchaeologically identified anthropogenic surface.

Charles Frederick and Ken Lawrence collected a cube column (a sediment column collected in 8cc paleomagnetic sampling cubes) and an OSL (Optically Stimulated Light) sample from the north profile designated Profile Section 03. A zone of finer sediment increased magnetic susceptibility, increased organics, and a trend of increased calcium carbonate was identified with the analysis (Figure 4.9).

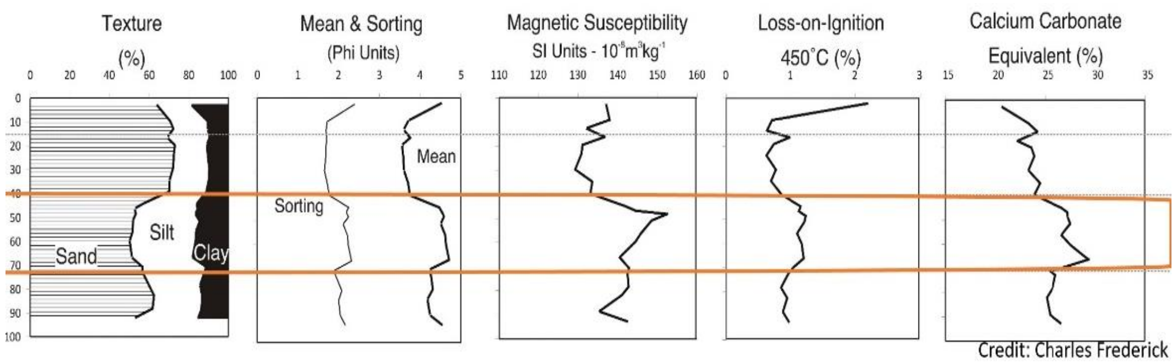



Figure 4.9: Results of the cube column collected by Charles Frederick and Ken Lawrence; this was to test if a difference was present in the sediments not seen in the field. The orange bracket indicates the inferred anthropogenic surface.

The Porch excavations did not encounter Mud Drape1, and there was no indication of a mud drape seen in the geoarchaeological data. However, a probable subtle cultural surface was identified. The cultural materials in a seemingly homogenous, unstratified alluvium deposit directed us to give more attention to the massive, homogenous alluvium deposit covering the site.

Several factors led to the close of excavations at the Porch; decline of cultural materials, the underlying limestone block (Figure 4.7) continued to expand into the units, and dense vegetation to the north and east of Unit E inhibited further horizontal expansion. An auger test was excavated through the Unit E floor, adjacent to the north wall (PS03), reached the bedrock below at about 50cm in depth. Therefore, we saw little potential for more excavation in the area and decided to concentrate on the Sand Box and Borrow Pit.

*Sand Box (SB)*

As discussed in Chapter 3, the Sand Box excavation area was opened following several failed attempts to auger below 1.4 meters. Realizing that a buried cultural deposit was present, we opened the area by rapidly removing the overlaying alluvium from a 3m-x-3m area with shovels to just above the Borrow Pit flood drape at roughly 90cmbs (Figure 4.10). We spot screened every fourth bucket of alluvium to check for artifacts with the bulk of the sediment being discarded without screening. Using this strategy allowed us to expediently target the FCR anomaly hit with the auger tests, which lay below Occupation #1.

Figure 4.10: ASWT crew and Tarrant County Archaeological Society volunteers, Art Tawater and Bryan Jameson, shoveling out bucket-loads of sandy alluvium to reach the flood drape seen in the Borrow Pit.

Using a combination of hand excavation and shovel skimming, we excavated the Sand Box in eight excavation units (Figure 4.11). The excavation sequence exposed the deposits at different angles, capturing a variety of both horizontal and vertical perspectives.

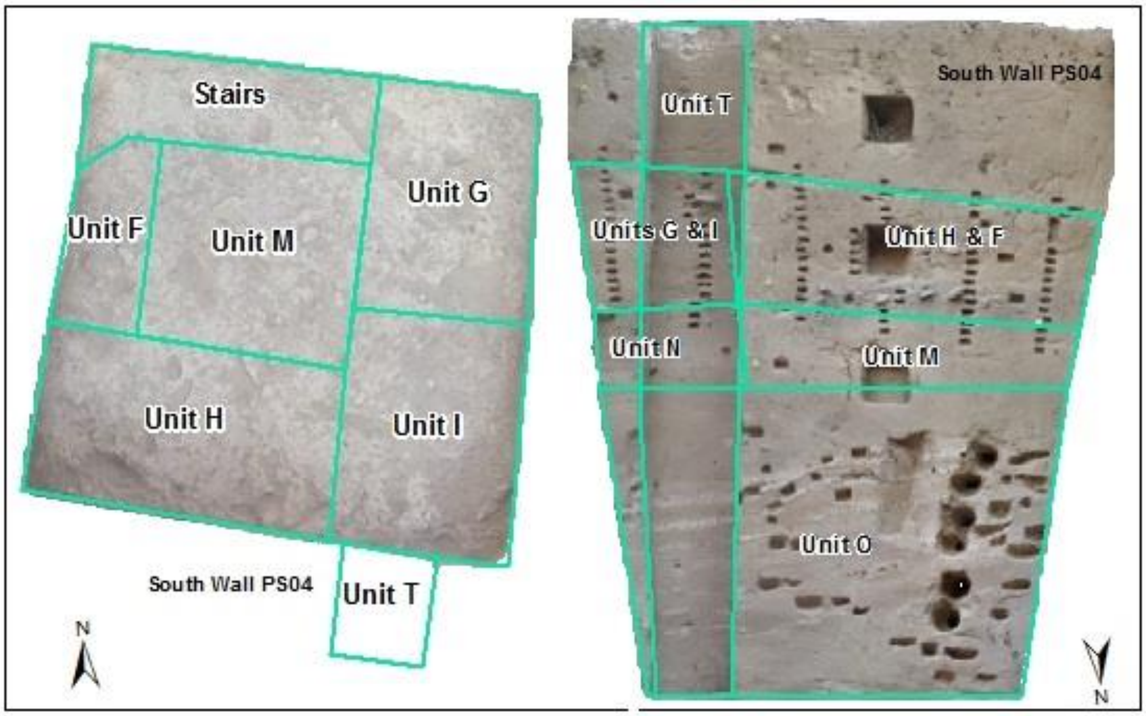



Figure 4.11: (a) Plan view of the units excavated in the Sand Box area. (b) Profile of the unit layout in the Sand Box, with Occupation 1 and 2 indicated in the shaded areas. Due to the puzzle-piece style of excavation, not all units are visible in both.

Unit H in the southwest corner of the Sand Box was excavated first, where auger tests and GPR indicated a potentially dense cultural zone (Figure 4.11). Like the Borrow Pit, there was an anthropogenic deposit (Occupation 1) directly below Mud Drape 1 (Figure 4.12 left). In the Sand Box, cultural materials associated with Occupation 1 were not as dense as in the BP, but a moderate amount of FCR scattered across the area. Work continued in Unit H, following the traces of the auger tests that could been seen in the first few layers of excavation, until we reached the deeper cultural layer from testing.


Figure 4.12: (Left) Unit H Layer 2 and 2b, excavations of Occupation 1 directly beneath Mud drape1. (Center) Layer 3 and 3b, showing the disappearance of FCR and homogeneousness of deposits. (Right) Layer 4 and 4b, appearance of a new level of FCR and activity clearly below Occupation 1.

Figure 4.12 depicts excavations of Unit H, from Mud Drape1 down to the second level of activity. When we reached the lower boundary of Occupation 1, auger holes still present, indicating we had not yet encountered the FCR hit by the auger tests. Excavations continued until we hit the new deposit and the auger holes disappeared. Due to the lack of cultural material and FCR between the boundary of Occupation 1 and this new surface, it was clear we were at a separate level of activity, dubbed Occupation 2.

Occupation 2 (Figure 4.12) lay roughly 30-40cm below Occupation 1 and yielded an increase in cultural materials, similar to Occupation 1 in the BP. This second zone of activity then became a marker for excavators as other units in the Sand Box progressed through Occupation 1. Units F, G, and I were excavated to the upper surface of Occupation 2. To our surprise, a butted knife, sometimes termed a Kerrville Biface (Turner et. al. 2011: 210-211), was discovered in Unit F at the Occupation 2 level (Figure 4.13). This type of artifact is rare within the canyon but not unheard of in the LPC region and will be further discussed in Chapter 7.


Figure 4.13: (Left) Unit H and Unit F excavated to Occupation 2, with the butted knife circled in yellow. (Right) Butted knife close-up prior to being shot-in and collected.

Once the main excavations were complete at a depth of roughly 3.4-mbs, four profile walls, Profile Sections (PS) 04 to 07[5], were documented before the removal of a sampling column (Unit T). Each profile was annotated for stratigraphic boundaries and sediment samples were collected from defined strats for curation and later analysis. As seen below in Figure 4.14, profile sections in the Borrow Pit and Sand Box were oriented on a similar axis in order to more easily correlate stratigraphy from each excavation area.

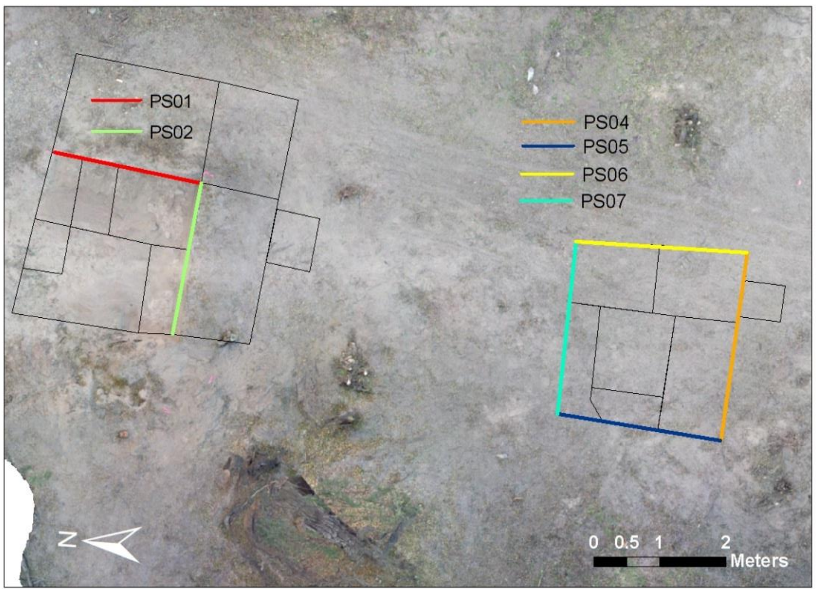



Figure 4.14: Plan map of the Sayles Adobe Surface with the location and orientation of the Sand Box and Borrow Pit profiles.

Unit T (Figure 4.11) was a 35cm-x-45cm sampling column dug from the surface to the excavation area floor (3.4mb). This involved the removal of complete sediment layers of 1-5 cm thickness following the stratigraphic boundaries annotated on the Profile Section 04 orthophoto. Each layer was screened through a ½" sieve in the field to remove the larger inclusions, such as burned rock that would be sorted in the field.

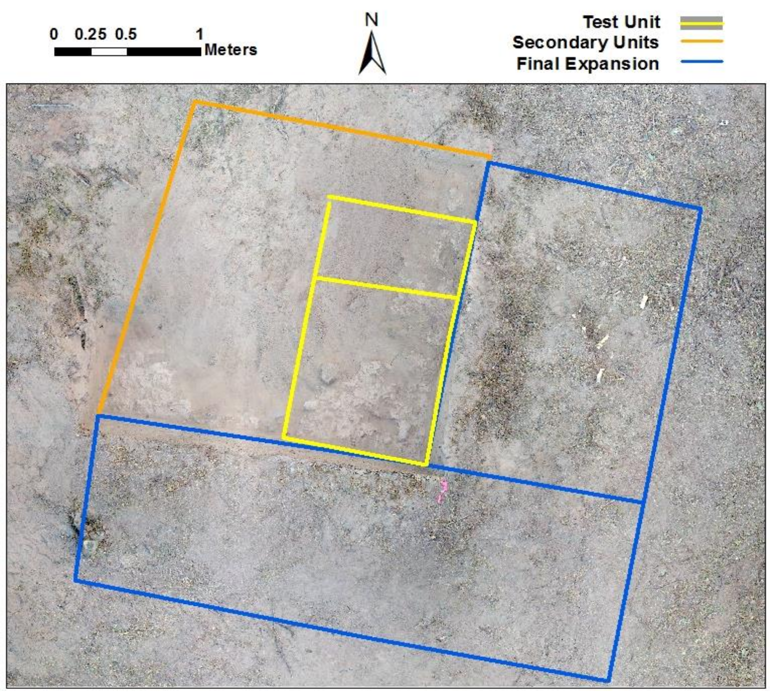
A 5-liter sample, of each layer, was transported to the field camp for water sieving where the 2mm, 1mm, and .5mm residuals were collected and dried. Residuals, which

[5] Profile Section 07 was annotated and assigned strats but was not sampled due to time constraints.

include charcoal, lithic debitage, faunal remains, and FCR fragments, which have been curated for future analysis and can be paired with the data from the Borrow Pit sampling column.

*Borrow Pit (BP)*

As discussed in Chapter 3, the results of our initial test unit led us to believe that the Borrow Pit area had great potential for large area excavation and was the best location to follow the Occupation 1 deposit toward the central section of the terrace. Auger test and GPR data had shown anomalies at the level of Occupation 1 (approximately 1mbs), outside of our previous test unit. Expanding off the test excavations (Figure 4.15), we excavated west of Unit A1 creating a wider excavation block.




The second stage of the Borrow Pit excavations included Units B, D, J, K, L, and P (Figure 4.16). Occupation 1 and Mud Drape 1 were present in Unit B, L, and D, with excavations continuing down (Units J, K, and P) through the two distinct markers. Unlike the Sand Box, no dense second occupation deposit (i.e., Occupation 2) was noted. However, a series of alternating deposits of fine mud drape and coarse flood alluvium were encountered around the 2.8-meter depth level in all profiles of the area. This sequence of flood deposits was present both the Borrow Pit and Sand Box excavation areas and will be further discussed in Chapter 6.

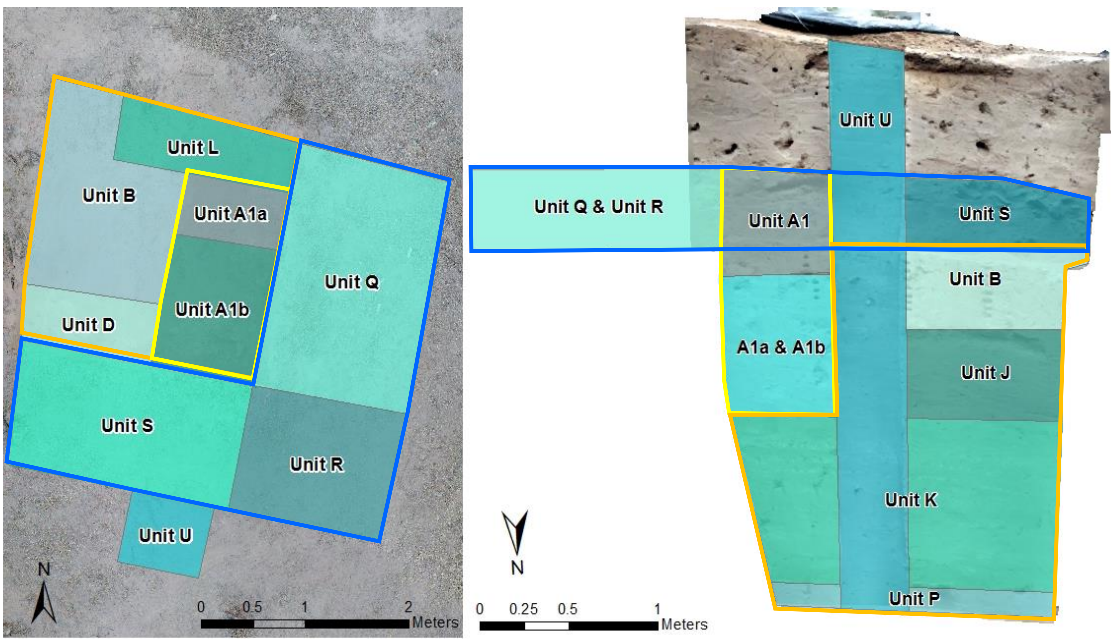


Figure 4.16: (Left) Plan layout of the Borrow Pit units. (Right) Profile perspective of Borrow Pit excavations.

The final stage of excavation consisted of removing the alluvium above Mud Drape1 and Occupation 1 to the south and east. This created an upper “excavation” shelf, which was divided into three units: R, S, and Q. These excavations were intended to intensely sample and document a midden feature (Feature 01) that was recognized in the south profile. Unit Q was excavated in arbitrary layers, while Units R and S were divided into strip units (Figure 4.17): Ra, Rb, Sa, and Sb. These excavations resulted in the discovery of two thermal features, which are discussed in detail in Chapter 7.

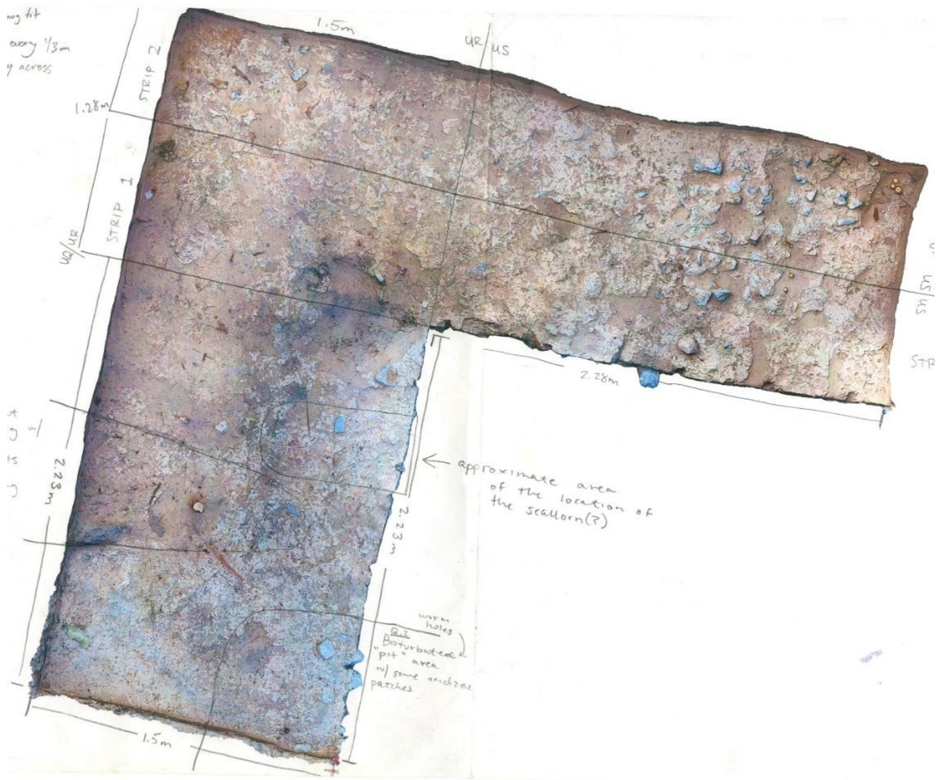



Figure 4.17: Plan orthophoto of the BP expansion (upper shelf) with annotations of proposed units Q, R, and S. Mud drape 1 covers the surface, with dense concentrations of FCR poking through. Also note, this section of mud drape has been impacted by roots and burrowing critters more so than previous exposures.

Excavations in the Borrow Pit resulted in the creation of two >3-meter profile sections (Figure 4.14): PS01 and PS02, which were sampled prior to the final expansion of the excavations. After all block excavations were completed, Profile Section 02 was targeted for additional sampling, in the form of a sampling column (Unit U) from which 5 cm layers were collected. All the sediment from Unit U was collected, not just 5-liter samples of the matrix, as was done in Sand Box Unit T. Here it was processed by recording the volume of material from each layer, taking a 200g sediment sample, and water sieving the matrix.

Again, we collected the 2mm, 1mm, and .5mm residuals; however, these residuals were sorted for microartifacts as part of this thesis. This was done in Unit U, and not Unit T, because we had a sediment sample from each layer to pair with the microartifact sample. These microartifacts (materials smaller than the typical ¼” or $^{1}/_{8}$” field screens), when paired with sediment data, can be used to identify anthropogenic surfaces that are ephemeral.

*Close of Excavations*

Once sampling and excavations were completed across the site, we used an auger to probe below the unit floors. Augering was an attempt to accomplish three goals that would provide information about the sites deposits we did not reach with excavations.

1) Document the deposits below the unit floors;
2) Recover sediment samples and cultural material —artifacts or charcoal;
3) Hit bedrock to show exactly how deep the Sayles terrace was.

Sediment samples were collected from the Sand Box and Borrow Pit augers, with cultural materials (both lithic debitage, FCR, and charcoal) recovered at multiple levels below the roughly 3.4-mbs unit floors. We did not hit bedrock in any of the areas. However, we may have been close in the Borrow Pit, where we were stopped by a level of coarser sediment and colluvium, presumably along the slope of the canyon wall. The site was backfilled in two sessions; first was the Porch and Sand Box on June 29th, 2016, and second was the Borrow Pit in March 2017.

The remainder of this thesis focuses on the geoarchaeological methods and analyses, and discussion of the cultural material recovered from the site. The geoarchaeological analyses and results concentrates on material recovered from the Borrow Pit excavations, the Unit U sampling column, and correlation of deposits across the site.

# V. GEOARCHAEOLOGICAL SAMPLING AND ANALYSIS[6]

As stated in Chapter 1, my thesis research was structured around site formation processes and identifying cultural activity present at the site. To do this, I worked closely with geoarchaeologists Charles Frederick and Ken Lawrence to learn sampling techniques in the field, and later in Frederick's Geoarchaeology Lab conducting the sediment analyses. This allowed me to attain training in geoarchaeological lab analyses and greatly aided my final interpretations

This chapter outlines the sampling procedures from the field, geoarchaeological lab methods, and provides short justifications for each chosen analysis. The geoarchaeological results presented focus on Unit U, which offers a 3.4-m continuous window of the deposits.

## GEOARCHAEOLOGICAL SAMPLING

*Sampling* refers to the collection of sediment (loose or in blocks) for later analysis. This analysis focused on goals to understand the flood regime and identify cultural surfaces. Most samples were pulled from field-described profile sections, particularly those that rest on a shared axis, such as PS01 and PS06 (Figure 5.1), in order to correlate stratigraphic units. Other samples were collected to target thermal features, deposits that would add to the ecological, or climatological interpretation of the site.

[6] All processing and analysis was completed by the author, at the Texas State Upper Pecos Lab or the Geoarchaeology lab in Dublin, TX, unless otherwise stated.

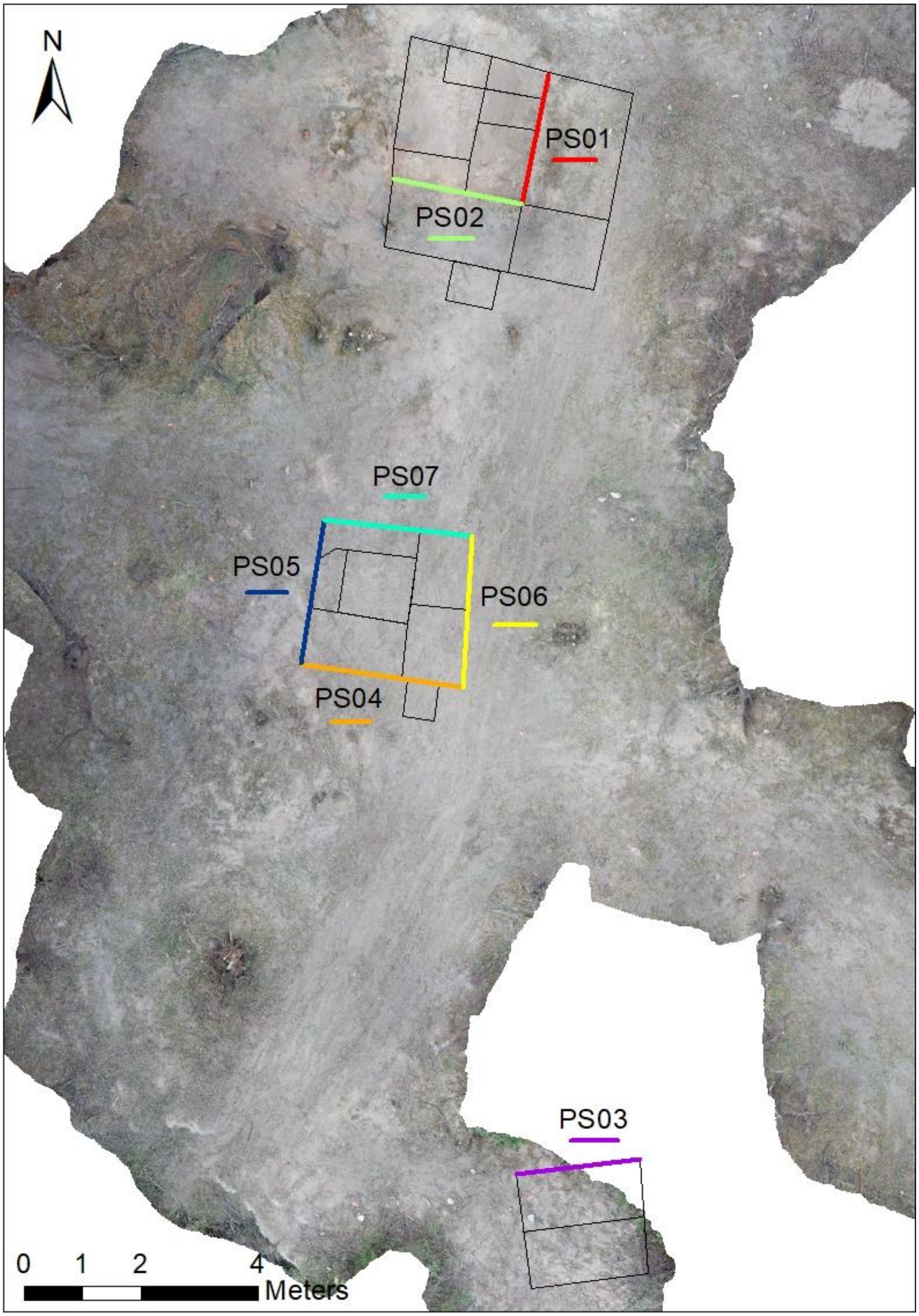


Figure 5.1: Profile Section locations across the terrace.

*Spot, Geo-matrix, and Bulk matrix Sampling*

Following the contextual approach discussed in Chapter 1, samples were collected to create climatic, archaeological, and ecological datasets that aid in the analysis of the site. Spot, geo-matrix, and bulk matrix are targeted samples. Spot samples averaged 50-150 g, geo-matrix 100-300 g, and bulk matrix ranged anywhere from 1-liter to 8-liters. Bulk matrix samples were collected for macrobotanical and malacological analyses (discussed further in Chapter 6), as well as for the geoarchaeological analysis. Figure 5.2 illustrates how intensely certain profiles were sampled.

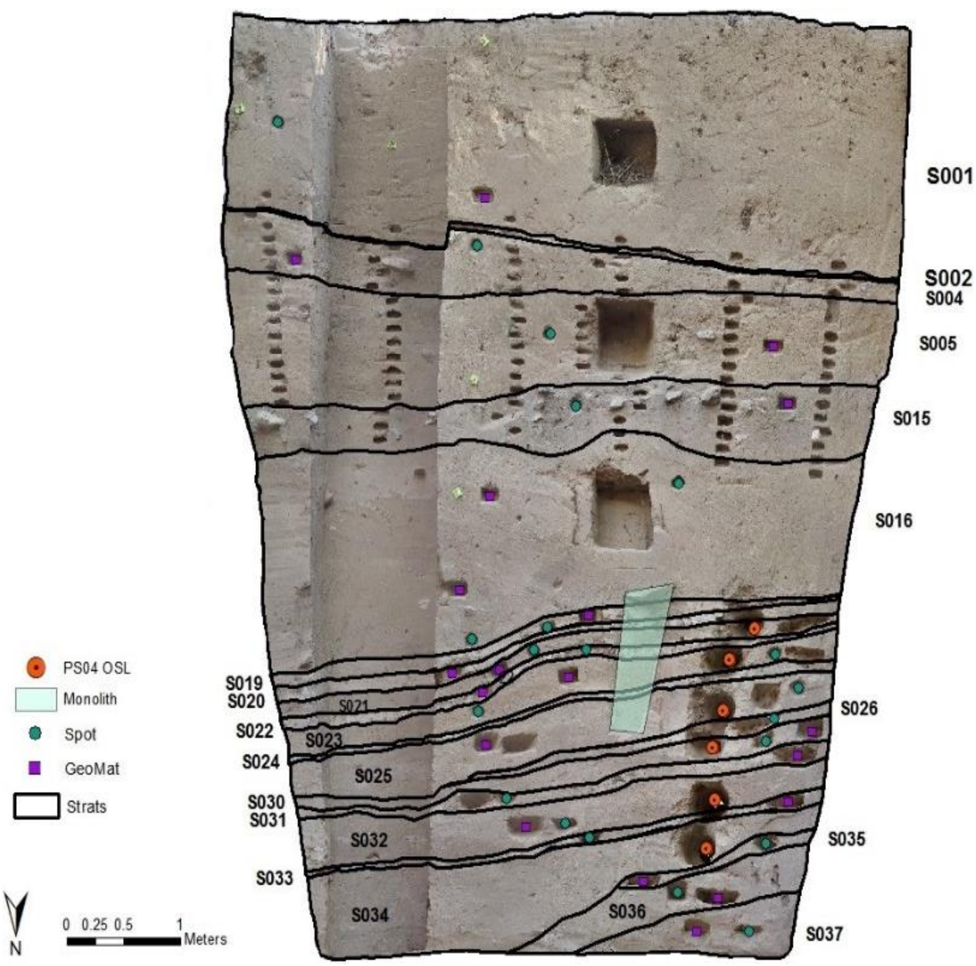



Figure 5.2: Sand Box Profile Section 04Figure 2.3: (Left) Early excavations of

*Borrow Pit Sampling Column -- Unit U*

Before the close of Borrow Pit excavations, a 40 cm-x-35 cm sampling column, located in the south wall of the excavation area (PS02) was excavated from the upper terrace surface to the area floor in 1-5 cm layers. Layers were excavated by trowel, and line level with a measuring tape to track depth below surface (Figure 5.3).

Figure 5.3: The author excavating the second level of the sampling column.

Since the profile had been annotated with stratigraphic boundaries the column was excavated following the natural stratigraphy of the site. However, if a defined deposit was thicker than 5cm it was divided evenly (i.e. 6cm thick = two 3cm layers), and if it was less than 5cm it was collected as a single layer. All excavated material was collected in 6-liter bags that were then transported to the field camp for processing, where the matrix was screened for large inclusions, measured for volume, and water sieved for microartifacts.

As discussed in Chapter 4, the purpose of this was to collect a continuous column of material, so the sediment properties and microartifacts could be evaluated. A microartifact analysis was conducted by sorting through the 2mm and 1mm residuals collected from each layer, picking out fragments of burned rock, lithic debris, faunal remains, etc. (Hassan 1978: 208).

Figure 5.4: Bags of collected sediment from Unit U waiting to be processed at the Shumla Campus (our field camp).

Three main steps were taken to process the collected matrix:

1) The volume of each 5cm level was recorded before passing the sediment through a ½”-inch geologic sieve to remove large inclusions (rocks, cultural materials, etc.).
2) Collecting a 200-gram sample of homogenized sediment before submersing the sample in water to sieve the material through 2mm, 1mm, and .5mm geologic sieves.
3) Collection of the residuals from each sieve in chiffon cloth, drying the materials, and later sorting the 2mm and 1mm materials.

As discussed above, the residuals -- i.e., the 2mm and 1mm particles caught in the sieves (Figure 5.5) was dried, sorted for cultural material (charcoal, burned earth, FCR, debitage, and faunal remains), materials were counted, then analyzed under a framework (See Chapter 7 for framework and the results). These data were then compared to the sediment data produced from each level (presented in Chapter 6). Together these data resulted in the identification of multiple ephemeral cultural units beyond Occupations 1 and 2, which were intially identified in the Borrow Pit and Sand Box excavation areas.

Figure 5.5: (Top Left) Water sieving matrix samples after the >1/2" materials were removed, sample was mixed, and soaked in water. (Top Right) 1mm geological sieve with the residual material from the sediment samples that was water screened. (Bottom) Results from a level of 2 mm microartifact sorting. The photo shows the FCR, charcoal, and debitage that was picked out from the residuals.

*Monolith and Micromorphology Samples*

Two types of block sediment samples were removed from the profiles of Sayles units before the close of excavations: micromorphology and monolith. Both capture intact, properly oriented sediments; however, monoliths tend to be longer column samples, whereas micromorphology samples are generally smaller blocks of sediment. Three monoliths were removed from the site, two in the Borrow Pit and one in the Sand Box, to provide a more detailed look at the alternating sequence of mud drapes and sandy alluvium. Five micromorphology samples were removed, four from the Borrow Pit and one from the Sand Box; these were taken from feature areas, to understand the amount of bioturbation and mixing was taking place.

LAB METHODS: TESTS & PROCEDURES

Figure 5.6: Photo of the lab setup while processing samples for magnetic susceptibility and particle size. The machine to the far left is the laser particle sizer used, opposed to the typical way, i.e. hydrometer.

As stated, a number of datasets were paired together to interpret and understand the use and formation of Sayles Adobe. To do this geoarchaeological tests (Figure 5.6) including magnetic susceptibility, particle size, calcium carbonate content, thin section analysis, total organic carbon content and carbon isotope, and X-ray diffraction sediment mineralogy were carried out. These analyses were chosen to create a multi-layered dataset that would allow me to identify ephemeral cultural levels in otherwise homogenous, massive-looking deposits, and to create a clearer image of the depositional sequence. Obvious cultural zones were encountered in excavations, discrete cultural surfaces were difficult to discern, thus the use of a rigorous geoarchaeological and archaeological analysis.

Each test identified properties that when paired with artifact data, supported the determination of multiple anthropogenic surfaces across the terrace. Paleomagnetic cubes (8 cc) were packed and weighed in the lab from sediments collected in the field (Figure 5.6). The same sediment samples were used to measure the magnetic susceptibility, particle size distribution, total organic carbon, and calcium carbonate equivalent. Stated more explicitly, a 14-20gram sub-sample was taken in the lab from each field sample; from this sub-sample, it was possible to further sub-sample the sediment for each analysis. Magnetic susceptibility is a nondestructive test and thus was run first, with sediment used afterward for the destructive tests, i.e., particle size, total organic carbon, and calcium carbonate equivalent.

*Magnetic Susceptibility*

Magnetic susceptibility is a measure of how susceptible a material is to magnetization (i.e., how magnetizable it is), and measured by the presence of magnetization rather than magnetic remanence (Dalan 2006: 162; Dalan 2008: 15). A number of factors influence values, such as human activity, pedogenesis, and particle size. Susceptibility of sediments and soils are also affected with depth as post-depositional influences work on the material (Szuzkiewwicz et.al. 2016: 465). In archaeology, this technique is paired with other geophysical and geoarchaeological analyses that help distinguish cultural from natural processes, helping archaeologists to identify buried cultural surfaces.

The high- and low- frequency magnetic susceptibility was measured with a Bartington MS2 meter & MS2b sensor, with mass specific susceptibility (□) and corrected volume susceptibility (K) values calculated in post-processing. Each volume susceptibility (K) measurement was collected twice, and calibrated with two air measurements, one prior to the sample measurements and once after. These measurements were then used to calculate the mass-corrected (□□□magnetic susceptibility.

*Particle Size Distribution*

Particle size analysis identified the ratio percentage of sand, silt, and clay per sample, aiding in identifying the mode of deposition, post-depositional process, and soil texture class. Larger particles mean more energy is needed to transport those particles. The traditional method of particle size analysis, uses a hydrometer or pipette in combination with sieving, adding water to samples within a graduated cylinder, shaking it, and then taking timed measurements that tie to when a certain particle size should fall out of suspension.

Sediments present at Sayles were all sand-size and smaller (clay), which allowed me to use a Beckman-Coulter LS 13 320 Multi-wavelength Laser Diffraction Particle Size analyzer. This process allowed me to run roughly 60 samples per day with a tiny amount of sediment (.1-.3g), with a minor amount of pre-processing for each sample (Figure 5.7), detailed below:


Figure 5.7: (Top left) Samples prior to heating. (Right) Samples heating. (Bottom left) Bleach and sodium hexametaphosphate.

1. 25 ml beakers were labeled with a sample number. The instrument required sample sizes between 0.1g and 0.3g depending on the estimated major particle size of the sediment. Not enough or too much could skew the results of the instrument and measurements would not be accurate.
2. Under a fume hood, approximately 5 ml of a 5% sodium hexametaphosphate and approximately 5 ml of chlorine bleach was added to each sample to break down colloidal bonds and dissolve organic matter. To aid in this process, the samples were heated on a hot plate at 150˚C for 20 minutes, swirling the samples individually on occasion.
3. Samples are poured into the aqueous liquid module (or ALM) one at a time, where they were sonicated to separate the particles before being flushed through a tube that will count and size the sediment.

4. The estimated time to measure one sample is close to 1-minute; however, the time it takes to run one sample start to finish is roughly 7-minutes. This is because the instrument takes a background reading prior to sample loading, and after the sample measurement is completed, the instrument auto-cleans the ALM and the system.

The computer software for the particle size analyzer produced an individual Excel spreadsheet for each sample (see Appendix D) reporting a range of detailed information. The software exports the percentages of sand (>63 microns), clay (% >6 microns and %>2 microns), and various descriptive statistics such as mean particle size, median, sorting (standard deviation), skewness, and kurtosis in phi values (a $-\log_2$ transformation of millimeters) and in microns. After determining the size distribution of particles, the USDA soil texture class calculator available on the Natural Resources Conservation Service (NRCS) website (NRCS 2018) was used to classify the sediments.

*Total Organic Carbon*

Organic carbon was measured to better understand the composition of the sediment present at the terrace. These data also help in the interpretation of the compiled sediment data, working with magnetic susceptibility in identifying buried cultural surfaces.

Due to the specialized nature of the total organic carbon analysis, samples went were sent to the Keck Paleoenvironmental & Environmental Stable Isotope Laboratory (KPESIL) at the University of Kansas. Due to cost, only 50 of a potential 83 samples were chosen for analysis. Known (or suspected) cultural surfaces and mud drape-alluvium interfaces (Figure 5.8) were chosen, and every third sample was selected from thicker deposits.

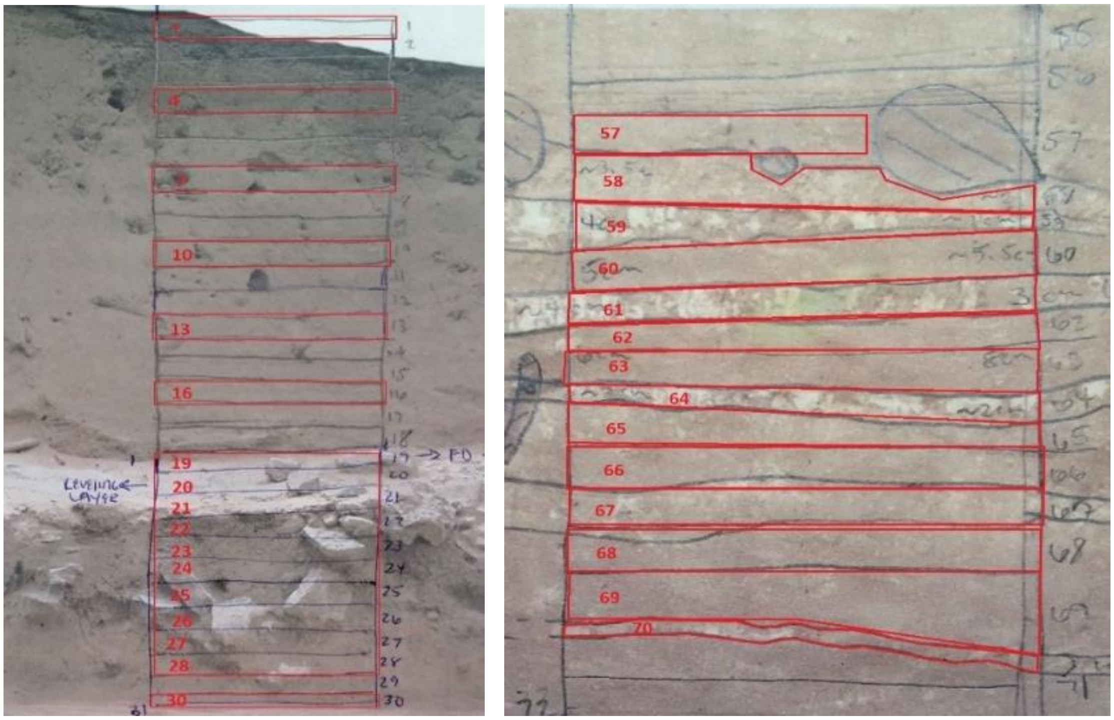


Figure 5.8: Unit U profile annotated with samples collected and chosen for total organic carbon analysis.

*Calcium Carbonate Equivalent*

Considering the location of Sayles Adobe (within a Cretaceous limestone canyon), we estimated that the presence of calcium carbonate would be highly variable between the sandy alluvium deposits and mud drapes. The Occupation 1 deposit in the Borrow Pit was targeted as a promising section to test for elevated carbonate present from thermal refuse. To do this, a Chittick apparatus was used to react 1.7 grams of sediment with hydrochloric acid, measuring the volume of evolved carbon dioxide and used to calculate the calcium carbonate equivalent (Loeppert and Suarez 1996).

*Mineralology and Micromorphology*

Block samples (micromorphology and monolith) were embedded with polyester resin, slabbed on a rock saw, and then sent to National Petrographic in Houston, Texas for mounting and polishing. Thin section analysis was done to assess the stratigraphic integrity of feature and flood deposits.

Specifically, I looked for features indicating bioturbation, pit digging, and other identifiable post-depositional features (Figure 5.9). This included looking at the sedimentary composition of the particles in the slides, as well as the relative amounts of identifiable ash and charcoal, burned rock, and organic material (roots, plant, and bone).

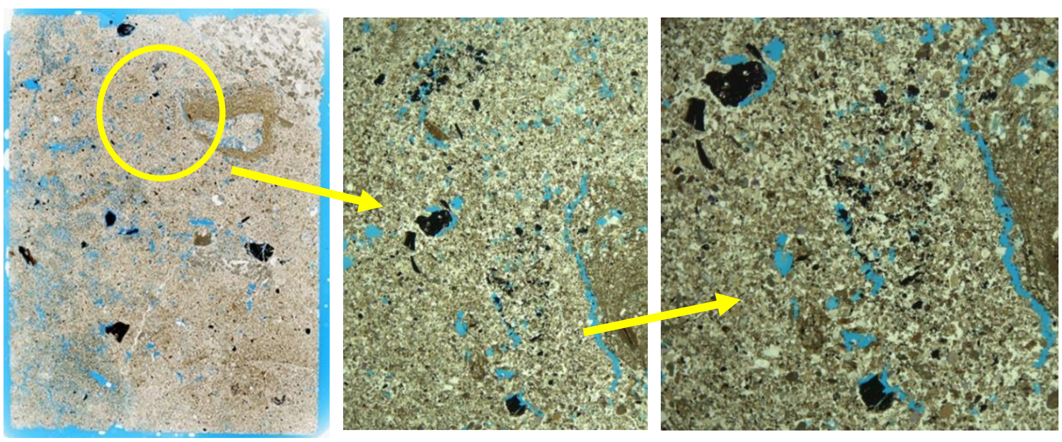


Figure 5.9: Thin section from a possible thermal feature; focus is on the mixed nature of the particles and the trail of charcoal left by an insect. The large dark brown circular feature in the slide scan (half included in the yellow circle) is a termite chamber with an organic-mineral laminated lining. (Left) Full slide; (center) Bioturbation feature (x15 magnification); (right) Bioturbation feature x27 magnification.

Prior to embedding, each block was microsampled (i.e., collecting samples directly from the block) which allowed me to obtain additional geoarchaeological data aiding in the differentiation between natural and cultural deposits (Figure 5.10). Microsampling the monolith was particularly useful as the block captured an alternating sequence of coarse and fine flood deposits that occur within an estimated 1000-1200 year period (Figure 5.11).

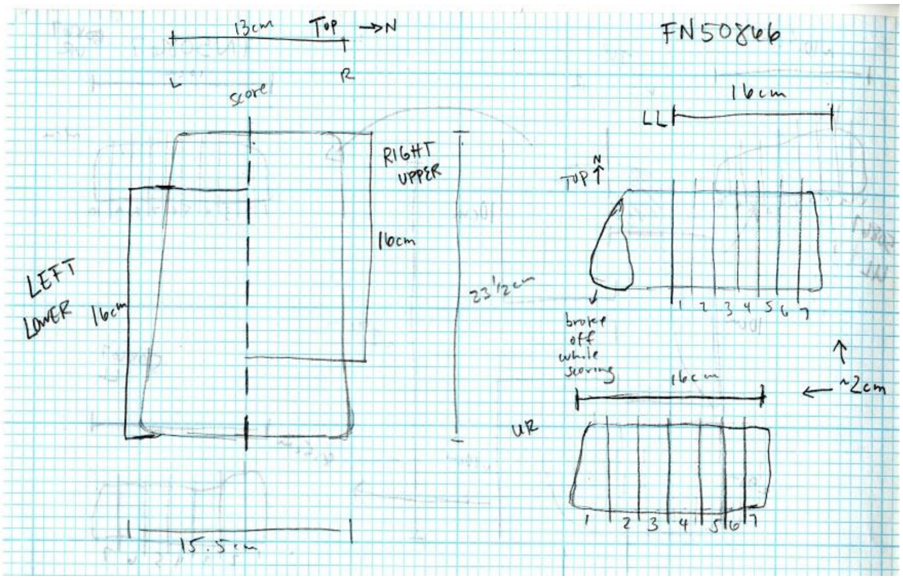



Figure 5.10: Lab sketch of one of the micromorphology blocks indicating how the block was cut and sampled prior to embedding.

This alternating sequence of mud drape and sandy alluvium captured by the monolith was present in all profile sections in both the Borrow Pit and Sand Box. This microsample dataset provided a finer resolution of the flood sediments allowing us to identify what individual floods looked like at the site. Identifying the characteristics of flood deposition at the site helped in delineating floods and cultural surfaces seen in the analysis of profile sediments.

Six of the thirty samples collected from the monolith were sent for total organic carbon analysis and two of the six sent were also sent to James Talbot of K-T Geoservices for XRD (X-ray diffraction) mineralogical analysis. XRD is a common technique used by soil scientists, geologists, and geoarchaeologists to identify the mineral composition of soils and sediments (Harris and White 2008: 81). Talbot’s work identified nine minerals: quartz, k-feldspar, plagioclase, calcite, dolomite, hematite, illite and mica, kaolinite, and chlorite (Table 5.1).

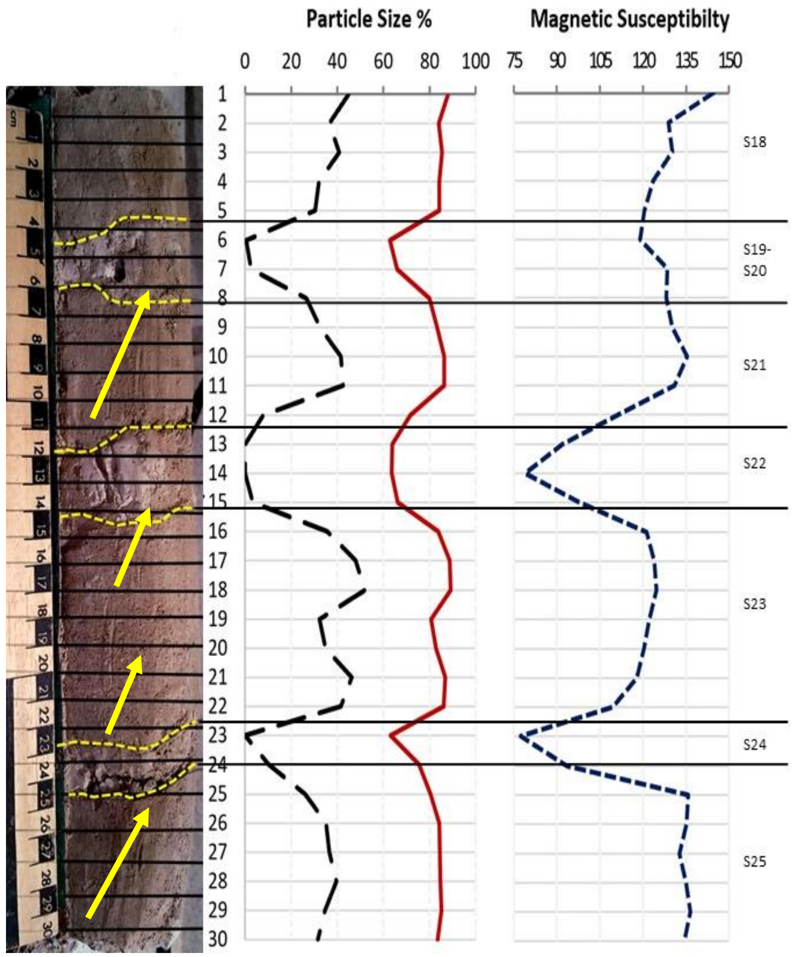



Figure 5.11: Monolith 50868 from PS02 (Borrow Pit), with strat boundary and sample annotations.

Table 5.1**:** Mineralogical composition of the two samples (one fine and one coarse) sent for XRD. Data reported by K-T Geoservices.

| Sample ID | 50868.14 | 50868.17 |
|---|---|---|
| Particle Size | Fine (Silt-Clay) | Coarse (Sand-Silt) |
| Quartz | 18.9 | 31.7 |
| K-Feldspar | 6.5 | 5.9 |
| Plagioclase | 6.5 | 9.9 |
| Calcite | 50 | 42.5 |
| Dolomite | 1.1 | 0.8 |
| Hematite | 0.5 | 0.5 |
| R0 M-L I/S (60%S)* | 3.4 | 1.9 |
| Illite&Mica | 9.4 | 2.9 |
| Kaolinite | 3.1 | 3.3 |
| Chlorite | 0.6 | 0.6 |
| TOTAL | 100 | 100 |

*Note: R0 M-L I/S (60%S) - R0 Ordered Mixed-Layer Illite/Smectite with 60% Smectite Layers

This analysis was performed on the coarsest and finest sediments that were present in the monolith to gain insight on the manner in which the mineralogy varies with particle size in Rio Grande flood deposits and how it may be reflected in other analyses such as the magnetic susceptibility. Mineralogical data also helped in the confirmation of the source of the flood sediments, which we expected show igneous minerals suggesting sediments from the upper Rio Grande.

*Microartifact Analysis Framework: Culltural Units*

In order to create a process that would systematically and consistently analyze the microartifact data from the Borrow Pit sampling column (discussed in Chapter 7), thresholds for count data were paired with concise terminology. This terminology framework, outlined in Table 5.2, was tiered to clearly indicate significance (i.e., time-depth or density) or ephemerality of the identified cultural deposits.

Table 5.2: Framework and terminology used to interpret the 2mm and 1mm microartifact data from the Unit U Sampling Column.

| **Cultural Unit** | | |
|---|---|---|
| **Term** | **Threshold** | **Category** |
| Compound episode (CE) | More than 2 episodes | Over 2 contiguous levels; except when there is a stratigraphic break |
| Episode (E) | More than 5 microartifacts | At least 2 different categories |
| Potential episode (PE) | Less than 5 microartifacts | In more than 1 category |

*Cultural Units* are defined as any level of human activity represented in the microartifact data; these were further broken down into: *Compound Episodes (CE), Epsiodes (E), and Potential Episodes (PE).* Starting first by identifying any Potential Episodes, then picking out the Episodes. Once the lower two categories were recognized, the individual depositional events parsed out of the sediment data (see Chapter 6: Borrow Pit Geoarchaeology) were compared side to side. This paired data was used to note any stratigraphic, depositional breaks in the column that would allow for the identification of the Compound Episodes.

In other words, if a series of Episodes or Potential Episodes were noted, the depositional data would indicate whether that series of events was a Compound Episode or a series of smaller events that were broken up by floods. Once this analysis was completed, with both cultural and depositional units identified, an Age-Depth model of deposits for the site could be used to calculate an estimated age range for the units. Additionally, to avoid confusion with any early terminology that was based off field observations (i.e., Occupation 1 or Occupation 2), these names were integrated into the new framework to retain those field designations but separate any additional activity that may be present in the higher resolution data.

# VI. GEOARCHAEOLOGICAL RESULTS

Excavation of the Sayles Adobe terrace concluded with intensive sampling and description of the deposits which reached depths of nearly 5.7-meters below surface. In the two large, deep units (Borrow Pit and Sand Box) we documented over 25 individual depositional events and cultural surfaces that were mirrored across the site. These stratigraphic correlations paired with the geoarchaeological and archaeological data have revealed the site to be far more intensely used than initially suspected when it was first discovered.

This chapter presents and discusses the geoarchaeological results produced from the lab analyses outlined in Chapter 5. A short overview of sediment sources, soil development, and depositional properties of terrace formation leads into a review of the previous definitions of Rio Grande alluvium. Geoarchaeological data from the site's deposits are used to provide a more concise definition of the Rio Grande alluvium, as well as support the understanding of site formation processes at Sayles Adobe. Then, radiocarbon dates, stratigraphic correlation – in field and in the lab, and the results of the geoarchaeological analyses for the Unit U sampling column are discussed.

## SOILS, SEDIMENTS, AND DEPOSITION

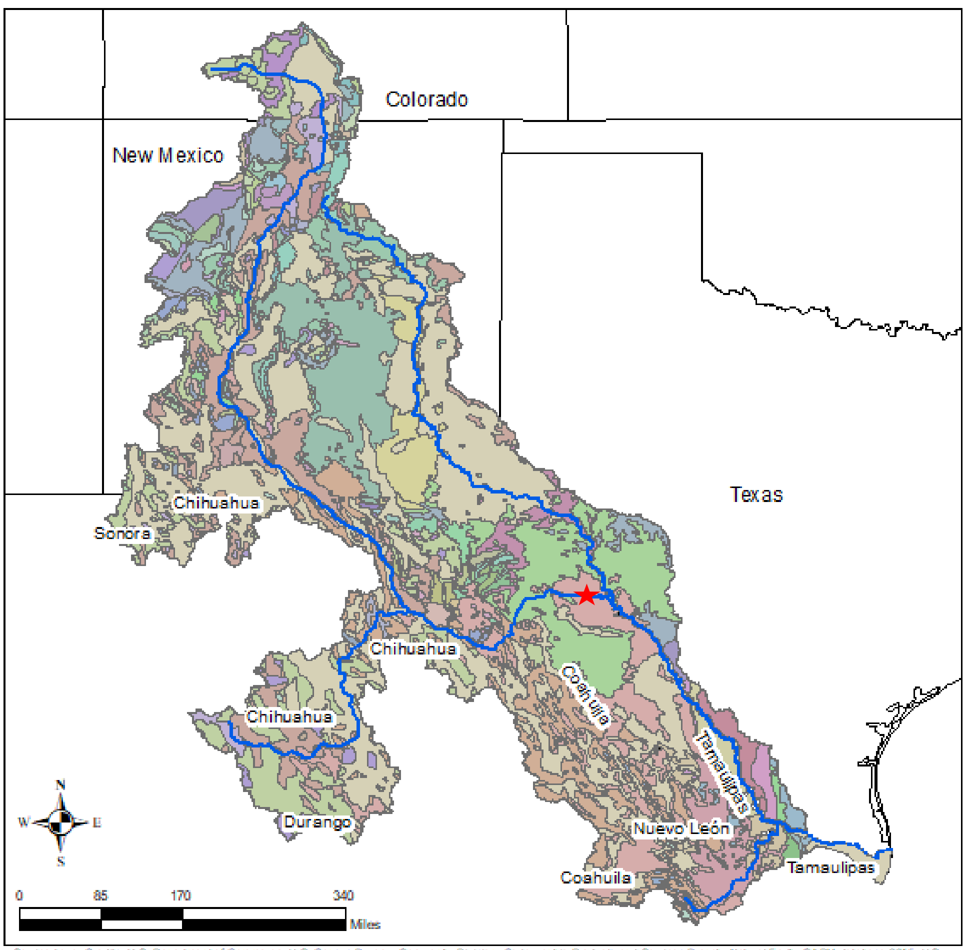
From the outset it was strongly suspected that the main source of alluvium forming the site was from the nearby Rio Grande, a product of massive flood events potentially originating outside of the local environment (higher in the Rio Grande drainage basin) that resulted in sediment-laden water from upstream flowing down river and backing up into Eagle Nest Canyon.

An auxiliary goal of this research was to refine the definition of Rio Grande alluvium that is present at Sayles Adobe. Previous work at sites in the region or within the Rio Grande floodplains refer to deposition of Rio Grande alluvium; however, few describe the sediment (Gustavson and Collins 1998; Kochel and Baker 1982: 215; Rodriguez 2015). These references to the Rio Grande alluvium often speak of the color, texture, inclusions, etc., or its identity as a soil series (Table 6.1); however, the geoarchaeological data from Sayles Adobe allow a more detailed, specific definition of the alluvium. These data are compared with previous descriptions of Rio Grande sediments and previous sediment analyses from Skiles Shelter, Kelley Cave, and other parts of the canyon.

Table 6.1: Soil descriptions of Rio Grande alluvium, adapted from the 1982 USDA soil survey. (Golden et.al. 1982: 45-46).

| Horizon | Color | Description |
|---|---|---|
| A1 | pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist | 0 to 9 inches; massive, upper 1 inch is single grained; slightly hard, very friable; common fine, medium, and coarse roots; common fine and medium discontinuous pores; calcareous; moderately alkaline; abrupt smooth boundary. |
| C1 | light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist | 9 to 14 inches; massive; slightly hard, friable; common fine and medium roots; common fine pores; few bedding planes; calcareous; moderately alkaline; abrupt smooth boundary. |
| C2 | light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist | 14 to 51 inches; massive; slightly hard, very friable; few fine roots; common bedding planes; calcareous; moderately alkaline; clear smooth boundary. |
| C3 | pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive | 51 to 64 inches; slightly hard, very friable; few fine roots; common bedding planes; calcareous; moderately alkaline. |

The texture of Val Verde county Rio Grande alluvium is variable, anywhere from silt loam, very fine sandy loam, loam, or loamy very fine sand (Table 6.1; USDA 1982). The mineralogical composition is typically characterized by calcareous 5 to 25 percent clay and 4 to 18 percent noncarbonated clays, with remaining mineralogy trending towards igneous and metamorphic minerals. On a larger scale the Rio Grande catchment encompasses the Southern Rockies of New Mexico and Colorado and the Sierra Madre Occidental as it makes it way to Texas along the border. Here it runs through hundreds of miles of mineralogically variable geology (Figure 6.1). These Texas regions contain a mix of limestones, volcanic rocks, and conglomerates that range from the Cretaceous to the Quaternary, with interspersed minor landforms older than the Cretaceous period (Figure 6.1).




Service Layer Credits: U.S. Department of Commerce, U.S. Census Bureau, Geography Division, Cartographic Products and Services Branch; Natural Earth; GADM database 2015; U.S. Geological Survey (USGS); U.S. Department of Agriculture - Natural Resource Conservation Service (NRCS); U.S. Environmental Protection Agency (EPA); National Watershed

Figure 6.2: Geology of the Rio Grande drainage basin; the red star indicates the location of Langtry, Texas.

Modes of deposition can vary in terrace formation; most important to the formation of a terrace is its placement on the landscape and the intensity of the erosional forces around it. In Eagle Nest Canyon, the geomorphology of the canyon and the location of Sayles Adobe near, but upstream, from the Rio Grande, the depositional forces at work are alluvial, colluvial, and eolian. This is evidenced by the sand to clay size sediments, with low density angular limestone gravels that were identified in the lower deposits (Appendix B). Sediments deposited at Sayles were less susceptible to erosion by lower magnitude floods due to its perched location above the canyon bottom. As the terrace grew, only higher magnitude flood events would have crested the terrace to deposit new sediment or erode the previous deposits. The nested nature of the site within a canyon bend, perched on top of fallen limestone blocks, added defenses against erosional forces from other floods and winds. Vegetation cover that must have varied in density and composition over the millennia also played a role in protecting the site (Figure 6.2). While vegetation can disturb deposits, it can also help stabilize sediments, protecting them from erosional forces.

*Soil Geomorphology*

Soil geomorphology, as defined by Birkeland (1999) concerns the study of soils and their use in evaluating landform evolution and age, landform stability, surface processes, and past climates. This focus becomes particularly important when studying an open site such as Sayles Adobe, which has seen many alternating periods of deposition, erosion, and anthropogenic activity. Unlike the other documented archaeological sites in the canyon (all rockshelters), which are relatively sheltered from the outside forces of the environment, Sayles's use was likely limited by the climate. Sheltered sites could be used at essentially any time, whereas Sayles was likely only used when the climate allowed – i.e. when not inundated by water.

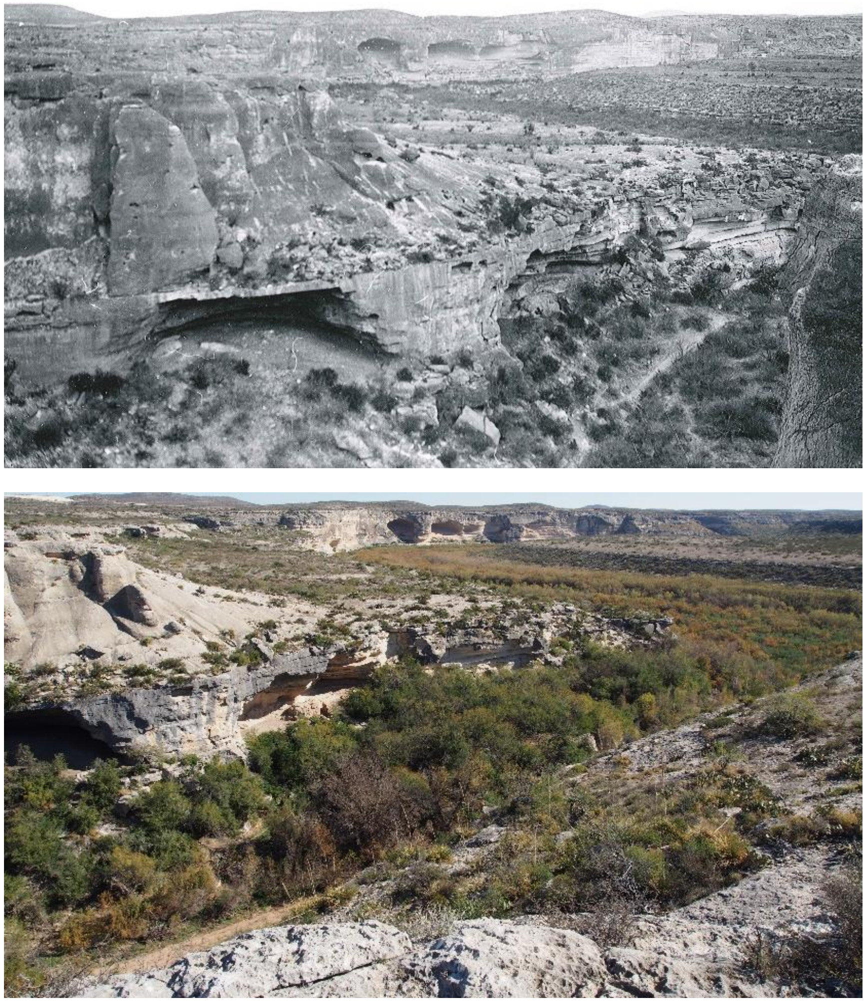


Figure 6.2: (Top) Photo taken by the 1932 Sayles Expedition; note the much lesser vegetative cover than the 2016 photo below.

Understanding the geomorphology of the site is critical to understanding not only when the site could be used, but how long the site was used (Ferring 1992). Developing the depositional history of the site falls in hand with studying soil formation because soils need stable surfaces to form, and people need a stable surface to live and work on. Identifying developing subtle soil horizons in seemingly homogenous, massive deposits can identify non-conformities in the flood chronology that may be missed when few erosional or depositional structures are found (Baker 2008). Soil formation requires a stable surface that allows for weathering of organic material.

Ferring (1992) differentiates between the classes of soil relevant to alluvial geoarchaeological research. Alluvial sediment is the parent material of alluvial soils, which can be identified as floodplain or terrace soils (Baker et. al. 1983; Gerrard 1987). These differ because of the landforms where they are found; floodplain soils are surficial and frequently have influxes of new parent material, whereas terrace soils are removed from active deposition and only see new parent material during rare, large magnitude floods. Terrace soil development is important to investigate in the case of Sayles, as the site is nested up the canyon up and away from the Rio Grande floodplain proper and protected by the canyon reentrant.

Holocene soil formation is important in North American archaeology exactly because of these terrace and floodplain deposits, which seal anthropogenic surfaces and soils (Ferring 1992; Hall 1988; Patton and Dibble 1982; Sayles 1935). With the development of geoarchaeological and geomorphological research, Holocene terrace and floodplains are increasingly targeted in surveys (Ferring 1992:7). Buried soils can define contacts between mappable sedimentary units – allostratigraphic units – and allow archaeologists to trace stable surfaces across an area. Continuous terrace deposits, like those at Sayles Adobe, can be used to prospect and correlate stratigraphy across the site, using a combination of excavated profiles and auger testing (Stein 1986).

ACROSS THE SITE: PROFILE SECTIONS AND STRATIGRAPHIC CORRELATION

As discussed in Chapter 4, each profile was annotated (e.g., stratigraphic boundaries determined and mapped) in the field on an orthophoto created from the SfM model, then described and sampled using Strat Forms (Appendix A). Prior to photography, the cleaned profile would be sprayed lightly with water to help bring out different features of the stratigraphy, sediment structure, and colors of the profile that are otherwise lost in a dry profile. This technique was also useful for identifying ephemeral mud drapes, as the high clay content of the drapes held water differently from the surrounding silty sand deposits.

After annotations and descriptions were complete, Spot and Geo-Matrix samples were removed from the defined stratigraphy to identify similar deposits across the site through sediment analysis. Charcoal, artifacts, or other special samples (i.e., botanical, entomological, etc.), that were identified during annotation, were collected from the profiles.

*Profile Sections*

Six profile sections were defined at the site (Figure 6.3) and are described below (See also Appendix C) two in the Borrow Pit (PS01 and PS02), three in the Sand Box (PS04, -05, -06), and one at the Porch (PS03). The profile sections were documented with the goal of correlating stratigraphic deposits across the site.

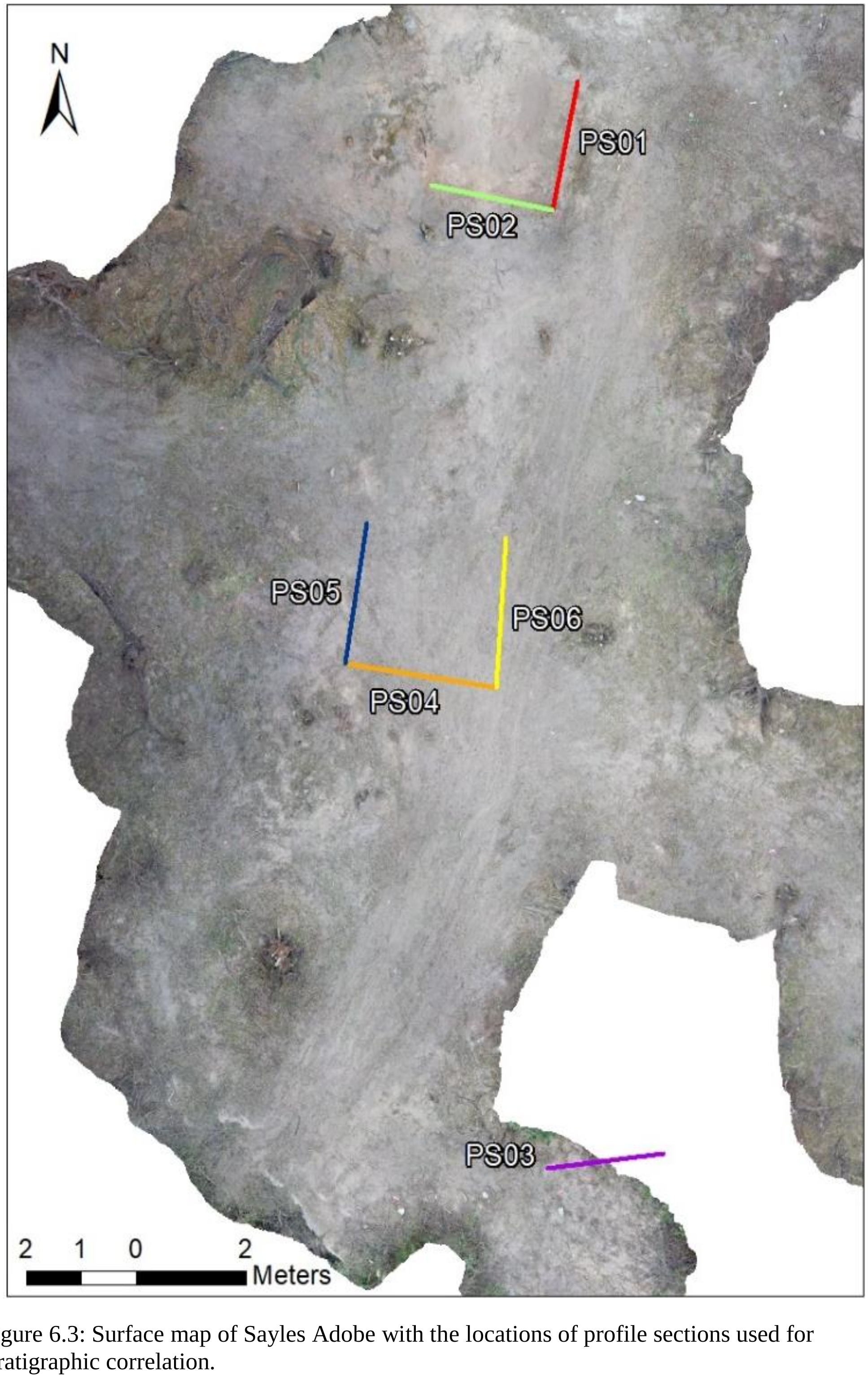



Figure 6.3: Surface map of Sayles Adobe with the locations of profile sections used for stratigraphic correlation.

Profile Section 01

Profile Section 01 (PS01) was the first profile exposed and documented on the site (Figure 6.4), it was created from Test Unit A, and it was our first opportunity to carefully study the deposits of the site. The profile slopes up from the North to the South, with a depth of 2.6-meters (N) and 3.23-meters (S). The profile is approx. 1.74-meters wide at the top and 1.03-meters at the bottom. The sloping upper deposit is fine tan sandy alluvium (19 to 85cm thick) that rests on a horizontally deposited very fine silt mud drape. The mud drape in profile looks horizontally deposited here; however, in other profiles across the site it slopes slightly following the topography of the terrace at that point.

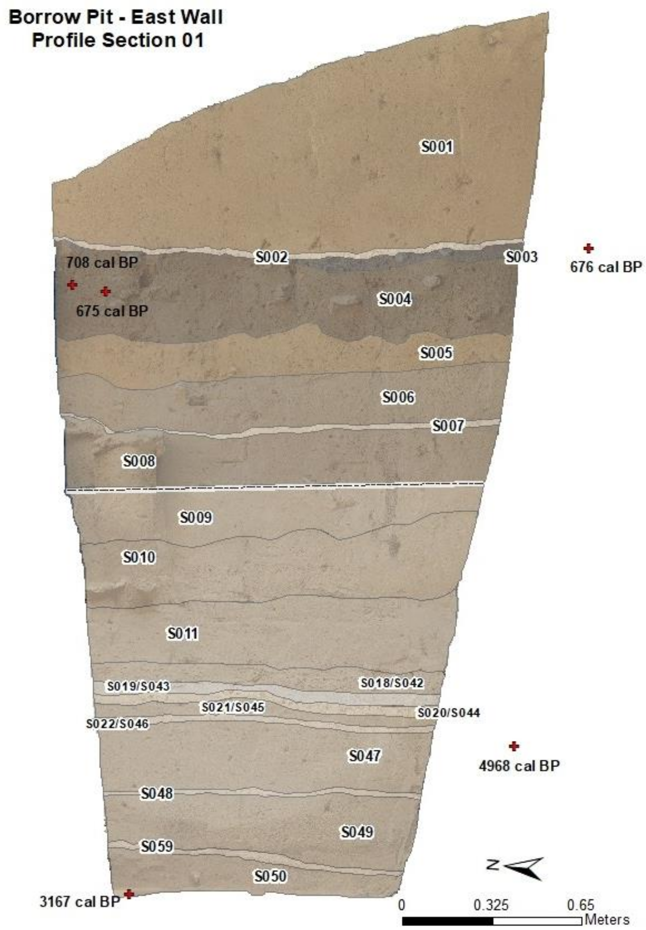



Figure 6.4: Illustrated Profile Section 01

Immediately below the mud drape is a distinct charcoal-stained grey anthropogenic palimpsest 30-35cm thick with burned rock, charcoal, and bioturbation visible in profile. These upper three strats (S001, S002, and S004) which were used as stratigraphic landmarks as we opened units in the Sand Box and the Porch. The remainder of the profile consists of beds of silty sandy alluvium, and a sequence of alternating mud drapes and alluvium that began 2.1-meters below surface (measured at the center of the profile).

Profile Section 02

Profile Section 02 (PS02) is the second profile section in the Borrow Pit and is aligned on an east-west axis, with a slight slope down from the east to the west (Figure 6.5). From the upper terrace surface to the floor of the excavation area the profile is 3.18-meters at the east and 3.06-meters at the west. The profile is approximately 2.32-meters wide at the top and 1.41-meters at the bottom. Similar to its adjacent profile—PS01—in PS02 we saw alternating natural deposits and one distinct charcoal stained deposit that had dense FCR. The profile showed evidence of many pockets of bioturbation (e.g., rodent burrows) that were discrete and easily distinguished by color and shape. Again, lower section of the profile had a sequence of alternating fine mud drapes and coarser alluvium that began 2.18-meters below surface (measured at the center of the profile).

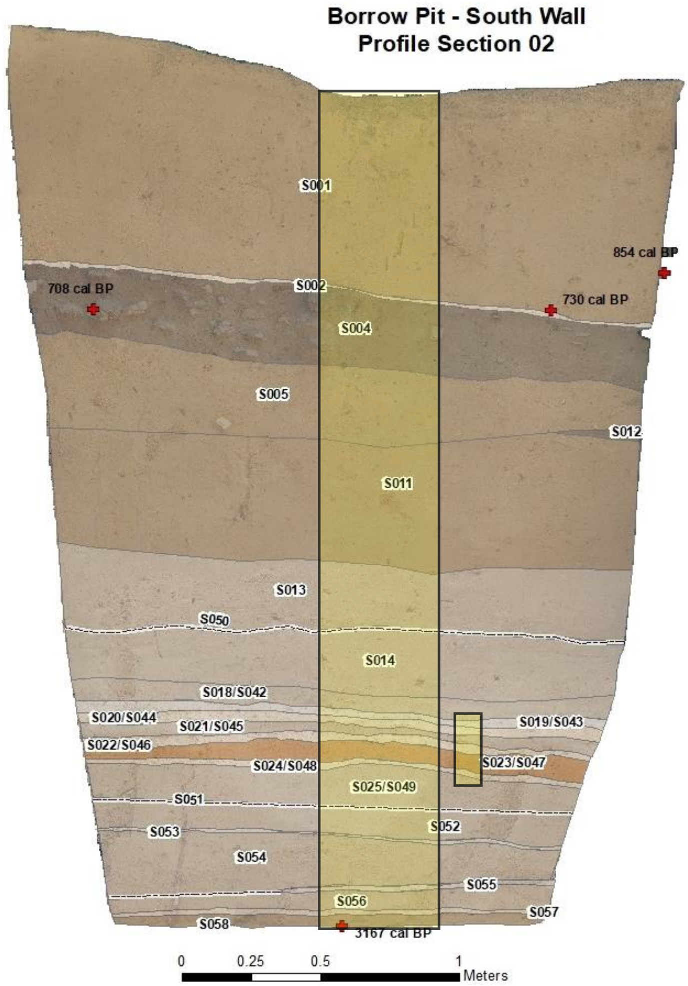



Figure 6.5: Illustrated Profile Section 02. Boxes indicate Unit U sampling column and Monolith 50868.

<u>Profile Section 03</u>

Profile Section (PS03) was the north face of Porch Unit E, measuring 65cm at the west corner and 96cm at the east corner (Figure 6.6). The profile is approximately 2.07-meters wide at the top and 1.78-meters at the bottom. The topography of the surface slopes significantly towards the east due to the drop off from the limestone blocks below the terrace. This profile was originally thought to be a singular homogenous bed of sandy alluvium with no indication of the uppermost mud drape seen in other parts of the site. However, after the profile was sprayed lightly with water, it was discovered that there were at least four layers present. To study this, Charles Frederick collected a 22-sample continuous cube column along the eastern edge of the profile from the upper surface to unit floor. Analysis of the samples confirmed the identification of four separate deposition events.

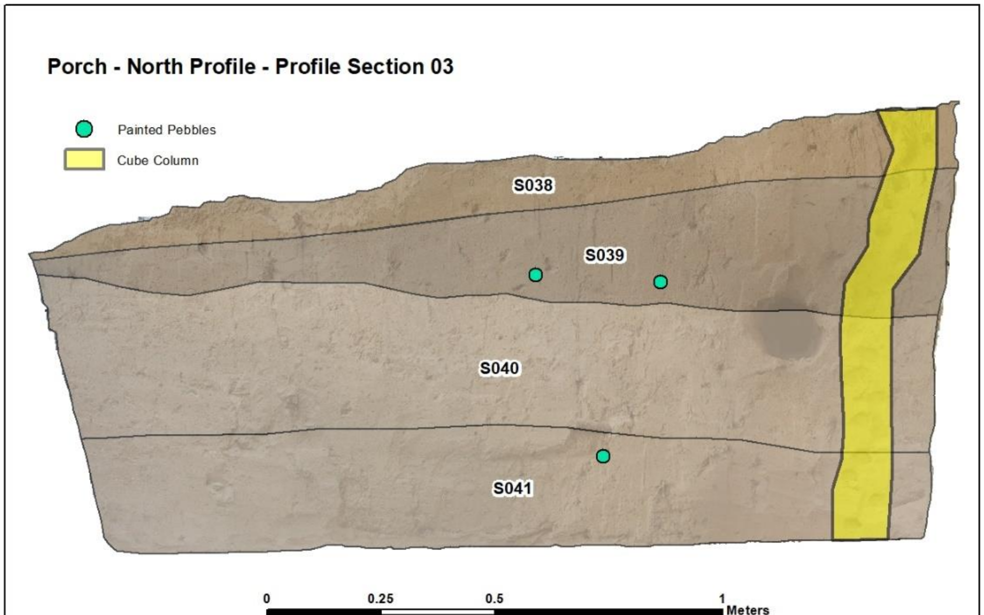



Figure 6.6: Profile Section 03 annotated with defined stratigraphy. The circular hole and smaller holes along the western edge where the OSL sample and cube column samples were taken.

<u>Profile Section 04</u>

Profile Section (PS04) is the south wall of the Sand Box excavation area; it has two distinct cultural deposits and a sequence of alternating mud drapes similar to those in the Borrow Pit (Figure 6.7). Due to the unit's location at the center of the terrace, the deposits are horizontal with a nominal amount of slope towards the west; however, the deposits in the lower 1.22-meters of the profile slope east; the eastern corner measures 3.35-meters and 3.33-meters at the western corner. The profile is approximately 2.73-meters wide at the top and 1.91-meters at the bottom. Multiple places in the profile have evidence of bioturbation from rodents, insect, and roots. Sampling column Unit T was excavated in 5cm intervals through the profile near the PS06-PS04 SE corner interface.

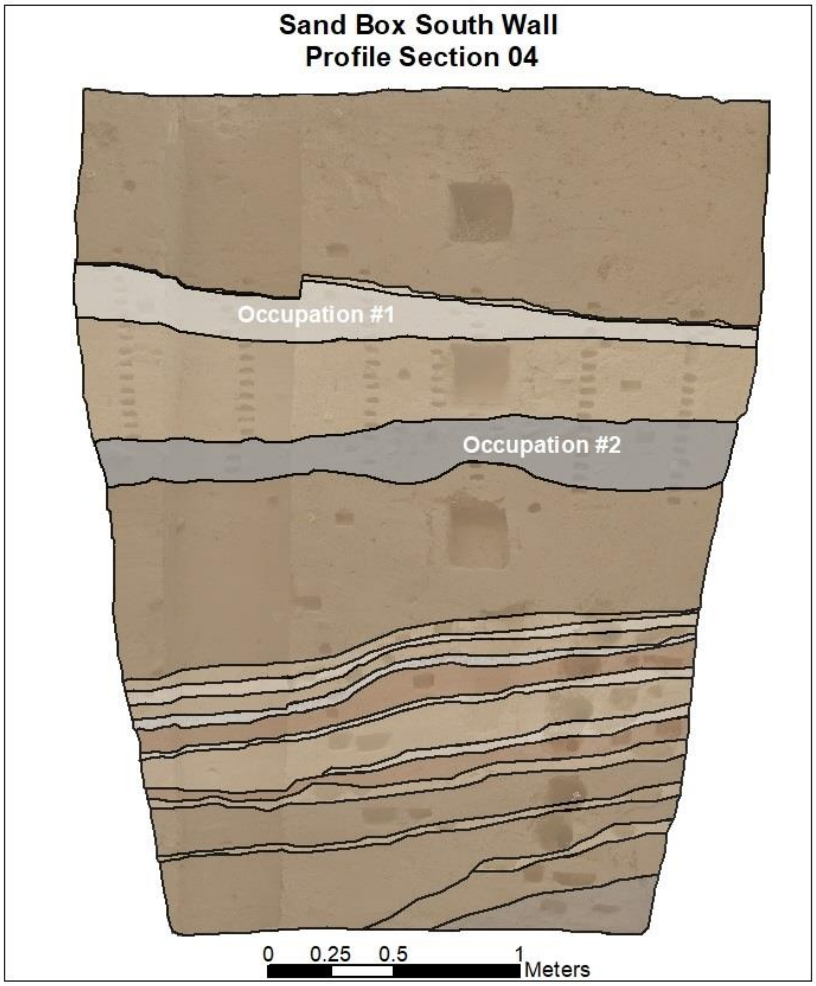



Figure 6.7: Annotated illustration of Profile Section 04, the south wall of the Sand Box.

Profile Section 05

Profile Section 05 (PS05) is the west wall of the Sand Box excavation area, it has two distinct cultural deposits and a sequence of alternating mud drapes similar to those in the Borrow Pit (Figure 6.8). Due to the unit's location at the center of the terrace the deposits are horizontal with a nominal amount of slope down to the south; however, the lower 1.3-meters of the profile slope down to the north. The southern corner measures 3.3-meters and 3.45-meters at the northern corner. The profile is approximately 1.92-

meters wide at the top and 90-centimeters at the bottom. Multiple places in the profile have evidence of bioturbation from rodents, insect, and roots.

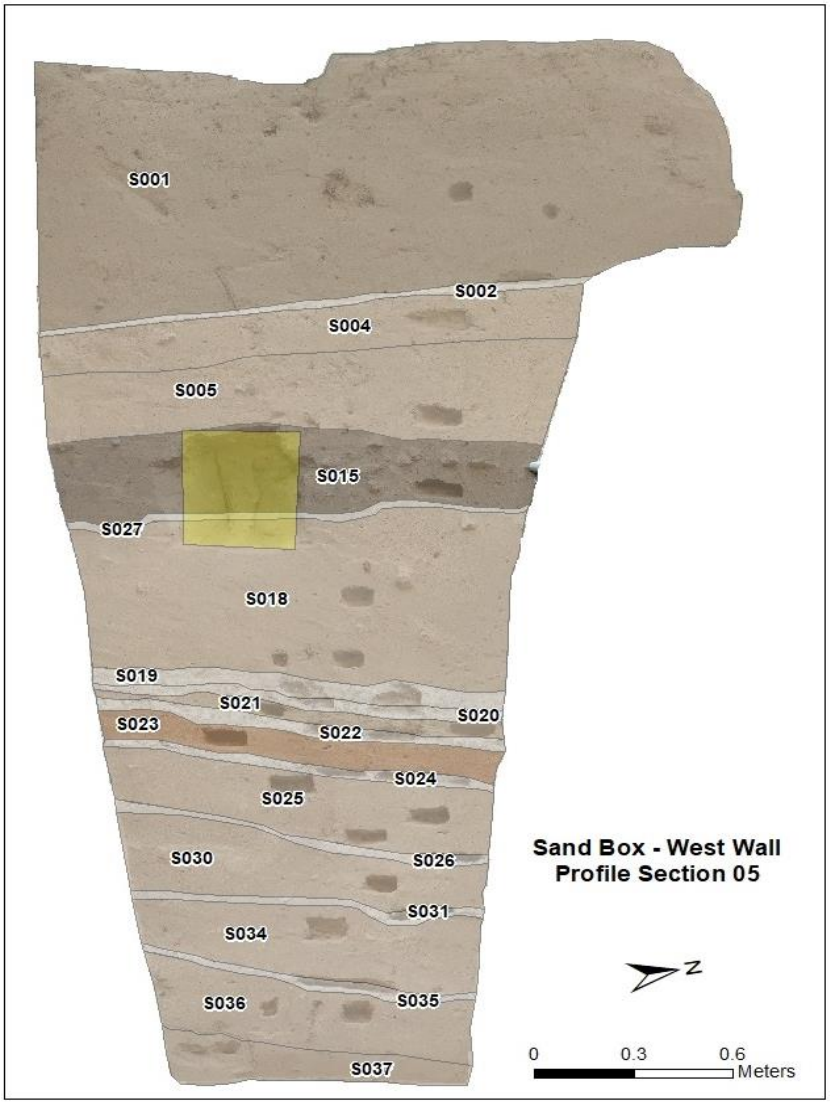


Figure 6.8: Illustrated Profile Section 05, the west wall of the Sandbox.

<u>Profile Section 06</u>

Profile Section 06 (PS06) is the east wall of the Sand Box (Figure 6.9), it has two distinct cultural deposits and a sequence of alternating mud drapes similar to those in the Borrow Pit. Unlike the two other Sand Box profiles (PS04 and PS05), almost no slope is noticeable looking at the profile. The southern corner measures 3.35-meters and 3.34-meters at the northern corner below the terrace surface. Multiple places in the profile have evidence of bioturbation from rodents, insect, and roots. The profile is approximately 2.74-meters wide at the top and 1.06-meters at the bottom. Like the other profiles there is a series of compact mud drapes, with alluvial deposits in between which begins at 2.42-meters below surface. The two cultural zones are likely ephemeral remnants of the main zone from the Borrow Pit and the secondary distinct zone from the southwest corner of the Sand Box.

**Sand Box - East Wall - Profile Section 06**

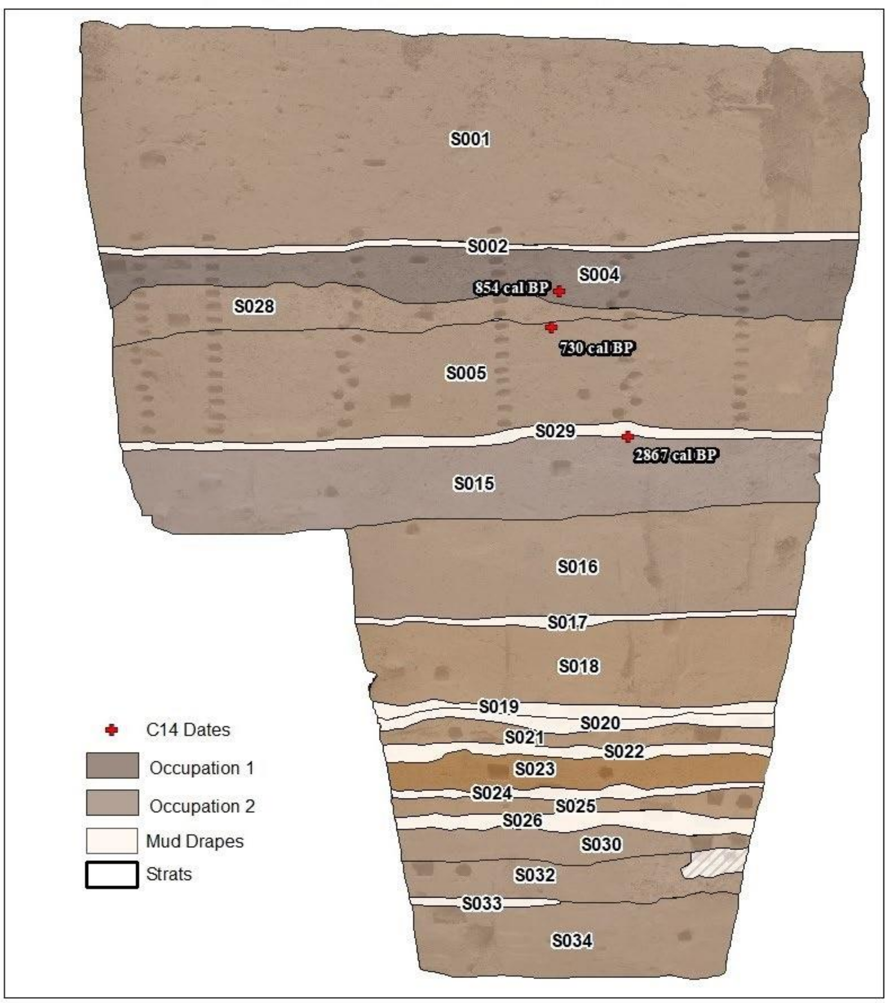



Figure 6.9: Illustrated Profile Section 06, the east wall of the Sandbox.

*Stratigraphic Correlation Using Profile Sections and Auger Tests*

Due to the location of the site within the canyon, the use of a backhoe to trench at the site was not an option; instead fifteen auger tests (see Chapter 2) were used to collect subsurface data. These sub-surface data were later used to correlate deposits across the terrace with levels seen in the auger columns and the profile sections. Observations from each auger bucketload focused on physical sediment properties like color, texture, as well as amount and type of inclusions (see Appendix D for raw data). The field descriptions along with the recorded depths of each auger bucket load were used to map the deposits (Figure 6.10).

Profile Section 01 in the Borrow Pit and Profile Section 06 in the Sand Box were both oriented on the same north-south axis of auger tests (Figure 6.10). The profiles served as large open windows into the lower depths of the terrace, providing the opportunity to correlate anthropogenic surfaces and major changes in the deposits seen in the augers.

The auger tests across the sites gave us insight into what to expect as we began excavation in  the Sand Box, and as we expanded the Borrow Pit to further investigate Occupation 1. As can be seen in Figure 6.10, the depths of the columns varied across the terrace, which was a reflection of their location on the terrace. NS1 and NS2 were located along the colluvial slope of the canyons north face, NS3 was located in the “trail”, NS4 to NS8 were on the main terrace deposit, and NS9-NS10 are along the downward slope on the south side of the terrace. NS10 is right on the edge of the terrace with the top edge of one of the limestone blocks that form the bowl of the catchment.

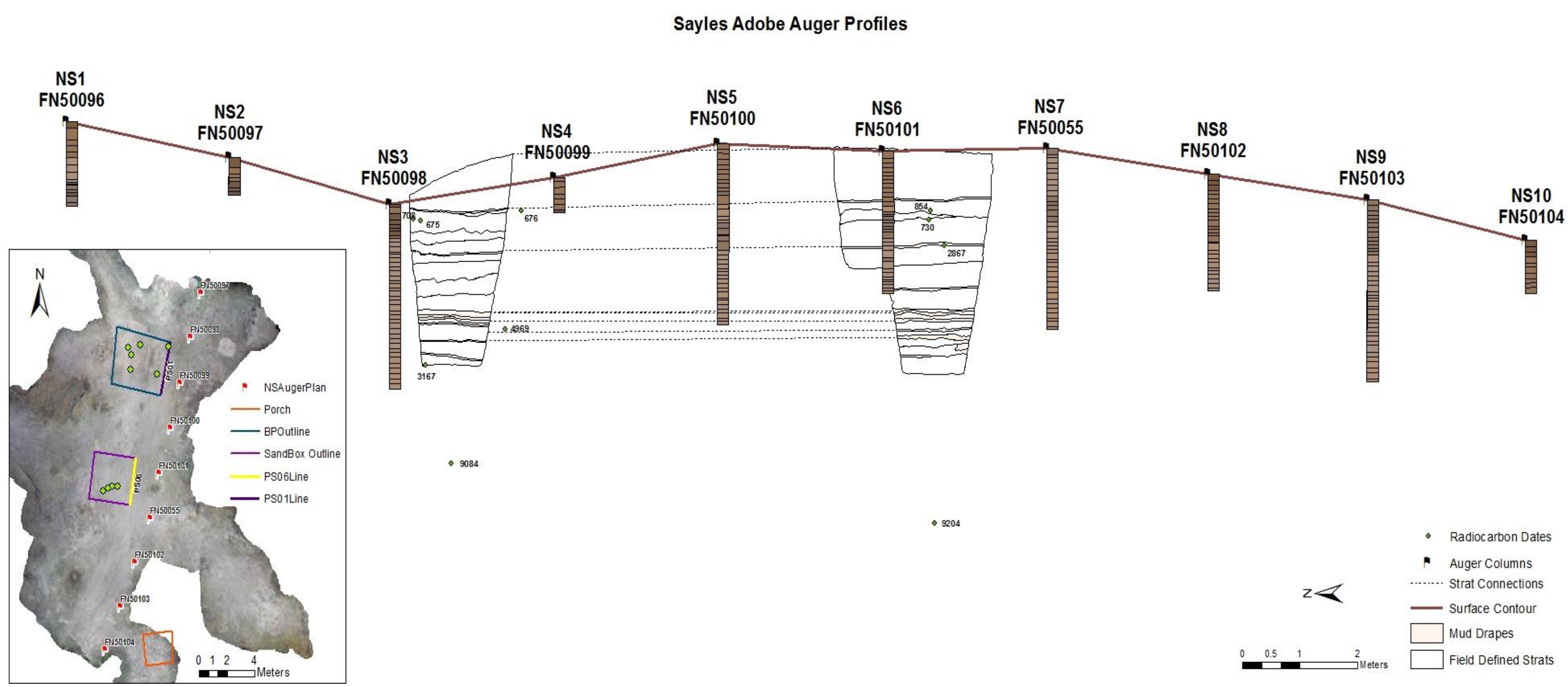



Figure 6.10: Geospatially correct plot of auger tests and profile sections with annotated stratigraphy. The profile sections were annotated with GIS off the orthophotos exported from their respective SfM models.

## BORROW PIT GEOARCHAEOLOGY

As discussed in Chapter 5, eighty-three layers of sediment were excavated in 5cm-thick arbitrary levels for microartifact and sediment analyses to create a high-resolution dataset that could be applied towards identifying ephemeral cultural episodes (i.e., human activity).

Exceptions to the 5-cm thickness were made for stratigraphic deposits which were thicker or thinner than 5cm, which resulted in variance in the thickness of some samples collected. Additionally, a monolith from the profile adjacent to the sampling column was used to create an interpretive framework for understanding the depositional events at Sayles Adobe. This section will discuss the results of the sediment analyses, microartifact analsyses, and micromorph thin section analyses from the sampling column excavated from Borrow Pit: Profile Section 02.

### *Monolith Analysis*

As previously mentioned in Chapter 5, a sediment monolith (approximately 30-cm long) was collected from Borrow Pit Profile Section 2 (FN 50868), which was located adjacent to the Unit U sampling column capturing eight distinct strata (Figure 6.11). This monolith was then microsampled (i.e., 1-cm sediment samples removed), embedded in polyurethene resin, slabbed, and finished into thin sections for micromorphological anaylsis. Sediment analysis and micromorphological data were used to create a discrete, high- resolution dataset to look at the structure, composition, and integrity of the multiple flood events present in the sample. Figure 6.11 and Table 6.2, present the data from this monolith.

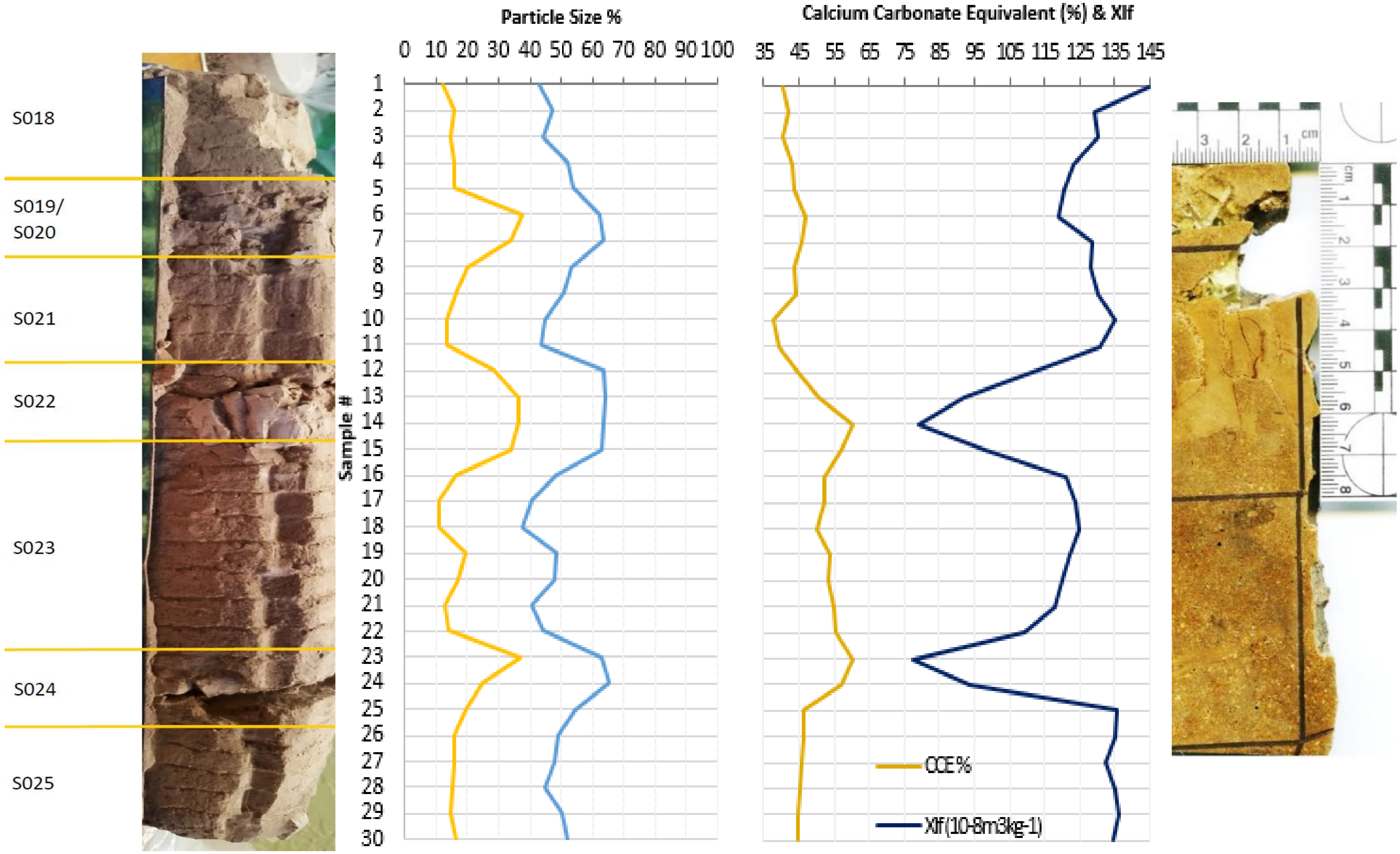



Figure 6.11: (Left) Annotated photo of the monolith; lines indicate field defined strata. (Center) Analysis results from the microsamples removed from the alternating sequence of flood deposits. (Right) Embedded section of the monolith prior to final slabbing and finishing.

Data from this monolith supports formation processes consistent with low-velocity depositional events (i.e., upward fining) which capped the terrace. Particle size, calcium carbonate, and magnetic susceptibilty data were used to support the boundaries of the strata defined in the field. Mineralogical and micromorph microscope analyses of the finest and coarsest sediments (Table 6.2) support the hypothesis of sediments coming from back-flood events of the Rio Grande.

Table 6.2 Mineralogical X-Ray Diffraction data from the BP monolith. Note the presence of volcanically derived minerals: quartz, k-feldspar, plagioclase, illite, and mica.

| XRD # | VP101 | VP102 |
|---|---|---|
| Sample ID | 50868.14 | 50868.17 |
| Particle Size | Fine (Silt-Clay) | Coarse (Sand-Silt) |
| Quartz | 18.9 | 31.7 |
| K-Feldspar | 6.5 | 5.9 |
| Plagioclase | 6.5 | 9.9 |
| Calcite | 50 | 42.5 |
| Dolomite | 1.1 | 0.8 |
| Hematite | 0.5 | 0.5 |
| R0 M-L I/S (60%S)* | 3.4 | 1.9 |
| Illite&Mica | 9.4 | 2.9 |
| Kaolinite | 3.1 | 3.3 |
| Chlorite | 0.6 | 0.6 |
| TOTAL | 100 | 100 |

*Note: R0 M-L I/S (60%S) - R0 Ordered Mixed-Layer Illite/Smectite with 60% Smectite Layers

The presence of volcanically derived minerals indicate the material must be sourcing from the river, which is known to run through miles of volcanic bedrock and gravels (Figure 6.1); if these sediments were being solely deposited by flooding down the canyon and from runoff of the edges. This does not, however, mean that no sedimentary minerals (i.e., calcite, dolomite, and kaolinite) would be present, as weathering of the limestone of Eagle Nest Canyon and along the path of the Rio Grande would provide these minerals.

Microscopic analysis of the particles also support the theory of alluvial sedimentation as the most consistant depostional process at work. Figure 6.12, shows a slide from the monolith and a slide from the Feature 01 deposits; these slides are roughly separated by 2 vertical meters. Particles in these slides range from rounded to sub-rounded, are poorly sorted, and lack structure; indicating that there were similar post-depositonal processes at play, or at least the post-depostional processes resulted in the mixed nature of the sediment.

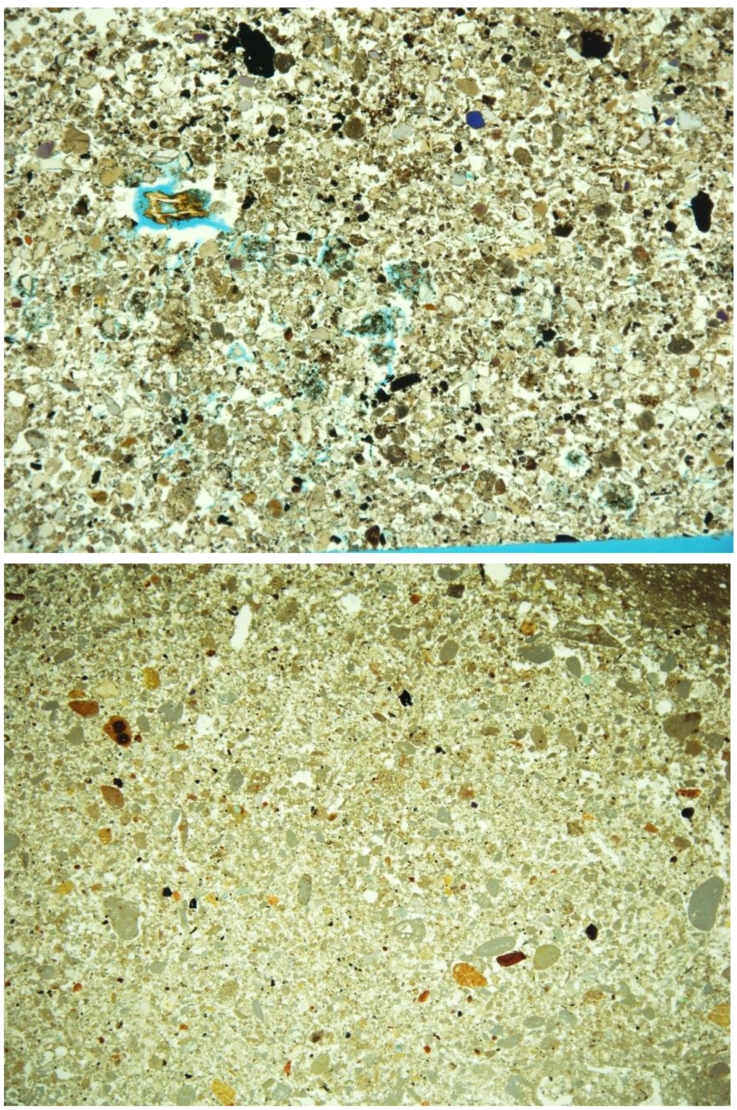


Figure 6.12: (Top) Microscope photo of Feature 01 thin section (~60cmbs). (Bottom) Microscope photo of flood deposits sampled from the monolith

Mixing of the deposits is undeniable, with any surface that is left open, the elements, fauna, and return visits to the site, would have indefinitely impacted the deposits. Sayles, however, also benefits from the frequency of flooding and deposition of new surfaces and the silty-clay mud drapes that sealed surfaces and essentially create bounding boxes around anthropogenic deposits. These mud drapes (we know from excavation) are not easily disturbed or frequently cut through by insects but were seen to have been impacted by small-medium mammals and roots. When dry, they typically have the hardness of baked clay; when wet, they are like chocolate, somewhat waxy and dense.

The alluvium that lays in between, and at the surface at the site, is far softer and is likely where much of the mixing took place. Micromorph analysis of the Occupation 1 deposits and the monolith supports this, with the identification of insect casts, feces, and pathways of the small bioturbators within the sandy alluvium deposits (Appendix D). Traces of activity can be seen along pieces of mud drape in some cases, however for the most part the drapes themselves remained untouched. However, this is a very small sample size and would benefit from more study.

## SAYLES'S DEPOSITIONAL ENVIRONMENT

The resulting geoarchaeological dataset (Appendix D) from the sampling column sediment analyses was compiled to present a cohesive visualization that could be used to identify individual depositional events. Figure 6.13 shows a compiled and simplified version of the geoarchaeological dataset used to interpret the depositional environment.

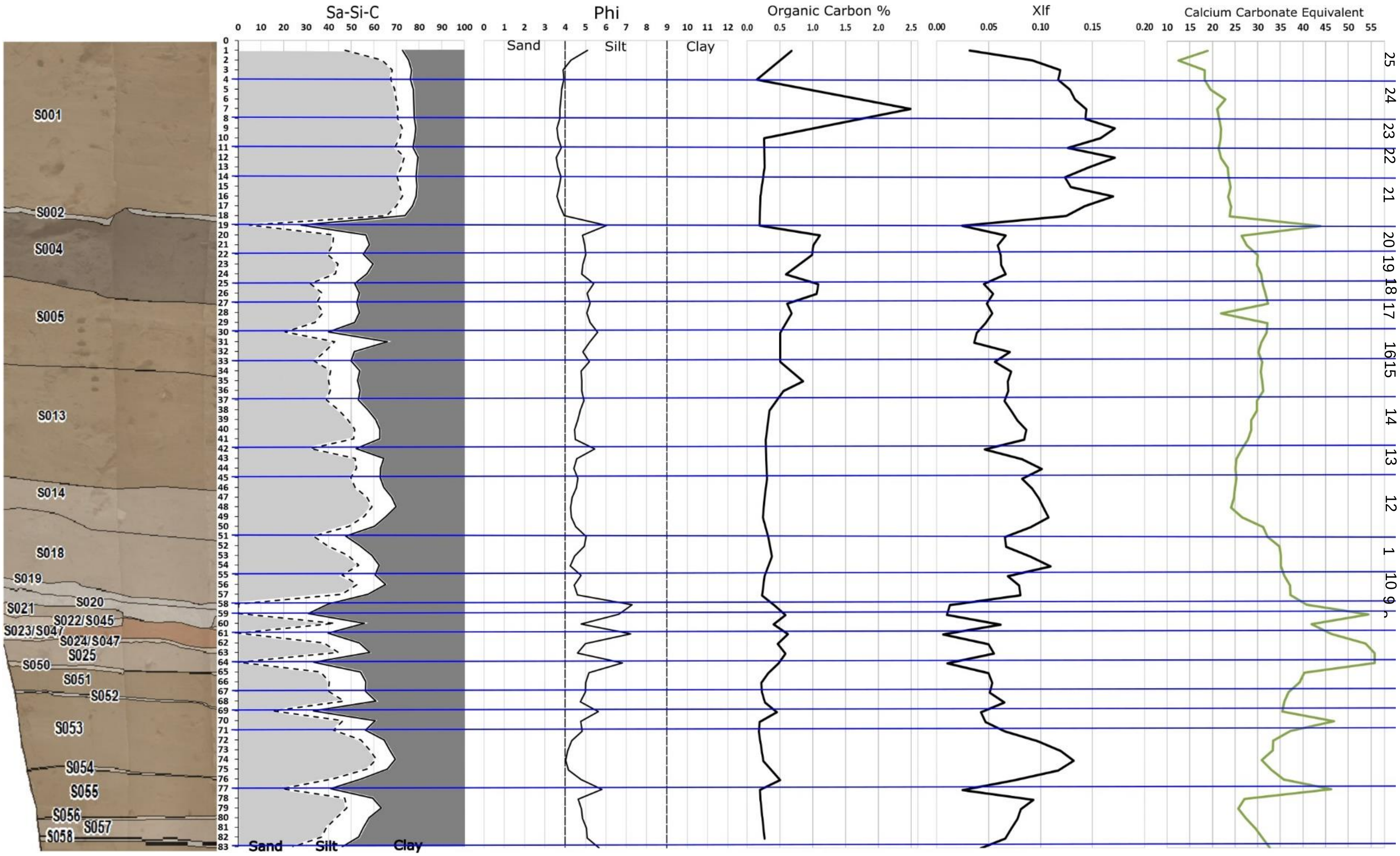


Figure 6.13: Profile Section 2 illustrated with field identified strata, plotted with particle size distribution, mean particle size, organic carbon %, magnetic susceptibility, and calcium carbonate equivalent %. These data were compared with the sampling column microartifact data (discussed further in Chapter 7) for identifying the low density, ephemeral cultural episodes. The lines indicate the top of depositional units identified as fining upward packages of sediment capped by flood drapes; these data support the early ideas about the formation of the Sayles terrace.

Table 6.3: Sayles Adobe radiocarbon dates.

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50309 | BP | Feature 1/ CU-3 | 0.97 | Wood | *Quercus* sect. *Quercus* | 730 | 23 | 697-656 | 676 |
| FN50076 | SB | Feature 1/ CU-3 | 0.98 | Agave | Prosopis glandulosa | 980 | 33 | 928-792 | 854 |
| FN50006 | BP | Feature 1/ CU-3 | 1.09 | Wood | Unidentifiable | 707 | 25 | 742-675 | 708 |
| FN50122 | SB | Feature 1/ CU-3 | 1.1 | Mesquite | Agavaceae | 770 | 32 | 789-684 | 730 |
| FN50436 | BP | Feature 2/ CU-3 | 1.12 | Agave | *Dasylirion* sp. | 727 | 21 | 690-659 | 675 |
| FN50162 | SB | Feature 3/ CU-4 | 1.5 | Wood | Unidentifiable | 2775 | 37 | 2955-2781 | 2867 |
| FN50734 | BP | CU-12 | 2.79 | Wood | Fabaceae | 4404 | 26 | 5046-4870 | 4968 |
| FN50233 | BP | CU-14 | 3.33 | Mesquite | Prosopis glandulosa | 2951 | 26 | 3239-3071 | 3167 |
| FN50679 | BP | Auger | 4.83 | Wood | Fabaceae | 8154 | 35 | 9248-9009 | 9084 |
| FN50627 | SB | Auger | 5.74 | Wood | *Senegalia berlandieri* | 8236 | 34 | 9397-9034 | 9204 |

Radiocarbon dates from the site, which range in age from the Late Paleoindian to the Late Prehistoric periods, were used with the depositional units identified through the sampling column sediment analyses (discussed in the previous section of this chapter) to create a model of the depostional timeline at the site (an age-depth model), which aided in the interpretation of site use. Table 6.3 lists the provenience, material, and raw data for the ten radiocarbon dates (Borrow Pit n= 6; Sand Box n=4) reported from the site. Criteria for chosen samples included: depth, material, and feature and/or diagnostic artifact association (when observed). The following section will discuss the process and use of the R-statistical program to create an age-depth model using Sayles's dates which could be used to extrapolate age estimates and sedimentation rates for the identified depositional units.

*Age-Depth Model*

An age-depth depositional model was generated using B-Chronology, an R statistical package developed for radiocarbon date calibration, age-depth, and sedimentation modelling (Parnell 2014; Parnell et.al. 2008). This coded-model plots the dates from a site according to their depth (Figure 6.14); with additional code, it can calculate and plot confidence intervals, as well as identify any outlier dates. For Sayles, the package was used to calibrate Sayles radiocarbon dates, create an age-depth model, determine the 2.5%, 95%, and 97.5% confidence intervals, and extrapolate sedimentation rates for depositional events identified by sediment analyses (Figure 6.14; Table 6.4).

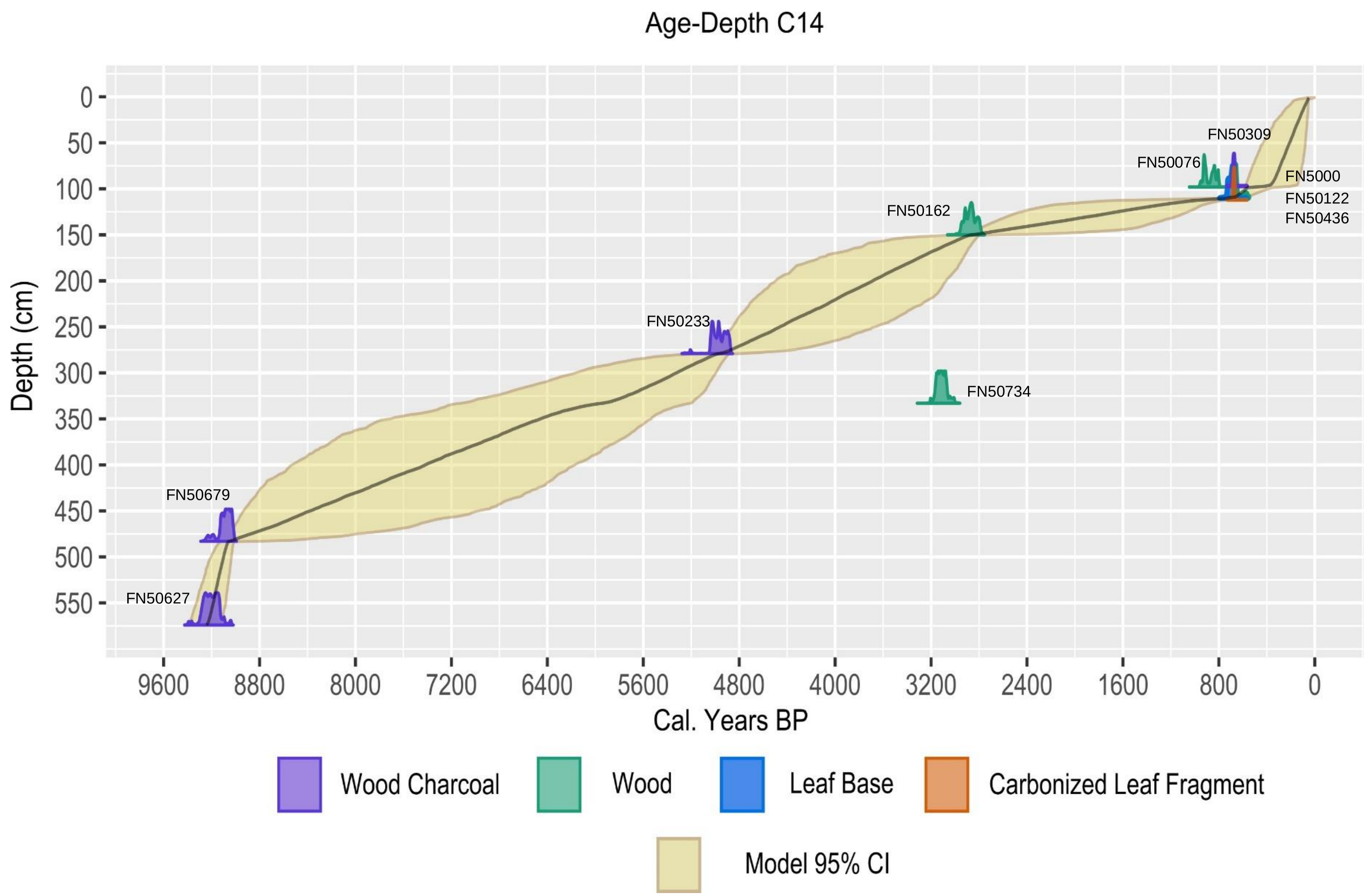



Figure 6.14: Age-depth model generated with Bchron in R; model parameters: 12,000 iterations with 2000 burns (i.e., the model ran 12,000 times and discarded the first 2000 runs). Additionally, the model had to be forced to 0 (top surface) due to the lack of dates above ~39cmbs; this was done so a more accurate estimate of sedimentation rate could be calculated.

6.4: Estimated age for individual flood packages and associated estimated sedimentation rates.

| Number | Midpoint Depth (cmbs) | Thickness (cm) | Mean (cal BP) | Standard Deviation | 95% CI | Sed Rate | Cm/100 years |
|---|---|---|---|---|---|---|---|
| 25 | 7.5 | 15.0 | 29.4 | ±22.67 | 89.00 | 0.11 | 11.30 |
| 24 | 26.5 | 23.0 | 158.2 | ±96.28 | 360.00 | 0.05 | 4.91 |
| 23 | 46.0 | 16.0 | 394.3 | ±119.32 | 429.00 | 0.10 | 10.23 |
| 22 | 59.5 | 11.0 | 633.9 | ±40.42 | 122.00 | 2.11 | 211.11 |
| 21 | 74.5 | 19.0 | 681.5 | ±14.58 | 51.78 | 0.37 | 36.67 |
| 20 | 89.5 | 11.0 | 694.0 | ±22.42 | 89.00 | 0.06 | 6.12 |
| 19 | 102.5 | 15.0 | 819.5 | ±101.55 | 344.33 | 0.02 | 1.78 |
| 18 | 115.0 | 10.0 | 1262.0 | ±307.94 | 1195.00 | 0.04 | 3.55 |
| 17 | 127.0 | 14.0 | 1778.0 | ±349 | 1343.65 | 0.02 | 2.25 |
| 16 | 140.5 | 13.0 | 2181.0 | ±326.27 | 1278.75 | 0.04 | 4.39 |
| 15 | 157.0 | 20.0 | 2717.0 | ±288.07 | 1235.20 | 0.06 | 5.67 |
| 14 | 178.5 | 23.0 | 3260.0 | ±328.07 | 1247.65 | 0.03 | 2.76 |
| 13 | 196.0 | 12.0 | 3621.0 | ±388.53 | 1460.98 | 0.12 | 12.00 |
| 12 | 215.5 | 27.0 | 3915.0 | ±392.44 | 1508.63 | 0.04 | 3.52 |
| 11 | 238.5 | 19.0 | 4240.0 | ±382.5 | 1463.85 | 0.03 | 3.28 |
| 10 | 254.5 | 13.0 | 4657.0 | ±293.9 | 1112.75 | 0.02 | 1.66 |
| 9 | 263.0 | 4.0 | 5125.0 | ±212.6 | 815.20 | 0.08 | 8.00 |
| 8 | 268.0 | 6.0 | 5303.0 | ±274.78 | 1075.63 | 0.14 | 14.04 |
| 7 | 277.0 | 12.0 | 5389.0 | ±311.07 | 1176.98 | 0.07 | 6.52 |
| 6 | 289.0 | 12.0 | 5534.0 | ±372.55 | 1445.00 | 0.05 | 4.83 |
| 5 | 300.0 | 10.0 | 5716.0 | ±439.71 | 1712.65 | 0.05 | 4.96 |
| 4 | 310.0 | 10.0 | 5910.0 | ±505.72 | 1942.25 | 0.05 | 4.96 |
| 3 | 329.0 | 28.0 | 6194.0 | ±581.77 | 2201.95 | 0.01 | 0.74 |
| 2 | 357.5 | 29.0 | 6693.0 | ±639.47 | 2407.88 | 0.05 | 4.81 |
| 1 | 374.5 | 5.0 | 7219.0 | ±666.89 | 2618.85 | 0.01 | 0.92 |

The age-depth model (Figure 6.15) was built using the mean reported date, age standard deviation, and depth below surface; the model was run for twelve-thousand iterations for best fit. Sedimentation rates were calculated using the *predict* function, and by inputting the top depth and thickness of identified flood deposits, a rate was extrapolated from the age-depth model. Dates from both excavation areas were considered when calculating the age and sedimentation rate estimates despite only having only identified flood packages in from the Borrow Pit. As mentioned abovel, his was justified by the general horizontal deposition seen across the site and the identification of multiple similar strata in the field.

As seen in Figure 6.14 and Table 6.4, two outliers were identified in the model (FN50122 and FN50233) and the remaining dates agree with their plotted depths. First to address FN0122, this date was produced by a carbonized *agavaceae* leaf base collected from approximately 1-meter below surface in the Sand Box area (Table 6.3). This would associate it with a deposit identified as Occupation 1, the first cultural deposit identified across the site during excavation. The date FN50122 is lower in depth but calculated as younger than FN50076 which is also in Occupation 1 deposits which have been identified as somewhat deflated and superimposed on each other due to intense activity (discussed further in Chapter 7). With this complexity of cultural deposition in mind, and considering the slightly overlapping one-sigma ranges, both dates were accepted.

Next to address FN50233, this date was produced from a sample of carbonized mesquite wood at a depth of 2.71-meters below surface and is juxtaposed with a date from carbonized *Fabaceae* (legume family) wood collected from 2.68-meters below surface (FN50734). FN50233 was collected from a surface with a small cluster of FCR and a modified flake. FN50734 was collected from a thin sandy alluvium deposit with FCR and oxidized sediment sandwiched between two mud drapes during sampling column excavation. After consideration of the model and the confidence in the context from which both samples were excavated, I believe the FN50233 date must be wrong and discarded from consideration.  This clearly older piece of wood may have been introduced into younger deposits via bioturbation or perhaps pit digging.

*Estimated Sedimentation Rates*

Twenty-five flood deposits were identified out of eighty-three samples from the Borrow Pit sampling column. These depositional packages were characterized by upward-fining sediments and often capped by a very fine silty mud drape. Using the top depths and thicknesses of these flood packages, I spliced the age-depth model to derive sedimentation rate estimates based off each deposit estimated age given in Table 6.4.

The estimation of sedimentation rates paired with the flood deposit ages indicates that frequency and magnitude of depositional events at Sayles Adobe was variable through time. This patterning of variation in the deposits was observed during excavation and documented in profile sections across the site, these lab-based model calculations support our field observations. More explicitly, the total excavated column (3.77-meters) is made up of no less than twenty-five flood deposits; these data support the conclusion that the deposits of Sayles are well-preserved with little pedogenic development. Therefore, any cultural materials layered between depositional events are considered expressions of human activity at the site (this conclusion will be elaborated upon in Chapter 7).

## DISCUSSION

The geoarchaeological and stratigraphic results presented in this chapter provide evidence that Sayles Adobe was formed through multiple repeated low-velocity flood events. These floods deposited fine to very fine sediments mainly of silt and sand size, with occasional high carbonate clay deposits (mud drapes). Stratigraphic correlation of the deposits through auger tests and excavation indicate that the majority of these depositional events capped the entire terrace, with an incalculable amount of erosion taking place.

Approximately 20 stratigraphic deposits have been correlated across the terrace through large-scale excavation and through auger testing. Identifying similar deposits across the site not only aids in the correlation of flood events, but in visualizing the changing topography of the site at different periods of its formation and use. Understanding these events and the topography aids in developing amore solid understanding of the sites use; how, when, and what areas of the site were being used. We see this differential site use in the Borrow Pit and the Sand Box in the form of dense occupational lenses at different depths in each excavation area (further discussed in the following chapter.

Micromorphologic other sediment focused analyses indicate that the majority of the deposits seen at Sayles Adobe are deposited through alluvial processes, but some eolian depositon may be present. While these deposits were buried relatively quickly, multiple surfaces were stable long enough for cultural activity to take place at the site. However, frequent inundation and periods of biogenic activity (human or animal), have at times mixed the deposits.

# VII. PEOPLE AT SAYLES ADOBE: MACRO- AND MICRO- MATERIAL ANALYSES

As discussed in Chapter 6, taking a high-resolution approach to the excavation of the site (i.e., and the Borrow Pit sampling column in particular) enabled the discrete sampling and analysis of the depositional and cultural history of the site. This chapter discusses the cultural units identified through the comparative microartifact and depositional sequence analysis (Table 6.4). The larger macro-scale analyses (i.e., macrobotanical, zooarchaeological, features, and more) completed for the site's deposits are integrated into the micro-scale analysis where correlations in the datasets can be made.

As discussed in Chapter 5, thresholds for count data were paired with concise terminology to create a framework to systematically and consistently analyze the microartifact data from the Borrow Pit sampling column. This framework, outlined in Table 5.2, was tiered to clearly indicate significance (i.e., time-depth or density) or ephemerality of the identified cultural deposits. *Cultural Units* are defined as any level of human activity represented in the microartifact data; these were further broken down into: *Compound Episodes (CE), Episodes (E), and Potential Episodes (PE)* (Table 7.1).

Once this analysis was completed, with both cultural and depositional units identified, an Age-Depth model of deposits for the site was used to calculate an estimated age range for the depositional units. This estimated age range extrapolated from the Age-Depth model (Figure 6.15) is simply that, an estimate. It is an informed model that calculates and allows the user to project the probable date for that depositional unit.

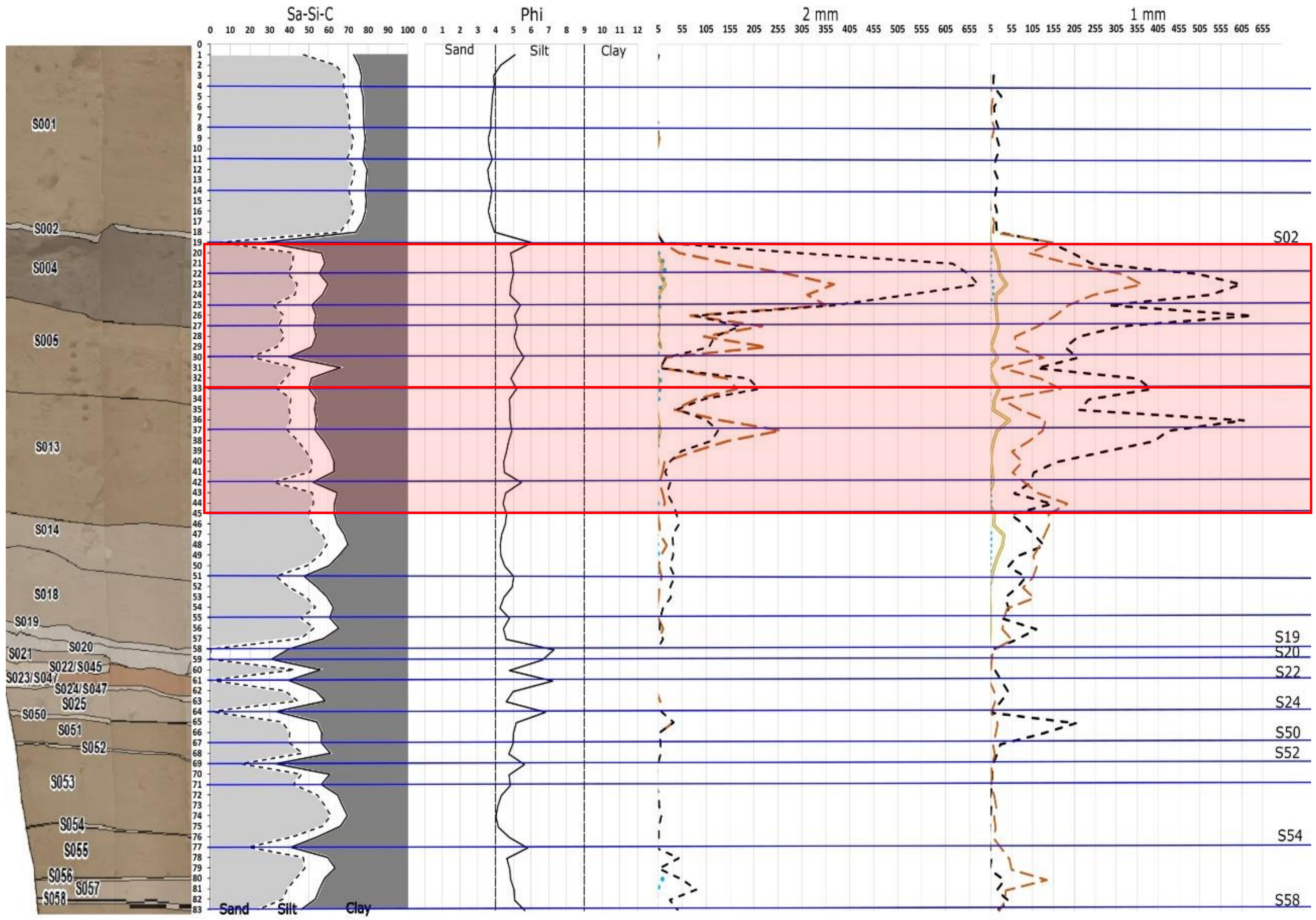



Figure 7.1: Graph of counts of microartifact counts plotted with the particle size distribution, mean particle size, 2mm, and 1mm microartifact counts. These data provided the foundation for identifying the low density, ephemeral cultural episodes, as outlined in

Table 7.1: Compiled table of the identified cultural units, depositional units, and materials present.

| Cultural Unit | Type of Unit | Depth (cmbs) | Depositional Unit | Age of Unit (cal BP) | Age of Unit (AD/BC) | Sedimentation Rate (cm/100 years) | Materials Present |
|---|---|---|---|---|---|---|---|
| Cultural Unit 1 | Episode 1 | 0-5 | 25 | 26.7 ± 25.2 | AD 1923 | 40.37 | Charcoal & FCR; total (7) |
| | Episode 2 | 11-15 | | | | | Charcoal, FCR, & Faunal; total (20) |
| Cultural Unit 2 | Compound Episode 1 | 15-38 | 24 | 86.11 ± 44.8 | AD 1863.89 | 20.65 | Charcoal, FCR, Debitage, And Faunal; total (110) |
| | Compound Episode 2 | 38-54 | 23 | 153.1 ± 73.3 | AD 1796.9 | 24.18 | Charcoal, FCR, Debitage, And Faunal; total (119) |
| | Compound Epsiode 3 | 54-65 | 22 | 209.5 ± 88.8 | AD 1740.5 | 57.58 | Charcoal, FCR, & Faunal; total (67) |
| | Compound Episode 4 | 65-84 | 21 | 251 ± 99.4 | AD 1699 | 17.46 | Charcoal, FCR, Debitage, & Faunal; total (141) |
| Cultural Unit 3 (Occupation 1) | Compound Episode 5 (Occupation 1) | 84-95 | 20 | 294.3 ± 108.9 | AD 1655.7 | 15.71 | Charcoal, FCR, Debitage, & Faunal; total (2287) |
| | Compound Episode 6 (Occupation 1) | 95-110 | 19 | 345 ± 118.9 | AD 1605 | 3.24 | Charcoal, FCR, Debitage, & Faunal; total (5567) |
| | Episode 3 (Occupation 1) | 110-120 | 18 | 560.3 ± 115.8 | AD 1389.7 | 2.11 | Charcoal, FCR, Debitage, & Faunal; total (2210) |
| | Compound Episode 7 (Occupation 1) | 120-134 | 17 | 1177.8 ± 341.5 | AD 772.2 | 1.88 | Charcoal, FCR, Debitage, & Faunal; total (2001) |
| Cultural Unit 4 (Occupation 2) | Compound Episode 8 (Occupation 2) | 134-147 | 16 | 1762 ± 382.7 | AD 188 | 3.02 | Charcoal, FCR, Debitage, & Faunal; total (1429) |
| | Compound Episode 9 (Occupation 2) | 147-167 | 15 | 2313 ± 352.5 | 363 BC | 5.46 | Charcoal, FCR, Debitage, & Faunal; total (2897) |
| | Compound Episode 10 (Occupation 2) | 167-190 | 14 | 3025 ± 262.6 | 1075 BC | 3.08 | Charcoal, FCR, Debitage, & Faunal; total (2751) |
| Cultural Unit 5 | Compound Episode 11 | 190-202 | 13 | 3406 ± 335.7 | 1456 BC | 15.38 | Charcoal, FCR, Debitage, & Faunal; total (861) |
| Cultural Unit 6 | Compound Episode 12 | 202-229 | 12 | 3649 ± 371.4 | 1699 BC | 4.44 | Charcoal, FCR, Debitage, & Faunal; total (1472) |
| Cultural Unit 7 | Compound Episode 13 | 229-248 | 11 | 3916 ± 401.4 | 1966 BC | 4.54 | Charcoal, FCR, Debitage, & Faunal; total (754) |
| Cultural Unit 8 | Comopound Episode 14 | 248-261 | 10 | 4240 ± 373.1 | 2290 BC | 2.02 | Charcoal, FCR, Debitage, & Faunal; total (411) |
| Cultural Unit 9 | Episode 4 | 261-265 | 9 | 4460 ± 324.9 | 2510 BC | 7.50 | Charcoal, FCR, & Faunal; total (20) |
| Cultural Unit 10 | Episode 5 | 265-271 | 8 | 4593 ± 276.0 | 2643 BC | 12.57 | Debitage and Charcoal; total (9) |
| Cultural Unit 11 | Compound Episode 15 | 271-283 | 7 | 4680 ± 246.5 | 2730 BC | 5.22 | Charcoal, FCR, Debitage, & Faunal; total (124) |
| Cultural Unit 12 | Compound Episode 16 | 283-295 | 6 | 4904 ± 184.3 | 2954 BC | 4.74 | Charcoal, FCR, & Faunal; total (485) |
| Cultural Unit 13 | Episode 6 | 295-305 | 5 | 5206 ± 229.5 | 3256 BC | 6.25 | Charcoal, FCR, & Faunal; total (97) |
| Cultural Unit 14 | Episode 7 | 305-315 | 4 | 5385 ± 295.8 | 3435 BC | 17.23 | Charcoal, FCR, & Faunal; total (39) |
| Cultural Unit 15 | Compound Episode 17 | 315-343 | 3 | 5543 ± 355.6 | 3593 BC | 4.24 | Charcoal, FCR, Debitage, & Faunal; total (150) |
| Cultural Unit 16 | Compound Episode 18 | 343-372 | 2 | 5922 ± 515.7 | 3972 BC | 0.85 | Charcoal, FCR, Debitage, & Faunal; total (723) |
| Cultural Unit 17 | Episode 8 | 372-377 | 1 | 6619 ±595.5 | 4669 BC | -244.01 | Debitage, Charcoal, & FCR; total (91) |

## CULTURAL UNITS

### *Cultural Unit 1 (CU 1)*

Cultural Unit 1 (Table 7.1) is the uppermost (0-15cmbs) unit identified from the sediment and microartifact dataset. CU 1 consists of a single depositional unit (DU 25) and two ephemeral activity levels: Episodes 1 & 2. Episode 1 is made up of a total of 7 artifacts that are a combination of charcoal and FCR; Episode 2 is comprised of charcoal, FCR, and faunal remains totaling 20 microartifacts. The two episodes are divided by a gap (5-11cmbs) in microartifacts but no stratigraphic break was identified, therefore they remained in the same depositional unit. The age-depth model returned a Historic age for this deposit but the cultural material that defines it is very likely prehistoric, and an estimated sedimentation rate of approximately 40.37 cm/100 years.

### *Cultural Unit 2 (CU-2)*

Cultural Unit 2 (Table 7.1) is a contiguous series of compound episodes (CE 1-4) delineated by several deposition events (DU 24-21). The overall age range for the cultural unit is estimated at 86.11 ± 44.8 cal BP to 251 ± 99.4 cal BP years (AD1864 – 1699); placing the depositional unit in the Historic to late Late Prehistoric periods, but the nature of the cultural material is prehistoric. Estimated sedimentation rates for the depositional units indicate a fluctuating depositional environment that ranges from as slow as 17.46 cm/100-years (CE-4) to 57.58 cm/100-years (CE-3).

Counts of artifacts from each compound episode is variable from a range of 67 (CE 3) to as many as 141 microartifacts in CE 4. Compound Episodes 1, 2, and 4 are made up of charcoal, FCR, debitage, and faunal remains; Compound Episode 3 is comprised of charcoal, FCR, and faunal remains. Additionally, two painted pebble cache features (Feature 4 and 5; Figure 7.2) were present in CE 1 and CE 4 respectively, which are discussed below.

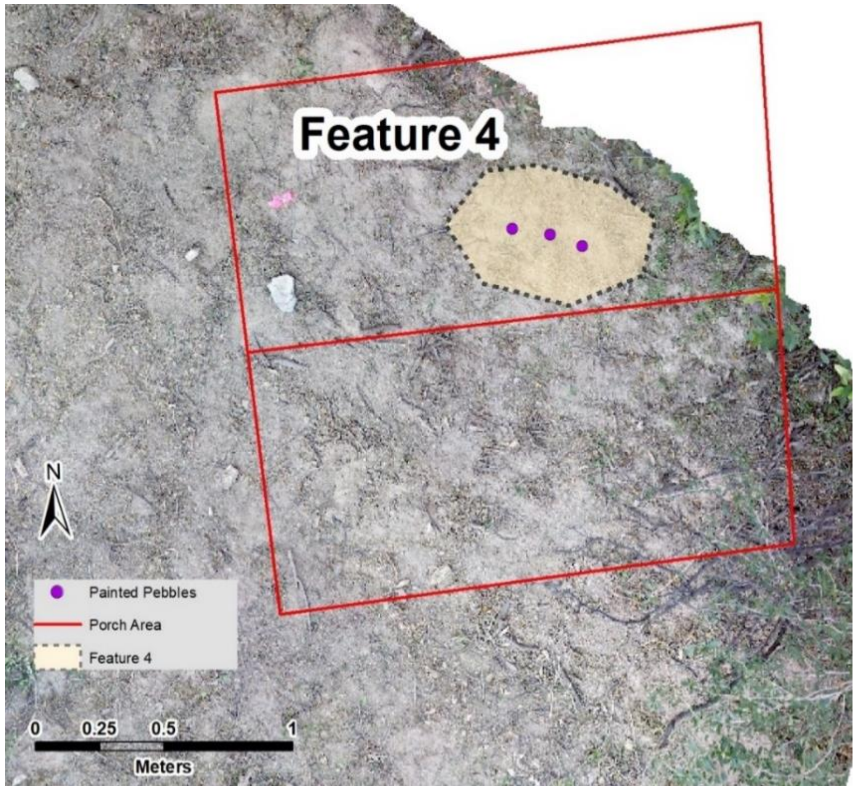


Figure 7.2: Feature 4 pebbles and approximated feature boundary. Feature 5 lays directly below (approximately 35cm below) the upper cache feature.

**CU2: Feature 4**

Feature 4 is a cache of three painted pebbles located in the Porch excavation unit (Figure 7.2; Figure 7.3) approximately 30 cmbs within cultural unit CU-2: CE 1. Painted pebbles are common in the Lower Pecos andseveral papers have detailed the styles and outlined a chronology of these artifacts (Mock 1987; Parsons 1965, 1986). Lacking any indication of a pit or other obvious cultural surface, this apparent was not initially defined as a feature. However, the clustering of the three artifacts coupled with sediment analyses from the unit suggest indicating that it was a cache a feature (Figure 7.3).

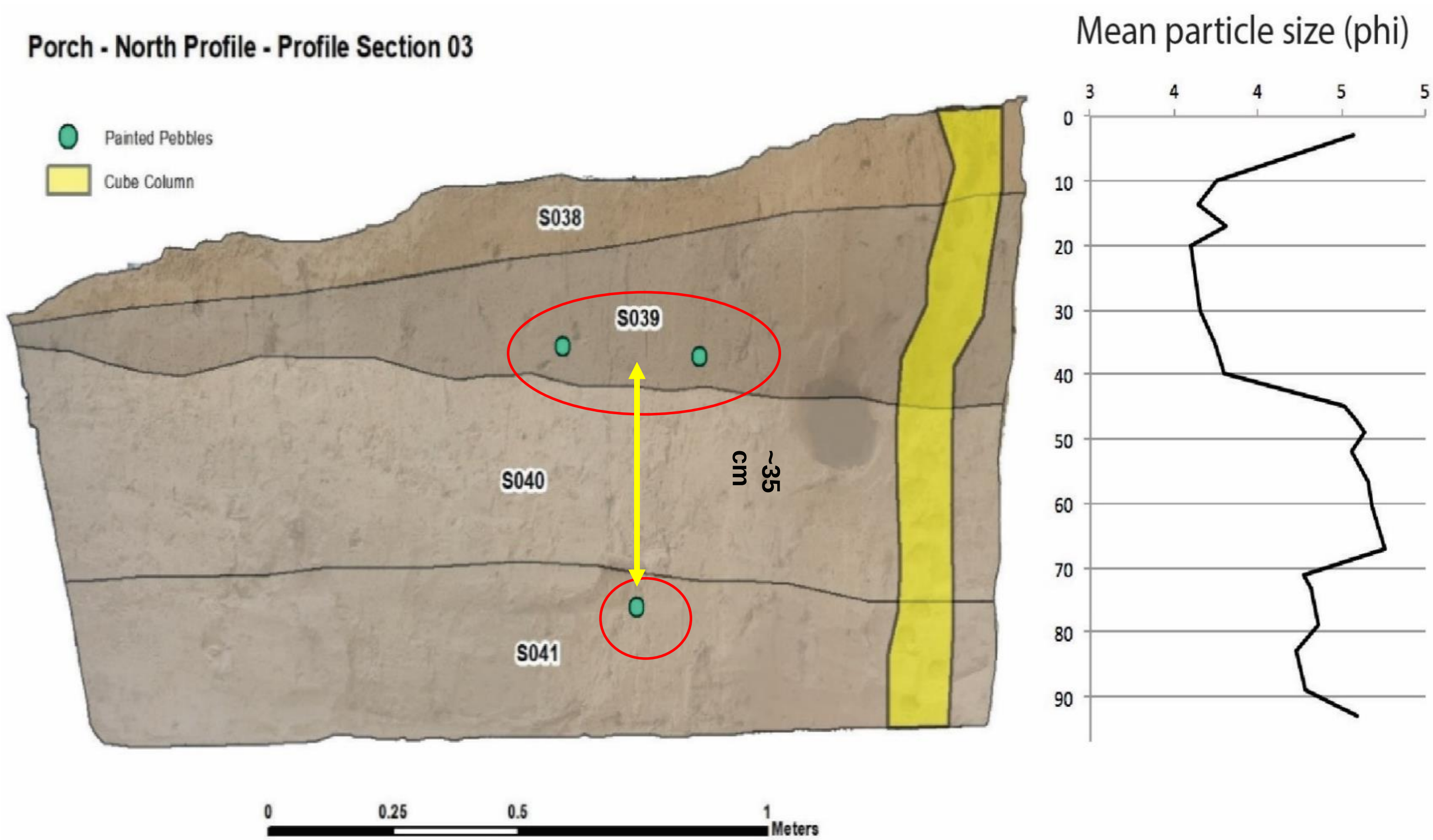



Figure 7.3: (Top) Profile Section 03, with the circled locations of Feature 4 and Feature 5 pebbles. Sediment analyses (yellow column) indicate four depositional breaks in stratigraphy, which indicates these two features are not the same event as they lay in separate depositional units.

Pebble #1 (Figure 7.4.1): Painted on two sides with no visible central, bisecting or flanking lines, but does show a resemblance to the lenticular and freeform flanking designs characteristic of Style IV[7]. Pebble #2 (Figure 7.4.2): Tapering form and central line that follows a wavy, zigzag-ish pattern, with v-forms off the central line. One visible flanking elongated element leading towards the edge. Design is seemingly most relevant to the Style V, substyle 2, with the additional flank element. Pebble #3 (Figure 7.4.3): There is such little pigment that can be seen that an attempt to type it will not be undertaken.

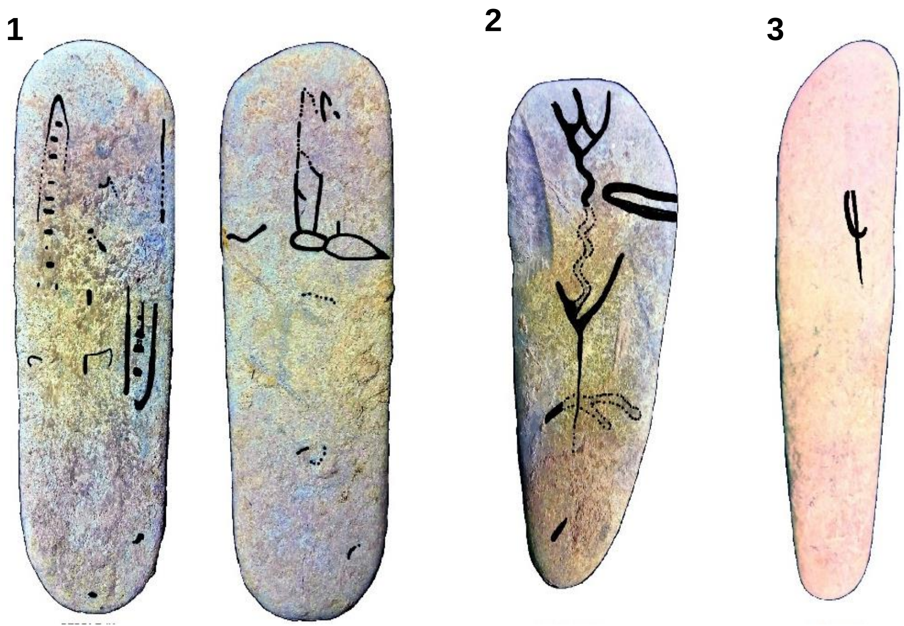



Figure 7.4: Feature 4 painted pebbles photo enhanced with D-Stretch and illustrated by the author. Not to scale.

**CU 2: Feature 5**

Feature 5 is an inferred cache of a single painted pebble located in the Porch unit (Figure 7.3) directly below Feature 4 at approximately 70 cmbs and is associated to CE 4. Pebble #4 (Figure 7.5) has a central motif clearly identifies this as a Style II, with the

[7] Style nomenclature derives from Parsons 1965.

central line, two outer paralleling lines, with a core motif and radiating curving lines off the flanking lines. Originally thought to be associated to the three pebbles above it (Feature 4), the sediment analysis shows that this pebble was not associated to the others. While Feature 5 is just a single artifact, it was intentionally placed in the Porch occurredat an earlier date and separate visit to the site.

Figure 7.5: Painted pebble #4 from Feature 5 in the Porch. Photo enhanced with D-Stretch and illustrated by the author. Not to scale.

*Cultural Unit 3 (CU-3): Occupation 1*

Cultural Unit 3 (Table 7.1) is the densest cultural deposit identified at the site, recognized in the field in both the Borrow Pit and the Sand Box. In the field the depositional unit matrix was observed as grey, charcoal flecked loam with moderate to very dense FCR that was capped by a silt-clay flood drape sealing the deposit. On the micro scale, CU 3 (Occupation 1) appears to have consisted of at least four different periods of activity (CE 5, CE 6, E 3, and CE 7), during which the site was exposed to a period of slower estimated sedimentation rates than deposits above and below. The average sedimentation rate for this cultural unit is estimated to be roughly 5.74 cm per 100 years. The assemblage from all four apparent surfaces includes charcoal, FCR, debitage, and faunal remains from both sieve sizes;  FCR and charcoal dominate.

After the completion of sediment and microartifact analyses it was determined that CU 3 (Occupation 1) could be broken into four separate events: CE 5 (DU20), CE 6 (DU19), E 3 (DU18), and CE 7 (DU17). Based on the estimated ages for the deposition units, CE 5 and CE 6 fall into the Late Prehistoric period (294 -345 cal BP/ AD 1655-1605), while E 3 and CE 7 formed during the terminal Late Archaic to earliest Late Prehistoric periods(560-1177 cal BP/ AD 1389-772). These Age-Depth estimates fall within the date ranges from radiocarbon assays of charcoal pulled from matrix and features in CU 3 (Occupation 1) from the Borrow Pit and Sand Box (Table 7.2).

Table 7.2 Four radiocarbon dates from Occupation 1 (CU 3) deposits.

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50309 | BP | Feature 1/ CU-3 | 0.97 | Wood | *Quercus* sect. *Quercus* | 730 | 23 | 697-656 | 676 |
| FN50076 | SB | Feature 1/ CU-3 | 0.98 | Agave | Prosopis glandulosa | 980 | 33 | 928-792 | 854 |
| FN50006 | BP | Feature 1/ CU-3 | 1.09 | Wood | Unidentifiable | 707 | 25 | 742-675 | 708 |
| FN50122 | SB | Feature 1/ CU-3 | 1.1 | Mesquite | Agavaceae | 770 | 32 | 789-684 | 730 |

**Occupation 1 Macroartifact Discussion**

While similar to the microartifact assemblage in many ways, the macro artifact assemblage is blurred by the manner of excavation of the major units, which does not constrain assemblages as a sampling column does. So where one thick deposit was seen in the field, in reality the deposit seems to represent no less than four different site visits or events. Therefore these macroscale assemblages (i.e., features, macrobotanical, faunal, and lithic) will be discussed within the broader scale, Occupation 1 deposits.

**Occupation 1 (CU3): Feature 1**

Feature 1 was initially seen in Profile Sections 01 and 02 (the east and south Borrow Pit walls respectively), as well as Units A1 and B which lay northeast of the profiles (Figure 7.6). When first encountered in the field, these deposits were thought to be an earth oven facility considering the tapered lens formed of FCR and carbon-stained sediment observed in the profiles, and a dense, circular scattering of burned rock mixed with debitage and charcoal was observed during excavation. A combination of typical horizontal layers and thin vertical slices gave us different perspectives on the deposits and allowed us to take discrete matrix samples for macrobotanical and geoarchaeological analyses.

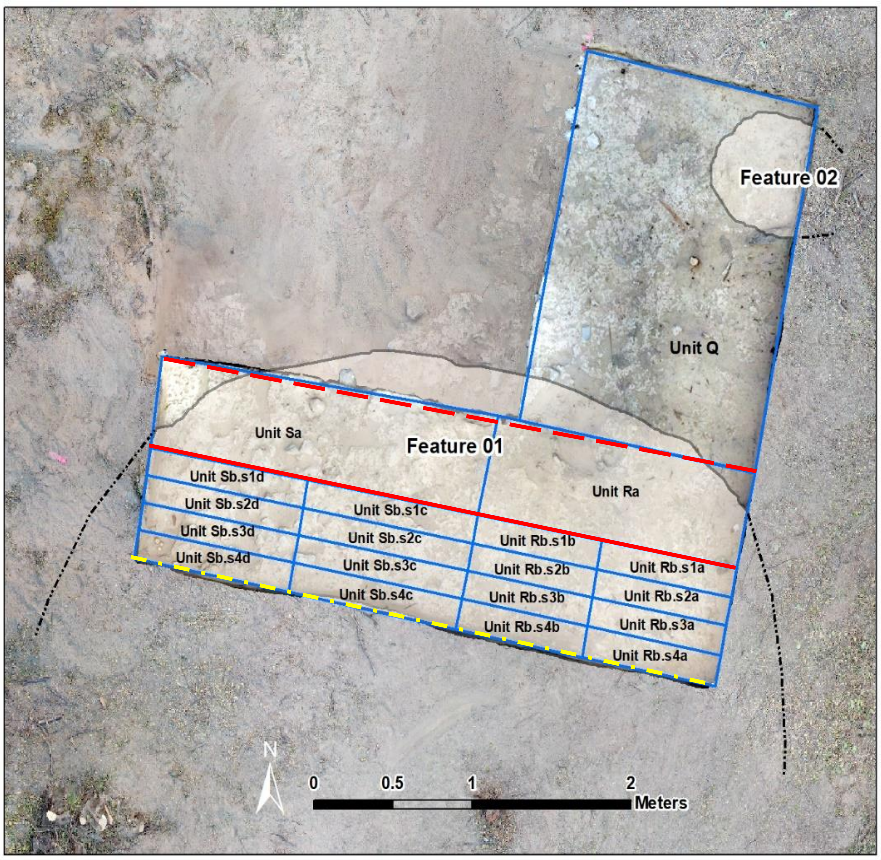



Figure 7.6: Feature 1 and Feature 2 excavation plan, Borrow Pit. Unit Rb (right side) and Unit Sb (left side) illustration of slices during excavation. Short-dash lines indicate the estimated projection of the features beyond what was excavated. The linear dashed and solid lines are the plan and oblique profiles.

We had several questions in mind that drove this style of excavation:

1. Is Feature 1 the result of a single event? If not, can we infer the number of events it may represent?
2. Is there a central heating element, or any intact heating element remnant?
3. Is this an actual ring midden with a discrete central pit

By sampling and discretely quantifying the FCR from the Feature 1 we were able to address the three questions about the formation of Feature 1 (discussed in Chapter 8) and relate it to the overall site use of Sayles Adobe. From this style of excavation, it could be seen that there was no patterning in the densities of rock that were present in the feature area (i.e., there was no clear ring to the suspected ring midden).

During excavation we quickly realized that this feature was a result of repeated cooking events that intersected and truncated one another as we observed churned sediments and randomly oriented FCR throughout the excavation of the Feature 1 area. As seen in Table 7.3, there were greater densities of rock as we moved from the east (Unit Rb.s1a to Rb.s4a) to the west (Unit Sb.s1d-Sb.s4d), which may indicate that more rock was discarded to that side or is just a product of not capturing the whole feature area in our excavations.

Table 7.3: Feature 1 rock sort masses (kg) by size and slice.

**Feature 01 Rocksort by Slice and Size Categories**

| Unit | <7.5cm | 7.5-11cm | 11-15cm | >15cm | | <7.5cm | 7.5-11cm | 11-15cm | >15cm | | <7.5cm | 7.5-11cm | 11-15cm | >15cm | | <7.5cm | 7.5-11cm | 11-15cm | >15cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit Rb.s1a | 0.3 | 2.9 | 1.6 | 0.0 | Unit Rb.s1b | 1.6 | 1.7 | 0.6 | 0.0 | Unit Sb.s1c | 2.8 | 3.7 | 3.7 | 0.0 | Unit Sb.s1d | 4.3 | 8.9 | 2.8 | 1.6 |
| Unit Rb.s2a | 0.3 | 3.3 | 3.6 | 0.9 | Unit Rb.s2b | 1.3 | 0.8 | 0.4 | 1.6 | Unit Sb.s2c | 3.6 | 4.4 | 7.4 | 0.6 | Unit Sb.s2d | 1.4 | 2.1 | 1.2 | 0.4 |
| Unit Rb.s3a | 1.3 | 5.3 | 3.7 | 2.0 | Unit Rb.s3b | 1.6 | 1.9 | 0.7 | 0.0 | Unit Sb.s3c | 1.4 | 2.3 | 5.1 | 0.5 | Unit Sb.s3d | 3.2 | 3.1 | 4.5 | 4.7 |
| Unit Rb.s4a | 1.0 | 0.2 | 0.8 | 1.7 | Unit Rb.s4b | 2.1 | 7.4 | 8.6 | 3.7 | Unit Sb.s4c | 1.4 | 3.8 | 3.7 | 0.8 | Unit Sb.s4d | 1.6 | 1.9 | 1.3 | 2.0 |

Perhaps this is just an indication that the eastern side of the feature area was the more intensively used side for the baking events, and the rock was discarded out to the western edges. Either way this feature is interpreted as representing multiple baking events during which the feature area was dug into and used several times.

The radiocarbon date from the feature (Table 7.2: FN50309) fell within the Late Prehistoric, 697-656 cal. BP.  This date overlapped in 1-sigma ranges with a date from Feature 2 (Table 7.2: FN50436: 609-659 cal. BP) and a date outside the feature areas within Occupation 1 (Table 7.2: FN50006: 742 -675 cal. BP). This further supported our field observation of reworked deposits, as would be expected for a feature area that was used repeatedly. Considering the location of this feature at the top of the Occupation 1 deposits (which is also the upper boundary of CU 3), this feature is most likely associated to CE 5 and possibly CE 6, as it cuts through previously deposited sediments. However, since no definitive boundaries of pits could be identified, no fully substantiated association can be made for the feature.

**Occupation 1 (CU3): Feature 2**

Feature 2, 75 cm by 75cm, was discovered in the northeast corner of Unit Q (Figure 7.7 & 7.8), as excavators moved through the outer edge of Feature 1 to the south. Excavators identified this as feature as a discrete pattern of FCR and charcoal. Due to the small nature of the feature, i.e., a circular patch of oxidized and charcoal stained sediment with two carbonized sticks in the center – it seemed the feature was likely a surface fire and not an earth oven. Present in the center of the feature were two *in situ* fully carbonized wooden sticks (Figure 7.7).

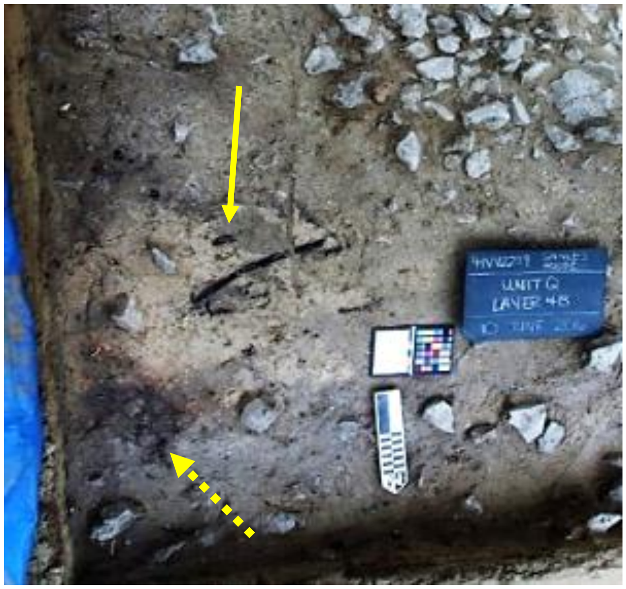



Figure 7.7: (Feature 2, Occupation 1, CE 5) The solid arrow points to the fully carbonized wood sticks, and the dotted arrow points to a patch of oxidized burnt sediment.

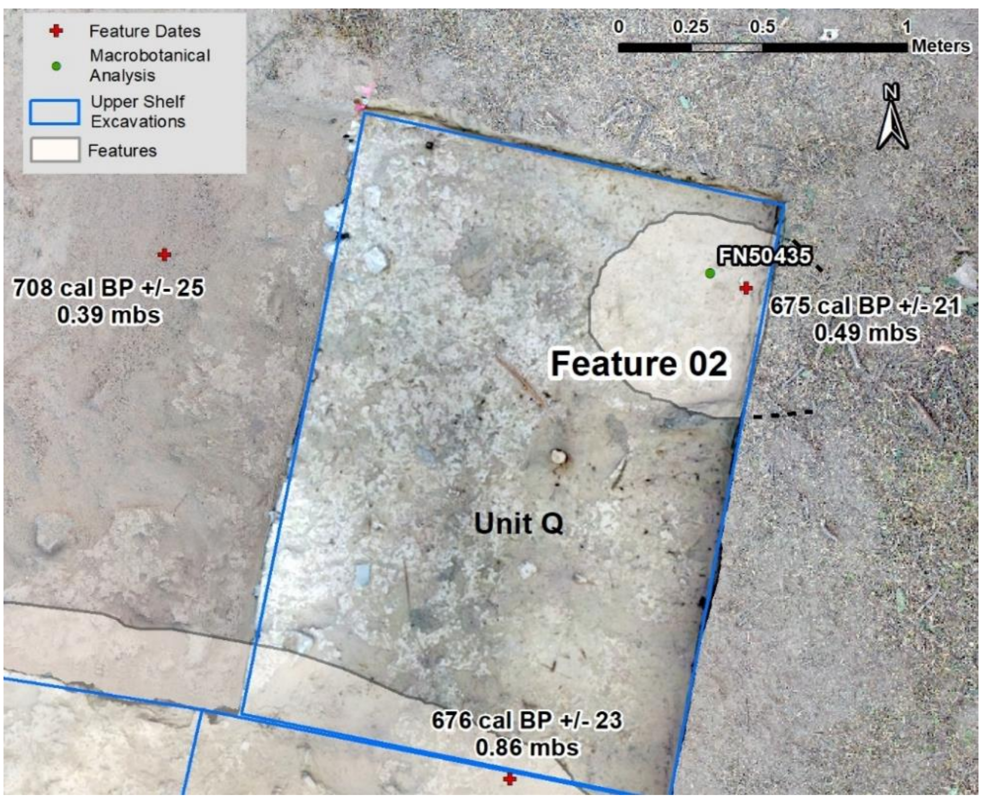



Figure 7.8: Feature 02 in the Borrow Pit

Three discrete matrix samples were collected from the center, middle and outer feature areas so that the feature matrix was not jumbled together. A section of each of the charcoal sticks was shot in with the TDS and collected for precise dating of the feature. Two micromorph blocks (discussed in Chapter 6) were collected from the profile to the east of the area to capture the stratigraphy of the feature are

It was clear during excavation that Feature 2 was an isolated feature that occurred slightly above the Feature 1 deposits, and this is supported by a slightly later Late Prehistoric date of 690-659 cal. BP (Table 7.4). As discussed, these two features (Feature 1 and Feature 2) overlapped in one sigma date ranges which indicates that little time elapsed between these events.

Table 7.4: Single radiocarbon date from the CU 4 (Occupation 2) deposits from the Sand Box.

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50436 | BP | Feature 2/ CU-3 | 1.12 | Agave | *Dasylirion* sp. | 727 | 21 | 690-659 | 675 |

**Occupation 1 (CU3): Macrobotanical Assemblage**

Macrobotanical analysis was completed on seven bulk-matrix samples (Figure 7.5), five collected from the Borrow Pit and one from the Sand box excavation area. Archaeobotanists Dr. Leslie Bush and Dr. Kevin Hanselka floated, dried, and sorted/identified the macrobotanical remains with specific interest in identifying taxa and the state of the remains (carbonized or not carbonized). Bush also worked to identify the possible prehistoric uses and sources of the plant materials that were identified; her report appears in Appendix F.

Table 7.5 summarizes Bush's findings; samples examined are from the Borrow Pit Feature 1 (n=4), Borrow Pit Feature 2 (n=1), and the Sandbox[8] (n=1) (Figure 7.10). Most of the organic plant material was preserved due to carbonization (Figure 7.9). The Sandbox sample produced lower densities of carbonized remains than the Borrow Pit samples. Leaf bases of agave and/or other large desert rosettes were present in all six samples. Agave, yucca, and beargrass could be identified among the leaf bases. Sotol and onion may be present among the specimens identified only as "Liliaceae" (lily family) but are not definitely identified.

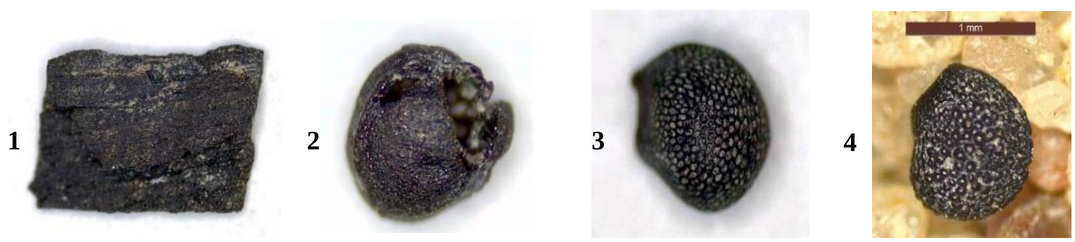



Figure 7.9: Microscopically identified botanical remains. 1) Yucca leaf fragment from FN 50656, probably *Yucca thompsoniana*, the thin-leaf yucca that grows in the area today. Specimen is 4.5 mm long. 2) Chenopodium seed (*Chenopodium sp*.) from FN 50673. Specimen is 0.75 mm at widest diameter. 3) Barrel cactus seed (*Ferocactus hamatacanthus*) from FN 50664. Specimen is 0.9 mm at widest diameter. 4) Strawberry pitaya seed (*Echinocereus enneacanthus*) from FN 50071. Photo credit Dr. Leslie Bush.

[8] The Sand Box matrix for macrobotanical analysis was not from a feature, as the five others were. It was however still from Occupation 1 (CU 3) deposits.

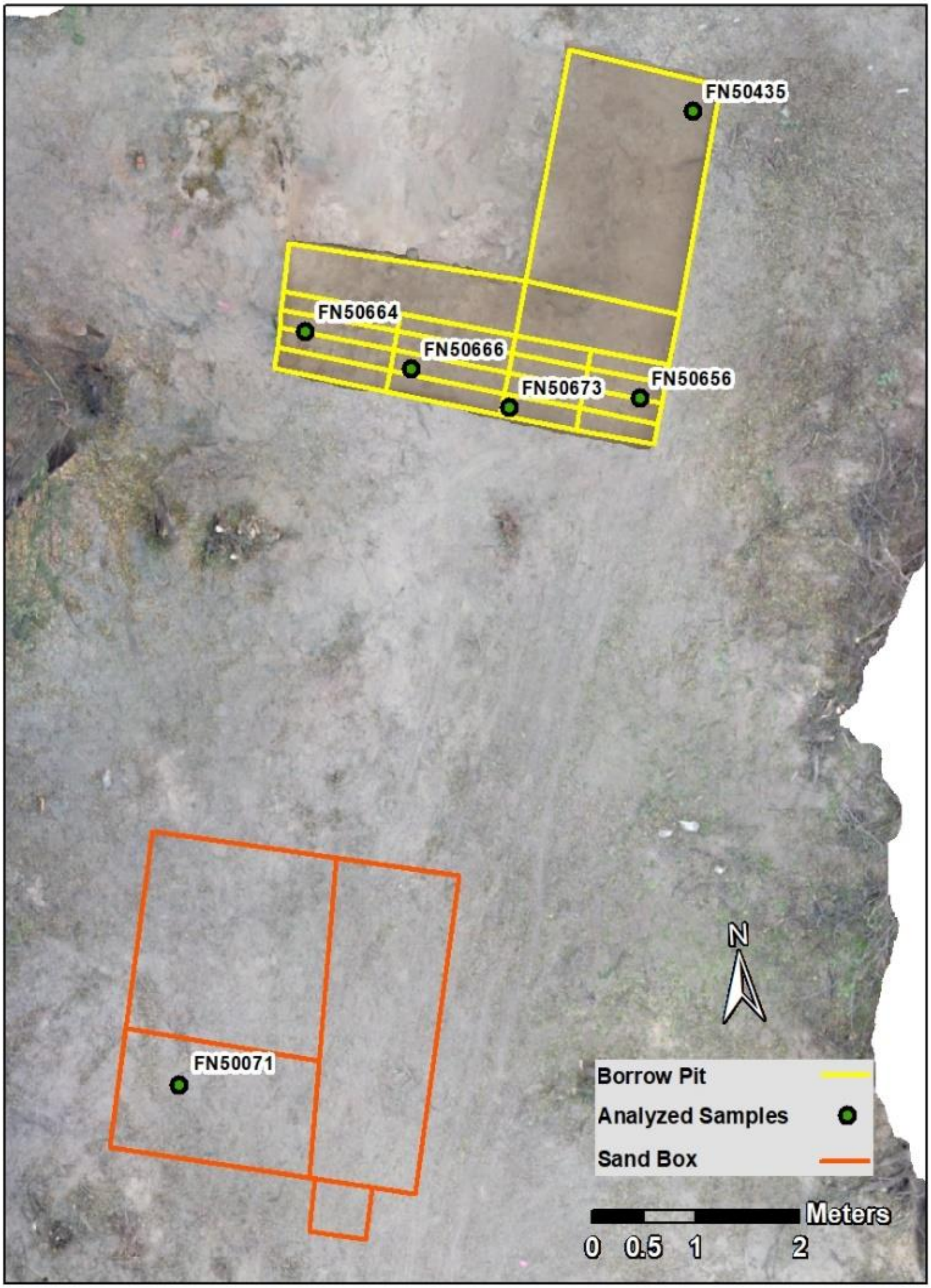



Figure 7.10: Macrobotanical samples analyzed by Dr. Bush. The boxes over each excavation area indicate excavation units, and in the case of the Borrow Pit, excavation slices through Feature 1.

Table 7.5: Carbonized Plant Remains from Sayles Adobe (41VV2239)

| FN | 50435 | 50656 | 50664 | 50666 | 50673 | 50071 | Site Total |
|---|---|---|---|---|---|---|---|
| Area | Borrow Pit | Borrow Pit | Borrow Pit | Borrow Pit | Borrow Pit | Sand Box | |
| Unit | Q | Rb | Sb | Sb | Rb | H | |
| Strat/Layer | 5 | 2a | 2d | 3c | 4b | 2 | |
| Feature | F2 | F1 | F1 | F1 | F1 | - | |
| Cultural Unit | 3 | 3 | 3 | 3 | 3 | 3 | |
| Sample volume (l) | 3.9 | 2 | 2 | 2 | 2 | 3.9 | 11.9 |
| **Leaf bases and fragments** | | | | | | | |
| Yucca/lechuguilla (Agavaceae) | 8 | 4 | 4 | 10 | 4 | 4 | 32 |
| Desert succulent (Agavaceae/Liliaceae) | 10 | 3 | 5 | 12 | 3 | 1 | 34 |
| Lechuguilla *(Agave lechuguilla)* | 7 | 1 | 1 | 4 | 1 | | 14 |
| Sotol/beargrass (Liliaceae) | | 1 | | | | | 1 |
| Beargrass *(Nolina texana)* | | | | 2 | | | 2 |
| Yucca *(Yucca* spp.) | | 2 | | | | | 2 |
| Seeds | | | | | | | |
| Chenopodium *(Chenopodium* sp.) | | | | | 2* | | 2 |
| Strawberry pitaya *(Echinocereus enneacanthus)* | | | 1 | | 1 | 2 | 2 |
| Barrel cactus *(Ferocactus hamatacanthus)* | | | 1 | | | | 1 |
| Indeterminable | 7 | | | | | | 7 |
| Rush *(Juncus* sp.) | | | 1 | | | | 1 |
| Prickly pear *(Opuntia* sp.) | | | 1 | | | | 1 |
| Grass (Poaceae) | 3 | | | | | | 3 |
| Purslane *(Portulaca* sp.) | 5 | | | | | | 5 |
| Stems | | | | | | | |
| Grass (Poaceae) | 12 | | | | | | 12 |
| Monocot | 5 | | | | | | 5 |
| Indeterminable | | | | | | 1 | |
| Wood charcoal | 787 | 55* | 55 | 95 | 297** | 30* | 1302 |
| Indeterminable | 18 | 5 | | 5 | 4 | | 32 |
| | 862 | 16 | 69 | 128 | 13 | 8 | 1458 |

*1 semi-carbonized
**4 semi-carbonized

Four samples (FN50071, FN50435, FN50664, and FN50673) produced small seeds suggesting consumption of wild greens (purslane, chenopodium), seeds (chenopodium, grasses), and cactus fruits (strawberry pitaya, barrel cactus, prickly pear). The presence of grass stem fragments in Feature 2 may suggest the use of grasses packing or insulating material in the cooking event associated with that feature. Often in experimental earth-oven baking events prickly pear pads are used in this role to insulate and/or add moisture to the cooking process. Wood charcoal was also present in all samples, and generally characterized as fuelwood by Bush (Appendix F. p4).

Species commonly known in archaeological deposits of the region, such as beargrass, yucca, sotol, and lechuguilla, were identified in all samples. While most of these species likely represent the residue from baked food, they may also reflect plant fiber processing for making items like cordage, basketry, etc., as the leaves of these plants were often used and recovered from archaeological sites. Additionally, Bush identified occasional uncarbonized botanical remains, mainly rootlets and some uncarbonized seeds, within all samples, which is common at archaeological sites. The uncarbonized seed remains Bush identified that may be more indicative of various forms of bioturbation were the spiny hackberry seeds which are resistant to decay due to their endocarp (inner seed casing). These plants are present in the canyon today and have been documented in the ethnographic record of native peoples.

Two identified wood taxa were given special attention due to their specific water and environmental conditions for growth. Live oak (*Quercus fusiformis)* was identified in the Feature 1 sample. According to Bush, the plant is uncommon west of Del Rio and does not currently grow in ENC, as it prefers wetter, more stable environments.

In addition to the macrobotanical analysis completed on the matrix samples, carbonized botanical remains were identified (Table 7.5) prior to radiocarbon dating so we understood precisely what it was we were dating. We tried to date materials we could identify as short-lived species so that a discrete temporal range could be identified; in other words, we tried to date material that would have only been alive and present during a small window of time. This provides useful information when paired with environmental data and when certain economic species (e.g., lechuguilla, edible seeds, sotol, etc.) were present.  In other words, if a plant has a short lifespan and specific climatic needs, that data is relevant to understanding the conditions of the site. By also identifying and dating economic species we add to the dataset of known uses, dates, and site types where the plants show up in the archaeological record.

**Occupation 1 (CU3): Faunal Assemblage**

Analysis of the faunal assemblage for the site were completed by zooarchaeologist, Dr. Christopher Jurgens (Appendix_). Jurgens worked to identify taxa, element assignment, and any additional taphonomic features present —be they cultural or natural (Table 7.6). Cultural modification was identified on a few of the larger remnants of bone as burning or roasting patterns; Jurgens was also able to identify cut marks commonly associated with butchering processes, which may indicate that there was both processing and cooking taking place at the site. This is supported by the location of the remains in association with CU 3 and its defined features (F1 and F2).

Jurgens identified ten specimens with evidence of carnivore ravaging (tooth marks) which may be reflective of the site's location and/or the activities that took place there. Sayles offers a perched, open location in the canyon and located near the canyon bottom, but also near the river.  This may have created a prime spot for scavengers to pick from the discard of site occupants as people used the site, or once the site was abandoned. Evidence for this taphonomy was evident on both small and medium faunal remains at the site (see full analysis table Appendix E).

Specimens with cultural modification were only associated with the dense occupation deposits seen in the Borrow Pit and the Sandbox. Most faunal remains, however, did not show evidence of cultural modification but are still in units and layers that lay within Occupation 1 or Occupation 2. The lowest depth specimen recovered from the site would be from the Sand Box (FN50175: Unit M. L1) and consists of a cottontail spp. metatarsal which does have evidence of carnivore ravaging.

The faunal assemblage recovered from Sayles Adobe is small, with only 143 specimens collected from the site. It is reasonable to speculate that site conditions may have impacted the quantity of bone preserved in the archaeological record at Sayles. However, considering that less than 20 specimens out of roughly 140 showed cultural modification would indicate that there likely was not much animal processing or cooking at the site. Alternatively, this could be a result of collection bias which did not capture smaller bone, which would have required a finer screen to collect.

Table 7.6: Jurgen's analysis of the CU 3 (Occupation 1) faunal assemblage.

| **Area** | **FN** | **Unit/ Layer** | **Jurgens ID** | **Jurgens Modification Observations** | **Count** |
|---|---|---|---|---|---|
| BP | 50008 | A1.L4 | small mammal, indeterminate long bone epiphysis fragment | | 1 |
| | 50014 | A1.L5 | Rodentia (small), 1 incisor tooth | | 1 |
| | 50014 | A1.L5 | small mammal, 5 indeterminate long bone fragments | | 5 |
| | 50015 | A1.L6 | small mammal, 2 indeterminate long bone fragments | | 2 |
| | 50015 | A1.L6 | Medium mammal, 1 indeterminate long bone diaphysis fragment | | 1 |
| | 50032 | B.L2 | cf. Artiodactyla, long bone fragments. 2 are modified by subsistence activities | Subsistence activities (butchering cutmarks and scrape marks (periosteum removal)) | 3 |
| | 50033 | B.L3 | small mammal, indeterminate long bone diaphysis fragment | | 1 |
| | 50038 | B.L4 | small mammal, 3 indeterminate long bone fragments | | 3 |
| | 50038 | B.L4 | Medium mammal, 1 indeterminate long bone diaphysis fragment | Burned (roasting pattern), longitudinal scrape marks | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | (periosteum removal), oblique cutmarks (defleshing) | |
| SB | 50070 | H.L2 | small mammal, vertebra fragment | | 1 |
| | 50089 | H.L3 | Medium mammal, indeterminate long bone diaphysis fragment | Carnivore ravaged and heavily weathered | 1 |
| | 50082 | H.L3 | small mammal, indeterminate bone fragments | | 7 |
| | 50082 | H.L3 | Osteichthyes, indeterminate bone fragment | | 1 |
| | 50082 | H.L3 | small mammal, indeterminate long bone diaphysis fragment | Burned (discard pattern) | 1 |
| | 50082 | H.L3 | cf. Sylvilagus spp., tooth fragment | | 1 |
| | 50082 | H.L3 | cf. Odocoileus spp., phalange II, distal fragment | Burned (roasting pattern) | 1 |
| | 50109 | I.L2 | cf. Lepus californicus, distal phalange epiphysis | | 1 |
| | 50109 | I.L2 | small mammal, indeterminate long bone diaphysis fragment | | 1 |
| | 50116 | G.L3 | cf. Sylvilagus spp., scapula, left, proximal fragment with glenoid process | | 1 |
| | 50116 | G.L3 | Small mammal, metapodial diaphysis fragment | | 1 |
| | 50117 | I.L3 | medium mammal, indeterminate bone fragments | | 18 |
| | 50117 | I.L3 | small mammal, lumbar vertebra fragment | | 1 |
| | 50117 | I.L3 | Soricidae, mandible, left, mesial fragment | | 1 |
| BP | 50196 | L.L2 | Squamata, vertebra fragment | | 1 |
| | 50245 | Q.L2 | Medium mammal, indeterminate long bone diaphysis fragment | Burned (discard pattern) | 1 |
| | 50245 | Q.L2 | Squamata, vertebra fragment | Calcined (discard pattern) | 1 |
| | 50245 | Sa.L3 | Rodentia (small), cervical vertebra | | 1 |
| | 50316 | Q.L3 | Small mammal, maxilla fragments | | 2 |
| | 50319 | Q.L3 | Medium mammal, indeterminate long bone epiphysis fragments | Heavily weathered | 3 |
| | 50319 | Q.L3 | Medium mammal, indeterminate bone fragments | Burned (discard pattern) | 7 |
| | 50319 | Q.L3 | Medium mammal, indeterminate long bone fragments | | 20 |
| | 50319 | Sa.L4 | Small mammal, indeterminate long bone diaphysis fragments | | 3 |
| | 50320 | Sa.L4 | cf. Sylvilagus spp., tooth fragment | | 1 |
| | 50320 | Sa.L4 | cf. Sylvilagus spp., humerus, right, distal diaphysis fragment | Carnivore ravaged, weathered | 1 |
| | 50320 | Q.L5 | cf. Sylvilagus spp., tibia, right, distal fragment | Heavily weathered | 1 |
| | 50352 | Q.L5 | cf. Sylvilagus spp., femur, left, distal diaphysis fragment | Carnivore ravaged | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | 50356 | Q.L6 | Ictaluridae, vertebra, anterior abdominal | | 1 |
| | 50439 | Q.L6 | Twig, possible thorn | | 2 |
| | 50439 | Q.L6 | Medium mammal, indeterminate long bone diaphysis fragment | Burned (discard pattern) | 2 |
| | 50439 | Q.L6 | Lepus californicus, tibia, left, disto-lateral diaphysis fragment | | 1 |
| | 50439 | Sa.L6 | small mammal, rib, proximal articulation | | 1 |
| | 50455 | Sa.L6 | small mammal, indeterminate long bone fragments | | 3 |
| | 50323 | Sa.L5 | small mammal, indeterminate long bone epiphysis | | 1 |
| | 50323 | Q.L7 | cf. Sylvilagus spp., tibia, right, proximal fragment w/tibial tuberosity | | 1 |
| | 50456 | Q.L7 | Lepus californicus, scapula, right, glenoid fossa | | 1 |
| | 50456 | Q.L7 | Medium mammal, axial bone fragment | | 1 |
| | 50456 | Q.L7 | Medium mammal, indeterminate long bone diaphysis fragment | Burned (discard pattern) | 1 |
| | 50456 | Q.L7 | Osteichthyes, rib fragment | | 1 |
| | 50456 | Q.L7 | cf. Lepus californicus, phalange II | Carnivore tooth mark | 1 |

**Occupation 1 (CU3): Lithic Assemblage**

The lithic assemblage (Table 7.7) of Occupation 1 includes 3 projectile points (Ensor dart point base, possible Ahumada arrow point, and Sabinal arrow point), 51 tools (i.e., 12 bifaces, 4 unifaces, 8 core/core fragments, 4 groundstone, and 25 modified flakes),  21 manuports, 1 painted pebble, and 1,948 pieces of debitage from 1/8" screens. Analysis for the lithic assemblage for Occupation 1 (as well as across the site) consisted of assigning an object name, material type, then counting, weighing, and describing the material (see Appendix _ for complete inventory and descriptions). When possible, if the artifact had distinct diagnostic characteristics, it was further described and briefly researched (e.g., butted biface, projectile points, painted pebbles), and discussed in the following section.

Table7.7: Occupation 1 (CU 3) lithic assemblage

| Area | Lot / Specimen # | Unit | Feature/ Occupation | Object Name | Material | Count | Weight (g) |
|---|---|---|---|---|---|---|---|
| BP | 50000 | A1.L1 | F1 / O1 | Debitage | Chert | 2 | 0.56 |
| | 50002.01 | A1.L2 | F1 / O1 | Manuport | Limestone | 1 | 68.45 |
| | 50002 | A1.L2 | F1 / O1 | Debitage | Chert | 16 | 2.82 |
| | 50007 | A1.L3 | F1 / O1 | Debitage | Chert | 9 | 2.85 |
| | 50008.01 | A1.L4 | F1 / O1 | Flake | Chert | 1 | 6.61 |
| | 50008.03 | A1.L4 | F1 / O1 | Biface | Chert | 1 | 1.9 |
| | 50008.04 | A1.L4 | F1 / O1 | Core | Chert | 1 | 20.29 |
| | 50008 | A1.L4 | F1 / O1 | Debitage | Chert | 22 | 2.82 |
| | 50014 | A1.L5 | F1 / O1 | Debitage | Chert & Igneous | 66 | 11.98 |
| | 50015 | A1.L6 | F1 / O1 | Debitage | Chert & Igneous | 100 | 62.54 |
| | 50016.01 | A1.L7 | F1 / O1 | Flake | Basalt | 1 | 30.4 |
| | 50016.02 | A1.L7 | F1 / O1 | Manuport | Chert | 1 | 60.5 |
| | 50016 | A1.L7 | F1 / O1 | Debitage | Chert & Igneous | 27 | 8.6 |
| | 50019.01 | A1.L8 | F1 / O1 | Manuport | Limestone | 1 | 21.8 |
| | 50019 | A1.L8 | F1 / O1 | Debitage | Chert & Igneous | 44 | 47.2 |
| | 50021.01 | A1A.L1 | F1 / O1 | Uniface | Chert | 1 | 32.1 |
| | 50021 | A1A.L1 | F1 / O1 | Debitage | Chert & Igneous | 18 | 8.5 |
| | 50022.01 | A1A.L2 | F1 / O1 | Modified Flake | Chert | 1 | 1.4 |
| | 50022 | A1A.L2 | F1 / O1 | Debitage | Chert & Igneous | 12 | 1.7 |
| | 50024.01 | A1B.L1 | F1 / O1 | Ground Stone | Igneous | 1 | 312.1 |
| | 50024.02 | A1B.L1 | F1 / O1 | Modified Flake | Chert | 1 | 2.1 |
| | 50024 | A1B.L1 | F1 / O1 | Debitage | Chert | 17 | 9.6 |
| | 50026.02 | A1B.L2 | F1 / O1 | Core | Chert | 1 | 736.3 |
| | 50026.03 | A1B.L2 | F1 / O1 | Biface | Chert | 1 | 73.3 |
| | 50026 | A1B.L2 | F1 / O1 | Debitage | Chert & Igneous | 15 | 14.8 |
| | 50032 | B.L2 | F1 / O1 | Debitage | Chert | 6 | 0.4 |
| | 50033.01 | B.L3 | F1 / O1 | Flake | Chert | 1 | 14.57 |
| | 50033.02 | B.L3 | F1 / O1 | Manuport | Limestone | 1 | 82.54 |
| | 50033.03 | B.L3 | F1 / O1 | Ground Stone | Limestone | 1 | 322.77 |
| | 50033 | B.L3 | F1 / O1 | Debitage | Chert & Igneous | 20 | 15.94 |
| | 50038.01 | B.L4 | F1 / O1 | Biface | Chert | 1 | 7.05 |
| | 50038.02 | B.L4 | F1 / O1 | Flake | Chert | 1 | 9.7 |
| | 50038.03 | B.L4 | F1 / O1 | Flake | Chert | 1 | 2.77 |
| | 50038.04 | B.L4 | F1 / O1 | Modified Flake | Chert | 1 | 15.25 |
| | 50038 | B.L4 | F1 / O1 | Debitage | Chert & Igneous | 151 | 48.67 |
| | 50065.02 | D.L2 | F1 / O1 | Chert Chunk | Chert | 1 | 6.43 |
| | 50065 | D.L2 | F1 / O1 | Debitage | Chert & Igneous | 45 | 7.74 |
| SB | 50159.01 | F.L2 | F1 / O1 | Biface | Chert | 1 | 0.64 |
| | 50159.02 | F.L2 | F1 / O1 | Modified Flake | Chert | 1 | 21.86 |
| | 50159.03 | F.L2 | F1 / O1 | Manuport | Limestone | 1 | 1.88 |
| | 50159 | F.L2 | F1 / O1 | Debitage | Chert & Igneous | 52 | 142.2 |
| | 50160 | F.L3 | F1 / O1 | Debitage | Chert & Igneous | 39 | 72.87 |
| | 50105 | G.L1 | F1 / O1 | Debitage | Chert & Igneous | 21 | 7.71 |
| | 50108.01 | G.L2 | F1 / O1 | Manuport | Limestone | 1 | 7.86 |
| | 50108.02 | G.L2 | F1 / O1 | Manuport | Limestone | 1 | 47.52 |
| | 50108 | G.L2 | F1 / O1 | Debitage | Chert & Igneous | 45 | 14.72 |
| | 50116.01 | G.L3 | F1 / O1 | Core | Chert | 1 | 40.58 |
| | 50116.02 | G.L3 | F1 / O1 | Manuport | Limestone | 1 | 9.2 |
| | 50116 | G.L3 | F1 / O1 | Debitage | Chert & Igneous | 14 | 4.1 |
| | 50124.01 | G.L4 | F1 / O1 | Modified Flake | Chert | 1 | 29.16 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 50124.02 | G.L4 | F1 / O1 | Modified Flake | Chert | 1 | 10.93 |
| | 50124.03 | G.L4 | F1 / O1 | Biface | Chert | 1 | 11.39 |
| | 50124 | G.L4 | F1 / O1 | Debitage | Chert & Igneous | 22 | 17.17 |
| | 50068.01 | H.L1 | F1 / O1 | Flake | Chert | 1 | 2.71 |
| | 50068 | H.L1 | F1 / O1 | Debitage | Chert & Igneous | 4 | 0.22 |
| | 50070.01 | H.L2 | F1 / O1 | Flake | Chert | 1 | 5.14 |
| | 50070.02 | H.L2 | F1 / O1 | Chert Chunk | Chert | 1 | 7.58 |
| | 50070.03 | H.L2 | F1 / O1 | Flake | Igneous | 1 | 26.21 |
| | 50070.04 | H.L2 | F1 / O1 | Flake | Chert | 1 | 13.91 |
| | 50070.05 | H.L2 | F1 / O1 | Core | Chert | 1 | 49.17 |
| | 50070.07 | H.L2 | F1 / O1 | Flake | Chert | 1 | 2.17 |
| | 50070.08 | H.L2 | F1 / O1 | Flake | Chert | 1 | 4.49 |
| | 50070 | H.L2 | F1 / O1 | Debitage | Chert | 98 | 28.15 |
| | 50070 | H.L2 | F1 / O1 | Debitage | Chert | 1 | 1.89 |
| | 50082.02 | H.L3 | F1 / O1 | Biface | Chert | 1 | 21.2 |
| | 50082.03 | H.L3 | F1 / O1 | Manuport | Limestone | 1 | 11.6 |
| | 50082.04 | H.L3 | F1 / O1 | Core | Chert | 1 | 29.29 |
| | 50082.05 | H.L3 | F1 / O1 | Modified Flake | Chert | 1 | 5.39 |
| | 50082.07 | H.L3 | F1 / O1 | Modified Flake | Chert | 1 | 5.46 |
| | 50082.08 | H.L3 | F1 / O1 | Modified Flake | Chert | 1 | 1.39 |
| | 50082.1 | H.L3 | F1 / O1 | Projectile Point | Chert | 1 | 0.98 |
| | 50082 | H.L3 | F1 / O1 | Debitage | Chert & Igneous | 77 | 26.02 |
| | 50095.01 | I.L1 | F1 / O1 | Modified Flake | Chert | 1 | 4.32 |
| | 50095.02 | I.L1 | F1 / O1 | Modified Flake | Chert | 1 | 5.71 |
| | 50095 | I.L1 | F1 / O1 | Debitage | Chert & Igneous | 22 | 5.73 |
| | 50109.01 | I.L2 | F1 / O1 | Biface | Chert | 1 | 23.99 |
| | 50109 | I.L2 | F1 / O1 | Debitage | Chert & Igneous | 112 | 42.75 |
| | 50117.01 | I.L3 | F1 / O1 | Manuport | Limestone | 1 | 5.84 |
| BP | 50170.01 | L.L1 | F1 / O1 | Projectile Point | Chert | 1 | 4.19 |
| | 50170.02 | L.L1 | F1 / O1 | Modified Flake | Chert | 1 | 3.67 |
| | 50170.03 | L.L1 | F1 / O1 | Manuport | Limestone | 1 | 52.69 |
| | 50170 | L.L1 | F1 / O1 | Debitage | Chert & Igneous | 30 | 52.73 |
| | 50196 | L.L2 | F1 / O1 | Debitage | Chert | 20 | 6.06 |
| | 50197 | L.L3 | F1 / O1 | Debitage | Chert | 25 | 5.13 |
| | 50242 | Q.L1 | F1 / O1 | Debitage | Chert | 7 | 4.01 |
| | 50245.04 | Q.L2 | F1 / O1 | Flake | Chert | 1 | 76 |
| | 50245.05 | Q.L2 | F1 / O1 | Manuport | Limestone | 1 | 55.4 |
| | 50245.06 | Q.L2 | F1 / O1 | Manuport | Limestone | 1 | 18.09 |
| | 50245 | Q.L2 | F1 / O1 | Debitage | Chert & Igneous | 133 | 127.5 |
| | 50319.01 | Q.L3 | F1 / O1 | Modified Flake | Chert | 1 | 14.09 |
| | 50319.02 | Q.L3 | F1 / O1 | Biface | Chert | 1 | 1.68 |
| | 50319.03 | Q.L3 | F1 / O1 | Core | Chert | 1 | 27.66 |
| | 50319.04 | Q.L3 | F1 / O1 | Manuport | Limestone | 1 | 18.5 |
| | 50319 | Q.L3 | F1 / O1 | Debitage | Chert & Igneous | 174 | 149.25 |
| | 50319.05 | Q.L3 | F1 / O1 | Modified Flake | Chert | 1 | 35.44 |
| | 50325.01 | Q.L4 | F1 / O1 | Modified Flake | Chert | 1 | 12.87 |
| | 50325.02 | Q.L4 | F1 / O1 | Modified Flake | Igneous | 1 | 9.38 |
| | 50325.03 | Q.L4 | F1 / O1 | Uniface | Chert | 1 | 4.53 |
| | 50325 | Q.L4 | F1 / O1 | Debitage | Chert & Igneous | 32 | 31.28 |
| | 50352.01 | Q.L5 | F2 / O1 | Projectile Point | Chert | 1 | 3.71 |
| | 50352 | Q.L5 | F2 / O1 | Debitage | Chert & Igneous | 50 | 67.38 |
| | 50352 | Q.L5 | F2 / O1 | Manuport | Limestone & Igneous | 3 | 23.74 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 50352 | Q.L5 | F2 / O1 | Debitage | Igneous | 1 | 3.53 |
| | 50356.01 | Q.L5 | F2 / O1 | Manuport | Igneous | 1 | 7.26 |
| | 50356.02 | Q.L5 | F2 / O1 | Modified Flake | Chert | 1 | 11.19 |
| | 50352 | Q.L5 | F2 / O1 | Debitage | Chert & Igneous | 10 | 8.20 |
| | 50439.01 | Q.L6 | F2 / O1 | Uniface | Chert | 1 | 13.28 |
| | 50439.02 | Q.L6 | F2 / O1 | Modified Flake | Chert | 1 | 1.46 |
| | 50439 | Q.L6 | F2 / O1 | Debitage | Chert & Igneous | 53 | 66.89 |
| | 50456.02 | Q.L7 | F2 / O1 | Modified Flake | Chert | 1 | 5.12 |
| | 50456.03 | Q.L7 | F2 / O1 | Biface | Chert | 1 | 16.15 |
| | 50456 | Q.L7 | F2 / O1 | Pebble | Limestone | -- | 0.3 |
| | 50456.04 | Q.L7 | F2 / O1 | Modified Flake | Chert | 1 | 3.17 |
| | 50456 | Q.L7 | F2 / O1 | Debitage | Chert & Igneous | 58 | 41.17 |
| | 50456.05 | Q.L7 | F2 / O1 | Modified Flake | Igneous | 1 | 26.93 |
| | 50456.06 | Q.L7 | F2 / O1 | Modified Flake | Chert | 1 | 4.2 |
| | 50456.07 | Q.L7 | F2 / O1 | Flake | Chert | 1 | 1.92 |
| | 50267 | Ra.L1 | F1 / O1 | Debitage | Chert | 1 | 0.68 |
| | 50270.01 | Ra.L2 | F1 / O1 | Biface | Chert | 1 | 21.3 |
| | 50270 | Ra.L2 | F1 / O1 | Debitage | Chert | 14 | 8.9 |
| | 50300.01 | Ra.L3 | F1 / O1 | Biface | Chert | 1 | 9.99 |
| | 50300 | Ra.L3 | F1 / O1 | Debitage | Chert/Igneous | 56 | 12.68 |
| | 50262 | Sa.L1 | F1 / O1 | Debitage | Chert & Igneous | 19 | 7.52 |
| | 50297 | Sa.L2 | F1 / O1 | Debitage | Chert & Igneous | 4 | 8 |
| | 50316.01 | Sa.L3 | F1 / O1 | Manuport | Igneous | 1 | 428.38 |
| | 50316 | Sa.L3 | F1 / O1 | Debitage | Chert | 16 | 2.32 |
| | 50320 | Sa.L4 | F1 / O1 | Debitage | Chert & Igneous | 20 | 6.91 |
| | 50320.01 | Sa.L4 | F1 / O1 | Modified Flake | Chert | 1 | 18.4 |
| | 50323.01 | Sa.L5 | F1 / O1 | Manuport | Igneous | 1 | 22.34 |
| | 50323 | Sa.L5 | F1 / O1 | Debitage | Chert | 6 | 1.35 |
| | 50455 | Sa.L6 | F1 / O1 | Debitage | Chert | 16 | 5.28 |
| | 50651.05 | Rb.S1b | F1 / O1 | Groundstone | Igneous | 1 | 272.49 |
| | 50651.06 | Rb.S1b | F1 / O1 | Manuport | Limestone | 1 | 250.97 |
| | 50651.07 | Rb.S1b | F1 / O1 | Modified Flake | Chert | 1 | 5.23 |
| | 50651 | Rb.S1b | F1 / O1 | Debitage | Chert | 2 | 16.95 |
| | 50655.05 | Rb.S2b | F1 / O1 | Modified Flake | Limestone | 1 | 28.25 |
| | 50655.01 | Rb.S2 | F1 / O1 | Flake | Igenous | 1 | 39.08 |
| | 50671.05 | Rb.S4a | F1 / O1 | Groundstone | Basalt | 1 | 138.94 |
| | 50671.06 | Rb.S4a | F1 / O1 | Flake | Chert | 1 | 11 |
| | 50659.05 | Sb.S1d | F1 / O1 | Core Fragment | Chert | 1 | 92.41 |
| | 50662.05 | Sb.S2d | F1 / O1 | Uniface | Chert | 1 | 12.95 |
| | 50674 | Sb.S4c | F1 / O1 | Debitage | Chert | 2 | 24.37 |
| | 50668.01 | Rb.S3b | F1 / O1 | Manuport | Limestone | 1 | 66.98 |
| | 50668.02 | Rb.S3b | F1 / O1 | Core Fragment | Chert | 1 | 21.74 |
| | 50668.03 | Rb.S3b | F1 / O1 | Biface Fragment | Chert | 1 | 8.35 |
| SB | 50279 | T.L3 | O1 | Manuport | Limestone | 1 | 2.98 |
| | 50304.04 | T.L3 | O1 | Painted Pebble | Limestone | 1 | 43.82 |
| | 50304 | T.L3 | O1 | Debitage | Chert | 7 | 1.95 |
| | 50304 | T.L3 | O1 | Debitage | Chert | 1 | 13.89 |
| | 50304 | T.L3 | O1 | Debitage | Chert | 7 | 1.29 |
| | 50304 | T.L3 | O1 | Debitage | Chert | 1 | 1.52 |
| | 50304 | T.L3 | O1 | Debitage | Chert | 7 | 1.49 |
| | 50304 | T.L3 | O1 | Debitage | Chert/Igneous | 2 | 11.4 |

As mentioned, much of the lithic material recovered from the Sayles Adobe excavations was composed of debitage (Table 7.7). The debitage (Figure 7.11) found across the site ranged widely in color, size, and reduction category (i.e., primary, secondary, tertiary). In many cases, the only material recovered from a given unit layer was debitage smaller than ¼” captured on 1/8” screens.


Figure 7.11: Debitage collections from two separate units; one from the Sand Box Unit F.L2 (left). The other from Borrow Pit Unit Q.L3 (right).

Tools included bifaces, unifaces, cores/core fragments, modified flakes, ground stone, and projectile points with identifiable wear or other characteristics that clearly indicated that the artifact was used for some type of activity. Tools such as, unifaces (4), modified flakes (25), core/core fragments (8), and bifaces (12), were only given a cursory analysis to describe their primary use if obvious  (e.g., scraper, perforator; Figure 7.12) and physical properties, color, material, flaking (Appendix H.2).


Figure 7.12: Occupation 1 tools: large scraper (uniface) 50021.01 ; small bifacial perforator 50008.03

Four ground stone tools (Figure 7.13) and 24 manuports were recovered from n Occupation 1 (Table 7.7). These artifacts characteristically range in size from 7-20cm in size at the site and are made from both sedimentary and igneous materials, most likely obtained from Rio Grande gravels. The differentiation between the two types of artifacts (ground stone and manuports) comes from the identification of wear or other culturally related taphonomy (e.g., pecking and smoothing) present on the artifact. In other words, ground stone had obvious indications of use, and manuports are simply stones that have been transported to the site by humans but have no clear indication of wear or shaping.


Figure 7.13: Occupation 1 ground stone: (1) 50024.01; (2) 50033.03; (3) 50671.05; (4) 50651.05

Projectile points for Occupation 1 (Figure 7.14), are temporally ascribed to the Late Prehistoric and early Late Prehistoric-Transitional Archaic periods of Lower Pecos cultural history, which is consistent with the radiocarbon dates from the features in Occupation 1. First, the Ensor dart point base, which is generally accepted as a Transitional Archaic point, as hunting technologies begin to shift from larger dart points to smaller, lighter arrow points (Suhm and Jelks 1962; Turner and Hester 2011: 101-102).


Figure 7.14: Projectile points from Occupation 1 deposits. (Left) Ensor dart point base (50170.01: L.L1); (Center) probable Ahumada arrow point (50325.01: Q.L5); (Right) Sabinal arrow point (50082.01: H.L3)

Second, the probable Ahumada arrow point, in discussion with Elton Prewitt, the closest morphology is to a transitional dart-arrow point Ahumada common in the western Trans-Pecos region, which would place it in the Terminal Archaic-early Late Prehistoric. Prewitt, however, did note that the point may simply be an untyped style. Lastly, the Sabinal arrow point have been placed within the early part of the Late Prehistoric and with a spatial range around the southwestern Edwards Plateau and into South Texas (Turner et.al. 2011: 200-201).

The Occupation 1 lithic materials included a single Painted Pebble #5 (Figure 7.15). This pebble was collected from the Occupation 1 deposit in the Sand Box, which is stratigraphically below the Porch pebble cache features, therefore this pebble predates those. Unlike the four previously discussed painted pebbles (Feature 4 & 5 in CU 2), there is no indication that this pebble was intentionally cached since it is within a dense activity deposit. Its location within Occupation 1, directly below the uppermost flood drape at the site, clearly places the stone within the Late Prehistoric period.

Figure 7.15: Painted Pebble # 5 (50304.04) from Occupation 1 in the Sand Box. Table 6.4 Figure

This pebble has one central and two parallel flanking lines are visible; the flanking lines having radiating lines going central and to the outer edge. From this it is believed that the range can at least be narrowed to Style II, III, or IV. The stone shape is also being considered as visible pigmentation is faded and style cannot be narrowed further at this point.

*Cultural Unit 4 (CU 4): Occupation 2*

Cultural Unit 4 (Table 7.1) was idenitified in the field; first, in the Sand Box and then later correlated to deposits in the Borrow Pit, as we looked more closely at the profiles. This cultural unit iconsists  of Cultural Episode 8 (DU 16), CE 9 (DU 15), and CE 10 (DU 14). Microartfact patterning in this cultural unit continues to follow a similar trend as the other surfaces, where there is a large peak with a decrease in cultural material with depth until a new peak is hit. The estimated sedimentation rate for this cultural unit is lower than the deposits directly above, at an average of  3.85 cm per 100-years.

Based on the estimated ages for the deposition units, CE 8 and CE 9 fall into the Late Archaic period (1762-2313 cal BP/ AD 188-363 BC), while CE 10 is estimated to be a  Late Archaic (3025 cal BP/ 1075 BC) deposit. Radiocarbon dates associated to this cultural unit (Table 7.8) that drove the R-model were also consistent with the estimated ages pulled from the Age-Depth Model (Table 6.15).

Table 7.8: Single radiocarbon date from the CU 4 (Occupation 2) deposits from the Sand Box.

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50162 | SB | Feature 3/ CU-4 | 1.5 | Wood | Unidentifiable | 2775 | 37 | 2955-2781 | 2867 |

**Occupation 2 (CU 4) Macroartifact Discussion**

The Occupation 2 (Figure 7.16) assemblage in many ways mirrors the Occupation 1 macroassemblage; what differs, is the density of material recovered as compared to Occupation 1 above. Unfortunately,  no macrobotanical analysis was undertaken for Occupation 2 (although numerous matrix samples were collected). At the macro scale, one thermal refuse feature (Feature 3, disscussed below) was identified in the Sand Box with the remainder of the occupation surface extending horizontally across the terrace surface with a lower concentration of material. The macro assemblage consisted of 16 tools (i.e., modified flakes and bifaces), 545 pieces of debitage, and 2 manuports.

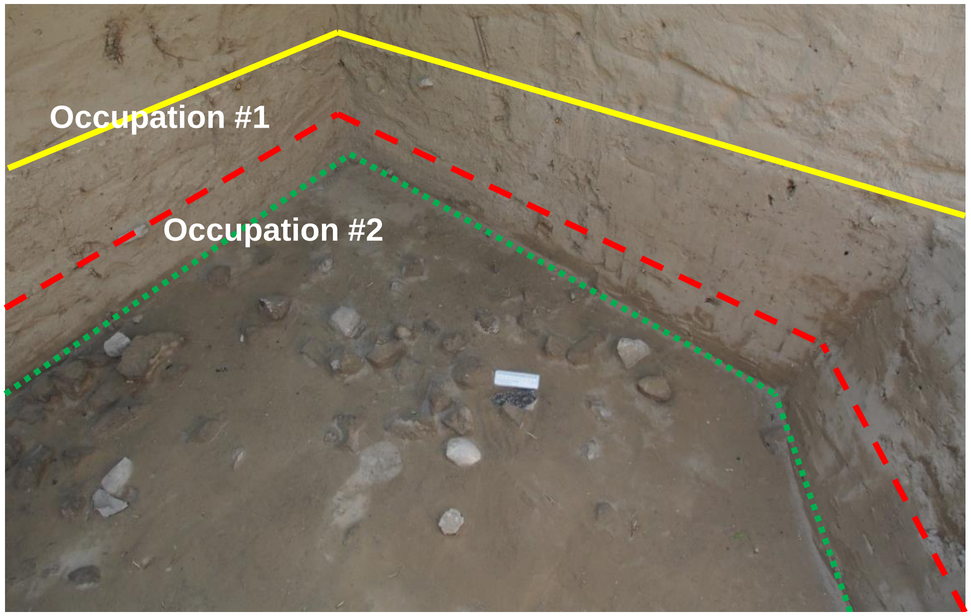



Figure 7.16: Occupation 2 was identified as a separate cultural surface during excavation, due to a break in the artifact density. The solid line and dashed lines indicate the upper and lower boundaries of the Occupation 1 deposits present in the Sand Box. The dotted line indicates the upper boundary of Occupation 2. The butted biface is visible just below the scale amid the uppermost Feature 3 rocks

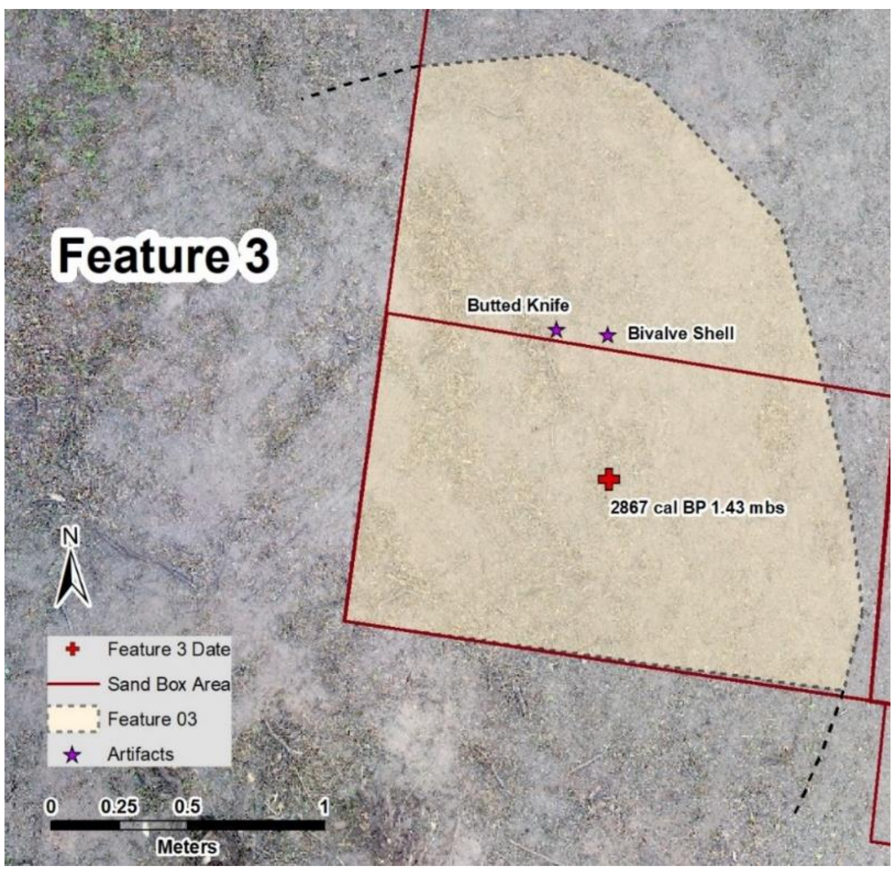



Figure 7.17: (Top) Sandbox profile sections with boxed in potential feature level. (Bottom) Seen and estimated Feature 3 extent.

### Occupation 2 (CU4): Feature 3

Feature 3 (Figure 7.16 & Figure 7.17) is a moderate density, incipient burned rock midden that is characterized by a dense concentration of FCR, artifacts, and charcoal stained sediment. This feature was initially encountered as we excavated Unit H and was separated by a layer of alluvium from the overlying Occupation 1 deposits (Figure 7.16). Resting at the very top of this newly identified cultural surface (i.e., the upper surface of Feature 3) was a butted biface (Figure 7.16, 7.17 and 7.18). Along with the butted biface was a mussel shell, FCR, and an increased amount of debitage and tools.

### Occupation 2 (CU4): Faunal Assemblage

The faunal assemblage of this occupation (CU 4) is minimal (Table 7.9), as compared to the CU3 (Occupation 1) deposits, and no taphonomy was attributed to cultural processes. The relative scarcity of faunal remains  may be due to several different factors including: less faunal material being processed at this section of the site, poorer preservation due to the lack of a protective flood drape over the deposit, or a more heavily scavenged/bioturbated deposit due to less dense quantities of burned rock making it easier for critters to mess with the bone left behind.

Table 7.9: Faunal assemblage of CU 4 (Occupation 2) deposits.

| Area | FN | Unit/ Layer | Jurgens ID | Jurgens Modification Observations | Count |
|---|---|---|---|---|---|
| BP | 50043 | B.L5 | Artiodactyla, tooth fragment | -- | 1 |
| | 50047 | B.L6 | small mammal, 2 indeterminate long bone fragments | -- | 2 |
| | 50047 | B.L6 | small mammal, phalange | Carnivore ravaged | 1 |
| SB | 50124 | G.L4 | cf. Sylvilagus spp., femur, left, proximal diaphysis fragment | Carnivore ravaged | 1 |
| | 50124 | G.L4 | Small mammal, axial bone fragment | -- | 1 |
| | 50124 | G.L4 | Aves, indeterminate long bone diaphysis fragment | Heavily weathered | 1 |
| | 50125 | I.L4 | Small mammal, indeterminate long bone fragments | -- | 6 |

### Occupation 2 (CU 4): Lithic Assemblage

The lithic assemblage (Table 7.10) of Occupation 2 consists of 16 tools (8 modified flakes and 7 bifaces), 2 manuports, and 566 pieces of debitage from 1/8" screens. Analysis for the lithic assemblage for Occupation 2 consisted of assigning an artifact category andmaterial type, then counting, weighing, and describing the material (see Appendix H.1 for complete inventory and descriptions). When the artifact had distinct diagnostic characteristics, it was further described and briefly researched (e.g., butted biface), and  discussed below.

Table 7.10: Lithic assemblage for Occupation 2.

| Area | Lot / Specimen | Unit | Feature/ Occupation | Object Name | Material | Count | Weight (g) |
|---|---|---|---|---|---|---|---|
| BP | 50023 | A1A.L3 | O2 | Debitage | Chert & Igneous | 21 | 8.7 |
| | 50029.01 | A1A.L4 | O2 | Modified Flake | Chert | 1 | 23.73 |
| | 50029 | A1A.L4 | O2 | Debitage | Chert | 7 | 1 |
| | 50028 | A1B.L3 | O2 | Debitage | Chert & Igneous | 10 | 1.6 |
| | 50030 | A1B.L4 | O2 | Debitage | Chert | 31 | 20.84 |
| | 50043.01 | B.L5 | O2 | Flake | Chert | 1 | 12.8 |
| | 50043.02 | B.L5 | O2 | Manuport | Limestone | 1 | 12.6 |
| | 50043.03 | B.L5 | O2 | Modified Flake | Chert | 1 | 38.4 |
| | 50043.04 | B.L5 | O2 | Modified Flake | Chert | 1 | 1.4 |
| | 50043.05 | B.L5 | O2 | Biface | Chert | 1 | 0.01 |
| | 50043.06 | B.L5 | O2 | Biface | Chert | 1 | 5.9 |
| | 50043 | B.L5 | O2 | Debitage | Chert & Igneous | 124 | 105.6 |
| | 50047.01 | B.L6 | O2 | Flake | Chert | 1 | 10.2 |
| | 50047.02 | B.L6 | O2 | Modified Flake | Chert | 1 | 15.77 |
| | 50047.03 | B.L6 | O2 | Modified Flake | Chert | 1 | 3.04 |
| | 50047.04 | B.L6 | O2 | Manuport | Limestone | 1 | 10.05 |
| | 50047.05 | B.L6 | O2 | Biface | Chert | 1 | 21.09 |
| | 50047 | B.L6 | O2 | Debitage | Chert & Igneous | 109 | 139.74 |
| | 50083 | D.L3 | O2 | Flake | Chert | 1 | 1.7 |
| | 50083.01 | D.L3 | O2 | Debitage | Chert & Igneous | 18 | 4.9 |
| | 50092.01 | D.L4 | O2 | Chert Chunk | Chert | 1 | 6.13 |
| | 50092 | D.L4 | O2 | Debitage | Chert | 7 | 1.89 |
| SB | 50158.01 | F.L4 | F3 / O2 | Biface | Chert | 1 | 199.67 |
| | 50158 | F.L4 | F3 / O2 | Debitage | Chert | 9 | 45.26 |
| | 50158 | F.L4 | F3 / O2 | Debitage | Chert & Igneous | 13 | 13.51 |
| | 50169 | G.L5 | F3 / O2 | Debitage | Chert | 5 | 3.97 |
| | 50153.01 | H.L5 | F3 / O2 | Biface | Chert | 1 | 9.91 |
| | 50153.02 | H.L5 | F3 / O2 | Modified Flake | Chert | 1 | 51.18 |
| | 50153.03 | H.L5 | F3 / O2 | Biface | Chert | 1 | 50.38 |
| | 50153 | H.L5 | F3 / O2 | Debitage | Chert | 22 | 26.93 |
| | 50167 | H.L6 | F3 / O2 | Debitage | Chert | 14 | 7.35 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 50125.01 | I.L4 | F3 / O2 | Biface | Chert | 1 | 13.6 |
| | 50125.02 | I.L4 | F3 / O2 | Modified Flake | Chert | 1 | 4.43 |
| | 50125 | I.L4 | F3 / O2 | Debitage | Chert & Igneous | 75 | 30.76 |
| | 50174 | I.L5 | F3 / O2 | Debitage | Chert | 8 | 29.14 |
| BP | 50199.01 | L.L4 | O2 | Modified Flake | Chert | 1 | 2.32 |
| | 50199 | L.L4 | O2 | Debitage | Chert | 32 | 39.61 |
| | 50201 | L.L5 | O2 | Debitage | Chert | 30 | 20.42 |
| | 50204 | L.L6 | O2 | Debitage | Chert | 6 | 1.24 |
| SB | 50304 | T.L5 | O2 | Debitage | Chert | 1 | 0.6 |
| | 50306 | T.L6 | O2 | Debitage | Chert | 1 | 0.01 |
| | 50306 | T.L6 | O2 | Debitage | Chert | 2 | 0.06 |

As seen in the above table, much of the lithic material recovered from Occupation 2 was composed of debitage (Table 7.10). The debitage found across the site ranged widely in color, size, and reduction category.). In many cases during the Occupation 2 excavations, the only material recovered was debitage smaller than ¼” which was picked from the 1/8” screens. Unlike Occupation 1, only a handful of lithic tools were recovered from Occupation 2, which included 8 modified flakes and 7 bifaces. Only one of these tools (e.g., butted biface; Figure 7.18) had characteristic features that enabled some further research and analysis of the tool.


Figure 7.18 Butted knife from the surface of Occupation #2 in the Sand Box which dates to the Late Archaic (~2867 cal BP).

Butted bifaces or knifes are more often identified at sites east of the Pecos River in in the western part of Central Texas (Johnson 1962; Turner et.al.2011); while this tool is known in other parts of the region and state, no other butted biface has been excavated or found in Eagle Nest Canyon. As Turner and Hester discuss, similar artifacts from Central Texas have been variously termed hand-axes, fist-axes, butted knives, and butted bifaces. Soon after the Sayles Adobe specimen was recovered, Black (2016) argued that the tool's primary use was as an agave/sotol harvesting and processing tool and was crafted to cut or slice rather than chop. This argument stems from the difference in form from Old World fist-axes and hand-axes which are generally more crude, chunky chopping tools. Butted bifaces/knives have more delicate forms more appropriate to cutting or slicing. Additionally, this specimen (and others that have been recovered at Archaic sites along the southwestern Edwards Plateau) has a very noticeable sheen that is characteristic of silica polish from plant processing[9].

The radiocarbon date recovered from Feature 3 in Occupation 2 (Table 7.8) and the discovery of the butted knife support the identification of the surface as an early Late Archaic period occupation surface. A 2955-2781 cal BP 95.4% probability range places the date and the artifact on Late Archaic.

*Cultural Unit 5 (CU 5)*

Cultural Unit 5 (190-202 cmbs) consists of a single depostional unit (DU 13) and one Compound Episode (CE 11). Micro artifacts from CU 5 (CE 11) include charcoal, FCR, debitage, and faunal remains totaling 861 pieces. The age of the cultural unit is estimated at 3406 cal. BP years (1456 BC), placing the unit in the Middle Archaic period.

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[9] It is important to note that this tool (i.e., the butted biface) remains unwashed untouched by human hands, with exception of the very base which was briefly handled to collect the piece.

Estimated sedimentation rates for the unit indicates a moderately faster rate of deposition than CU 4 above at approximately 15.38cm/100 years. In the field this deposit was fairly homogenous and sterile looking with only a few indicators of cultural activity.

*Cultural Unit 6 (CU 6)*

At a depth of 202-229-cmbs, Cultural Unit 6 consists of a single depostional unit (DU 12) and one Compound Episode (CE 12); similar to CU 5, this section in profile seemed fairly homogenous. Microartifacts from CU 6 (CE 12) include charcoal, FCR, debitage, and faunal remains totaling 1472 pieces, making this cultural unit the densest unit except for the field-identified Occupations 1 and 2. The age of this unit is estimated at 3649 cal. BP years (1699 BC), placing the unit in the Middle Archaic period. Estimated sedimentation rates for the unit indicates a moderately slower rate of deposition than seen above in CU 5 at approximately 4.44 cm/100 years, which may indicate a more stable environment, thus the higher artifact count data.

*Cultural Unit 7 (CU 7)*

Cultural Unit 7 (229-248) is consists of a single depostional unit (DU 11) and one Compound Episode (CE 13). Counts of artifacts from CU 7 (CE 13) are made up of a combination of charcoal, FCR, debitage, and faunal remains totaling 754 pieces. The age of the cultural unit is estimated at 3916 cal. BP years (1966 BC), placing the unit in the Middle Archaic period. Estimated sedimentation rates for the unit are similarly low as compared to CU 6 above at approximately 4.54 cm/100 years.

*Cultural Unit 8 (CU 8)*

Cultural Unit 8 (248-261 cmbs) consists of a single depostional unit (DU 10) and one Compound Episode (CE 14). Counts of artifacts from CU 5 (CE 11) are made up of a combination of charcoal, FCR, debitage, and faunal remains totaling 411 pieces. The age of the cultural unit is estimated at 4240 cal. BP years (2290 BC), placing the unit in the Middle Archaic period. Estimated sedimentation rates for the unit indicates a quicker rate of deposition than seen previously at approximately 2.02cm/100 years.

*Cultural Unit 9 (CU 9)*

At a depth of 261-cmbs, Cultural Unit 9 (DU 9) is the uppermost flood drape observed in the field that is associated to the lower section of Profile Section 2 (Figure 6.5). CU 9 consists of a single depostional unit (DU 9) and one cultural unit, Episode 4 (E 4). Episode 4 is a rather ephemeral representation of site use with 20 artifacts counted from 2mm and 1mm sieves, a combination of charcoal, FCR, and faunal remains. The age of the cultural unit is estimated at 4460 cal. BP years (2510 BC), placing the unit in the Middle Archaic period. Estimated sedimentation rates for the unit indicates a moderately quicker rate of deposition than seen in the unit above, at approximately 7.5 cm/100 years.

*Cultural Unit 10 (CU 10)*

Cultural Unit 10 (DU 8) is thin package of sandy alluvium capped by a flood drape (approximately 6 cm thickness) with one cultural episode identified, Episode 5. This unit has an estimated age of 4593 cal. BP years (2643 BC); placing the unit in the Middle Archaic. artifact assemblage consists of 9 microartifacts that are a combination of debitage and charcoal. Estimated sedimentation rates for the unit indicates a moderately high rate of deposition as compared to the four units above it and next three below it, at approximately 12.57 cm/100 years.

*Cultural Unit 11 (CU 11)*

Cultural Unit 11 (DU 7) made up of one compound episode, CE 15; a package of sandy alluvium capped by a flood drape (approximately 12 cm thickness). This unit has an estimated age of 4680 cal. BP years (2730 BC); placing the unit in the Middle Archaic. The artifact assemblage consists of 124 microartifacts that are a combination of debitage, FCR, charcoal, and faunal remains. Estimated sedimentation rates for the unit indicate a lower rate of approximately 5.22 cm/100 years.

*Cultural Unit 12 (CU 12)*

Cultural Unit 12 (DU 6) made up of one compound episode, CE 16; a package of sandy alluvium capped by a flood drape (approximately 12 cm thickness). The artifact assemblage consists of 485 microartifacts that are a combination of FCR, charcoal, and faunal remains. One radiocarbon date (Table 7.11) comes from a charcoal sample collected from the sampling column at this level which dates to 4904 cal. BP (2954 BC), which is consistent with the extrapolated date range for the cultural unit. Estimated sedimentation rates for the unit indicate a lower rate of approximately 4.74 cm/100 years.

Table 7.11: Single radiocarbon date from the CU 12.

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50734 | BP | CU-12 | 2.79 | Wood | Fabaceae | 4404 | 26 | 5046-4870 | 4968 |

*Cultural Unit 13 (CU 13)*

Cultural Unit 13 (DU 5) made up of one compound episode, E 6; a package of sandy alluvium approximately 10 cm thick. This unit has an estimated age of 5206 cal. BP years (3256 BC); placing the unit in the Middle Archaic. The artifact assemblage consists of 97 microartifacts that are a combination of FCR, charcoal, and faunal remains.

Estimated sedimentation rates for the unit indicates a slightly quicker rate of deposition than seen in the two units above, at approximately 6.25 cm/100 years.

*Cultural Unit 14 (CU 14)*

Cultural Unit 14 (DU 4) made up of one compound episode, E 7; a package of sandy alluvium approximately 10 cm thick capped by an ephemeral flood drape remnant. The artifact assemblage consists of 97 microartifacts that are a combination of FCR, charcoal, and faunal remains. Estimated sedimentation rates for the unit indicates a moderately quicker rate of deposition than seen previously at approximately 17.23 cm/100 years.

One radiocarbon date, 3167 cal. BP (1217 BC) is associated to CU 14 from a charcoal sample dated in a layer of the same depth from a separate unit in the Borrow Pit (Table 7.12). This unit has an estimated age of 5385 cal. BP years (3435 BC); placing the unit in the Middle Archaic. As seen in the Age-Depth model in Chapter 6 (Figure 6.15), this radiocarbon date falls outside of the confidence interval of the model and is juxtaposed with an older date. In other words, the younger radiocarbon date (CU 14) is lower in depth than the older radiocarbon date (CU 12). Additionallly, this date does not agree with the extrapolated date from the model, where as the radiocarbon date and the model date agree for CU 12. It is because of this, that this radiocarbon date (3167 cal BP) is not being accepted as a true date.  It is reasonable to suggest that the charred mesquite fragment was introduced from overlying deposits through animal burrowing or other disturbance.

Table 7.12: Single radiocarbon date from the CU 14 deposits. Figure 4.15: Plan view of the

| FN # | Area | Feature/ Cultural Unit | Meters Below Surface | Material Dated | Botanical Name | DAMS-Rcybp | 1σ error | cal BP 95.4% Probability Ranges | Oxcal cal BP median |
|---|---|---|---|---|---|---|---|---|---|
| FN50233 | BP | CU-14 | 3.33 | Mesquite | Prosopis glandulosa | 2951 | 26 | 3239-3071 | 3167 |

*Cultural Unit 15 (CU 15)*

Cultural Unit 15 (DU 3) made up of one compound episode, CE 17; a package of sandy alluvium approximately 28 cm thick. This unit has an estimated age of 5543 cal. BP years (3593 BC) which falls at the beginning of the Middle Archaic and the end of the Early Archaic. The artifact assemblage consists of 150 microartifacts including debitage, FCR, charcoal, and faunal remains. The estimated sedimentation rate for this unit is approximately 4.24 cm/100 years.

*Cultural Unti 16 (CU 16)*

Cultural Unit 16 (DU 2) made up of one compound episode, CE 18; a package of sandy alluvium approximately 29 cm thick capped by a flood drape. This unit has an estimated age of 5922 cal. BP years (3972 BC), dating the cultural unit to the mid-Early Archaic. The artifact assemblage consists of 723 microartifacts that are a combination of debitage, FCR, charcoal, and faunal remains. This cultural unit has the lowest estimated sedimentation rate at 0.85 cm/100 years, which may have indicated a more stable surface and therefore the higher count data.

*Cultural Unit 17 (CU 17)*

The final deposit from the bottom of the sampling column is Cultural Unit 17 (DU 1) made up of one episode, Episode 8. Similar to those above, it was a package of sandy alluvium that is capped by a flood drape with a thickness of about 5cm; however, as this was also the last layer of the column and it seems clear that the full cultural/depositional unit was not captured. This unit has an estimated age of 6619 cal. BP years (4669 BC), dating the unit to the Early Archaic. The artifact assemblage consists of 91 microartifacts tincluding of debitage, FCR, and charcoal. As seen in Table 7.2, this unit is reported with a -244.01 cm/100 year sedimentation rate; the reason for this data is not known by the author and is thought to be a product of missing depositional data for the remaining approximately 1.5 meters of deposits that were not excavated, but were dated from samples of charcoal pulled from an auger.

## DISCUSSION

As detailed above, the cultural units that have been identified at Sayles Adobe range from dense zones of activity to thin, ephemeral lenses that are hardly recognizable in the field. It is these ephemeral levels of activity that give depth to understanding and interpreting the use of Sayles and other sites in the canyon. This is due to the preserved stratification of the deposits that were visible in the field as well as through the sediment analysis. Combined these two factors and Sayles proximity to the adjacent shelters (Skiles and Kelley) opens the door for a wider analysis of how the shelters were used and the formation processes at work for both site types.

# VIII. SAYLES ADOBE: A TERRACE IN A CANYON OF ROCKSHELTERS

This thesis has focused on understanding the natural and cultural formation processes that formed the Sayles Adobe terrace (41VV2239). Prior to the investigation of Sayles Adobe only three deeply stratified alluvial terrace sites had been excavated in the region: Arenosa Shelter (41VV99), Devils Mouth site (41VV188), and Nopal Terrace (41VV301), all investigated in the 1960s during the Amistad Reservoir Salvage Project (Black 2013; Dibble 1967; Johnson 1961).

Sayles Adobe is the first terrace site to be excavated in the region in nearly 60 years, and the second terrace site in the region excavated with a geoarchaeological focus (the other being Arenosa Shelter). Four questions were at the focus of my research and analysis:

1) What type of flood events and deposits form the terrace?
2) How do site use behaviors seen at Sayles Adobe relate to other sites in the canyon?
3) Do the alluvial deposits at Sayles Adobe correlate to other flood deposits seen in sites in the canyon?
4) What can the Sayles Adobe terrace deposits tell us about the climatic and environmental conditions at the time the site formed?

To answer these questions, I detailed the flood chronology, depositional characteristics of flood events, and identified when and how prehistoric peoples used the site. The site was introduced in Chapter 1: *Sayles Adobe (41VV2239)* made note of the other sites within the canyon and their relevance to Sayles Adobe. Additionally, this chapter detailed my initial observations of the site, the research framework, and research questions that formed the foundation of this work. Chapter 2: *Geomorphology and Archaeology* focused on alluvial formation processes, geomorphology, and previous terrace excavations completed in the Lower Pecos region. This was followed by Chapter 3: *Field Methods - Testing* which discussed the methods used to test the subsurface deposits and how these data helped plan the excavation of the site.

Chapter 4: *Field Methods* detailed the techniques and processes we followed for excavation, documentation, and collection across the terrace; and introduced the excavation areas, preliminary results, and the close of excavations. In Chapter 5: *Geoarchaeological Sampling and Analysis* the geoarchaeological sampling, analyses, and laboratory procedures were discussed. The bulk of the geoarchaeological data was presented and discussed in Chapter 6: *Geoarchaeological Results*, detailing soil geomorphology, profile section definitions, stratigraphic correlation, and the Borrow Pit depositional analyses. Cultural deposits and environmental data (i.e., cultural units, macro botanical, zooarchaeological, lithic, and micro fauna, etc.) were presented and discussed in Chapter 7: *People at Sayles Adobe: Material Analyses and Cultural Features*. The appendices provide supporting data to the excavation methods, geoarchaeological and stratigraphic analysis, and material assemblages. This includes additional tables and figures which are referred to in the text and, in some cases, the complete reports of the experts who completed the analyses (i.e., macrobotanical, faunal, and malacological analyses).

This final chapter brings together the natural and cultural deposition data to interpret the relevant formation processes, cultural chronology, and material assemblages for the site. Additionally, I discuss the relevance of the contextual approach and geoarchaeological analysis, and comment on the nature of the relationship between Sayles, Skiles, and Kelley in prehistory. The chapter concludes with reflections on my research and on the future research potential of the curated Sayles Adobe data and of the site itself.

## FORMATION PROCESSES

My original hypothesis for site formation was grounded in the thought that Sayles Adobe is essentially the result of a bedrock block bowl nestled on the downstream side of a canyon spur, above the canyon bottom where higher velocity water would flow. Natural depositional processes seen at the site were proved to be the result of low velocity floods but floods that were often of large magnitude, the evidence of which can been seen in profile sections across the site and in the geoarchaeological analyses of sediment data (Appendix C and D).

Site formation refers to not only to the modes of natural deposition that created the site and the deposition of cultural material by people, or, but also to all the factors and influences that have affected and preserved the site. Ward and Lacombe (2003) have presented a process-oriented conceptual model of site formation that considers the biological, environmental, and geomorphic processes that preserve an archaeological site. As they emphasize, an archaeological site along with its associated artifacts and deposits are products of a varying number of taphonomic processes which work constantly on the site even as it is excavated. These processes can include both human modifications (e.g., pit digging) and environmental modifications (e.g., rodent burrowing) to the site's formation, continuing through to its excavation. Analyses (such as, microartifacts, sediment analyses, and micromorphology) were aimed towards understanding the various elements of deposition and disturbance that may be present at the site in relation to the contextual (Waters 1998) and process-oriented models (Ward and Lacombe 2003) of site formation analysis.

*Stratigraphic Correlation*

The stratigraphic profiles of Borrow Pit, Sand Box, and Porch excavations were correlated based on their lithologic characteristics; most useful were the thin, silt-clay flood drapes that stretched across the site. As discussed in Chapter 3, the first mud drape recognized at the outset of work in the Borrow Pit was used as a distinct stratigraphic marker as we opened new excavations in the Sand Pit. Other identified mud drapes became not just guides for excavation, but tools for correlating the stratigraphy at the site. Unlike the sandier and thicker alluvial deposits, the mud drapes have clearly defined upper and lower boundaries that make the general correlation of homogenous deposits substantially more feasible. The auger data from testing discussed in Chapter 2 allowed me to map the depth of the mud drapes across the site and then tie them back to the profiles (Figure 8.1).

These data were then used to build the chronostratigraphic record of the site and interpolate the dates, cultural activity, and lithostratigraphy seen in deposits at different locations across the site. Deposits across the terrace are generally flat lying, which facilitated correlation across the site.

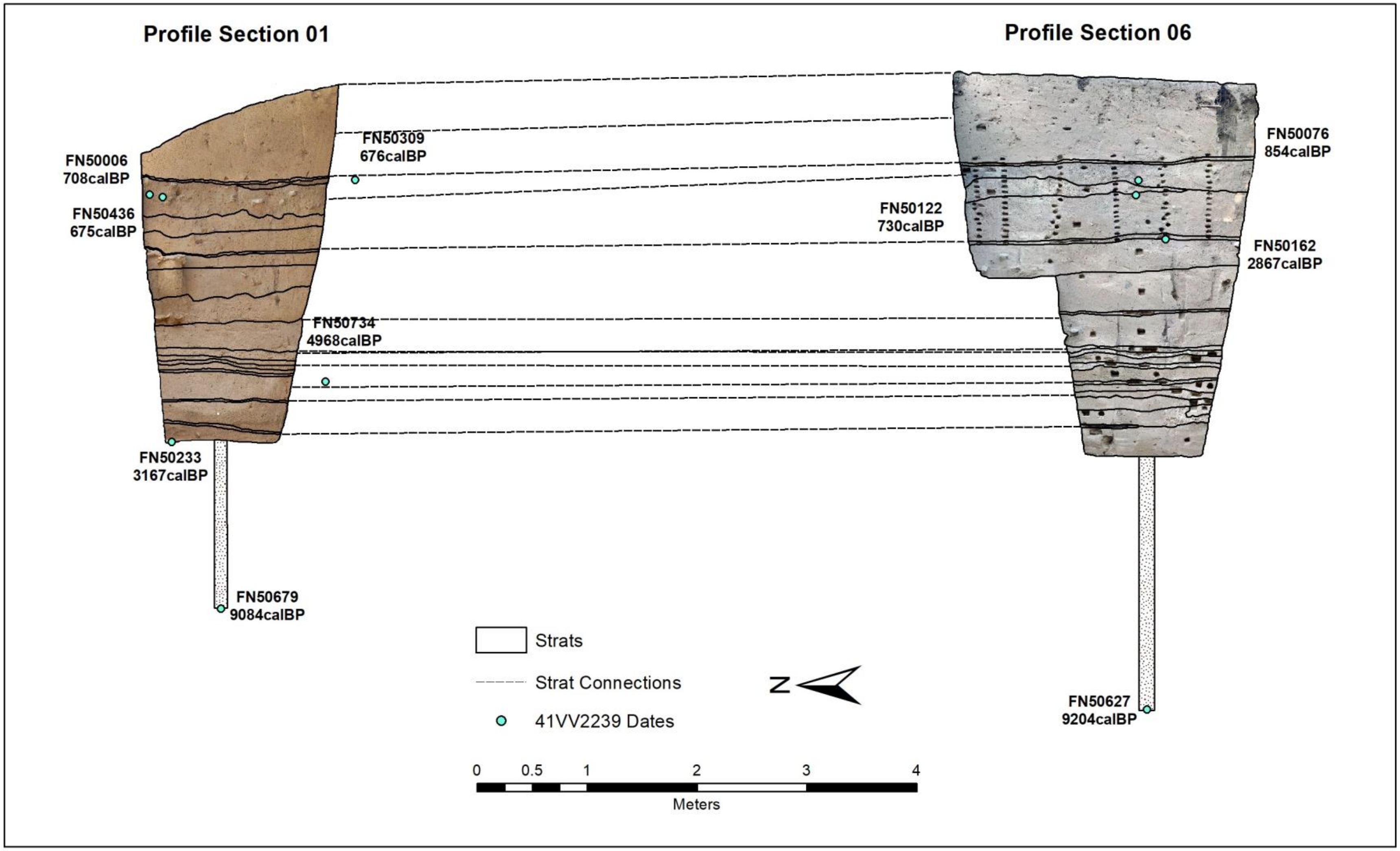



Figure 8.1: PS1 (BP) and PS6 (SB) flood drape correlations with radiocarbon dates.

*Natural-Cultural Site Formation*

Seventeen cultural units and twenty-five depositional units were identified from the Borrow Pit sampling column microartifact and sediment analyses (Chapter 6). These deposits were recognized through a comparative analysis of particle size distribution, NCRS soil classifications, magnetic susceptibility, organic carbon, carbonate, and microartifact analysis of a column of continuous sediments (Chapters 6 and 7). Volcanic minerals present in the results of mineralogical analysis (Table 6.2), calcium carbonate equivalence, and micromorph thin section analysis (Figure 6.12) support the conclusion that this sediment is alluvium deposited by the Rio Grande. At this locale, Rio Grande alluvium can be defined as fine sand-silts to very fine silt-clays that are dominated by calcite and quartz minerals (Table 6.2). The low-velocity flood events from the Rio Grande sealed and preserved Sayles Adobe deposits, often as cultural surfaces (Figure 7.1), as well as the topography of the site at different periods through time (Appendix C: Profile Sections).

As discussed in Chapter 5, the terminology framework developed for identifying and naming the levels of cultural activity (potential episode, episode, and compound episode), allowing the systematic delineation of cultural units. The collection and analysis of a continuous column of discrete samples from the Borrow Pit excavation area was essential to understanding the deposits present at the site. Additionally, the micromorphology thin section analysis, and micro-sampling of those sediments, aided in the identification of depositional and post-depositional features.

*Cultural and Depositional Units*

The Age-Depth model (Table 6.4; Figure 6.15) created a visual representation of the changing flood/depositional regime that occurred within the canyon and was preserved at Sayles Adobe. With this model driven by radiocarbon dates and their depths, the stratigraphic delineations in cultural and natural deposits could be used to extrapolate sedimentation rates of the natural deposits. All this resulted in the identification of four deposition packages. In other words, the model created a visualization of these changes in deposition from the data which matched with the larger scale depositional trends identified in the field.

First, a distinctly variable depositional environment was easily observed at the macro scale (i.e., the field) that from the top was characterized by a massive sandy deposit, followed by a series of medium to thin loam to sandy loam deposits that were often capped by silty-clay flood drapes. A micro-scale analysis of the deposits shed light on precisely how variable deposition was and how many natural-cultural depositional events took place at the site.

No distinctly visible stratigraphic breaks (e.g., mud drapes) were identified in the upper approximately 85 cm of the site, which may be a result of the relatively looser sandy sediments that characterize this section of the sites deposits (Figure 6.10 & 6.13; Appendix D). At first glance, prior to the analysis of the sediments in the Borrow Pit and Porch, it was thought that this was a product of a combination of environmental and depositional changes, such as: increasing flood magnitude (i.e., higher flood velocity depositing coarser sediment); and, looser sediments without the protective flood drapes seen in the lower deposits would likely increase the amount of bioturbation occurring.

The Porch and Borrow Pit sediment data (Figure 6.13; Appendix D), however, suggest that these deposits are in fact made up of intact depositional units, if faint ones. The fact that these depositional units are still intact in both sections of the site indicates that the homogeneousness seen at the macro level is more likely a product of flood events that receded more quickly, which prohibited the settling out of the finer sediments as the waters receded. It is also likely that the recent thick growth of willow and mesquite trees and dense brush on the Sayles Adobe terrace over the past half century have also contributed to the blurring of the uppermost natural deposits.

Continuing down the profile to the mid-section of deposits (85-261 cmbs) it is clear that the climate and depositional environment changed, with floods occurring at a lower rate which created favorable conditions for the aggradation of more cultural material at the site (Figure 4.12; Table 7.5, 7.6, and 7.7). This is embodied by both Occupation 1 and Occupation 2, the two densest sets of cultural deposits. The variation in the microartfiact distribution and evident breaks in the deposits that were seen in the magnetic susceptibility, particle size, carbonate, and organic carbon would suggest that these deposits have been somewhat mixed through intense human use and bioturbation over time.

Below 261 cmbs (261 – 313 cmbs) in a third period of changing flood patterns occurs, represented by closely layered, alternating sandy alluvium beds capped by mud drapes of varying thicknesses (2-5 cm thickness) (Appendix C; Figure 6.15; Table 6.4). However, as supported by the microartifact assemblage and a single radiocarbon date from this section of the deposits, there was a stable surface long enough for inhabitants of the canyon to use the site.

The lowest and final identified shift in the depositional environment came at 313 to 377 cmbs. Here the deposits are on a macro-scale homogenous and lacking in distinct characteristics, similar to what was seen in the second depositional package. Unlike that package of events, in this lower section there were mud drapes preserved within the profile that may not have seen as much bioturbation and far less cultural activity.

## SITE USAGE

As discussed throughout this thesis, the results of geomorphic and sedimentologic analyses support a fluctuating flood regime throughout the over 9000 years of deposition present at Sayles Adobe. Thermal features, artifact analysis, burned rock quantification and other supporting analyses (i.e., botanical, faunal, malacological) were essential to the understanding of how the site was used at different stages of its formation. Botanical analyses of materials recovered through flotation from the burned rock accumulations show the presence of flora similar to what we have today in the region.

Unburned botanicals were also identified, which may be a result of bioturbation in the deposits, which is evidenced by the identification of a number of burrows during excavation. Faunal analysis shows the presence of common game animals known in the region (e.g., deer and rabbits), many bones with cultural modifications that indicate butcher marks and thermal alteration. Malacological analysis of bulk sediment collected from different elevations and locations across the site characterize the micro snail assemblage as arid, land-adapted species.

*Feature 1*

Feature 1 (Figure 7.6) was initially seen in Profile Sections 01 and 02 (the east and south Borrow Pit walls respectively), as well as Units A1 and B which lay northeast of the profiles. When first encountered, these deposits were suspected to be an incipient ring midden (earth oven facility) based on the tapered lens formed of FCR and carbon-stained sediment observed in the profiles, and the dense, circular scattering of burned rock mixed with debitage and charcoal that was observed during excavation. In the end, a few conclusions were formed after the excavation and analysis of the feature was completed:

(1) We did not capture the whole feature area; more of Feature 1 continues towards the central terrace. This is supported by the auger tests that were placed in that direction, and the subtle presence of suspected Feature 1 deposits in the northeastern corner of the Sand Box.

(2) Feature 1 is not a distinct ring midden, but a more amorphous earth-oven facility at least five meters in diameter where relatively shallow and small earth oven pits were dug and used an unknown but modest number of times (less than a dozen). With each oven event, discarded rock tossed out towards the margins of the most recently used pit. The pits intruded and disturbed one another such that we could not see any intact well-formed pits and heating elements in the excavated area. The presence of high quantities of discarded rock and the wavy to irregular lower cultural deposit boundary across the feature clearly indicates that Feature 1 represents repeated events. The concentrations of discarded rock across the feature area suggest that an incipient midden was developing before the surface was capped and sealed by a silt-clay flood drape.

(3) The diffuse discarded rock patterning seen from the rock sort data supports the final hypothesis that the upper level of dense cultural activity (Occupation 1) was formed through multiple baking events at this location. Unlike most locales in the region, the thick sandy deposits at Sayles Adobe would have made pit digging and earth oven capping quite easy and unconstrained.

*Feature 2*

It was clear during excavation that this was a small isolated feature (Figure 7.7 and 7.8) that was slightly below the Feature 1 deposits, an observation supported by a slightly earlier Late Prehistoric date of 690-659 cal. BP (95.4% probability range). These two features (Features 1 and 2) overlapped in one sigma date ranges (Table 6.3), suggesting that these events did not take place too far apart in time. The presence of this small thermal feature interpreted as a surface hearth supports the identification of multiple ephemeral cooking feature remnants across the Occupation 1 deposits. The fact that this feature preserved intact charred sticks is likely the result of the flood event which deposited the thin layer of sandy-silt on top of Feature 2. This is not to say that a flood drape was deposited, but that there was a depositional event after the use of Feature 2. This depositional event likely served a similar function as the flood drape capping Feature 1, helping to preserve Feature 2.

*Feature 3*

Similar to Feature 1, Feature 3 (though likely less intensely used) is also an incipient burned rock midden. Quantities of burned rock, faunal remains, and lithic materials, were substantially lower than what was recovered from Feature 1. The radiocarbon date recovered from Feature 3 in Occupation 2 (Table 6.3: FN 50162) and the discovery of the butted biface support the identification of Late Archaic period occupation surface in the Sand Box area.

*Features 4 and 5*

The argument for painted pebble caches at Sayles Adobe is founded upon the discovery of three painted pebbles within close proximity of each other and an additional painted pebble located approximately 35 cm below the upper three. Initially we suspected that all four were a single event, however, sediment analyses of the Porch deposits indicated four depositional breaks in stratigraphy (Figure 6.6). The painted pebbles were located within the first (lowest, S41) stratum and the third (S39) stratum. These breaks in deposition, and the locations of the pebbles, tell us that the original cultural surfaces are more or less intact, and these artifacts must have been placed in the Porch at separate times.

A fifth pebble[10] (CU 3/Occupation 1: Figure 7.15) was found within a definite occupation deposit that has three Late Prehistoric dates associated to it in Occupation 1 (CU 3) in the Sand Box. This indicates the four cached pebbles (Features 4 &5) were placed in the Porch after Occupation 1, yet likely still within the Late Prehistoric period which is ends around 250 BP (1700 AD) in the Lower Pecos.

The idea that multiple painted pebble cache events took place in Eagle Nest Canyon is most intriguing! It is uncommon to find these types artifacts at open air sites, let alone finding them cached. Sayles Adobe is not only an open site with painted pebbles, but that it is the second site in the canyon to have painted pebble caches. The Sayles Adobe caches were located above dated Late Prehistoric deposits, while the Bonfire Shelter cache dates to the Late Archaic. Clearly indicating that these two sites

[10] No evidence suggests that the fifth painted pebble is part of Feature 4 or 5.

were selected at different times to deposit these stones, and at Sayles they deposited them twice in the exact same location.

*Malacological Analysis*

Dr. Kenneth M. Brown of the Texas Archeological Research Laboratory conducted a preliminary malacological (snail) analysis (Appendix G) of eight discrete bulk-matrix samples from the Borrow Pit and Sand Box excavation areas (Figure 8.2). The main purpose of this study was to assess the potential for snail recovery at Sayles Adobe from the alluvial sediments to determine whether a full study would be feasible. The pilot study also allowed comparison of the present assemblage with what might be expected in similar environments to better understand the climatic conditions through time at the site.

Results of this study are as follows: snail specimen density and taxonomic diversity were low at the site, which may be indicate drought stress and/or dilution of the assemblage due to the high sedimentation rate. Taxa identified at the site, however, were identified as arid-adapted species, often the most drought resistant and common to open sites like Sayles.

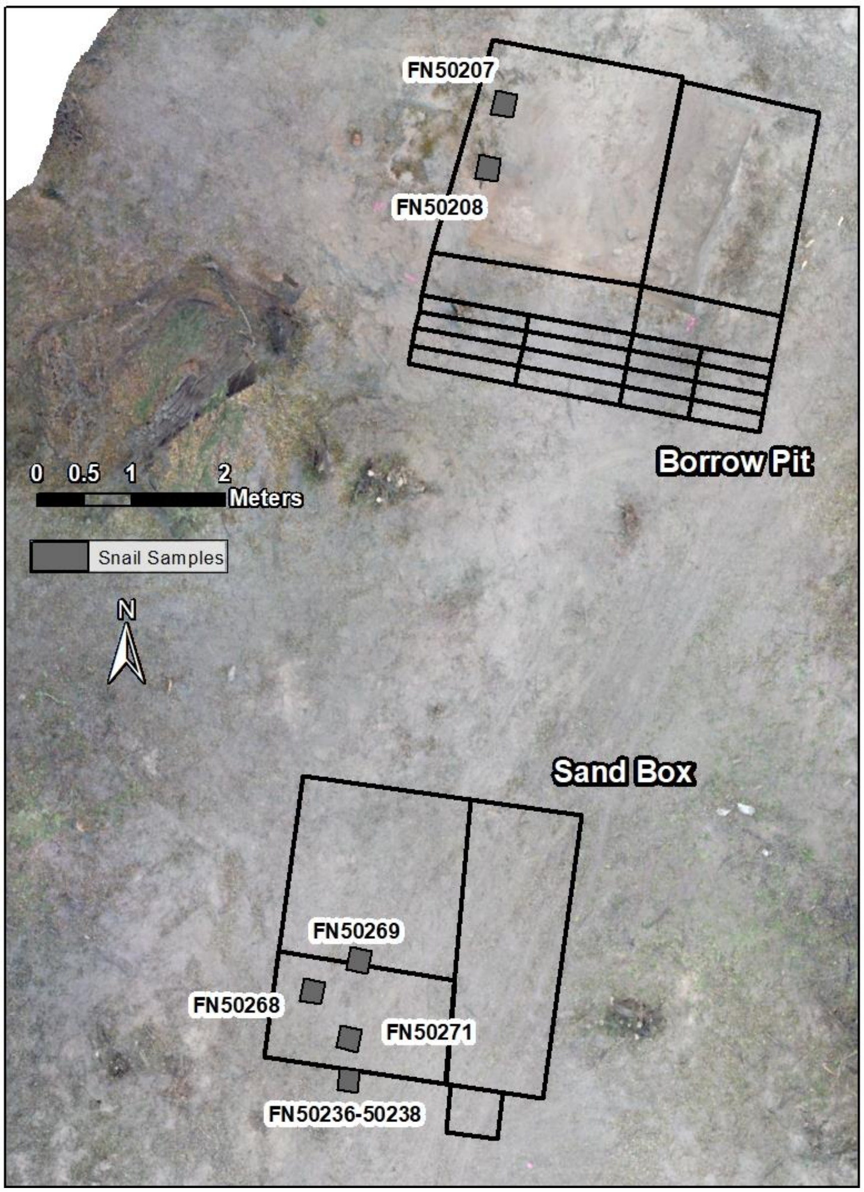



Figure 8.2: Plan map of the site with the locations of the malacological samples. Each sample was recovered from varying elevations within deposits.

Two dominant characteristics of the assemblage were very small specimens and large numbers of juvenile snails, which again may be indicators of drought stress experienced by the populations present. Surprisingly, only two-percent (ten specimens) of the total number of snails counted were identified as aquatic snails; this is less than one would expect from alluvial deposits, however, Sayles does sit approximately 11-meters above the canyon bottom where water tends to flow during normal rains.

Overall, Brown concludes that high depositional rates and/or poor habitat quality are the most likely explanations as to why the Sayles assemblage is low in quantity, diversity, and size of specimens. This study, however, is only representative of the general snail assemblage present at the site. Larger samples from additional depositional contexts would be necessary to fully assess the malacological assemblage and the paleoclimatic record of the site.

*Lithic Assemblage*

Much of the lithic material recovered from the Sayles Adobe excavations was composed of debitage, most of it of very small size, less than ¼" (Appendix H.1). Only a very few diagnostic projectile points and other types of formally worked tools were recovered from the site. The amount of debitage recovered suggests the site was used for retouching previously made tools and perhaps creating small expedient tools.

## SAYLES ADOBE IN TIME AND SPACE

> "The concentration of human activity here was obviously related to favorable conditions presented by the shallow overhang situated near the river and perhaps other factors of choice not now apparent." – D. Dibble on Arenosa Shelter terrace deposits (1967:71)

Like Arenosa Shelter, at Sayles Adobe there was a shelter and a deeply stratified terrace component to the locale. Although Kelley, Skiles and Sayles have been recorded and investigated as separate sites, it is my opinion that all three represent a single locale used by prehistoric peoples. It is difficult to believe that any of these sites would be used singularly for long when they are in such close proximity. This is supported by the parallel cultural records of over 9000-years that have has been documented at the three adjacent sites (Rodriguez 2015) (Figure 8.3).

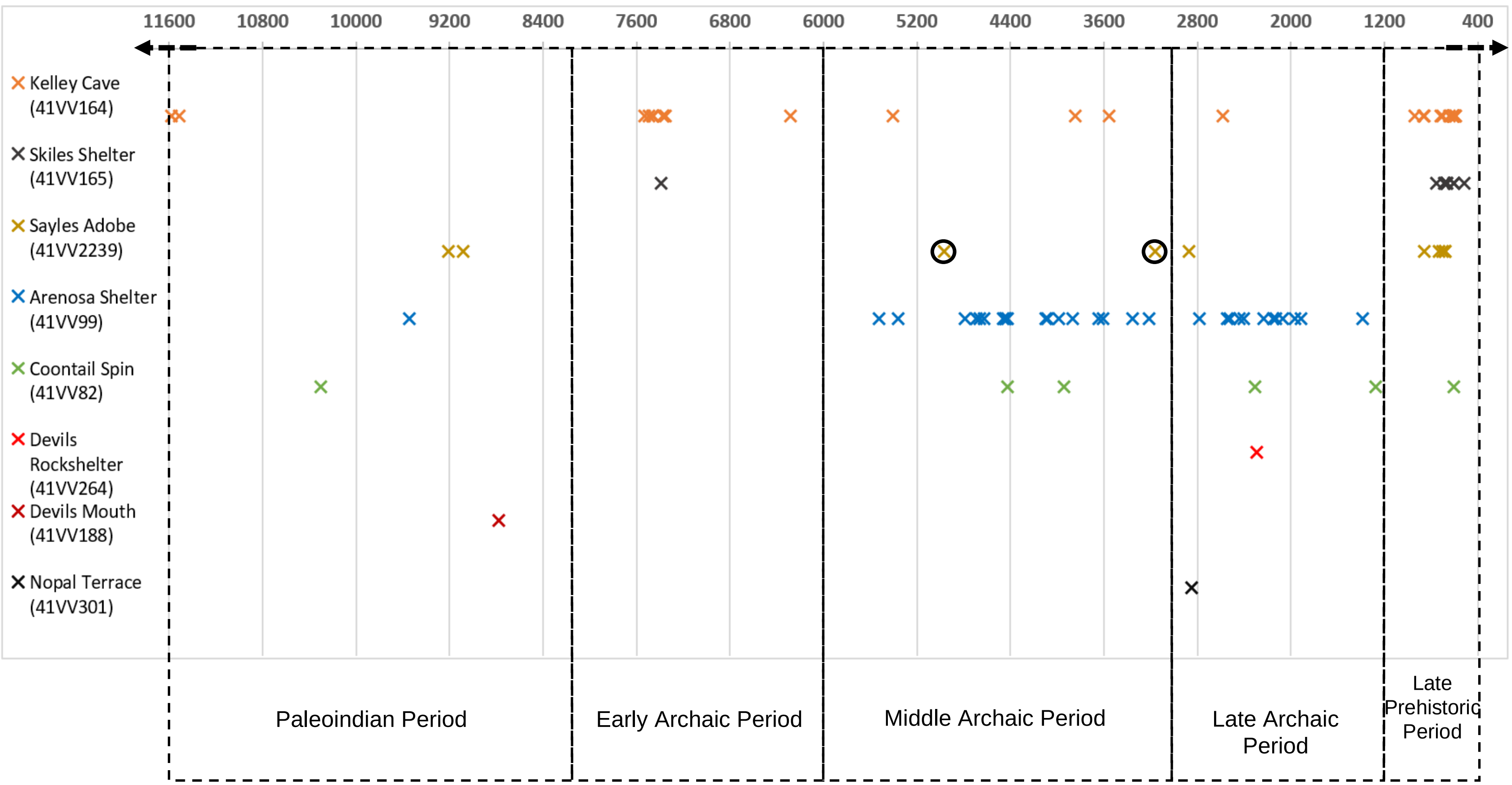



Figure 8.3: Lower Pecos terrace site dates plotted across the cultural chronology of the region. Circled dates are juxtaposed Sayles Adobe dates, which are not considered in the overall analysis of the site's deposits.

The ongoing analyses of Kelley Cave, Skiles Shelter, and Horse Trail Shelter further support the characterization of Sayles Adobe as a site that has seen human activity that fluctuates with the stability of the landscape. Undoubtably the repeated use of Sayles Adobe was tied to the presence of the nearby shelters which enticed the canyon's inhabitants back time and time again.

Sayles Adobe, Skiles Shelter, and Kelley Cave offer multiple lines of sight up and down the canyon, across to what we know today as Mexico, as well as across the canyon to the notches in the canyon wall that allow people to climb in and out of the canyon. The intense use and long record of occupation at these sites, the presence of rockart panels in Skiles and Kelley, and the caches of painted pebbles at Sayles Adobe, shows that these sites were important landscape features for the hunter gatherers of the Lower Pecos Canyonlands who frequented the Rio Grande valley west of the Pecos River. Studies of Lower Pecos rockart prove the intentionality of pigment use, artistic design, and often for the location of panels (Boyd 2003; 2016). Indicating that prehistoric people of the Lower Pecos were thinking about and trying to understand their landscape.

Ethnography and present-day settlement pattern analysis of cultures across the world and throughout time, often support location bias. Bias that can be driven by climatic conditions, defensive (or offensive) preferences, agricultural potential, and many more potentially limiting factors. Schlanger (1992: 91-93), in her study of the prehistoric Anasazi landscape in southwestern Colorado, used the evocative phrase *persistent place* to highlight the repeated use of a locale at multiple periods through time within a region. She argued that while the phrase may be used to refer to a single locale, it can be further extended in the interpretation of the long-term use of larger landscapes.

## DISCUSSION AND FURTHER RESEARCH

Excavations at Sayles Adobe have revealed the site's deposits to be far more extensive than initially realized by its discoverers. We now know that the combined cultural and natural record present at Sayles Adobe stretches for over 9000 years. This is evidenced by the identification of twenty-five depositional units and seventeen cultural units in the over 3.5 meters of excavated deposits, and cultural materials (and radiocarbon dates) that are at depths nearing 6 meters below the terrace surface. The intense testing, excavation, and sampling along with the analyses of the materials were used to develop an understanding of the number of deposition events and periods of site use.

These data also highlight the research potential of deeply stratified terrace sites that present with low density ephemeral site visits. A contextual analytic approach to sites such as these is essential to recovering the data necessary to build a comprehensive dataset which can be used to understand formation processes across the Lower Pecos Canyonlands landscape. The increasing use of geoarchaeology and geomorphology over the last few decades in Texas has validated the importance and research potential of terrace sites.

Terrace sites are now recognized for their potential as windows into landscape use and paleoclimate in the Holocene as many consist of several low-density occupational zones. Recent examples of this can be found at sites like the Siren site (41WM1126; Carpenter et.al. 2013), the Rush site (41TG346; Quigg and Peck 1995), the Lino site (41BW437; Quigg et. al. 2000), and the Richard Beene site (41BX831; Thoms and Mandel et.al. 2007).

*Reflections Upon Work Completed*

As I have moved through this process from research design to excavation, then to analysis and interpretation, I have identified multiple points of the work that I would do again in a more efficient and timely manner for framing and researching the analysis of the site. Starting with maintaining a better stratigraphic context when excavating deposits, rather than relying on SfM modelling to keep track of the contexts for me. This is not a fault of the process but of my own folly and inexperience in leading a geoarchaeological centered excavation, which would have benefitted from better context between macro-deposits and the micro-deposits. Overall, this process (excavation, analysis, and writing) would have benefitted from a pointed discussion about the goals of the research and my approach to it. In other words, I should have asked for more clarification on certain sampling techniques that I was unfamiliar with and been less afraid about asking questions. I have learned from this experience!

*Suggestions for Work Going Forward*

The artifacts, samples, and records from Sayles Adobe are now curated in the Ancient Southwest Texas Project collections at the Center for Archaeological Studies at Texas State University. Over 100 liters of sediment, hundreds of artifacts, and an assortment of other samples from the site have considerable as-yet-unrealized research potential.

Many dozens of the liters of curated matrix were samples from three thermal refuse features at the site could be used for further macrobotanical, faunal, and/or malacological analyses. The analysis of these samples alone would undoubtedly add to the understanding of the environment and activities that took place. However, the feature samples could also be paired with more extensive sediment analyses.

Continued analysis and interpretation of the multiple geoarchaeological datasets that were compiled for this thesis would be a benefit not only to understanding the site, but to understanding the flood regime along the Rio Grande and for the region. Further research into the depositional records and data recovered from the other terrace sites discussed from the Lower Pecos would help tie the flood events seen at Sayles with the regional flood chronology.

Further research could (and should be) invested in understanding painted pebble chronology and cache events in the Lower Pecos. The documentation of caches at Sayles Adobe and Bonfire Shelter raises questions about why other caches have not been documented at the other sites in the canyon, or region, that have painted pebbles. Could it be because of the intensity of site use, where Bonfire is known to be discontinuously occupied for only short periods of time, Sayles seemingly occupied discontinuously, but frequently. Both contrast with sites like Eagle Cave and other shelters which were used more intensely used than either Sayles or Bonfire.

The collection of lithic materials from the site, which range from 1/8" debitage to formal tools (e.g., bifaces, scrapers, ground stone, and more), has not yet been subject of a detailed analysis. While only few temporally diagnostic artifacts were recovered from the site, other tools from the site (specifically the butted biface) would make great specimens for use-wear and residue analysis.

Last but not least, the vast amount of data available from the sorting, counting, weighing, and categorizing all burned and unburned rock excavated from the site, which was just barely utilized for this thesis. Analysis of this data would greatly benefit the interpretation of the use of the site and how it compares to the other sites in the canyon that have datasets created through the same Rock Sort technique.

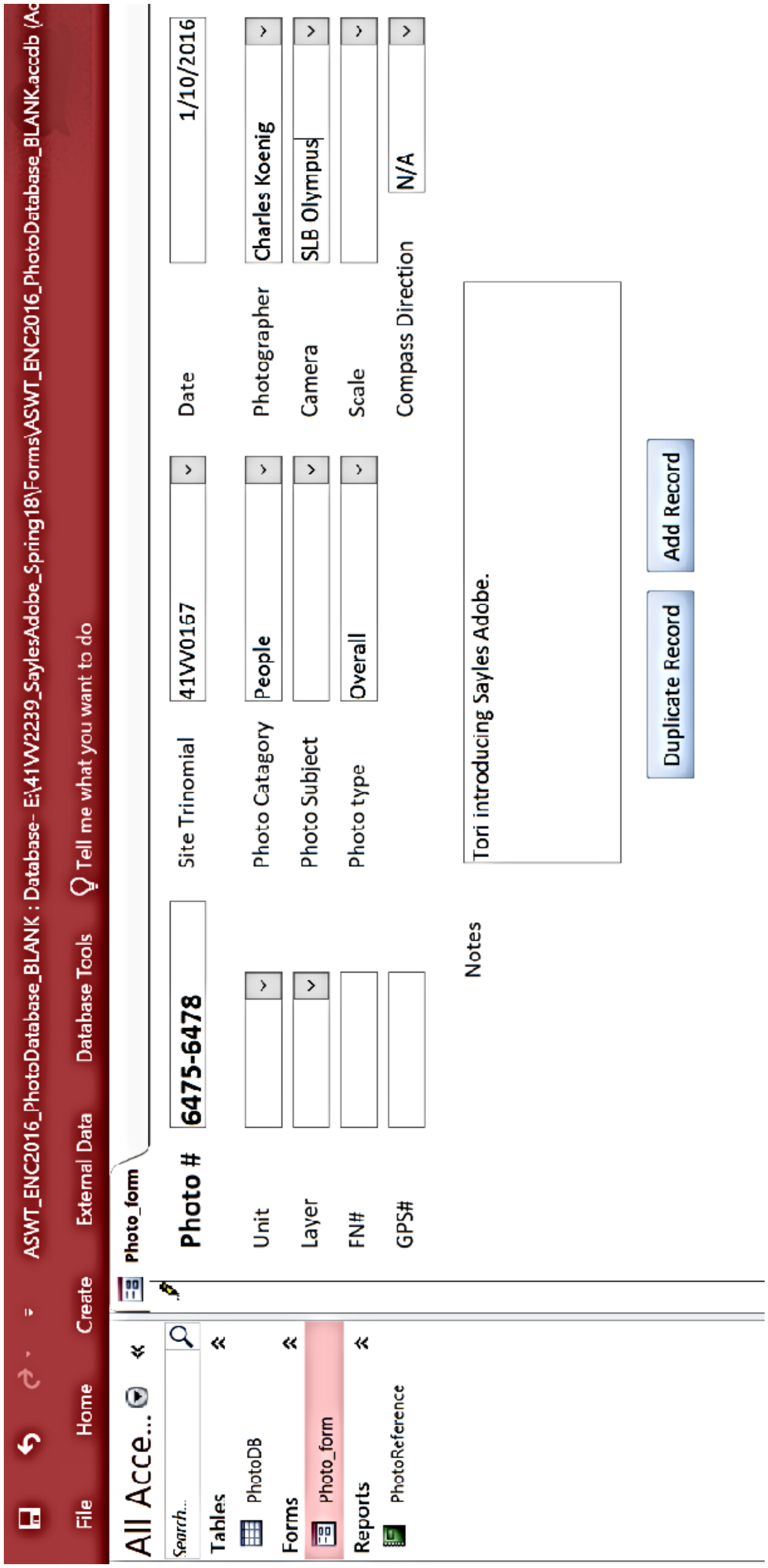
All in all, many stories in the Sayles Adobe sand have yet to be told!

## APPENDIX SECTION

# APPENDIX A: EXCAVATION FORMS & FIELD LOGS

Appendix A consists of the forms used for recording photo information, field numbers, TDS shot points, as well as for documenting unit-layer, strat, profile section, and feature information. These forms were used in the field and later digitized for curation purposes. Digitizing the records was also necessary to easily manipulate the data and use it in other formats for analysis (i.e., exporting and importing to Excel, Word, Adobe, etc.).

The Ancient Southwest Texas Project uses a standardized set of forms and digital documents, which may be adapted to capture site specific information.



ASWT_ENC2016_PhotoDatabase_BLANK : Database- E:\41VV2239_SaylesAdobe_Spring18\Forms\ASWT_ENC2016_PhotoDatabase_BLANK.accdb
File
Home
Create
External Data
Database Tools
Tell me what you want to do
All Acce...
Search...
Tables
PhotoDB
Forms
Photo_form
Reports
PhotoReference
Photo_form
Photo #
6475-6478
Site Trinomial
41VV0167
Date
1/10/2016
Unit
Photo Catagory
People
Photographer
Charles Koenig
Layer
Photo Subject
Camera
SLB Olympus
FN#
Photo type
Overall
Scale
GPS#
Compass Direction
N/A
Notes
Tori introducing Sayles Adobe.
Duplicate Record
Add Record

| | 41VV02239 - Sayles Adobe: TDS Log | | | | |
|---|---|---|---|---|---|
| **TDS** | **Description** | **Easting** | **Northing** | **Elevation** | **Notes** |
| 1016 | 0165-DAT-C-DUP | 3106.5338 | 5032.8324 | 964.6254 | " " |
| 1017 | 0165-DAT-C-DUP | 3106.5352 | 5032.8299 | 964.6248 | " " |
| 1018 | 0165-DAT-C-DUP | 3106.5338 | 5032.8324 | 964.6253 | " " |
| 1019 | 0165-DAT-C-DUP | 3106.5338 | 5032.8324 | 964.6253 | " " |
| 1020 | 0165-DAT-C-FINAL | 3106.5343 | 5032.8316 | 964.6252 | Final DAT-C |
| 1021 | 2239-GCP001 | 3103.3746 | 5027.7379 | 964.0232 | Root in s. wall PS02 |
| 1022 | 2239-GCP003 | 3102.6277 | 5028.6675 | 963.9436 | Root in w.wall first unit |
| 1023 | 2239-GCP005 | 3105.3765 | 5029.6914 | 964.0637 | Nail in N.end PS01 |
| 1024 | 2239-GCP006 | 3105.056 | 5027.3047 | 964.8434 | Nail in S. end PS01 |
| 1025 | 2239-GCP007 | 3101.5514 | 5027.8928 | 964.6442 | Nail in W. end PS02 |
| 1026 | 2239-GCP008 | 3105.0604 | 5010.3313 | 964.3855 | Nail S. end of site; stake point |
| 1027 | 2239-GCP009 | 3102.0403 | 5027.2798 | 964.7359 | Nail near GCP007; stake point |
| 1028 | 2239-GCP010 | 3102.0236 | 5010.211 | 963.5037 | Nail SW end of site; stake point |
| 1029 | 2239-GCP002 | 3103.9302 | 5027.8749 | 963.8108 | Flat rock in S. center floor |

Figure A.2: Example of the TDS log used in the field and later digitized.

| | Eagle Nest Canyon Expedition 2016: Sayles Adobe FN Log | | | | | | |
|---|---|---|---|---|---|---|---|
| Field Number (FN) | FN Type | TDS Shot | Profile Section | Excavation Unit | Strat/Layer | Notes | Date Assigned |
| FN50000 | | | | | | | |
| FN50001 | | | | | | | |
| FN50002 | | | | | | | |
| FN50003 | | | | | | | |
| FN50004 | | | | | | | |
| FN50005 | | | | | | | |
| FN50006 | | | | | | | |
| FN50007 | | | | | | | |
| FN50008 | | | | | | | |
| FN50009 | | | | | | | |
| FN50010 | | | | | | | |
| FN50011 | | | | | | | |
| FN50012 | | | | | | | |
| FN50013 | | | | | | | |
| FN50014 | | | | | | | |
| FN50015 | | | | | | | |
| FN50016 | | | | | | | |
| FN50017 | | | | | | | |
| FN50018 | | | | | | | |

Figure A. 3: Example of the FN Log used in the field.

# Eagle Nest Canyon Expedition 2016: **Unit-Layer Form**

ASWT
Texas State University

Site: ______________________

Excav. Area: ____________ **Excav. Unit:** ____________

Strats: ______________ **Layer:** ______________

**Field Number:** __________________

Recorder 1: ____________ Recorder 2: ____________

Date Started: ______________

Date Completed: ______________

QAQC: Yes No Initials:

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

**What to collect from 1/8", 1/4", 1/2", and 1" screens:**

**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 bone

Collect all lithics unless otherwise directed

Count and weigh FCR and unburned rock >1", but discard once finished

**PUT ALL DISTURBED SEDIMENT INTO A 5 GALLON BUCKET AND MEASURE THE VOLUME AND WEIGH ONCE THE LAYER/STRAT IS COMPLETE**

Excavation Tools (check all that apply):

Trowels Brushes Ice Picks Splints

Shovels Picks Garden Claw Poofer

Other

**SfM Models**

Camera: ____________ Descrip: ____________

SfM Photo Range: ______________

Camera: ____________ Descrip: ____________

SfM Photo Range: ______________

Camera: ____________ Descrip: ____________

SfM Photo Range: ______________

Other SfMs: ______________

______________

**6 Required GCPs**

1st GCP: ________ 2nd GCP: ________

3rd GCP: ________ 4th GCP: ________

5th GCP: ________ 6th GCP: ________

Additional GCPs: ______________

Describe excavation methods, sequence, and problems. ______________

______________

______________

______________

______________

______________

______________

______________

______________

______________

______________

**Page 1 of 4**

Figure A. 2: ASWT Unit-Layer form used at all sites in 2016; page 1 of 4

# Unit-Layer Form

Describe any bioturbation (e.g., for burrows describe size, frequency, and orientation): ______

Volume of disturbed fill: ______ Mass of disturbed fill: ______

List artifacts collected from disturbed fill: ______

What are diagnostic attributes of the matrix (circle all that apply)?: "Ashy" Fiber Flecked Charcoal
Charcoal Rich Dense FCR Scattered FCR Roof Spalls Lots of small rocks
Decomposing Limestone Disturbed Alluvial Sediment Other

*If Other, Describe:* ______

Describe any visible stratification (including intrusions): ______

Other Remarks: ______

**Associated Features** FN#s: ______

**Page 2 of 4**

Figure A. 5: ASWT Unit-Layer form used at all sites in 2016; page 2 of 4

# Unit-Layer Form

## General Artifact Observations

*As you are excavating, check if these types of arifacts are encountered (even if they are not collected).*

| Artifact Type | Present | |
|---|---|---|
| | Yes | No |
| Debitage | | |
| Chipped-Stone Tools | | |
| Groundstone/Manuports | | |
| Faunal Remains - Bone | | |
| Faunal Remains - Snail Shell | | |
| Faunal Remains - Mussel Shell | | |
| Un-charred Botanical Remains | | |
| Charcoal | | |
| FCR | | |
| Unburned rocks | | |
| Bone/Wood/Fiber Tools | | |
| Other | | |

Describe “other” ______________________________

## Point-Provenienced Artifacts

*Describe artifacts shot in with the TDS*

| Artifact Type | FN# | Photo #s |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Artifact notes: ______________________________

**Sampling Protocols for Column Samples:**

Collect at least 1 matrix and 1 spot sample from “pure” deposits. When appropriate, collect a residue rock. The maximum size of a matrix sample is an 18x12 tie-off bag. If additional matrix samples are needed, assign a new FN and shoot with TDS. Describe sample locations.

**Matrix Samples** FN#s: ______________________________

**Spot Samples** FN#s: ______________________________

**Residue Rocks** FN#s: ______________________________

**Other Samples** FN#s: ______________________________

**Sample Notes:**

Page 3 of 4

Figure A. 6: ASWT Unit-Layer form used at all sites in 2016; page 3 of 4

# Unit-Layer Form: Rock Sort

## 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 or Angular Limestone | | | | | | | |
| Rounded Limestone | | | | | | | |
| Spall Limestone | | | | | | | |
| Indeterminate Limestone | | | | | | | |
| TOTALS | | | | | | | |

## 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 or Angular Limestone | | | | | | | |
| Rounded Limestone | | | | | | | |
| Spall Limestone | | | | | | | |
| Indeterminate Limestone | | | | | | | |
| TOTALS | | | | | | | |

**Rock Sort Photos taken? Yes No Camera:____________ Photo Range: ________________________**

Rock Sort Notes: ____________________________________________________________

**Residue Rocks** ***ONLY ADD THESE COUNTS/MASS TO THE TOTAL VALUES IN ABOVE CHARTS***

Residue Rock: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Residue Rock: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Residue Rock: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Residue Rock: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

**Rocks ≥1" from 1/2" Sieve** ***ONLY ADD THESE COUNTS/MASS TO THE TOTAL VALUES IN ABOVE CHARTS***

Matrix: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Matrix: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Matrix: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

Matrix: FN______________ Size Class_____________ Rock Type_______________ Mass___________________

**Page 4 of 4**

Figure A. 7: ASWT Unit-Layer form used at all sites in 2016; page 4 of 4

## Eagle Nest Canyon Expedition 2016: **Profile Section Form**

ASWT
Texas State University

Site: ____________________________________

Excav. Area: _____________ Excav. Unit ________

**Profile Section:** ___________ Field Number: ________

Recorder 1: __________________ Date Started: _____________ QAQC: Yes No Initials:

Recorder 2: __________________ Date Completed: ___________

| Strat | Strat FN | Spot FN | Geomatrix FN | 14C FN |
|---|---|---|---|---|
| | | | | |
| | | | | |
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**SfM Models**

Camera: _____________ Descrip: ___________

SfM Photo Range: ______________________

Camera: _____________ Descrip: ___________

SfM Photo Range: ______________________

Camera: _____________ Descrip: ___________

SfM Photo Range: ______________________

Other SfMs: ____________________________

________________________________________

**6 Required GCPs**

1st GCP: __________ 2nd GCP: ___________

3rd GCP: __________ 4th GCP: ___________

5th GCP: __________ 6th GCP: ___________

Additional GCPs: _______________________

Describe the profile:

________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

**Page 1 of 2**

Figure A. 8: ASWT Profile Section form used at all sites in 2016; page 1 of 2

## ENC Expedition 2016: **Eagle Cave Strat Form**

Site: ____________________

Excav. Area: __________ Excav.Unit: __________

ASWT
Texas State University

**Profile Section:** __________ **Strat:** __________

Date Started: __________

**FN:** __________

Date Completed: __________

Recorder 1: __________ Recorder 2: __________ QAQC: Yes No Initials:

### General Strat Observations

Briefly characterize strat (e.g., thin sandy deposit sloping down toward the dripline): ____________________

Layer Type: __________

Initial Identification: Yes No

Munsell Dry __________

Munsell Wet __________

What are diagnostic attributes of the strat (circle all that apply)?: "Ashy" Fiber Flecked Charcoal

Charcoal Rich Dense FCR Scattered FCR Roof Spalls Small rocks

Decomposing Limestone Disturbed Alluvial Sediment Other

*If Other, Describe:* ____________________

Matrix Texture (circle all that apply): Sand Sandy-Loam Loam Silt Loam Clay Loam Clay

Fiber Charcoal Gritty Silty Other

Matrix Consistency (circle all that apply): Extremely Firm Firm Friable Loose

Does the strat matrix appear mixed? Describe____________________

What additional cultural materials are observed (circle all that apply)?: Chipped-Stone Groundstone FCR

Manuports Animal Bone Mussel Shell Snail Shell Other

How distinct is the lower strat boundary? Very Abrupt Abrupt Clear Gradual Diffuse Unobserved

What is the topography of the lower strat boundary? Smooth Wavy Irregular Broken Sloping Unobserved

Briefly describe any bioturbation (e.g., for burrows describe size, frequency, and orientation): ____________________

Figure A. 9: ASWT Profile Section form used at all sites in 2016; page 2 of 2



Figure A.10: ASWT Strat form used at all sites in 2016; page 1 of 2

# Strat Form

## Stratigraphic Observations

Strats overlaying and contacting this Strat: ____________________

Strats intruding into this Strat: ____________________

Strats originating from this Strat: ____________________

Strats underlying and contacting this Strat: ____________________

Does Strat continue beyond the section? Yes No Unknown

If "Yes," is the strat ID'd in other sections? Yes No

If "Yes," list the Profile Sections: ____________________

**Measurements from GIS**

Elevation of uppermost portion of strat: ____________________

Elevation of lowermost portion of strat: ____________________

Max Thickness of Strat: ____________________

## General Strat Description

Is this strat part of a feature? If so, describe how it relates to other strats within the feature and list the feature FN:

____________________

Additional Strat Notes: ____________________

## Strat Sampling

**Geomatrix Sample** FN#: ____________________

**Spot Sample** FN#: ____________________

**$^{14}$C Sample** FN#: ____________________

**Other Samples** FN#: ____________________

**Artifacts** FN#: ____________________

**Strat Sampling Protocols:**

Collect the following samples directly from the profile:

1 Spot Sample 1 Geo-matrix Sample

If appropriate, collect a $^{14}$C sample

List any additional samples or artifacts collected from profile

Sample Notes: ____________________

**Page 2 of 2**

Figure A.11: ASWT Strat form used at all sites in 2016; page 2 of 2

## Eagle Nest Canyon Expedition 2016: **Feature Form**

Site: ______________________________

ASWT
*Texas State University*

Excavation Area: ______________________

Recorder 1: ______________

Excav. Unit: ___________ Layer: ________

Recorder 2: ______________

Section: __________________________

Date Started: ______________

**Feature:** ___________

Date Completed: ___________

**Field Number:** _________________

QAQC: Yes No Initials:

### General Feature Observations

Feature Description: ________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

Strats Included in Feature: _______________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

**Page 1 of 3**

Figure A.12: ASWT Feature form used at all sites in 2016; page 1 of 3

## Feature Form

F_______ page 2 of 3

Feature Dimensions: Length ________________ Width __________________

Depth _________________ Height __________________

Impacts/Level of Disturbance: ______________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Associated Artifacts: ____________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Additional Feature Notes (include any special samples taken, additional forms completed, etc.):

________________________________________

________________________________________

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**SfM Data**

SfM Photo Ranges: ______________________

**4 Required GCPs**

1st GCP: ______________________

2nd GCP: ______________________

3rd GCP: ______________________

4th GCP: ______________________

**2 Optional GCPs**

5th GCP: ______________________

6th GCP: ______________________

Additional Feature Photos:

________________________________________

________________________________________

________________________________________

Figure A.13: ASWT Feature form used at all sites in 2016; page 2 of 3

**Feature Form** F_______ page 3 of 3

Site: ________________ Excav Area: ___________________ Feature: _____________

Date: ____________________ Scale: ___________________________ Recorder: _______________________

Figure A.14: ASWT Feature form used at all sites in 2016; page 3 of 3

## Feature Form Rocksort 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 | | | | | | | |

**Camera:** ______________________

**Rock Sort Photos taken?** **Yes** **No** **Photo Range:** ___________________________

Rock Sort Notes: ______________________________________________

Figure A.15: ASWT Rock Sort table used for quantifying and categorizing burned and unburned rock

# APPENDIX B: GPR & AUGER TESTING DATA

Appendix B is all data collected from the GPR and auger testing that was completed in January and February 2016. GPR data was collected by Tiffany Osburn with 270Hz and 400Hz antennae, with assistance by the author and other ASWT crew members. Auger testing followed the GPR transects that criss-crossed the site from north to south and east to west. These complimentary data helped identify areas that we wanted to target with expanded excavation areas, as well as document the upper 3-meters of depostis of the site.

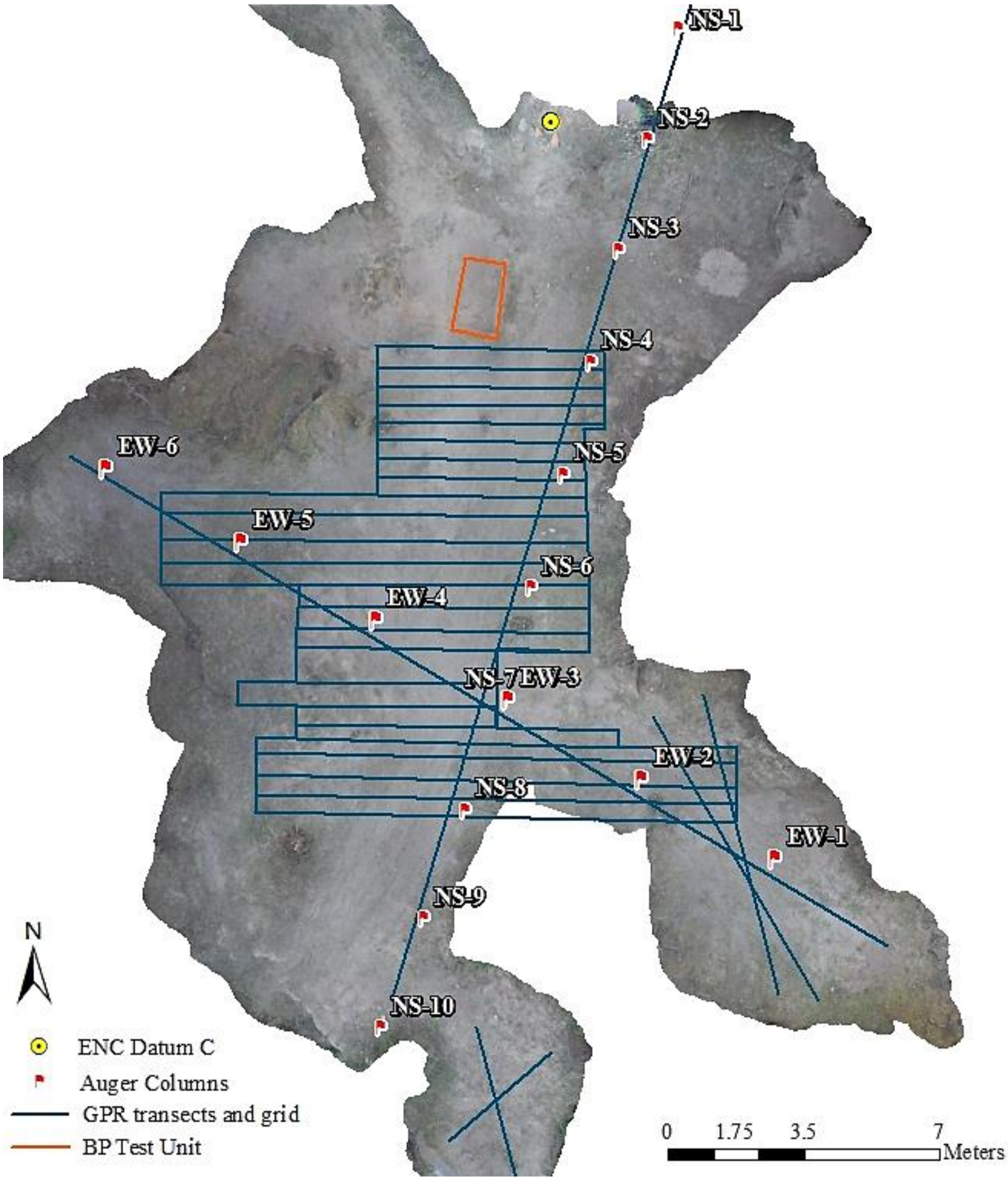


Figure B. 1: Plan map of Sayles Adobe (41VV2239) with the GPR grid, GPR transects, and auger transects.

| 41VV2239 Sayles Adobe: Auger Sampling Data | | | | | | |
|---|---|---|---|---|---|---|
| Location | FN # | Depth (m) | Depth (cmbs) | Color | Texture | Notes |
| EW1: 4m | 50053-01 | 0.12 | 12cm | 7.5YR 4/4 - 10YR 4/4 (wet) | Fine sandy loam | Flecks of organic material throughout; roots, bark, leaves |
| -- | 50053-02 | 0.08 | 20cm | 7.5YR 5/4 | Fine sandy loam | Flecks of organic material; roots, bark, leaves; small pebbles |
| -- | 50053-03 | 0.08 | 28cm | 7.5YR 5/3-5/4 | Fine sand loam | Flecks of organic material; roots, bark, leaves; small pebbles; whiteish inclusions, probably broken up snail shell or limestone |
| -- | 50053-04 | 0.08 | 36cm | 7.5YR 5/3-5/4 | Fine sand loam | Flecks of organic material; roots, bark, leaves; small pebbles; more roots |
| -- | 50053-05 | 0.07 | 43cm | 10YR 5/4 | Fine sand loam | Flecks of organic material; roots, bark, leaves; small pebbles; fragment of burned snail shell |
| -- | 50053-06 | 0.08 | 51cm | 10YR 5/4 | Fine sand loam | Flecks of organic material; roots, bark, leaves; small pebbles |
| -- | 50053-07 | 0.08 | 59cm | 10YR 5/4 | Fine sand loam | Flecks of organic material; roots, bark, leaves; small pebbles |
| -- | 50053-08 | 0.09 | 68cm | 10YR 5/4 | Fine sand loam | Less roots and organics |
| -- | 50053-09 | 0.1 | 78cm | 10YR 5/4 | Fine sand loam | Some roots and organic materials; shell fragment; small peds; no rock |
| -- | 50053-10 | 0.1 | 88cm | 10YR 5/3-5/4 | Fine sand w/silt peds | Possibly hitting mud-drape; silty clumps in the sieve |
| -- | 50053-11 | 0.04 | 92cm | 10YR 6/3-6/4 | Fine sand w/silt peds | Two rocks <1in, one possibly FCR; one 3mm snail shell; FCR frags; peddy; Justin hit something hard at the bottom of this sample |
| -- | 50053-12 | 0.09 | 101cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Firmer peds; less organic material; FCR fragments; Justin was able to move through whatever hard stuff he hit above |
| -- | 50053-13 | 0.1 | 111cm | 10YR 6/3 | Silty-fine sand w/peds | Peddy; small angular rock fragments burned & unburned; root pieces |
| -- | 50053-14 | 0.06 | 117cm | 10YR 6/3 | Silty-fine sand w/peds | Small firm peds in sieve; FCR fragments <1cm in size; small charcoal flecks |
| -- | 50053-15 | 0.04 | 121cm | 10YR 6/3 | Silty-fine sand w/peds | Small firm peds in sieve; FCR fragments <1cm in size; small charcoal flecks |
| -- | 50053-16 | 0.07 | 128cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Small firm peds in sieve; FCR fragments <1cm in size; small charcoal flecks |
| -- | 50053-17 | 0.08 | 136cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Small firm peds in sieve; FCR fragments <1cm in size; small charcoal flecks |
| -- | 50053-18 | 0 | 136cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Small firm peds in sieve; FCR fragments <1cm in size; small charcoal flecks |

| | | | | | | |
|---|---|---|---|---|---|---|
| -- | 50053-19 | 0.04 | 140cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Firm small peds; rock frags <1cm; charcoal flecks |
| -- | 50053-20 | 0.05 | 145cm | 10YR 6/3-6/4 | Silty-fine sand w/peds | Firm small peds; rock frags <1cm; charcoal flecks |
| -- | 50053-21 | 0.08 | 153cm | 10YR 6/4 | Silty-fine sand w/peds | Firm small peds; no rock frags; small gravels |
| -- | 50053-22 | 0.06 | 159cm | 10YR 6/3 | Fine sand-silt loam | Sediment feels more compact while drilling; firm silty peds & sandy peds |
| -- | 50053-23 | 0.04 | 163cm | 10YR 6/3 | Fine sand-silt loam | Small peds but little else |
| -- | 50053-24 | 0.05 | 168cm | 10YR 6/3 | Very fine sand loam | Lots of 1-3mm peds & little else; wettish |
| -- | 50053-25 | 0.08 | 176cm | 10YR 6/3 | Silty-very fine sand loam | One unburned ~1in; FCR frag ~5mm; silt peds |
| -- | 50053-26 | 0.03 | 179cm | 10YR 6/4 | Fine sand-silt loam | Some seed pods; mostly small peds; loose |
| -- | 50053-27 | 0.03 | 182cm | 10YR 6/3 | Fine sand-silt loam | Some organics; small peds; loose; one FCR frag <1in |
| -- | 50053-28 | 0.1 | 192cm | 10YR 6/4 | Fine sand-silt loam | Loose when sieved; a bit of resisitance while turning; few organics; one 2mm snail shell |
| -- | 50053-29 | 0.08 | 200cm | 10YR 6/4 | Fine sand-silt loam | Loose when sieved; a bit of resisitance while turning; few organics |
| -- | 50053-30 | 0.08 | 208cm | 10YR 6/4 | V.F. sandy-silt loam | Loose when sieved; a bit of resisitance while turning; few organics |
| -- | 50053-31 | 0.07 | 215 | 10YR 6/3-6/4 | Silty-v.f. sand loam | Firmer peds but otherwise similar to samples above |
| -- | 50053-32 | 0.09 | 224 | 10YR 6/3-6/4 | Silty-v.f. sand loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds |
| -- | 50053-33 | 0.07 | 231 | 10YR 6/4 | Silty-v.f. sand loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds; one FCR ~1in |
| -- | 50053-34 | 0.05 | 236 | 10YR 6/4 | Silty-v.f. sand loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds; small charcoal piece |
| -- | 50053-35 | 0.09 | 245 | 10YR 6/4 | Silty-v.f. sand loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds; 1-2mm snail shell |
| -- | 50053-36 | 0.08 | 253 | 10YR 6/4 | Silty-v.f. sand loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds |
| -- | 50053-37 | 0.06 | 259 | 10YR 6/4 | Fine sandy-silt loam | Firmer larger peds (mm-1cm), with looser sediment; lots of peds, but with sandier peds |
| -- | 50053-38 | 0.07 | 266 | 10YR 6/4 | Fine sandy-silt loam | Firm-soft sandy-silt peds |
| -- | 50053-39 | 0.07 | 273 | 10YR 6/4 | Fine sandy-silt | Firm-soft sandy-silt peds |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | loam | |
| -- | 50053-40 | 0.08 | 281 | 10YR 6/4 | Fine sandy-silt loam | Firm-soft sandy-silt peds |
| EW2: 8m | 50054-01 | | 10 | 10 YR 5/4 | Fine sandy loam | Organic rich; roots, leaves, oher decaying stuff |
| -- | 50054-02 | | 20 | 10 YR 5/3 | Fine sandy loam | Organic rich; roots, leaves, oher decaying stuff; snail shell frag; small peds |
| -- | 50054-03 | | 29 | 10 YR 6/3 | Fine sandy loam | Less organic materials; some roots |
| -- | 50054-04 | | 34 | 10 YR 5/3 | Fine sandy loam | Less organic materials; some roots |
| -- | 50054-05 | | 45 | 10YR 6/3 - 5/3 | Fine sandy loam | Some roots; snail shell fragments |
| -- | 50054-06 | | 55 | 10 YR 5/3 | Fine sandy loam | Snail shell frag; fragmented organic pieces |
| -- | 50054-07 | | 65 | 10 YR 5/3 | Fine sandy loam | Very homogenous |
| -- | 50054-08 | | 77 | 10 YR 5/3 | Fine sandy loam | Very homogenous |
| -- | 50054-09 | | 85 | 10 YR 5/3 | Fine sandy loam | Very homogenous; mini millipede |
| -- | 50054-10 | | 94 | 10 YR 5/3 | Fine sandy loam | Hitting roots while turning; few 1mm peds |
| -- | 50054-11 | | 103 | 10YR 5/2-5/3 | Silitier-fine sandy loam | One FCR ~1in; 2mm snail shell; firm peds; 3 FCR frags |
| -- | 50054-12 | | 109 | 10YR 5/2 | V.F. sandy-silt loam | >1in FCR & FCR fragments; lots of charcoal; snail frag |
| -- | 50054-13 | | 118 | 10YR 5/2 | V.F. sandy-silt loam | Less couscous peds; FCR frag (<1cm->1cm) |
| -- | 50054-14 | | 127 | 10 YR 5/3 | V.F. sandy-silt loam | Less <1in FCR; less charcoal; more couscous |
| -- | 50054-15 | | 132 | 10YR 5/3-6/3 | V.F. sandy-silt loam | Snail shell; some charcoal; hackberry seed; little couscous |
| -- | 50054-16 | | 137 | 10YR 6/3-6/4 | Silty-vf sandy loam | Peddy mm-2cm size soft to semi-firm peds |
| -- | 50054-17 | | 147 | 10YR 6/4 | Silty-vf sandy loam | Peddy mm-2cm size soft to semi-firm peds |
| -- | 50054-18 | | 153 | 10YR 6/3-6/4 | Silty-vf sandy loam | Peddy mm-2cm size soft to semi-firm peds |
| -- | 50054-19 | | 157 | 10YR 6/3-6/4 | Silty-vf sandy loam | Peddy mm-2cm size soft to semi-firm peds |
| -- | 50054-20 | | 163 | 10YR 6/4 | Silty-vf sandy | Soft peds, small peds (2-3mm) |

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|---|---|---|---|---|---|---|
| | | | | | loam | |
| -- | 50054-21 | | 171 | 10YR 6/3-6/4 | Silty-vf sandy loam | Soft-firm peds (2-3mm) |
| -- | 50054-22 | | 178 | 10 YR 6/3 | Silty-vf sandy loam | Fewer soft peds; small FCR frag |
| -- | 50054-23 | | 186 | 10 YR 6/3 | VF Sandy-silt loam | Soft gritty peds mm size |
| -- | 50054-24 | | 194 | 10 YR 6/3 | VF Sandy-silt loam | Few peds; bit gritty; soft peds |
| -- | 50054-25 | | 203 | 10 YR 6/3 | VF Sandy-silt loam | Few peds; bit gritty; soft peds; snail shell frags; some resistance while turning |
| -- | 50054-26 | | 209 | 10 YR 6/3 | Silty-vf sandy loam | Resistance while turning; firm silty peds (mm-~1cm size); lots of peds |
| -- | 50054-27 | | 217 | 10 YR 6/3 | very silty-vf sand loam | Resistance while turning; firm silty peds (mm-~1cm size); lots of couscous peds |
| -- | 50054-28 | | 225 | 10YR 6/3-6/4 | very silty-vf sand loam | Firmer silty peds; angular rock chips |
| -- | 50054-29 | | 233 | 10YR 6/3-6/4 | very silty-vf sand loam | Firmer silty peds; angular rock chips |
| -- | 50054-30 | | 241 | 10YR 6/3-6/4 | very silty-vf sand loam | Hard-firm peds with soft peds too. We got a flake! |
| -- | 50054-31 | | 250 | 10YR 6/4 | very silty-vf sand loam | Hard-firm peds with soft peds too; burned shell fragment |
| -- | 50054-32 | | 256 | 10YR 6/4 | very silty-vf sand loam | Very peddy; unburned rock chips; 8mm snail |
| -- | 50054-33 | | 264 | 10YR 6/4 | very silty-vf sand loam | Very peddy; unburned rock chips; FCR ~.5cm, soft-firm peds |
| -- | 50054-34 | | 270 | 10YR 6/4 | very silty-vf sand loam | Very peddy; unburned rock chips; FCR ~.5cm, soft-firm peds |
| -- | 50054-35 | | 278 | 10YR 6/4 | very silty-vf sand loam | Soft-silty peds; on erock <1in |

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|---|---|---|---|---|---|---|
| EW3: 12m | 50055-01 | | 10 | 10 YR 5/3 (wettish) | VF Sandy-silt loam | Soft peds; organic materials, roots, leaves, etc |
| -- | 50055-02 | | 15 | 10 YR 6/3 | VF Sandy-silt loam | Soft peds; organic materials, roots, leaves, etc |
| -- | 50055-03 | | 23 | 10 YR 6/3 | VF Sandy-silt loam | Soft peds; organic materials, roots, leaves, etc |
| -- | 50055-04 | | 31 | 10 YR 6/3 | VF Sandy-silt loam | Soft peds; organic materials, roots, leaves, etc; snail shell fragment |
| -- | 50055- | | 39 | 10 YR 6/3 | Fine | Less organic materials; some |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 05 | | | | sandy-silt loam | roots; firm peds |
| -- | 50055-06 | | 48 | 10 YR 6/3 | Fine sandy-silt loam | Few very soft peds |
| -- | 50055-07 | | 57 | 10 YR 6/3 | Fine sandy-silt loam | Few very soft peds |
| -- | 50055-08 | | 65 | 10 YR 6/3 | Fine sandy-silt loam | Few very soft peds |
| -- | 50055-09 | | 73 | 10 YR 6/3 | Fine sandy-silt loam | Few very soft peds; hitting some roots |
| -- | 50055-10 | | 82 | 10YR 5/3 | Silty-vf sandy loam | Lots of firm-silty peds; few mm size rocks; couscous peds |
| -- | 50055-11 | | 87 | 10 YR 6/3-5/3 | Silty-vf sandy loam | Hit rock; 2 1in FCR; lots of couscous; small peds semi-firm |
| -- | 50055-12 | | 94 | 10YR 5/3 | very silty-vf sand loam | Flake!; charcoal piece; peddy; lots of couscous |
| -- | 50055-13 | | 104 | 10YR 5/3 | very silty-vf sand loam | 1 FCR <1in; shell frag; lots of firm peds |
| -- | 50055-14 | | 113 | 10YR 5/3 | very silty-vf sand loam | 1in spall(?) frag; peds |
| -- | 50055-15 | | 120 | 10 YR 6/3 | very silty-vf sand loam | Spall frag; 1 flake; charcoal piece; very firm peds |
| -- | 50055-16 | | 128 | 10 YR 6/3 | very silty-vf sand loam | Semi-firm peds; a few angular limestone frags; couscous present |
| -- | 50055-17 | | 138 | 10 YR 6/3 | very silty-vf sand loam | Charcoal; lots of peds;  couscous present |
| -- | 50055-18 | | 144 | 10 YR 6/3 | very silty-vf sand loam | Hit rock or root; charcoal; few FCR chips; peddy |
| -- | 50055-19 | | 149 | 10 YR 6/3 | very silty-vf sand loam | Hit rock or root; charcoal; few FCR chips; peddy |
| -- | 50055-20 | | 155 | 10 YR 6/3 | very silty-vf sand loam | Hit rock or root; charcoal; few FCR chips; peddy |
| -- | 50055-21 | | 160 | 10 YR 6/3 | very silty-vf sand loam | Soft-firm peds; few FCR chips (<2mm) |
| -- | 50055-22 | | 1.7 | 10 YR 6/3 | Silty-sandy loam | FCR frags; firm-soft peds; snail shell; mud casts;unburned limestone |
| -- | 50055-23 | | 175 | 10 YR 6/4 | Silty-vf sandy | Firm-soft peds; snail shell; small rocks; couscous |

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|---|---|---|---|---|---|---|
| | | | | | loam | |
| -- | 50055-24 | | 181 | 10 YR 6/4 | Silty-vf sandy loam | Soft peds silty; some hard peds; couscous |
| -- | 50055-25 | | 189 | 10 YR 6/4 | Silty-vf sandy loam | One FCR frag ~1in; small charcoal pieces; soft silty peds |
| -- | 50055-26 | | 197 | 10 YR 6/4 | Silty-vf sandy loam | Small charcoal pieces; soft silty peds |
| -- | 50055-27 | | 204 | 10 YR 6/4 | Silty- fine sandy loam | Small charcoal pieces; soft silt-sand peds; hard silty peds; couscous; gritty |
| -- | 50055-28 | | 213 | 10 YR 6/4 | Silty- fine sandy loam | Small charcoal pieces; soft silt-sand peds; hard silty peds; couscous; gritty |
| -- | 50055-29 | | 221 | 10 YR 6/4 | Silty- fine sandy loam | Small charcoal pieces; soft silt-sand peds; hard silty peds; couscous; gritty; mm snails; small angular limestone frags; bit grittier |
| -- | 50055-30 | | 230 | 10 YR 6/4 | Silty- fine sandy loam | Couscous; firm peds; gritty |
| -- | 50055-31 | | 237 | 10 YR 6/4 | Fine sandy-silt loam | Lots of soft peds; couscous; tough to turn auger |
| -- | 50055-32 | | 244 | 10 YR 6/4 | Fine sandy-silt loam | Lots of soft peds; couscous; tough to turn auger; NO SAMPLE COLLECTED |
| -- | 50055-33 | | 251 | 10YR 6/3-6/4 | Fine sandy-silt loam | Hard silty peds --> angular; few small limestone pieces; tough to turn auger |
| -- | 50055-34 | | 260 | 10 YR 6/4 | Silty- fine sandy loam | Couscous; lots of peds; tough to turn auger |
| -- | 50055-35 | | 264 | 10 YR 6/4 | Silty- fine sandy loam | Very angular hard silty peds; very tough turning |
| -- | 50055-36 | | 272 | 10 YR 6/4 | Silty- vf sandy loam | Small to 2cm silty peds; some soft rounded peds; firm-hard angular peds; couscous |
| -- | 50055-37 | | 278 | 10 YR 6/4 | very silty-fine sand loam | Sieve full of angular very hard silty chunks; some mm size some ~2cm; couscous |

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|---|---|---|---|---|---|---|
| EW4: 16m | 50056-01 | | 14 | 10YR 5/4 | Fine sandy-silt loam | Organic deitritus; soft sandy peds; organic flecks through sieve |
| -- | 50056-02 | | 22 | 10YR 5/4 | Fine sandy-silt loam | Organic deitritus; soft sandy peds; organic flecks through sieve |
| -- | 50056-03 | | 31 | 10YR 5/3 | Fine sandy-silt loam | Organic deitritus; soft sandy peds; organic flecks through sieve; some couscous; fine roots |

| | | | | | | |
|---|---|---|---|---|---|---|
| -- | 50056-04 | | 39 | 10YR 5/3-6/3 | Silty- fine sandy loam | Hitting roots making it difficult to pull up auger w/o losing sediment; less peds |
| -- | 50056-05 | | 50 | 10YR 6/3 | Silty- fine sandy loam | Hitting roots making it difficult to pull up auger w/o losing sediment; less peds |
| -- | 50056-06 | | 60 | 10YR 6/3 | Silty- fine sandy loam | Almost no peds; roots |
| -- | 50056-07 | | 69 | 10YR 6/3 | V.F. sandy-silt loam | Almost no peds; roots |
| -- | 50056-08 | | 78 | 10YR 6/3 | V.F. sandy-silt loam | Almost no peds; roots; very loose |
| -- | 50056-09 | | 86 | 10YR 6/3 | V.F. sandy-silt loam | Harder silty angular peds; firm sandy-silt peds; one microdeb; tough to turn |
| -- | 50056-10 | | 92 | 10YR 6/3 | Silty- vf sandy loam | Charcoal chunks; peds; tough to turn |
| -- | 50056-11 | | 102 | 10YR 6/3 | Silty- vf sandy loam | Small charcoal pieces; few <1in FCR frags; peds; tough to turn |
| -- | 50056-12 | | 109 | 10YR 6/3 | Silty- vf sandy loam | Lots of small mm-1cm sized firm sandy peds; few charcoal pieces; couscousy |
| -- | 50056-13 | | 117 | 10YR 6/3 | Silty- vf sandy loam | Soft-firm peds; snail shell; spall? Frag; couscous |
| -- | 50056-14 | | 125 | 10YR 6/3 | Silty- vf sandy loam | Soft-firm peds; snail shell; FCR frag; couscous |
| -- | 50056-15 | | 131 | 10YR 6/3 | Silty- vf sandy loam | Soft-firm peds; snail shell; couscous; some charcoal; FCR frags |
| -- | 50056-16 | | 140 | 10YR 6/3 | Silty- vf sandy loam | Soft-firm peds; snail shell; spall? Frag; couscous; hit something |
| -- | 50056-17 | | 149 | 10YR 6/3 | Silty- vf sandy loam | FCR frags that we had to break through |
| -- | 50056-18 | | 156 | 10YR 6/3 | Silty- vf sandy loam | Flake!; gritty lots of peds; some couscous; some FCR <1in frags |
| -- | 50056-19 | | 164 | 10YR 6/3 | Silty- vf sandy loam | peds, root pieces |
| -- | 50056-20 | | 164 | 10YR 6/3 | Silty- vf sandy loam | Lots of small peds; sandy peds; one FCR ~1in; couscous |

| | | | | | | |
|---|---|---|---|---|---|---|
| EW5: 20m | 50057-01 | | 10 | 10YR 5/3 | Silty-sand loam | Organic detritus; soft peds; couscous |
| -- | 50057- | | 19 | 10YR 5/3 | Silty-sand | Organic detritus; soft peds; |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 02 | | | | loam | couscous |
| -- | 50057-03 | | 23 | 10YR 5/3 | Very silty-vf sandy loam | Organic detritus; soft peds; lots of peds |
| -- | 50057-04 | | 30 | 10YR 6/3-6/4 | Very silty-vf sandy loam | Organic detritus; soft peds; couscous |
| -- | 50057-05 | | 39 | 10YR 6/3 | Very silty-vf sandy loam | Organic detritus; soft peds; couscous |
| -- | 50057-06 | | 48 | 10YR 6/3 | Very silty-vf sandy loam | Less organic; lots of soft peds |
| -- | 50057-07 | | 55 | 10YR 6/3 | Silty- vf sand loam | Less couscous; few roots; mostly small peds |
| -- | 50057-08 | | 63 | 10YR 6/3 | Silty- vf sand loam | Few peds; soft; some couscous |
| -- | 50057-09 | | 70 | 10YR 6/3 | Silty- vf sand loam | Few peds; soft; some couscous |
| -- | 50057-10 | | 80 | 10YR 6/3 | Silty- vf sand loam | Very little roots; very soft peds; few couscous |
| -- | 50057-11 | | 88 | 10YR 6/3 | Silty- vf sand loam | Firmer peds; few couscous |
| -- | 50057-12 | | 97 | 10YR 6/3 | Silty- vf sand loam | Few silty angular ped (mud-drape?); some couscous |
| -- | 50057-13 | | 110 | 10YR 6/3 | Silty- vf sand loam | Snail; hard silty peds; no FCR; mud-drape?; charcoal soft peds; small rock frags; couscous |
| -- | 50057-14 | | 120 | 10YR 6/3 | Silty- vf sand loam | Soft-hard peds; lots of small peds; no charcoal; FCR chip |
| -- | 50057-15 | | 128 | 10YR 6/3 | Silty- vf sand loam | Less peds; hard peds small; one charcoal piece; couscousy |
| -- | 50057-16 | | 137 | 10YR 6/3 | Silty- vf sand loam | Rock frags; soft peds; some couscous |
| -- | 50057-17 | | 144 | 10YR 6/3 | Silty- vf sand loam | Soft-hard peds; charcoal frags |
| -- | 50057-18 | | 151 | 10YR 6/3 | Silty- vf sand loam | Soft-hard peds; charcoal frags; rock frags; lots of couscous |
| -- | 50057-19 | | 159 | 10YR 6/3-6/4 | Silty- vf sand loam | Soft-hard peds; rock frags; lots of couscous; snail |
| -- | 50057-20 | | 165 | 10 YR 6/4 | Silty- fine sandy loam | Soft-hard peds; gritty; couscous; snail |
| -- | 50057-21 | | 170 | 10 YR 6/4 | Silty- fine sandy loam | Charcoal; snail; hard small angular silt peds; firm rounded peds; FCR chips |
| -- | 50057-22 | | 178 | 10 YR 6/4 | Silty- fine sandy loam | Some soft silt-sand peds; couscous |
| -- | 50057-23 | | 183 | 10 YR 6/4 | Fine sandy-silt loam | Lots of peds; firm & silty; lots of couscous |
| -- | 50057-24 | | 188 | 10 YR 6/4 | Silty-fine sandy loam | Tough turning; lots of angular silty-mud peds (mm-cm size); lots of couscous; |

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| -- | 50057-25 | | 192 | 10 YR 6/4 | Silty-fine sandy loam | Tough turning; lots of angular silty-mud peds (mm-cm size); lots of couscous |
| -- | 50057-26 | | 195 | 10 YR 6/4 | Very silty-vf sandy loam | Tough turning; lots of angular silty-mud peds (mm-cm size); lots of couscous |
| -- | 50057-27 | | 204 | 10 YR 6/4 | Very silty-sandy loam | Sandy rounded peds; couscous; gritty |
| -- | 50057-28 | | 207 | 10 YR 6/4 | Silty- fine sandy loam | Silty rounded firm-hard 7 soft |
| -- | 50057-29 | | 216 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of rounded slty soft-firm-hard peds; couscous |
| -- | 50057-30 | | 222 | 10YR 6/3 | Very silty-vf sandy loam | Lots of rounded slty soft-firm-hard peds; couscous; gritty |
| -- | 50057-31 | | 228 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of rounded slty soft-firm-hard peds; couscous; very silty; powdery |
| -- | 50057-32 | | 236 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of soft-hard silty-gritty peds; couscous |
| -- | 50057-33 | | 243 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of soft-hard silty-gritty peds; couscous; snail; unburned rock |
| -- | 50057-34 | | 250 | 10YR 6/3 | Very silty-vf sandy loam | Rounded peds (mm-cm size); unburned rock pieces; couscous |
| -- | 50057-35 | | 256 | 10YR 6/3 | Very silty-vf sandy loam | Rounded peds (mm-cm size); couscous; slightly gritty |
| -- | 50057-36 | | 260 | 10YR 6/3 | Very silty-vf sandy loam | Hit rock; FCR chip; small charcoal piece |
| EW6: 24m | 50058-01 | | 12 | 10YR 5/3-5/4 | Sandy-silt loam | Organic detritus; soft peds; couscous |
| -- | 50058-02 | | 20 | 10YR 5/3-5/4 | Sandy-silt loam | Organic detritus; soft peds; couscous |
| -- | 50058-03 | | 27 | 10YR 6/4 | Fine sandy-silt loam | Organic detritus; soft peds; couscous; clods of dirt |
| -- | 50058-04 | | 37 | 10YR 6/4 | Fine sandy-silt loam | Soft-firm peds; couscous |
| -- | 50058-05 | | 44 | 10YR 6/4 | Fine sandy-silt loam | Soft small peds; roots; couscous |
| -- | 50058-06 | | 52 | 10YR 6/4 | Silty-fine sandy loam | Soft small peds; roots; couscous |
| -- | 50058-07 | | 58 | 10YR 6/4 | Silty-fine sandy | Round swirly snail; few soft peds; couscous |

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| | | | | | loam | |
| -- | 50058-08 | | 62 | 10YR 6/4 | Silty-fine sandy loam | Few small soft peds; couscous |
| -- | 50058-09 | | 67 | 10YR 6/4 | V silty-fine sandy loam | Angular hard peds; no organics; couscous |
| -- | 50058-10 | | 76 | 10YR 6/4 | Silty-fine sandy loam | Lots of peds; tough angular silty; couscous |
| -- | 50058-11 | | 80 | 10YR 6/4 | Silty-fine sandy loam | Angular hard peds; small unburned rock frags; couscous |
| -- | 50058-12 | | 85 | 10YR 6/4 | Silty-fine sandy loam | FCR pieces; round firm peds; fine roots |
| -- | 50058-13 | | 90 | 10YR 6/4 | Silty-fine sandy loam | Round firm-soft gritty peds; charcoal pieces; silty-sandy peds |
| -- | 50058-14 | | 96 | 10YR 6/4 | Silty-fine sandy loam | Lots of rounded peds; fine roots; mostly firm peds; little charcoal |
| -- | 50058-15 | | 106 | 10YR 6/4 | Silty-fine sandy loam | Lots of peds; plant material; soft & hard; silty angular; gritty |
| -- | 50058-16 | | 114 | 10YR 6/4 | V silty-fine sandy loam | Lots of peds; plant material; soft & hard; silty angular; gritty; some charcoal |
| -- | 50058-17 | | 122 | 10YR 6/4 | V silty-fine sandy loam | Hard silty angular peds; soft rounded peds; maybe mud-drape?; small Charcoal pieces; fine roots |
| -- | 50058-18 | | 129 | 10YR 6/4 | V silty-vf fine sandy loam | Hard silty angular peds; soft rounded peds; maybe mud-drape?; small Charcoal pieces; fine roots; ~2cm soft round peds |
| -- | 50058-19 | | 135 | 10YR 6/4 | V silty-vf fine sandy loam | Roundish firm; some angular; fine roots |
| -- | 50058-20 | | 141 | 10YR 6/4 | V silty-vf fine sandy loam | Angular firm peds; lots of peds; silty |
| -- | 50058-21 | | 149 | 10YR 6/4 | Silty- vf sand loam | Round firm-soft; roots |
| -- | 50058-22 | | 155 | 10YR 6/4 | Silty- vf sand loam | Roundish; roots; silty |
| -- | 50058-23 | | 161 | 10YR 6/4 | Silty- vf sand loam | Roundish; roots; soft silty |
| -- | 50058-24 | | 169 | 10YR 6/4 | V silty- vf sandy loam | Roundish; roots; soft silty |
| -- | 50058-25 | | 176 | 10YR 6/4 | V silty- vf sandy loam | Angular firm silty (mud-drape?); peds angular & rounded; tough to turn through; lots of couscous |

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| -- | 50058-26 | | 180 | 10YR 6/4 | V silty- vf sandy loam | Angular firm silty (mud-drape?); peds angular & rounded; tough to turn through; lots of couscous |
| -- | 50058-27 | | 193 | 10YR 6/4 | V silty- vf sandy loam | Angular firm silty (mud-drape?); smaller peds angular & rounded; tough to turn through; lots of couscous |
| -- | 50058-28 | | 201 | 10YR 6/4 | V silty- vf sandy loam | Rounded peds; firm-hard; some couscous |
| -- | 50058-29 | | 205 | 10YR 6/4 | V silty- vf sandy loam | Firm-hard angular; lots of couscous |
| -- | 50058-30 | | 211 | 10YR 6/4 | V silty- vf sandy loam | Firm-hard angular; lots of couscous; root |
| -- | 50058-31 | | 221 | 10YR 6/4 | V silty- vf sandy loam | Firm-soft lots of mm-cm; silty; couscous |
| -- | 50058-32 | | 230 | 10YR 6/4 | V silty- vf sandy loam | Firm-soft lots of mm-cm; silty; couscous |
| NS1: 0m | 50096-01 | 0.1 | 10 | 10 YR 4/4 | Very fine sand-silt loam | Organic debris |
| -- | 50096-02 | 0.18 | 28 | 10 YR 5/4 | Very fine sand-silt loam | few roots |
| -- | 50096-03 | 0.09 | 37 | 10 YR 5/4 | Very fine sand-silt loam | roots; 2 <1 in pieces of FCR |
| -- | 50096-04 | 0.09 | 48 | 10 YR 5/4 | Very fine sand-silt loam | Roots; small FCR (<2cm); charcoal; some couscous |
| -- | 50096-05 | 0.09 | 57 | 10 YR 5/4 | Very fine sand-silt loam | 2-3cm sized angular pebles; charcoal fleck; fine roots |
| -- | 50096-06 | 0.11 | 68 | 10 YR 6/3-6/4 | Very fine sand-silt loam | 1 chert flake (1/8"_; charcoal flecks; some couscous |
| -- | 50096-07 | 0.12 | 80 | 10 YR 6/3 | Very fine sand-silt loam | clumps of grey sediment; charcoal flecks; 1 FCR chip ~3cm; couscous; a few small angular gravels |
| -- | 50096-08 | 0.1 | 90 | 10 YR 6/3 | Very fine sand-silt loam | snail shell; roots; charcoal pieces; angular; some angular pebbles |
| -- | 50096-09 | 0.05 | 95 | 10 YR 6/3 | Very fine sand-silt loam | 1in unburned rock angular; charcoal flecks |
| -- | 50096-10 | 0.02 | 97 | 10 YR 5/3 | Very fine sand-silt loam | Small angular ub. Rock; 15+ charcoal flecks; large rock hit at bottom |

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| -- | 50096-11 | 0.02 | 99 | 10 YR 5/3 | Silty- vf sand loam | 1 chert flake; 2" burned rocks angular; smll charcoal; smll FCR angular chips |
| -- | 50096-12 | 0 | 99 | 10 YR 5/3 | Silty- vf sand loam | 1 chert flake; 3.5" FCR angular; small charcoal; debris, small FCR angular chips |
| -- | 50096-13 | 0.07 | 106 | 10 YR 5/2 | Silty- vf sand loam | Organic pieces; lots of small FCR, & charcoal pieces; small gravels unburned |
| -- | 50096-14 | 0.04 | 110 | 10 YR 4/2 | Silty- vf sand loam | 1" angular FCR; 2 1/4" FCR angular;3 1/8" deb; small ang gravels; charcoal |
| -- | 50096-15 | 0.06 | 116 | 10 YR 5/2 | Silty- vf sand loam | 5 1" FCR ang; charcoal debris; small ang gravels; 2 deb (1/8" & 1/4") |
| -- | 50096-16 | 0.1 | 126 | 10 YR 5/2 | Silty- vf sand loam | 2 basalt deb (1/2" & 1/8"); FCR >1in; b & ub angular gravels |
| -- | 50096-17 | 0.05 | 131 | 10 YR 5/3 | Silty- vf sand loam | 1 1" FCR ang; 15 1/4" FCR ang; b & ub angular gravels; charcoal debris; 1 1/8" microdeb |
| -- | 50096-18 | 0.06 | 137 | 10 YR 6/3 | Silty- vf sand loam | lots of angular b&ub gravels; char deb; few 1/4" ang FCR |
| -- | 50096-19 | 0 | 137 | 10 YR 6/3 | Silty- vf sand loam | >1in FCR; charcoal deb |
| NS2: 3m | 50097-01 | 0.15 | 15 | 10 YR 4/4 | Sandy-silt loam | Organics; small bone frag; ang gravel pieces; roots |
| -- | 50097-02 | 0.1 | 25 | 10YR 5/4 | Sandy-silt loam | Roots; very little in sieve; 1 (1/8") chert |
| -- | 50097-03 | 0.05 | 30 | 10YR 5/4 | Sandy-silt loam | Roots; shell frag; seed casing |
| -- | 50097-04 | 0.06 | 36 | 10YR 5/4 | Sandy-silt loam | Roots; shell frag |
| -- | 50097-05 | 0.09 | 45 | 10 YR 4/3 | Fine sandy-silt loam | Roots; charcoal pieces; small gravels; couscous |
| -- | 50097-06 | 0.06 | 51 | 10 YR 4/2 | Fine sandy-silt loam | Lots of charcoal; 1/4" chert; angular b& ub gravels; couscous |
| -- | 50097-07 | 0.06 | 57 | 10 YR 4/2 | Fine sandy-silt loam | 1 >7.5cm FCR; charcoal; roots; couscous. Hit rock; moved column 50cm SW, and hit rock again. |
| NS3: 6m | 50098-01 | 0.04 | 4 | 10 YR 4/4 (wet) | Fine sandy-silt loam | Organic rich |
| -- | 50098-02 | 0.1 | 14 | 10 YR 5/4 (wet) | Fine sandy-silt loam | FCR pieces; organics |
| -- | 50098-03 | 0.1 | 24 | 10 YR 4/3 (wet) | Fine sandy-silt loam | FCR pieces; organics |
| -- | 50098-04 | 0.07 | 31 | 10 YR 4/3 (wet) | Fine sandy-silt loam | FCR pieces; organics |
| -- | 50098- | 0.06 | 37 | 10 YR 4/3 | Fine | Burned & unburned rocks; |

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| | 05 | | | (wet) | sandy-silt loam | couscous |
| -- | 50098-06 | 0.04 | 41 | 10 YR 4/3 (wet) | Fine sandy-silt loam | Burned & unburned rocks; couscous; roots |
| -- | 50098-07 | 0.06 | 47 | 10 YR 4/4 (wet) | Silty- fine sandy loam | Burned & unburned rocks; couscous; charcoal flecks |
| -- | 50098-08 | 0.05 | 52 | 10 YR 5/4 (wet) | Silty- fine sandy loam | Burned & unburned rocks; couscous; charcoal flecks; roots |
| -- | 50098-09 | 0.05 | 57 | 10 YR 6/3 | Silty- fine sandy loam | Burned & unburned rocks; couscous; charcoal flecks |
| -- | 50098-10 | 0.07 | 64 | 10 YR 6/3 | Silty- fine sandy loam | Burned & unburned rocks; couscous; charcoal flecks |
| -- | 50098-11 | 0.09 | 73 | 10 YR 6/3 | Very silty-fine sandy loam | Roots; 1-3 small angular rocks; couscous |
| -- | 50098-12 | 0.03 | 76 | 10 YR 6/3 - 6/4 | Very silty-fine sandy loam | Charcoal; roots; angular pebbles; couscous |
| -- | 50098-13 | 0.06 | 82 | 10 YR 6/3 - 6/4 | Very silty-fine sandy loam | Charcoal; roots; angular pebbles; couscous |
| -- | 50098-14 | 0.06 | 88 | 10 YR 6/3 - 6/4 | Silty- fine sandy loam | Flake; lots of angular firm-hard peds; couscous |
| -- | 50098-15 | 0.08 | 96 | 10 YR 6/3 | Silty- fine sandy loam | 2 flakes (1/4"); rocks angular; firm-hard peds; couscous |
| -- | 50098-16 | 0.05 | 101 | 10 YR 6/3 | Silty- fine sandy loam | rocks angular; firm-hard peds; 1 small snail; couscous |
| -- | 50098-17 | 0.09 | 110 | 10 YR 6/3 | Silty- fine sandy loam | Small firm peds; 1 1in rock; few peds; couscous |
| -- | 50098-18 | 0.07 | 117 | 10 YR 6/3 | Silty- fine sandy loam | FCR piece (5cm); firm-soft peds |
| -- | 50098-19 | 0.04 | 121 | 10 YR 6/4 | Silty- fine sandy loam | Roots; subangular silty; couscous |
| -- | 50098-20 | 0.06 | 127 | 10 YR 6/4 | Silty- fine sandy loam | Roots; subangular silty; couscous |
| -- | 50098-21 | 0.05 | 132 | 10 YR 6/4 | Very silty-fine sandy loam | Roots; subangular silty; couscous |
| -- | 50098-22 | 0.08 | 140 | 10 YR 6/3 | Very silty-fine sandy loam | Roots; subangular silty; couscous |
| -- | 50098-23 | 0.06 | 146 | 10 YR 6/3 | Very silty-fine sandy | Roots; subangular silty; couscous |

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| -- | 50098-24 | 0.07 | 153 | 10 YR 6/3 | Very silty-fine sandy loam | Roots; subangular silty; couscous |
| -- | 50098-25 | 0.09 | 162 | 10 YR 6/4 | Very silty-fine sandy loam | Firm-soft peds |
| -- | 50098-26 | 0.06 | 168 | 10 YR 6/4 | Very silty-fine sandy loam | Angular rock chips; soft peds |
| -- | 50098-27 | 0.07 | 175 | 10 YR 6/4 | Very silty-fine sandy loam | Angular rock chips; soft peds |
| -- | 50098-28 | 0.06 | 181 | 10 YR 6/4 | Very silty-fine sandy loam | Angular rock chips; soft peds |
| -- | 50098-29 | 0.08 | 189 | 10 YR 6/3 | Very silty-fine sandy loam | Angular rock chips; soft peds |
| -- | 50098-30 | 0.09 | 198 | 10 YR 6/3 | Very silty-fine sandy loam | Burned & unburned angular chips; roots |
| -- | 50098-31 | 0.06 | 204 | 10 YR 6/3 | Very silty-fine sandy loam | ~1in FCR rock chips; peds |
| -- | 50098-32 | 0.07 | 211 | 10 YR 6/3 | Very silty-fine sandy loam | A few rock chips; peds |
| -- | 50098-33 | 0.09 | 220 | 10 YR 6/3 | Very silty-fine sandy loam | A few rock chips; peds |
| -- | 50098-34 | 0.05 | 225 | 10 YR 6/3 | Very silty-fine sandy loam | Roots; small angular rock chips |
| -- | 50098-35 | 0.07 | 232 | 10 YR 6/4 | Very silty-fine sandy loam | Hard peds; roots; b & ub rock chips; couscous |
| -- | 50098-36 | 0.1 | 242 | 10 YR 6/4 | Very silty-fine sandy loam | Soft small peds; roots; couscous |
| -- | 50098-37 | 0.07 | 249 | 10 YR 6/4 | Very silty-fine sandy loam | Few ub rock frags; soft peds |
| -- | 50098-38 | 0.09 | 258 | 10 YR 6/4 | Very silty-fine sandy loam | Few ub rock frags; soft peds |
| -- | 50098-39 | 0.08 | 266 | 10 YR 6/4 | Very silty-fine sandy loam | Soft peds |
| -- | 50098-40 | 0.07 | 273 | 10 YR 6/4 | Very silty-fine sandy loam | Few ub rock frags; soft peds; tiny snails |
| -- | 50098-41 | 0.08 | 281 | 10 YR 6/4 | Very silty-fine sandy loam | Few angular gravels; soft-firm peds |

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| NS4: 9m | 50099-01 | 0.06 | 6 | 10 YR 5/3 | Fine sandy-silt loam | Lots of organic plant materials |
| -- | 50099-02 | 0.09 | 15 | 10 YR 5/4 | Fine sandy-silt loam | Some organics |
| -- | 50099-03 | 0.1 | 25 | 10 YR 5/4 | Fine sandy-silt loam | Roots |
| -- | 50099-04 | 0.07 | 32 | 10 YR 5/4 | Fine sandy-silt loam | Roots |
| -- | 50099-05 | 0.09 | 41 | 10 YR 5/4 | Fine sandy-silt loam | Roots |
| -- | 50099-06 | 0.08 | 49 | 10 YR 5/4 | Silty-fine sandy loam | Roots; some darker (5/3) clods |
| -- | 50099-07 | 0.04 | 53 | 10 YR 4/2 | Silty-vf sandy loam | Large root fragments; chert flake **We got stuck here by rock, moved over 40cm and got stopped at the same level** |
| NS5: 12m | 50100-01 | 0.09 | 9 | 10 YR 5/4 (wet) | Sandy-silt loam | Organic plant materials |
| -- | 50100-02 | 0.06 | 15 | 10 YR 5/4 (wet) | Sandy-silt loam | Less organics, but plenty of roots |
| -- | 50100-03 | 0.09 | 24 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Less organics, but plenty of roots |
| -- | 50100-04 | 0.08 | 32 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Less organics, but plenty of roots |
| -- | 50100-05 | 0.08 | 40 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Less organics, but plenty of roots |
| -- | 50100-06 | 0.06 | 46 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |
| -- | 50100-07 | 0.09 | 55 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |
| -- | 50100-08 | 0.06 | 61 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |
| -- | 50100-09 | 0.07 | 68 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |
| -- | 50100-10 | 0.05 | 73 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |
| -- | 50100-11 | 0.06 | 79 | 10 YR 5/4 (wet) | Fine sandy-silt loam | A few roots |

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| -- | 50100-12 | 0.13 | 92 | 10 YR 6/4-5/4 | Fine sandy-silt loam | A few roots |
| -- | 50100-13 | 0.08 | 100 | 10 YR 6/4 | Silty-fine sandy loam | Very fine roots; mud-silt frags |
| -- | 50100-14 | 0.1 | 110 | 10 YR 6/4 | Silty- vf sand loam | Very fine roots; mud-silt frags |
| -- | 50100-15 | 0.06 | 116 | 10 YR 6/4 | Silty- vf sand loam | Roots; snail; mud silt; FCR |
| -- | 50100-16 | 0.05 | 121 | 10 YR 5/3 | Silty- vf sand loam | Roots; snail; mud silt; FCR; charcoal |
| -- | 50100-17 | 0.08 | 129 | 10 YR 5/2-5/3 | Silty- vf sand loam | More FCR frags & chips; charcoal; chert; snail |
| -- | 50100-18 | 0.09 | 138 | 10 YR 5/3 | Silty- vf sand loam | More FCR frags & chips; charcoal; chert; snail |
| -- | 50100-19 | 0.02 | 140 | 10 YR 5/2-4/2 | Silty- vf sand loam | Few FCR frags; few charcoal pieces; snail; roots |
| -- | 50100-20 | 0.09 | 149 | 10 YR 5/3 | Silty- vf sand loam | Few small FCR chips; small charocal pieces; firm peds |
| -- | 50100-21 | 0.14 | 163 | 10 YR 5/3-6/3 | Silty- vf sand loam | Few small charcoal pieces; firm peds; small FCR chips |
| -- | 50100-22 | 0.06 | 169 | 10 YR 6/3-6/4 | Siltier- vf sand loam | Few small charcoal pieces; firm peds; small FCR chips |
| -- | 50100-23 | 0.08 | 177 | 10 YR 6/3-6/4 | Silty- vf sand loam | Nothing really; soft peds |
| -- | 50100-24 | 0.06 | 183 | 10 YR 6/3-6/4 | Silty- vf sand loam | charcoal fleck; ub rock |
| -- | 50100-25 | 0.07 | 190 | 10 YR 6/3-6/4 | Silty- vf sand loam | charcoal fleck; ub rock |
| -- | 50100-26 | 0.05 | 195 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft and peds |
| -- | 50100-27 | 0.05 | 200 | 10 YR 6/3-6/4 | Silty- vf sand loam | snail shell; Soft and peds |
| -- | 50100-28 | 0.06 | 206 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft and peds |
| -- | 50100-29 | 0.07 | 213 | 10 YR 6/4 | Silty- vf sand loam | 2in ub rock; soft-firm peds |
| -- | 50100-30 | 0.07 | 220 | 10 YR 6/4 | Silty- vf sand loam | Firm-hard peds; FCR chip |
| -- | 50100-31 | 0.05 | 225 | 10 YR 6/4 | Silty- vf sand loam | Firm-hard peds; FCR chip |
| -- | 50100-32 | 0.1 | 235 | 10 YR 6/4 | Silty- vf sand loam | Firm-hard peds; FCR chip |
| -- | 50100-33 | 0.03 | 238 | 10 YR 6/4 | Silty- vf sand loam | FCR(broken); firm peds |
| -- | 50100-34 | 0.07 | 245 | 10 YR 6/3-6/4 | Silty- vf sand loam | Charcoal flecks |
| -- | 50100-35 | 0.07 | 252 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft peds; roots |
| -- | 50100-36 | 0.06 | 258 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft peds; roots; thicker live roots |
| -- | 50100-37 | 0.08 | 266 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of angular mud-silt firm-hard |

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| -- | 50100-38 | 0.04 | 270 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of angular mud-silt firm-hard |
| -- | 50100-39 | 0.07 | 277 | 10 YR 6/4 | Very silty-vf sandy loam | Lots of angular mud-silt firm-hard |
| NS6: 15m | 50101-01 | 0.1 | 10 | 10 YR 5/4 (wet) | Sandy-silt loam | Organic rich |
| -- | 50101-02 | 0.07 | 17 | 10 YR 5/4 (wet) | Sandy-silt loam | Organic rich |
| -- | 50101-03 | 0.07 | 24 | 10 YR 5/4 (wet) | Sandy-silt loam | Some roots |
| -- | 50101-04 | 0.07 | 31 | 10 YR 5/4 (wet) | Sandy-silt loam | Some roots |
| -- | 50101-05 | 0.06 | 37 | 10 YR 5/4 (wet) | Sandy-silt loam | Some roots |
| -- | 50101-06 | 0.06 | 43 | 10 YR 5/4 (wet) | Sandy-silt loam | Some roots |
| -- | 50101-07 | 0.06 | 49 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-08 | 0.07 | 56 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-09 | 0.07 | 63 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-10 | 0.07 | 70 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-11 | 0.06 | 76 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-12 | 0.08 | 84 | 10 YR 5/4 (wet) | Fine sandy-silt loam | Some roots |
| -- | 50101-13 | 0.08 | 92 | 10 YR 6/3-6/4 | Silty- vf sand loam | Mud-drapeish chunks |
| -- | 50101-14 | 0.04 | 96 | 10 YR 5/3 | Silty- vf sand loam | Broken FCR chips; md chunks |
| -- | 50101-15 | 0.03 | 99 | 10 YR 5/3 | Silty- vf sand loam | FCR chips |
| -- | 50101-16 | 0.06 | 105 | 10 YR 5/2 | Silty- vf sand loam | FCR chips; charcoal chunks; roots |
| -- | 50101-17 | 0.04 | 109 | 10 YR 5/2 | Silty- vf sand loam | Charcoal pieces; small FCR chips |
| -- | 50101-18 | 0.06 | 115 | 10 YR 5/2-5/3 | Silty- vf sand loam | Lots of charcoal; FCR chips |
| -- | 50101-19 | 0.04 | 119 | 10 YR 5/2-5/3 | Silty- vf sand loam | FCR 3cm; roots; charcoal |
| -- | 50101-20 | 0.04 | 123 | 10 YR 5/2-5/3 | Silty- vf sand loam | Many FCR (~3-4cm); limestone red manuport; charcoal |
| -- | 50101-21 | 0.1 | 133 | 10 YR 5/3 | Silty- vf sand loam | FCR; soft peds |

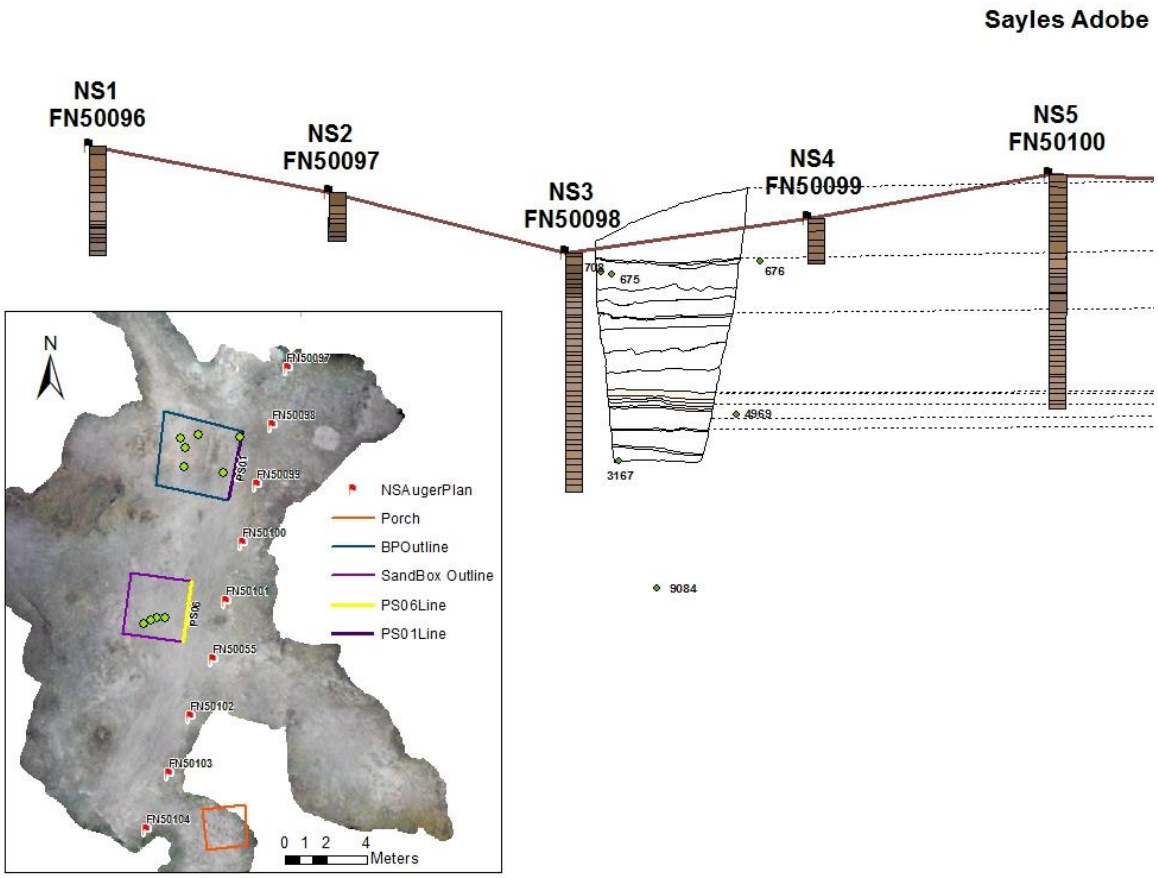
| | | | | | | |
|---|---|---|---|---|---|---|
| -- | 50101-22 | 0.05 | 138 | 10 YR 5/3 | Silty- vf sand loam | FCR; soft peds |
| -- | 50101-23 | 0.05 | 143 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft peds |
| -- | 50101-24 | 0.07 | 150 | 10 YR 6/3-6/4 | Silty- vf sand loam | Soft peds; charcoal pieces |
| -- | 50101-25 | 0.12 | 162 | 10 YR 6/3-6/4 | Silty- vf sand loam | FCR; firm-soft peds |
| -- | 50101-26 | 0 | 162 | 10 YR 6/3-6/4 | Silty- vf sand loam | 1 FCR; firm-soft peds |
| -- | 50101-27 | 0.06 | 168 | 10 YR 6/3-6/4 | Silty- vf sand loam | 1 FCR; firm-soft peds |
| -- | 50101-28 | 0.11 | 179 | 10 YR 6/3-6/4 | Silty- vf sand loam | Roots; 1 or 2 FCR pieces; firm-soft peds |
| -- | 50101-29 | 0.06 | 185 | 10 YR 6/3-6/4 | Silty- vf sand loam | Few small angular gravels; firm peds |
| -- | 50101-30 | 0 | 185 | 10 YR 6/3-6/4 | Silty- vf sand loam | Charcoal; a few small angular gravels; firm peds |
| -- | 50101-31 | 0.06 | 191 | 10 YR 6/3-6/4 | Silty- vf sand loam | FCR frag; soft peds |
| -- | 50101-32 | 0.04 | 195 | 10 YR 6/3-6/4 | Silty- vf sand loam | Roots; firm-soft peds |
| -- | 50101-33 | 0.03 | 198 | 10 YR 6/4 | Silty- vf sand loam | Roots; insect casing; FCR chips; soft |
| -- | 50101-34 | 0.04 | 202 | 10 YR 6/4 | Silty- vf sand loam | Roots; soft peds |
| -- | 50101-35 | 0.06 | 208 | 10 YR 6/4 | Silty- vf sand loam | Roots; soft peds; charcoal piece |
| -- | 50101-36 | 0.05 | 213 | 10 YR 6/4 | Silty- vf sand loam | Chert; roots; firm-hard peds |
| -- | 50101-37 | 0.04 | 217 | 10 YR 6/4 | Silty- vf sand loam | Roots; firm-hard peds; rock chips |
| NS8-21m | 50102-01 | | 9 | 10 YR 4/4 (wet) | Sandy-silt loam | Organics |
| -- | 50102-02 | | 17 | 10 YR 4/4 (wet) | Sandy-silt loam | Organics |
| -- | 50102-03 | | 25 | 10 YR 4/4 (wet) | Sandy-silt loam | Less organics; few roots |
| -- | 50102-04 | | 31 | 10 YR 5/4 (wet) | Sandy-siltier loam | Less organics; few roots |
| -- | 50102-05 | | 38 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102-06 | | 45 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102-07 | | 53 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102-08 | | 59 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102-09 | | 64 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102-10 | | 70 | 10 YR 5/4 (wet) | Silty-fine sand loam | Few roots |
| -- | 50102- | | 80 | 10 YR 5/4 | Silty-fine | FCR chips; roots; 1/16" chert |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 11 | | | (wet) | sand loam | |
| -- | 50102-12 | | 83 | 10 YR 5/4 (wet) | Silty-fine sand loam | Broken FCR pieces <1in; snail; very fine roots; charcoal flecks |
| -- | 50102-13 | | 89 | 10 YR 5/4 (wet) | Silty-fine sand loam | Snail; FCR piecesl charocal fleck; 1/8" chert |
| -- | 50102-14 | | 94 | 10 YR 5/4 (wet) | Silty-fine sand loam | Firm-hard peds |
| -- | 50102-15 | | 103 | 10 YR 5/4 (wet) | Silty-fine sand loam | Tiny snail |
| -- | 50102-16 | | 105 | 10 YR 5/4 (wet) | Silty-fine sand loam | Broken FCR pieces >1in; fine roots **Hit rock;moved column 40cm NE** |
| -- | 50102-17 | | 116 | 10 YR 6/4 | Silty-fine sand loam | Firm-hard subangular; roots |
| -- | 50102-18 | | 122 | 10 YR 6/4 | Silty-fine sand loam | Firm-hard subangular; roots |
| -- | 50102-19 | | 128 | 10 YR 6/4 | Silty-fine sand loam | Firm-hard subangular; shell frags; roots |
| -- | 50102-20 | | 134 | 10 YR 6/4 | Silty-fine sand loam | Few small charcoal pieces; firm-soft; ub rock |
| -- | 50102-21 | | 143 | 10 YR 6/4 | Silty-fine sand loam | Snail fragments; soft peds |
| -- | 50102-22 | | 147 | 10 YR 6/4 | Silty-vf sand loam | 1in chert flakes; roots; soft |
| -- | 50102-23 | | 153 | 10 YR 6/3-6/4 | Silty-vf sand loam | Charcoal flecks; soft; very fine roots |
| -- | 50102-24 | | 160 | 10 YR 6/3-6/4 | Silty-vf sand loam | 1in FCR; snails; firm-soft |
| -- | 50102-25 | | 167 | 10 YR 6/3-6/4 | Silty-vf sand loam | 1in FCR; snails; firm-soft |
| -- | 50102-26 | | 173 | 10 YR 6/3-6/4 | Silty-vf sand loam | Charcoal flecks; soft-firm |
| -- | 50102-27 | | 178 | 10 YR 6/3-6/4 | Silty-vf sand loam | Broken possible FCR; soft charcoal |
| NS9: 24m | 50103-01 | | 8 | 10 YR 5/3 (wet) | Sandy-silt loam | Lots of organics |
| -- | 50103-02 | | 16 | 10 YR 5/3 (wet) | Sandy-silt loam | Lots of organics |
| -- | 50103-03 | | 23 | 10 YR 5/3 (wet) | Sandy-silt loam | Less organics |
| -- | 50103-04 | | 29 | 10 YR 5/3 (wet) | Silty-vf sand loam | Less organics |
| -- | 50103-05 | | 35 | 10 YR 5/3 (wet) | Silty-vf sand loam | Few roots |
| -- | 50103-06 | | 42 | 10 YR 5/3 (wet) | Silty-vf sand loam | Few roots |
| -- | 50103-07 | | 48 | 10 YR 5/3 (wet) | Silty-vf sand loam | Few roots |
| -- | 50103-08 | | 87 | 10 YR 5/3 (wet) | Silty-vf sand loam | Few roots |
| -- | 50103-09 | | 63 | 10 YR 5/3 (wet) | Silty-vf sand loam | Few roots |
| -- | 50103-10 | | 68 | 10 YR 5/3 (wet) | Silty-vf sand loam | Bit more organics; chert; charcoal; |

| | | | | | | |
|---|---|---|---|---|---|---|
| -- | 50103-11 | | 73 | 10 YR 5/3 (wet) | Silty-vf sand loam | Snail; rock chips; roots |
| -- | 50103-12 | | 78 | 10 YR 5/3 (wet) | Silty-vf sand loam | Roots; charcoal |
| -- | 50103-13 | | 84 | 10 YR 5/3 (wet) | Silty-vf sand loam | Shell frags; 1 charocal; roots |
| -- | 50103-14 | | 95 | 10 YR 6/3-6/4 | Silty-vf sand loam | Small FCR piece; firm-soft peds |
| -- | 50103-15 | | 100 | 10 YR 6/3-6/4 | Silty-vf sand loam | Roots |
| -- | 50103-16 | | 108 | 10 YR 6/3-6/4 | Silty-vf sand loam | Soft-firm-hard peds; roots; snail |
| -- | 50103-17 | | 116 | 10 YR 6/3-6/4 | Silty-vf sand loam | Soft-firm-hard peds; roots; snail; charcoal |
| -- | 50103-18 | | 123 | 10 YR 6/3-6/4 | Silty-vf sand loam | Soft-firm-hard peds; roots; snail |
| -- | 50103-19 | | 129 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Silty subangular peds; firm; charcoal |
| -- | 50103-20 | | 139 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Angular silt; hard-firm; roots |
| -- | 50103-21 | | 145 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Angular silt; hard-firm; roots |
| -- | 50103-22 | | 149 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Roots; less angular silt peds mixed w/ soft sandier peds |
| -- | 50103-23 | | 153 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Roots; firm subrounded |
| -- | 50103-24 | | 162 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Roots; firm subrounded; rock |
| -- | 50103-25 | | 166 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Roots; soft peds |
| -- | 50103-26 | | 174 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Ub rock; soft peds; roots |
| -- | 50103-27 | | 181 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Ub rock; soft peds; roots |
| -- | 50103-28 | | 186 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-soft; roots |
| -- | 50103-29 | | 193 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots |
| -- | 50103-30 | | 200 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots; charcoal |
| -- | 50103-31 | | 207 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots; charcoal |

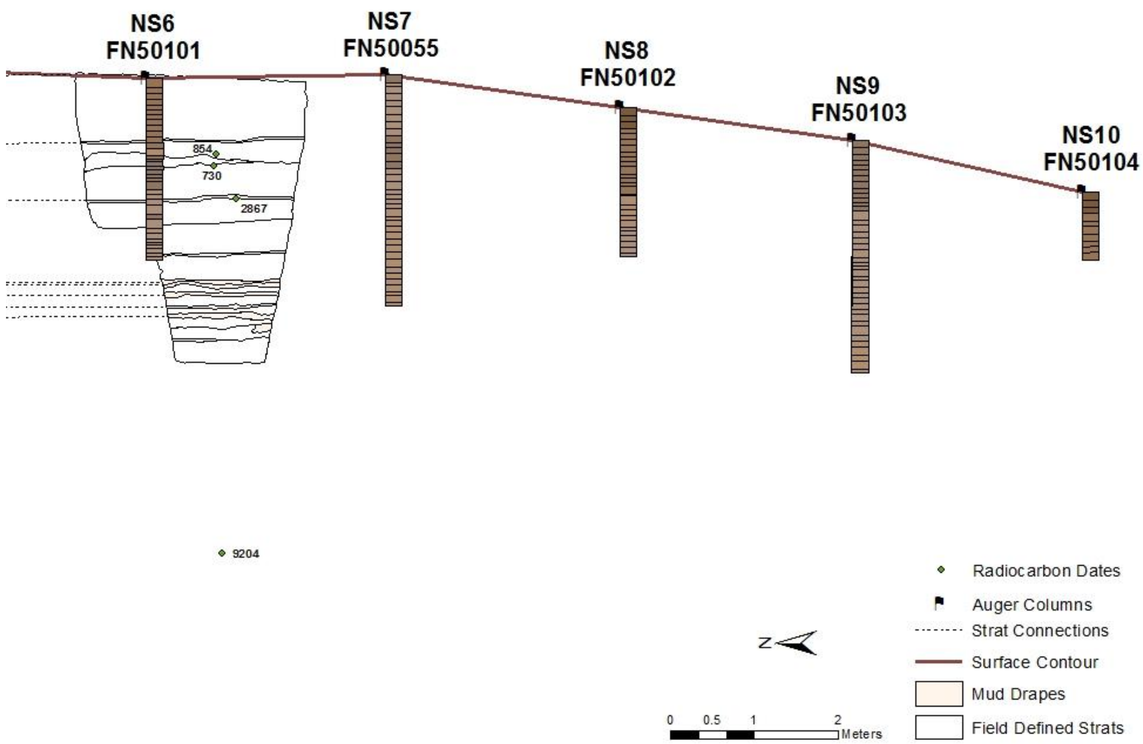
| | | | | | | |
|---|---|---|---|---|---|---|
| -- | 50103-32 | | 215 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots; charcoal; snail |
| -- | 50103-33 | | 220 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots; charcoal |
| -- | 50103-34 | | 231 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Firm-hard; roots; charcoal; snail |
| -- | 50103-35 | | 238 | 10 YR 6/3-6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |
| -- | 50103-36 | | 245 | 10 YR 6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |
| -- | 50103-37 | | 256 | 10 YR 6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |
| -- | 50103-38 | | 263 | 10 YR 6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |
| -- | 50103-39 | | 272 | 10 YR 6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |
| -- | 50103-40 | | 278 | 10 YR 6/4 | Very silty-vf sandy loam | Subangular-rounded; hard-firm |

| | | | | | | |
|---|---|---|---|---|---|---|
| NS10: 27m | 50104-01 | | 10 | 10 YR 4/4 (wet) | Sandy-silt loam | Organics |
| -- | 50104-02 | | 18 | 10 YR 4/4 (wet) | Sandy-silt loam | Organics |
| -- | 50104-03 | | 25 | 10 YR 4/4 (wet) | Sandy-silt loam | Less organics; rocks |
| -- | 50104-04 | | 35 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-05 | | 41 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-06 | | 50 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-07 | | 58 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-08 | | 65 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-09 | | 72 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |
| -- | 50104-10 | | 81 | 10 YR 5/4 (wet) | Silty-fine sand | More organics; mainly roots |



Sayles Adobe
NS1
FN50096
NS2
FN50097
NS3
FN50098
NS4
FN50099
NS5
FN50100
675
676
3167
9084
N
FN50097
FN50098
FN50099
FN50100
FN50101
FN50055
FN50102
FN50103
FN50104
PS01
PS06
NSAugerPlan
Porch
BPOutline
SandBox Outline
PS06Line
PS01Line
0 1 2 4
Meters

## Auger Profiles



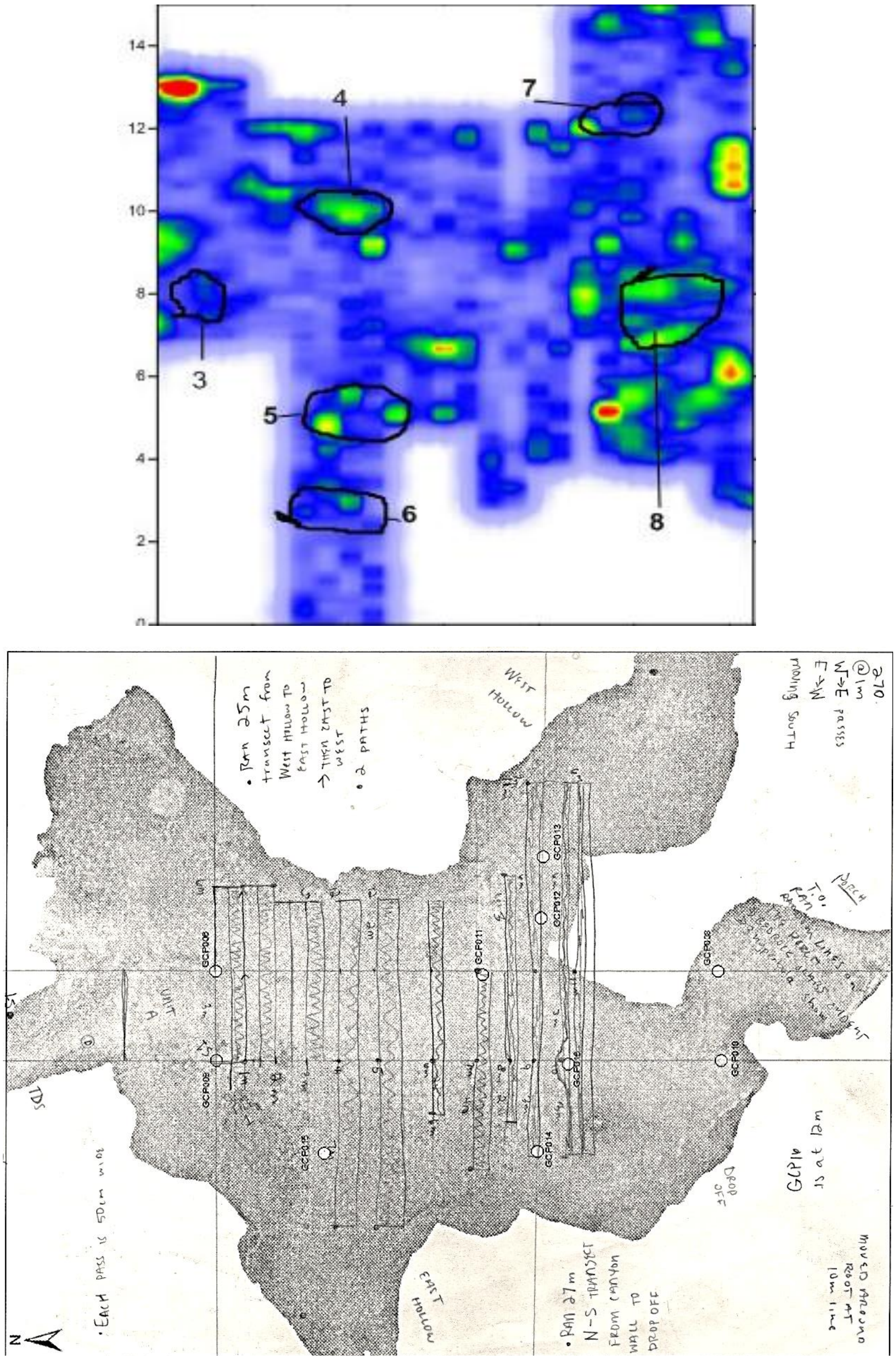



Figure B. 2: Plan map of Sayles Adobe (41VV2239) with GPR overlay.

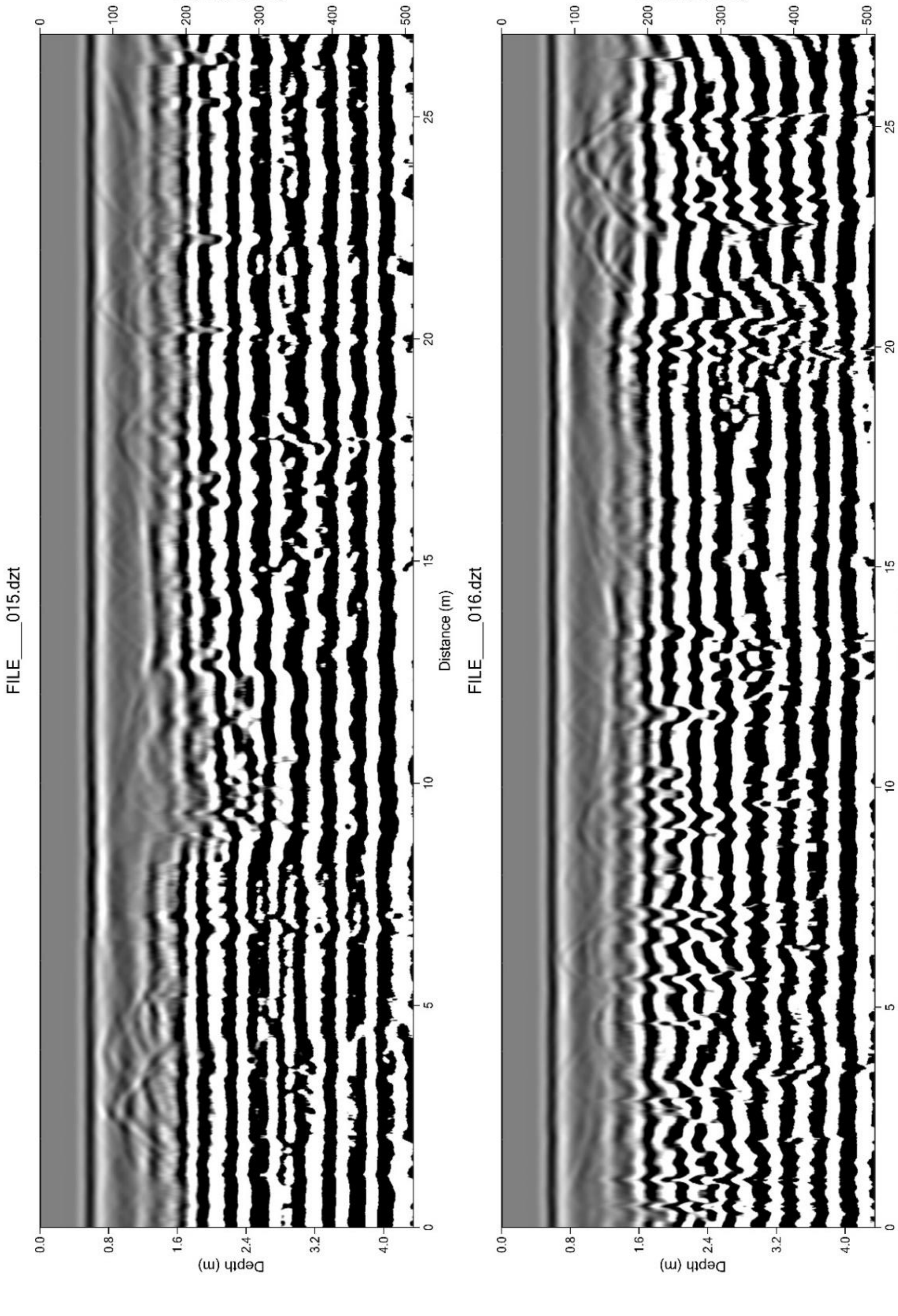



Figure B.3: GPR readings (top) North to South and (bottom) South to North profiles

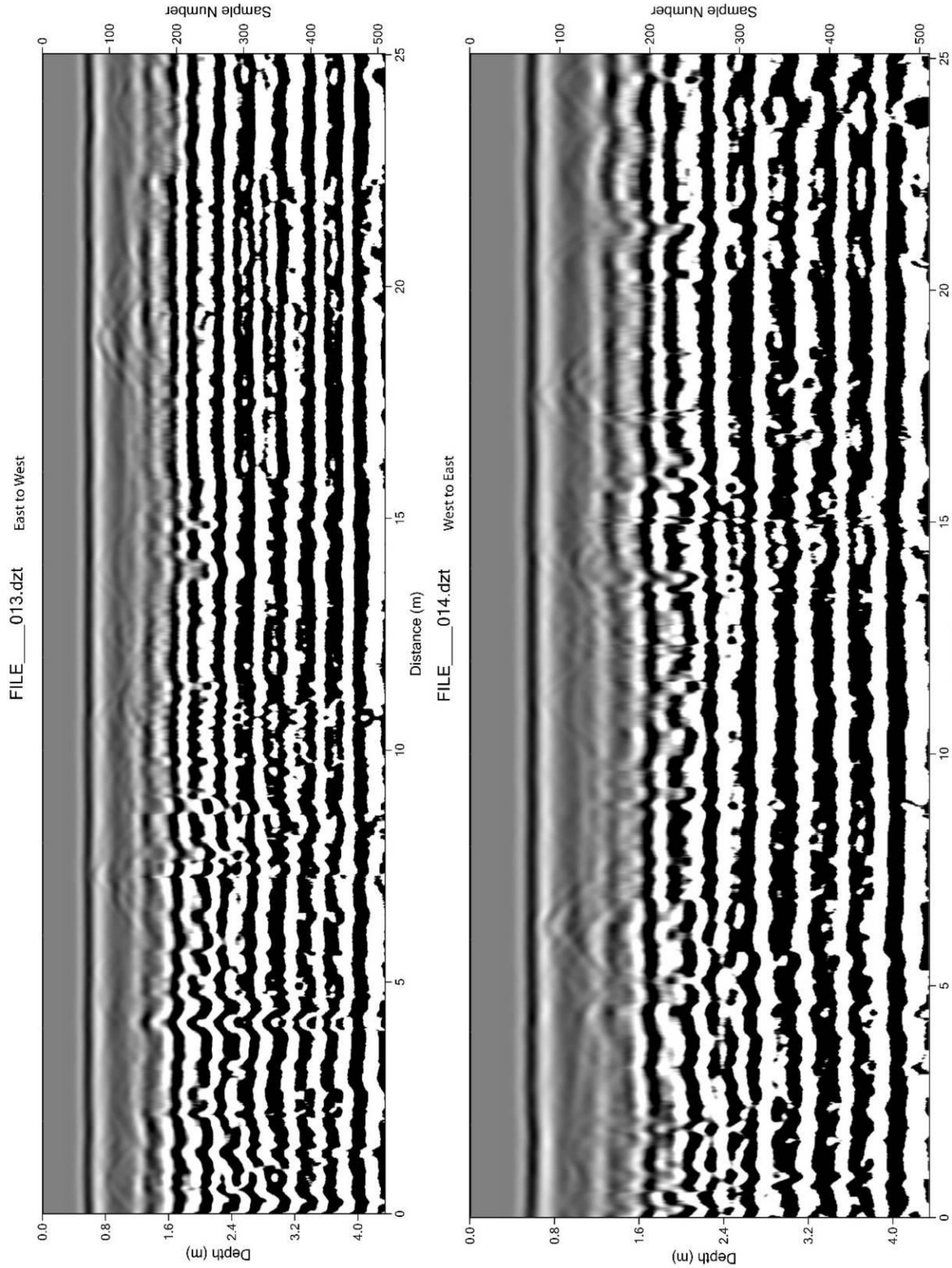
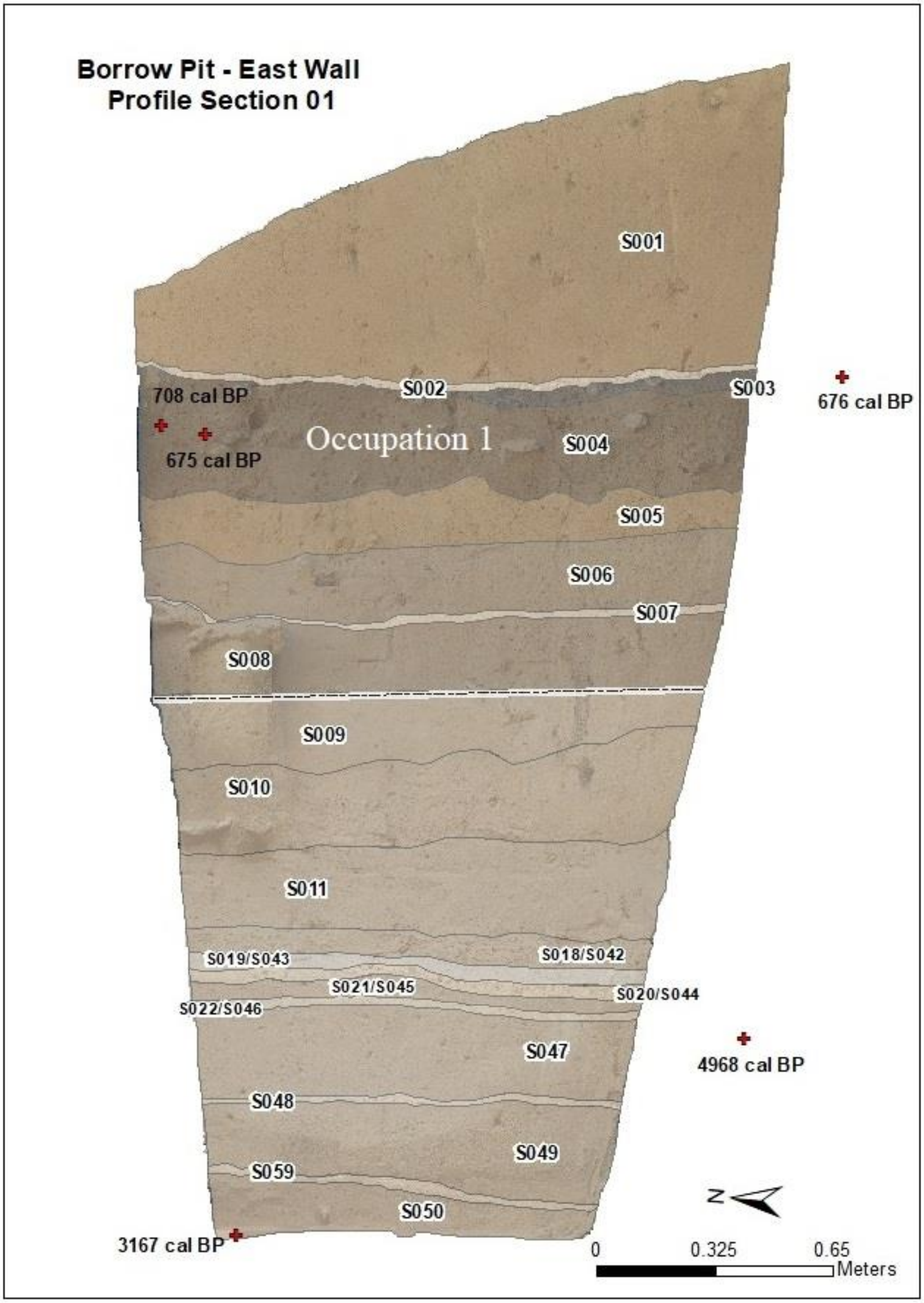
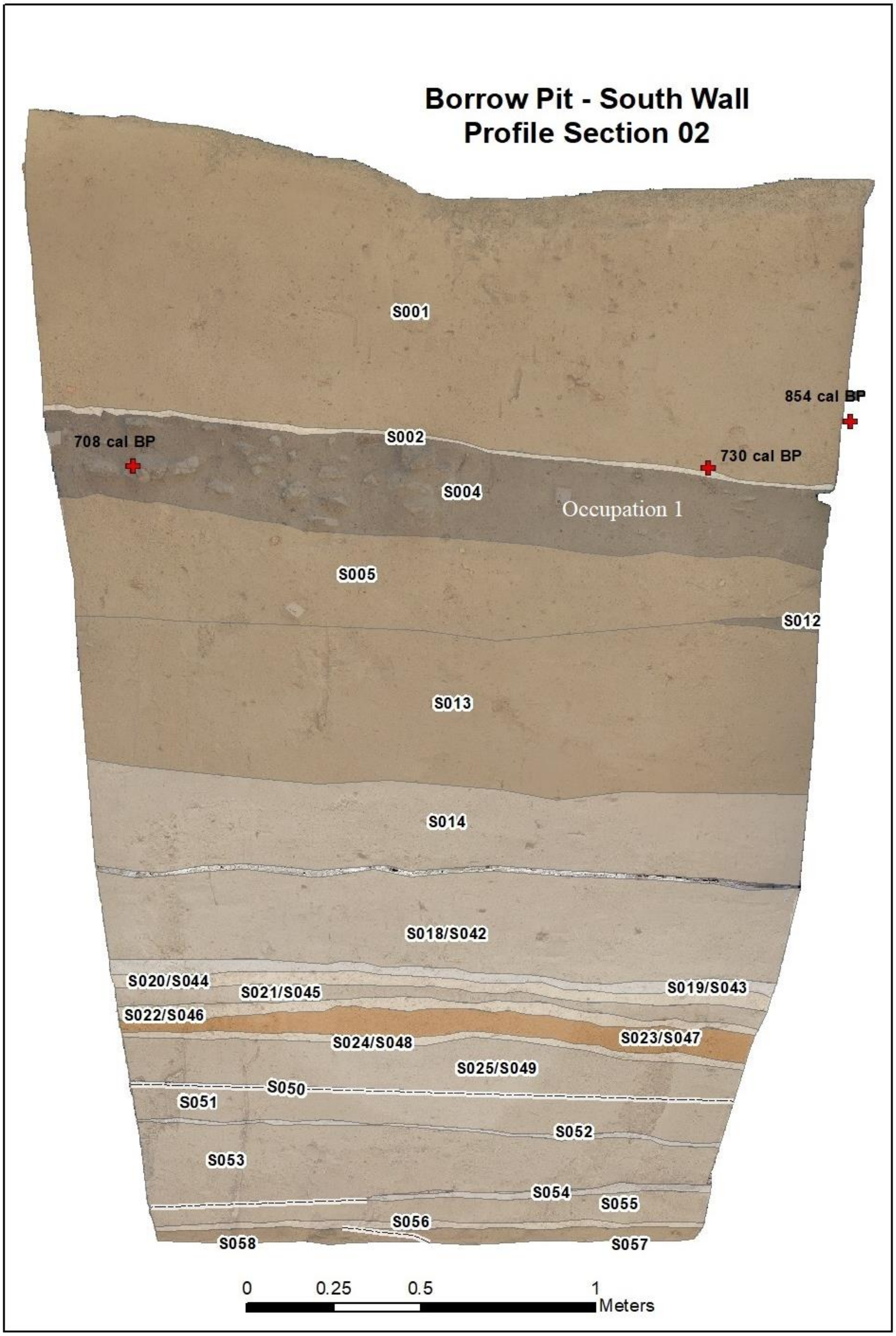


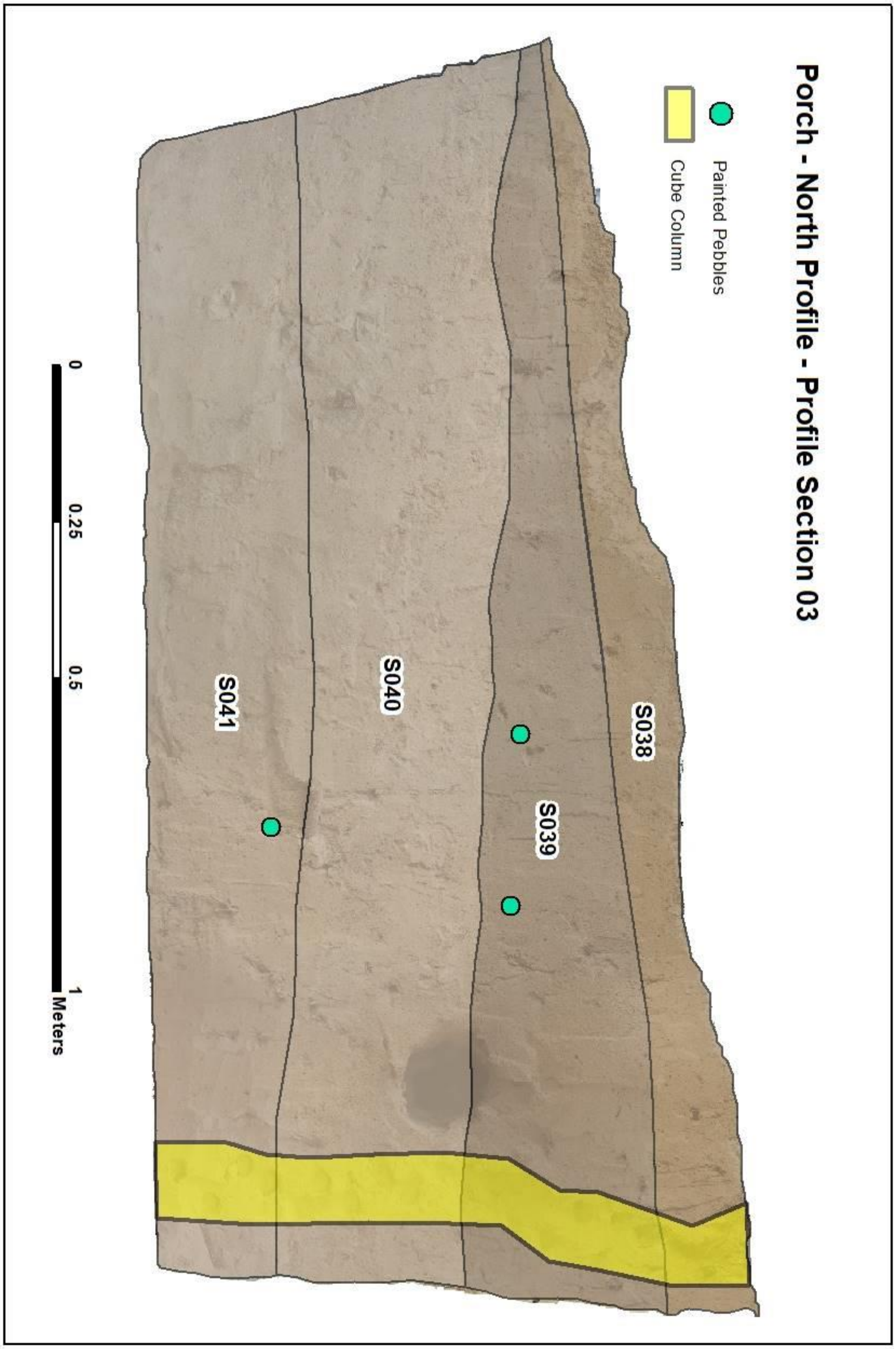

Figure B.4: GPR readings (top) East to West and (bottom) West to East profiles

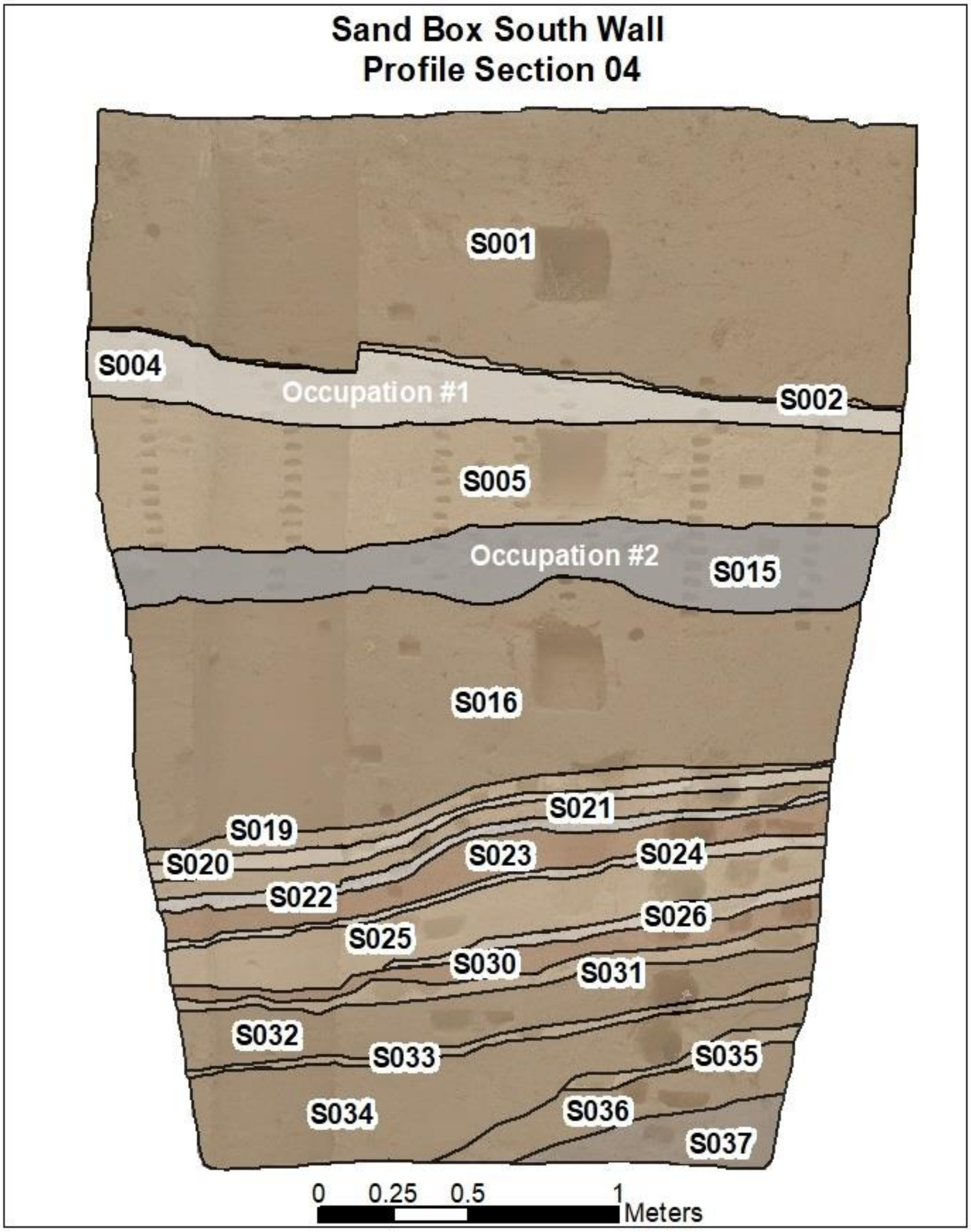
# APPENDIX C: PROFILE SECTIONS

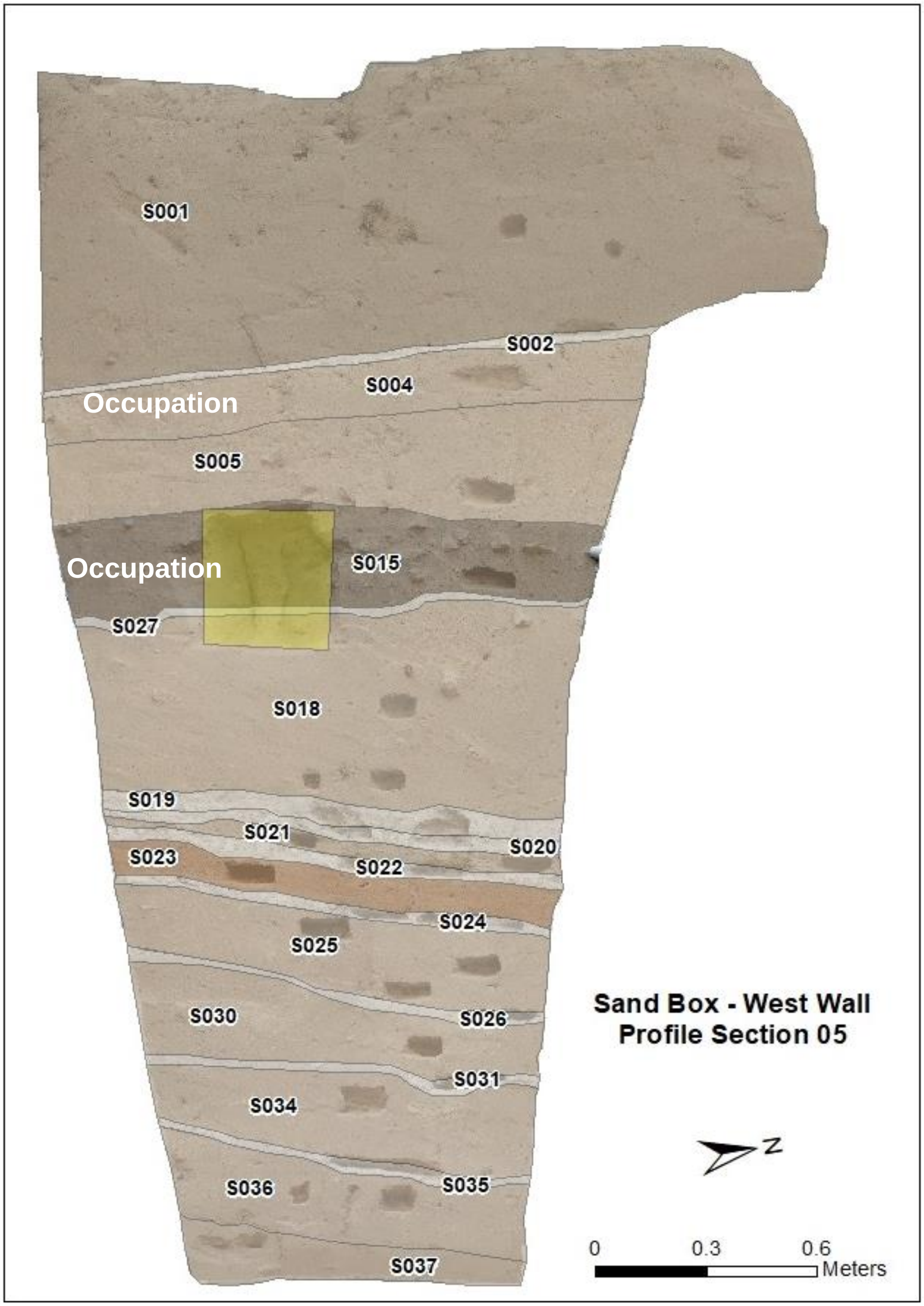
Appendix C consists of the illustrated, defined, and sampled stratigraphy of the profile sections from the site. These profile sections were annotated in the field and the stratigraphy was correlated, when possible, back in the lab during illustration.


Borrow Pit - East Wall
Profile Section 01
S001
S002
S003
708 cal BP
675 cal BP
676 cal BP
Occupation 1
S004
S005
S006
S007
S008
S009
S010
S011
S019/S043
S018/S042
S021/S045
S020/S044
S022/S046
S047
4968 cal BP
S048
S049
S059
S050
3167 cal BP
N
0
0.325
0.65
Meters

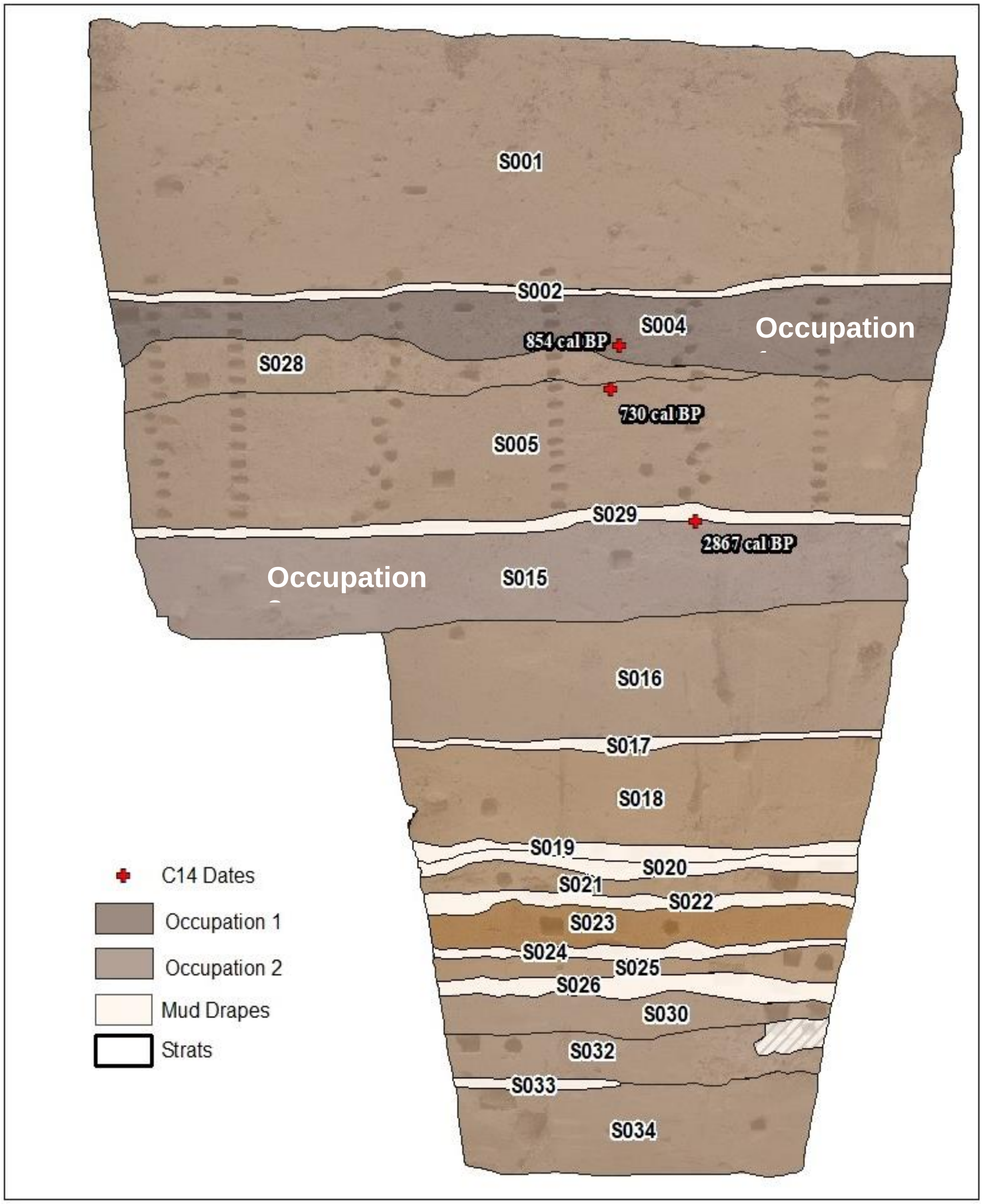

Borrow Pit - South Wall
Profile Section 02
S001
854 cal BP
708 cal BP
S002
730 cal BP
S004
Occupation 1
S005
S012
S013
S014
S018/S042
S020/S044
S021/S045
S019/S043
S022/S046
S024/S048
S023/S047
S025/S049
S050
S051
S052
S053
S054
S055
S056
S058
S057
0
0.25
0.5
1
Meters


Porch - North Profile - Profile Section 03
Painted Pebbles
Cube Column
S038
S039
S040
S041
0
0.25
0.5
1
Meters


Sand Box South Wall
Profile Section 04
S001
S004
Occupation #1
S002
S005
Occupation #2
S015
S016
S021
S019
S020
S023
S024
S022
S026
S025
S030
S031
S032
S033
S035
S034
S036
S037
0
0.25
0.5
1
Meters


S001
S002
S004
Occupation
S005
Occupation
S015
S027
S018
S019
S021
S020
S023
S022
S024
S025
S030
S026
S031
S034
S036
S035
S037
Sand Box - West Wall
Profile Section 05
N
0
0.3
0.6
Meters

Sand Box - East Wall - Profile Section 06



# APPENDIX D: GEOARCHAEOLOGY DATA

Appendix D discloses data produced by the geoarchaeological lab analyses completed over sediments collected from Sayles Adobe. First, the excavations note for the Borrow Pit sampling column (Unit U). Followed by Unit U sediment analysis.

| LOWER BOUNDARY DEPTH | LAYER # | FIELD NOTES/DESCRIPTION |
|---|---|---|
| **5** | 1 | The sloping N& W made the 5cm kind of difficult trying to measure in corners to keep 5cm |
| **10** | 2 | Root encountered in west side (~2-3cm diameter); still sandy w/ roots and various organics |
| **15** | 3 | Root was exposed enough to cut out; fewer organic bits and pieces, just roots remain for the most part |
| **20** | 4 | Using a line level to try and keep 5cm true; roots impacted this layer quite a bit, the sample is less than what we've had |
| **26** | 5 | Despite constant vigilance I suck at keeping levels 5cm |
| **31** | 6 | Roots & burrowing has become extensive; lots of collapse at the north 15-20cm edge |
| **38** | 7 | Still dealing w/ collapse in the north sector |
| **44** | 8 | Beginning to see the end of the burrow and root collapse; the unit is also drying out and being crumbly once it is sand, roots poking through are quite annoying |
| **50** | 9 | Small hole from burrow/root left in the NE corner but should be done w/ after this section |
| **54** | 10 | Sandy with roots will complete an SfM after this at the 1/2m level |
| **58** | 11 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **61** | 12 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **65** | 13 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **68** | 14 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **72** | 15 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **76** | 16 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the |

| | | |
|---|---|---|
| | | back & side walls square |
| **80** | 17 | Sandy w/ roots disturbing mainly the northern edge; also dealing with a front slope of the profile face so volumes are more variable despite 5cm levels & attempts to keep the back & side walls square |
| **84** | 18 | Sloping lower boundary will be present due to interface w/ mud drape & 1 level was not quite 5cm across w/ it the south higher than the north down sloping edge. Mud drape is fairly well-preserved w/ exception of burrow &/or root run along northern edge |
| **87** | 19 | ~3cm level, slightly varying; solitary collection of the mud drape |
| **90** | 20 | Leveling layer, bringing all corners to 90cm; interface of MD and occ #1 |
| **95** | 21 | Burrow persisted, but was a sandy fairly loose fill which was removed before the level itself ; larger pieces (~1cm size) of charcoal, w/ few <7.5cm FCR scattered |
| **100** | 22 | burrow almost gone |
| **105** | 23 | burrow gone; lighter inclusions of clay(?) but still grey w/ charcoal; small scattered FCR still ~7.5cm |
| **110** | 24 | 105-110cm |
| **115** | 25 | 110-115cm |
| **120** | 26 | 115-120cm; hit burrow/root pocket in north edge |
| **125** | 27 | 120-125cm |
| **130** | 28 | 125-130cm |
| **134** | 29 | 130-135cm (true depth 134.5cm) |
| **138** | 30 | ~5cm across (last level on the upper shelf before moving to the lower shelf (~1.2m north of the upper shelf section of the column; (134.5-138cm) |
| **142** | 31 | There was more layer than I thought so I did 5cm & will collect remainder as 31; starting at 138cm to top shelf since it was a walking surface |
| **147** | 32 | Not perfectly level at the top since it was a walking surface; the next few levels are likely very bioturbated lots of mottling, roots, & insect casts |
| **152** | 33 | 0-5cm |
| **157** | 34 | 10-15cm |
| **162** | 35 | 15-20cm, I let Amelia excavate this level since she hasn't done much |
| **167** | 36 | I am not sure what is the intact, this whole section just seems very churned w/ insect casts charcoals flecks, mud inclusions. throughout; fairly compact |
| **172** | 37 | I am not sure what is the intact, this whole section just seems very churned w/ insect casts charcoals flecks, mud inclusions. throughout; fairly compact |
| **177** | 38 | I am not sure what is the intact, this whole section just |

| | | |
|---|---|---|
| | | seems very churned w/ insect casts charcoals flecks, mud inclusions. throughout; fairly compact |
| **182** | 39 | I am not sure what is the intact, this whole section just seems very churned w/ insect casts charcoals flecks, mud inclusions. throughout; fairly compact |
| **186** | 40 | I am not sure what is the intact, this whole section just seems very churned w/ insect casts charcoals flecks, mud inclusions. throughout; fairly compact |
| **190** | 41 | Began to see a shift to sandier w/ fewer mixed inclusions & somewhat looser/easier to trowel |
| **194** | 42 | Began to see a shift to sandier w/ fewer mixed inclusions & somewhat looser/easier to trowel |
| **198** | 43 | Began to see a shift to sandier w/ fewer mixed inclusions & somewhat looser/easier to trowel |
| **202** | 44 | Began to see a shift to sandier w/ fewer mixed inclusions & somewhat looser/easier to trowel |
| **207** | 45 | 60-65cm |
| **211** | 46 | 65-70cm |
| **215** | 47 | North edge more compact w/ southern half sandier; 70-75cm |
| **220** | 48 | 75-80cm |
| **226** | 49 | 80-85cm |
| **229** | 50 | 85-90cm |
| **233** | 51 | |
| **238** | 52 | |
| **243** | 53 | |
| **248** | 54 | |
| **253** | 55 | |
| **257** | 56 | |
| **261** | 57 | |
| **265.5** | 58 | S019 collected as one variable thickness; ~3.5cm at thickest edge |
| **268.5** | 59 | S020; thickness 3cm at NE corner & 0 at SW |
| **271** | 60 | S021; thicker in NE corner & sloping; ~5-5.cm |
| **276.5** | 61 | ~4-3cm along N edge; should level at bottom of this layer |
| **280** | 62 | Orangish sloping bit coarse; S023 |
| **283** | 63 | Orangish sloping bit coarse; S023; did leveling layer w/in strat because it's a thick strat |
| **288** | 64 | Lower boundary uneven due to next strat; S024 ~2cm thickness |
| **290** | 65 | S025; FD strat ~2cm thick @ N. edge undulating surface slight slope down to NW; last truly definable strat for next ~.5m or so |
| **295** | 66 | S025; Leveling layer to 150cm; .5cm down when I came across what looks like it might be oxidized sediment w/ some charcoal present; photographed and sampled |

| | | |
|---|---|---|
| **300** | 67 | 153cm-158cm; S050 |
| **305** | 68 | S051 |
| **313** | 69 | Did not level out at 5cm; the MD below is fairly intact & undulating will attempt to collect separately |
| **315** | 70 | MD; S052(S031) ~1cm at N edge, thicker inwards towards south |
| **320** | 71 | S053 |
| **322** | 72 | S053 |
| **328** | 73 | S053 |
| **334** | 74 | S053 |
| **335** | 75 | S053 |
| **343** | 76 | S053; uneven bottom surface due to mud drape below |
| **345** | 77 | S054; MD; Will be collecting this by itself ~1cm thickness; one FCR(~7.5cm) directly below the mud drape. No noticeable evidence of burrow. There is a an FCR (>7.5cm) almost directly north in the BP North wall at same elevation |
| **350** | 78 | S055; Seeing some coloration / shift to orangish & slightly coarser texture |
| **355** | 79 | S055; texture/ color change more prominent |
| **360** | 80 | S055; orangish coarser sediment w/ some burned and unburned ~1cm rocks angular |
| **365** | 81 | S055; orangish coarser sediment w/ some burned and unburned ~1cm rocks angular |
| **372** | 82 | S057; Same type of sediment as above strat but there's an ephemeral mud drape present |
| **377** | 83 | Same type of sediment as above strat but there's an ephemeral mud drape present; Final layer of the sampling column |

| Layer # | Lower Boundary Depth | Sand 63.00 | Silt | Clay % 6 micron | Sa + Si | NRCS Classification | CCE % | d13C VPDB | C% |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 47.30 | 11.70 | 25.3 | 72.60 | Sandy Clay Loam | 18.95 | -23.78 | 0.68 |
| 2 | 10 | 63.60 | 40.90 | 11.8 | 75.40 | Sandy Loam | 12.47 | | |
| 3 | 15 | 68.10 | 27.94 | 8.46 | 76.56 | Sandy Loam | 18.28 | | |
| 4 | 20 | 67.40 | 23.13 | 8.77 | 76.17 | Sandy Loam | 18.29 | -23.24 | 0.15 |
| 5 | 26 | 69.20 | 24.46 | 8.14 | 77.34 | Sandy Loam | 19.53 | | |
| 6 | 31 | 69.70 | 23.00 | 7.8 | 77.50 | Sandy Loam | 22.86 | | |
| 7 | 38 | 70.60 | 23.12 | 7.18 | 77.78 | Sandy Loam | 21.00 | -26.34 | 2.49 |
| 8 | 44 | 70.40 | 21.95 | 7.45 | 77.85 | Sandy Loam | 21.43 | | |
| 9 | 50 | 72.40 | 23.52 | 6.08 | 78.48 | Sandy Loam | 21.92 | | |
| 10 | 54 | 71.50 | 21.10 | 6.5 | 78.00 | Sandy Loam | 21.79 | -22.11 | 0.26 |
| 11 | 58 | 69.20 | 20.46 | 8.04 | 77.24 | Sandy Loam | 21.34 | | |
| 12 | 61 | 73.40 | 24.70 | 6.1 | 79.50 | Sandy Loam | 21.92 | | |
| 13 | 65 | 72.20 | 19.81 | 6.79 | 78.99 | Sandy Loam | 23.41 | -23.31 | 0.27 |
| 14 | 68 | 70.20 | 19.37 | 8.43 | 78.63 | Sandy Loam | 23.55 | | |
| 15 | 72 | 71.30 | 22.10 | 7.7 | 79.00 | Sandy Loam | 24.04 | | |
| 16 | 76 | 72.60 | 22.62 | 6.08 | 78.68 | Sandy Loam | 23.44 | -23.05 | 0.21 |
| 17 | 80 | 69.90 | 20.26 | 7.14 | 77.04 | Sandy Loam | 24.07 | | |
| 18 | 84 | 65.60 | 22.01 | 8.09 | 73.69 | Sandy Loam | 23.77 | | |
| 19 | 87 | 5.05 | 11.60 | 22.8 | 27.85 | Silt Loam | 43.88 | -24.34 | 0.19 |
| 20 | 90 | 42.20 | 80.75 | 14.2 | 56.40 | Loam | 26.46 | -23.38 | 1.11 |
| 21 | 95 | 41.90 | 41.70 | 16.1 | 58.00 | Loam | 27.65 | -23.47 | 1.01 |
| 22 | 100 | 39.50 | 42.30 | 15.8 | 55.30 | Loam | 30.08 | -22.67 | 0.99 |
| 23 | 105 | 44.00 | 44.90 | 15.6 | 59.60 | Loam | 29.83 | -22.26 | 0.79 |
| 24 | 110 | 42.90 | 42.00 | 14 | 56.90 | Loam | 30.75 | -22.33 | 0.59 |
| 25 | 115 | 31.80 | 37.40 | 19.7 | 51.50 | Loam | 31.07 | -18.70 | 1.09 |
| 26 | 120 | 37.00 | 51.70 | 16.5 | 53.50 | Loam | 31.69 | -21.85 | 1.06 |
| 27 | 125 | 34.70 | 45.20 | 17.8 | 52.50 | Loam | 32.23 | -22.18 | 0.61 |
| 28 | 130 | 37.50 | 49.20 | 16.1 | 53.60 | Loam | 21.91 | -21.16 | 0.68 |
| 29 | 134 | 33.90 | 44.90 | 17.6 | 51.50 | Loam | 32.20 | | |
| 30 | 138 | 20.70 | 46.80 | 19.3 | 40.00 | Silt Loam | 31.93 | -22.14 | 0.50 |
| 31 | 142 | 42.60 | 56.00 | 23.3 | 65.90 | Loam | 30.74 | | |
| 32 | 147 | 38.40 | 44.40 | 13 | 51.40 | Loam | 30.16 | | |
| 33 | 152 | 33.50 | 45.20 | 16.4 | 49.90 | Silt Loam | 31.00 | -21.51 | 0.50 |
| 34 | 157 | 40.90 | 53.70 | 12.8 | 53.70 | Loam | 30.69 | | |
| 35 | 162 | 39.90 | 46.20 | 12.9 | 52.80 | Loam | 31.02 | -21.41 | 0.85 |
| 36 | 167 | 40.70 | 46.90 | 13.2 | 53.90 | Loam | 31.21 | -21.71 | 0.55 |
| 37 | 172 | 39.00 | 45.20 | 14.1 | 53.10 | Loam | 29.84 | -23.35 | 0.45 |
| 38 | 177 | 44.20 | 48.00 | 13 | 57.20 | Loam | 29.80 | -22.25 | 0.34 |
| 39 | 182 | 48.30 | 43.30 | 12.5 | 60.80 | Loam | 28.55 | | |
| 40 | 186 | 51.50 | 40.60 | 11.1 | 62.60 | Loam | 28.60 | | |
| 41 | 190 | 51.00 | 36.90 | 11.6 | 62.60 | Loam | 27.82 | -21.74 | 0.28 |
| 42 | 194 | 31.90 | 28.80 | 20.2 | 52.10 | Loam | 26.48 | | |
| 43 | 198 | 51.60 | 55.30 | 12.8 | 64.40 | Loam | 25.30 | -21.78 | 0.29 |
| 44 | 202 | 52.30 | 37.70 | 10.7 | 63.00 | Sandy Loam | 25.08 | | |
| 45 | 207 | 49.80 | 34.70 | 13 | 62.80 | Loam | 25.22 | -24.09 | 0.30 |
| 46 | 211 | 51.60 | 37.40 | 12.8 | 64.40 | Loam | 24.91 | | |
| 47 | 215 | 56.90 | 37.40 | 11 | 67.90 | Sandy Loam | 24.75 | -21.33 | 0.26 |
| 48 | 220 | 59.10 | 32.50 | 10.6 | 69.70 | Sandy Loam | 24.13 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 49 | 226 | 55.60 | 31.14 | 9.76 | 65.36 | Sandy Loam | 26.59 | -22.33 | 0.24 |
| 50 | 229 | 48.90 | 33.10 | 11.3 | 60.20 | Loam | 31.18 | | |
| 51 | 233 | 33.20 | 36.80 | 14.3 | 47.50 | Silt Loam | 32.10 | -21.99 | 0.32 |
| 52 | 238 | 39.30 | 52.40 | 14.4 | 53.70 | Loam | 34.82 | | |
| 53 | 243 | 48.50 | 50.00 | 10.7 | 59.20 | Loam | 35.11 | -24.23 | 0.38 |
| 54 | 248 | 53.20 | 42.41 | 9.09 | 62.29 | Sandy Loam | 35.12 | | |
| 55 | 253 | 45.90 | 32.20 | 14.6 | 60.50 | Loam | 35.90 | -22.70 | 0.27 |
| 56 | 257 | 52.70 | 41.60 | 12.5 | 65.20 | Sandy Loam | 37.09 | | |
| 57 | 261 | 45.80 | 35.70 | 11.6 | 57.40 | Loam | 37.24 | -20.71 | 0.23 |
| 58 | 265.5 | 0.00 | 14.50 | 39.7 | 39.70 | Silty Clay Loam | 40.77 | -23.69 | 0.42 |
| 59 | 268.5 | 0.36 | 69.30 | 30.7 | 31.06 | Silty Clay Loam | 54.50 | -25.20 | 0.58 |
| 60 | 271 | 42.40 | 86.24 | 13.4 | 55.80 | Loam | 41.83 | -24.06 | 0.40 |
| 61 | 276.5 | 0.00 | 17.80 | 39.8 | 39.80 | Silty Clay Loam | 46.23 | -23.87 | 0.62 |
| 62 | 280 | 37.80 | 84.30 | 15.7 | 53.50 | Loam | 53.82 | -24.13 | 0.47 |
| 63 | 283 | 44.20 | 48.20 | 14 | 58.20 | Loam | 55.83 | -22.98 | 0.58 |
| 64 | 288 | 0.14 | 22.60 | 33.2 | 33.34 | Silty Clay Loam | 55.83 | -23.21 | 0.48 |
| 65 | 290 | 36.40 | 82.16 | 17.7 | 54.10 | Loam | 40.28 | -22.91 | 0.32 |
| 66 | 295 | 40.20 | 47.30 | 16.3 | 56.50 | Loam | 39.19 | -22.84 | 0.22 |
| 67 | 300 | 40.00 | 43.60 | 16.2 | 56.20 | Loam | 36.81 | -22.70 | 0.23 |
| 68 | 305 | 46.80 | 45.90 | 14.1 | 60.90 | Loam | 35.85 | -24.97 | 0.27 |
| 69 | 313 | 15.40 | 35.40 | 17.8 | 33.20 | Silt Loam | 35.39 | -23.13 | 0.45 |
| 70 | 315 | 46.30 | 70.40 | 14.2 | 60.50 | Loam | 46.82 | -23.74 | 0.19 |
| 71 | 320 | 42.20 | 39.70 | 14 | 56.20 | Loam | 37.21 | -22.10 | 0.18 |
| 72 | 324 | 54.20 | 47.50 | 10.3 | 64.50 | Sandy Loam | 33.46 | | |
| 73 | 329 | 58.00 | 36.85 | 8.95 | 66.95 | Sandy Loam | 33.31 | | |
| 74 | 333 | 61.10 | 33.63 | 8.37 | 69.47 | Sandy Loam | 30.88 | -24.42 | 0.25 |
| 75 | 338 | 56.90 | 29.78 | 9.12 | 66.02 | Sandy Loam | 33.00 | | |
| 76 | 343 | 41.90 | 30.40 | 12.7 | 54.60 | Loam | 35.73 | -20.86 | 0.51 |
| 77 | 345 | 19.30 | 36.50 | 21.6 | 40.90 | Silt Loam | 46.23 | -24.46 | 0.20 |
| 78 | 350 | 47.10 | 68.40 | 12.3 | 59.40 | Loam | 27.07 | -21.78 | 0.20 |
| 79 | 355 | 48.00 | 37.70 | 15.2 | 63.20 | Loam | 25.67 | | |
| 80 | 360 | 43.40 | 37.50 | 14.5 | 57.90 | Loam | 27.39 | | |
| 81 | 365 | 39.00 | 40.30 | 16.3 | 55.30 | Loam | 29.52 | | |
| 82 | 372 | 36.90 | 44.60 | 16.4 | 53.30 | Loam | 31.04 | -24.52 | 0.27 |
| 83 | 377 | 24.20 | 41.30 | 21.8 | 46.00 | Silt Loam | 32.72 | | |

| Layer # | Lower Boundary Depth | Mass (g) | MS Avg Hi | MS Avg Low | Avg MS Hi + Low | Avg Hi + Low | Xhf | Xlf<br>Xlf<br>$10^{-8} m^3 kg^{-1}$ | Xfd<br>Coefficient of Frequency Dependence<br>% |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 15.38 | 113.3 | 114.5 | 80.28 | 28.25 | -0.009401 | 0.0317 | 129.6 |
| 2 | 10 | 15.86 | 153.3 | 154.2 | 108.45 | 54.23 | 0 | 0.0919 | 100.0 |
| 3 | 15 | 15.3 | 132.9 | 135.2 | 100.50 | 50.25 | 0 | 0.1188 | 100.0 |
| 4 | 20 | 16.1 | 137.6 | 138.9 | 102.48 | 39.62 | -0.026505 | 0.1168 | 122.7 |
| 5 | 26 | 16.21 | 139.4 | 141.6 | 104.32 | 52.16 | 0 | 0.1282 | 100.0 |
| 6 | 31 | 16.14 | 137.6 | 139.2 | 103.65 | 51.83 | 0 | 0.1329 | 100.0 |
| 7 | 38 | 15.83 | 136.1 | 137.9 | 103.33 | 38.49 | -0.036692 | 0.1439 | 125.5 |
| 8 | 44 | 15.93 | 142.9 | 144.1 | 106.67 | 53.34 | 0 | 0.1432 | 100.0 |
| 9 | 50 | 15.93 | 136.3 | 137.6 | 104.33 | 52.16 | 0 | 0.1716 | 100.0 |
| 10 | 54 | 15.83 | 133.7 | 135.6 | 102.58 | 40.23 | -0.034015 | 0.1578 | 121.6 |
| 11 | 58 | 15.97 | 133.8 | 139.2 | 101.48 | 50.74 | 0 | 0.1262 | 100.0 |
| 12 | 61 | 15.99 | 136.0 | 138.1 | 104.70 | 52.35 | 0 | 0.1716 | 100.0 |
| 13 | 65 | 16.04 | 126.1 | 133.6 | 99.17 | 37.93 | -0.034325 | 0.1461 | 123.5 |
| 14 | 68 | 16.05 | 138.1 | 139.6 | 104.13 | 52.06 | 0 | 0.1235 | 100.0 |
| 15 | 72 | 15.91 | 127.2 | 132.0 | 99.25 | 49.62 | 0 | 0.1289 | 100.0 |
| 16 | 76 | 15.9 | 134.1 | 136.9 | 103.35 | 40.15 | -0.03791 | 0.1700 | 122.3 |
| 17 | 80 | 15.77 | 133.4 | 134.4 | 101.65 | 50.82 | 0 | 0.1424 | 100.0 |
| 18 | 84 | 15.96 | 135.9 | 137.4 | 100.75 | 50.37 | 0 | 0.1245 | 100.0 |
| 19 | 87 | 15.25 | 105.1 | 107.4 | 55.07 | 15.37 | -0.010677 | 0.0242 | 144.2 |
| 20 | 90 | 15.55 | 146.6 | 150.7 | 94.40 | 35.51 | -0.016463 | 0.0665 | 124.8 |
| 21 | 95 | 15.61 | 146.8 | 150.9 | 94.33 | 35.43 | -0.014575 | 0.0586 | 124.9 |
| 22 | 100 | 16.12 | 154.7 | 157.1 | 97.08 | 37.20 | -0.014347 | 0.0614 | 123.4 |
| 23 | 105 | 15.7 | 149.3 | 151.7 | 96.67 | 37.21 | -0.014271 | 0.0620 | 123.0 |
| 24 | 110 | 15.2 | 142.6 | 145.9 | 92.75 | 35.21 | -0.015948 | 0.0663 | 124.1 |
| 25 | 115 | 15.86 | 147.0 | 150.3 | 89.40 | 35.35 | -0.009495 | 0.0454 | 120.9 |
| 26 | 120 | 15.71 | 141.4 | 144.2 | 89.20 | 33.67 | -0.013244 | 0.0541 | 124.5 |
| 27 | 125 | 15.63 | 136.8 | 138.5 | 85.73 | 31.77 | -0.01246 | 0.0482 | 125.9 |
| 28 | 130 | 15.92 | 135.1 | 136.1 | 86.28 | 32.56 | -0.01314 | 0.0536 | 124.5 |
| 29 | 134 | 15.92 | 131.9 | 133.7 | 82.92 | 41.46 | 0 | 0.0471 | 100.0 |
| 30 | 138 | 15.73 | 128.1 | 130.7 | 74.38 | 26.12 | -0.011472 | 0.0385 | 129.8 |
| 31 | 142 | 15.73 | 126.4 | 128.2 | 84.50 | 42.25 | 0 | 0.0363 | 100.0 |
| 32 | 147 | 15.78 | 144.5 | 147.0 | 91.45 | 45.73 | 0 | 0.0703 | 100.0 |
| 33 | 152 | 16.19 | 150.2 | 152.8 | 91.83 | 35.16 | -0.013119 | 0.0560 | 123.4 |
| 34 | 157 | 16.23 | 142.2 | 145.7 | 91.53 | 45.76 | 0 | 0.0715 | 100.0 |
| 35 | 162 | 15.93 | 136.4 | 138.8 | 88.15 | 33.37 | -0.016598 | 0.0683 | 124.3 |
| 36 | 167 | 16.02 | 140.4 | 141.8 | 90.55 | 34.42 | -0.016444 | 0.0686 | 124.0 |
| 37 | 172 | 16.12 | 144.4 | 146.8 | 91.70 | 34.17 | -0.016563 | 0.0650 | 125.5 |
| 38 | 177 | 15.86 | 142.1 | 143.7 | 93.15 | 35.45 | -0.017113 | 0.0717 | 123.9 |
| 39 | 182 | 16.29 | 145.9 | 147.0 | 97.12 | 48.56 | 0 | 0.0777 | 100.0 |
| 40 | 186 | 15.92 | 139.4 | 141.4 | 95.45 | 47.72 | 0 | 0.0860 | 100.0 |
| 41 | 190 | 16.11 | 144.3 | 146.3 | 97.65 | 37.96 | -0.018739 | 0.0842 | 122.3 |
| 42 | 194 | 16.26 | 154.6 | 155.2 | 93.23 | 46.61 | 0 | 0.0462 | 100.0 |
| 43 | 198 | 16.1 | 158.5 | 160.2 | 105.05 | 41.63 | -0.017017 | 0.0821 | 120.7 |
| 44 | 202 | 16.65 | 164.4 | 166.7 | 108.37 | 54.19 | 0 | 0.1013 | 100.0 |
| 45 | 207 | 16.55 | 163.4 | 164.3 | 106.62 | 41.27 | -0.018532 | 0.0820 | 122.6 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 46 | 211 | 16.5 | 183.0 | 184.6 | 117.30 | 58.65 | 0 | 0.0916 | 100.0 |
| 47 | 215 | 16.26 | 159.1 | 159.6 | 108.00 | 43.34 | -0.019388 | 0.0982 | 119.7 |
| 48 | 220 | 16.19 | 158.4 | 160.2 | 108.77 | 54.39 | 0 | 0.1026 | 100.0 |
| 49 | 226 | 16.07 | 154.7 | 157.2 | 105.13 | 41.40 | -0.022881 | 0.1077 | 121.2 |
| 50 | 229 | 16.14 | 154.9 | 156.7 | 101.90 | 50.95 | 0 | 0.0902 | 100.0 |
| 51 | 233 | 16.16 | 154.8 | 156.3 | 93.98 | 35.99 | -0.015379 | 0.0657 | 123.4 |
| 52 | 238 | 16.38 | 152.9 | 154.7 | 96.10 | 48.05 | 0 | 0.0667 | 100.0 |
| 53 | 243 | 16.02 | 144.2 | 146.5 | 96.33 | 36.05 | -0.022643 | 0.0900 | 125.2 |
| 54 | 248 | 16.13 | 146.3 | 148.6 | 99.75 | 49.88 | 0 | 0.1097 | 100.0 |
| 55 | 253 | 16.62 | 153.6 | 155.1 | 99.75 | 38.53 | -0.015546 | 0.0683 | 122.8 |
| 56 | 257 | 16.33 | 145.9 | 148.4 | 99.32 | 49.66 | 0 | 0.0795 | 100.0 |
| 57 | 261 | 16.24 | 141.1 | 143.8 | 93.45 | 36.37 | -0.017852 | 0.0806 | 122.2 |
| 58 | 265.5 | 15.75 | 101.7 | 103.3 | 50.85 | 13.58 | -0.005968 | 0.0128 | 146.6 |
| 59 | 268.5 | 14.23 | 58.6 | 60.0 | 29.48 | 2.14 | -0.008209 | 0.0096 | 185.5 |
| 60 | 271 | 15.83 | 122.5 | 124.4 | 82.47 | 29.21 | -0.017952 | 0.0615 | 129.2 |
| 61 | 276.5 | 15.11 | 49.1 | 51.5 | 24.58 | 0.35 | -0.005998 | 0.0062 | 197.1 |
| 62 | 280 | 16.22 | 118.8 | 120.6 | 78.30 | 27.09 | -0.015368 | 0.0499 | 130.8 |
| 63 | 283 | 15.9 | 110.4 | 113.1 | 77.28 | 27.15 | -0.016417 | 0.0552 | 129.7 |
| 64 | 288 | 15.46 | 68.3 | 70.5 | 34.20 | 5.49 | -0.006991 | 0.0103 | 167.9 |
| 65 | 290 | 16.28 | 139.9 | 141.9 | 88.17 | 32.63 | -0.012944 | 0.0498 | 126.0 |
| 66 | 295 | 16.46 | 134.4 | 136.2 | 87.30 | 32.23 | -0.014013 | 0.0536 | 126.2 |
| 67 | 300 | 16.05 | 125.7 | 128.0 | 82.85 | 30.08 | -0.01401 | 0.0511 | 127.4 |
| 68 | 305 | 16.25 | 136.9 | 138.8 | 91.85 | 33.44 | -0.017706 | 0.0651 | 127.2 |
| 69 | 313 | 16.42 | 136.1 | 138.9 | 75.75 | 26.31 | -0.012992 | 0.0426 | 130.5 |
| 70 | 315 | 15.77 | 86.7 | 88.4 | 66.50 | 21.38 | -0.016716 | 0.0468 | 135.7 |
| 71 | 320 | 16.28 | 141.3 | 142.7 | 91.77 | 34.84 | -0.015784 | 0.0656 | 124.1 |
| 72 | 324 | 15.95 | 145.5 | 147.2 | 99.85 | 49.93 | 0 | 0.0969 | 100.0 |
| 73 | 329 | 16.53 | 155.6 | 158.3 | 106.78 | 53.39 | 0 | 0.1193 | 100.0 |
| 74 | 333 | 16.29 | 159.6 | 161.3 | 110.35 | 42.97 | -0.029175 | 0.1318 | 122.1 |
| 75 | 338 | 16.53 | 156.1 | 156.7 | 106.50 | 53.25 | 0 | 0.1168 | 100.0 |
| 76 | 343 | 16.79 | 147.1 | 150.1 | 94.50 | 36.82 | -0.016429 | 0.0744 | 122.1 |
| 77 | 345 | 15.88 | 86.8 | 88.2 | 53.05 | 14.30 | -0.011324 | 0.0246 | 146.1 |
| 78 | 350 | 16.89 | 182.1 | 182.9 | 114.60 | 46.41 | -0.017709 | 0.0932 | 119.0 |
| 79 | 355 | 16.88 | 197.5 | 199.7 | 122.75 | 61.38 | 0 | 0.0808 | 100.0 |
| 80 | 360 | 16.43 | 181.8 | 184.8 | 112.60 | 56.30 | 0 | 0.0777 | 100.0 |
| 81 | 365 | 17.15 | 194.7 | 196.0 | 116.83 | 58.41 | 0 | 0.0717 | 100.0 |
| 82 | 372 | 17.04 | 179.2 | 182.6 | 108.03 | 41.75 | -0.014951 | 0.0659 | 122.7 |
| 83 | 377 | 16.76 | 159.8 | 160.9 | 92.00 | 46.00 | 0 | 0.0422 | 100.0 |

## APPENDIX E: MACROBOTANICAL ANALYSIS

Macro-botanical analysis was completed on six bulk-matrix samples, five collected from the Borrow Pit and one from the Sand box excavation area. Dr. Leslie Bush and Dr. Kevin Hanselka floated, dried, and sorted/identified the macrobotanical remains with specific interest in identifying taxa and the state of the remains (carbonized or not carbonized. Bush also worked to identify the possible pre-historic uses and sources of the plant materials that were identified. The following is Dr. Bush's final report.

# Seven Flotation Samples

# from

# Sayles Adobe (41VV2239)

# Eagle Nest Canyon,

# Val Verde County, Texas

March 2, 2018

Prepared for:

Victoria C. Pagano

Graduate Program

Department of Anthropology

Texas State University

San Marcos, Texas 78666

Prepared by:

Leslie L. Bush, Ph.D., R.P.A.

Macrobotanical Analysis

12308 Twin Creeks Rd., B-104

Manchaca, Texas 78652

Seven flotation samples were submitted for processing and identification from Sayles Adobe (41VV2239). The site is located in western Val Verde County in a box canyon approximately 400 meters north of the Rio Grande. It is an open site situated in deep sandy soils on an alluvial terrace above the canyon floor and below Skiles Shelter (41VV165) (Texas Historical Commission Site Form 1/5/2016). Radiocarbon dates indicate occupations in the Late Archaic (2700 cal BP; Sandbox area) and Late Prehistoric (600-900 cal BP; Borrow Pit area).

## METHODS

Flotation samples from Sayles Adobe were processed at Macrobotanical Analysis in a bucket-to-bucket flotation system with light fractions poured into no-see-um mesh with triangular openings of 0.3 x 0.4 x 0.5 mm. Heavy fractions were poured through a 1.0 mm wire mesh. Samples were sorted according to standard procedures at the Macrobotanical Analysis laboratory in Manchaca, Texas (Pearsall 2015). Each heavy fraction was examined under a stereoscopic microscope at 6 X. Carbonized plant material from the heavy fraction was added to the light fraction for each sample prior to sorting and identification. Thin pieces of chert and identifiable small bones were placed in gelcaps and returned to the heavy fraction. Each flotation light fraction was weighed on an Ohaus Scout II 200 x 0.01 g electronic balance before being size-sorted through a stack of graduated geologic mesh. All carbonized botanical remains that did not pass through the No. 10 mesh (2 mm square openings) were sorted under a Leica S9i stereozoom microscope at 6-55 X, then counted, weighed, recorded, and labeled. Gastropods, soil peds, and uncarbonized botanical material larger than 2 mm (usually rootlets) were weighed, recorded, and labeled as “contamination”. Materials that fell through the 2 mm mesh (“residue”) were examined under the same microscope at 6-55 X magnification for carbonized botanical remains that had not been previously identified in the 2 mm size fraction. Identifiable botanical materials were removed from residue, counted, weighed, recorded, and labeled. Carbonized frass, probably termite droppings, was noted in all samples but one (FN 50435). Uncarbonized macrobotanical remains other than rootlets (mostly seeds) were recorded on a presence/absence basis on laboratory forms.

Wood charcoal fragments were evaluated for roundedness on an ordinal scale: rounded/subrounded/subangular/angular/very angular. Wood charcoal identification was not systematically attempted, but wood taxa were recorded when clean transverse sections presented themselves during sorting. When no such sections turned up during sorting, two or three fragments were broken after sorting so that at least one or two wood identifications could be recorded for each sample.

To retain suitability for radiocarbon dating, carbonized plant material was handled with forceps or latex gloves only. Sorting was done on clean glassware, and contact with paper, wooden pencils, and other modern plant material was avoided.

Botanical materials were identified to the lowest possible taxonomic level by comparison to materials in the Macrobotanical Analysis comparative collection and through the use of standard reference works (e.g., Core et al. 1979; Davis 1993; Hoadley 1990; InsideWood 2004; Martin and Barkley 1961; Panshin and de Zeeuw 1980; Wheeler 2011). Plant nomenclature follows that of the PLANTS Database (USDA, NCRS 2018).

## RESULTS

Archaeological plant materials recovered are given in Tables 1 and 2 by count and weight respectively. Uncarbonized plant materials other than rootlets are shown on a presence/absence basis in Table 3.

### Uncarbonized (modern) plant remains

Most uncarbonized plant parts in the samples appear in the form of rootlets that are clearly related to the modern vegetation at the site. Uncarbonized seeds are a common occurrence on most archaeological sites, and they usually represent seeds of modern plants that have made their way into the soil either through their own dispersal mechanisms or by faunalturbation, floralturbation, or argilliturbation (Bryant 1985:51-52; Miksicek 1987:231-232). In all except the driest areas of North America, uncarbonized plant material on open-air sites can be assumed to be of modern origin unless compelling evidence suggests otherwise (Lopinot and Brussell 1982; Miksicek 1987:231). With the exception of spiny hackberry (*Celtis ehrenbergiana*), discussed below, the uncarbonzied seeds at Sayles Adobe are scarce, in keeping with the depth of the samples (one to two meters below the modern surface). They consist of weedy annuals, grasses, and trees relating to the current vegetation and recent disturbances. Uncarbonized plant parts, including seeds, are interpreted here as non-archaeological. Semi-carbonized plants were recovered in the form of wood and chenopdium seeds. They are treated with the carbonized plants because they overlap in taxa and plant part. Their ancient status should be treated as tentative, however.

**Hackberry** seeds' high resistance to decay presents particular interpretive difficulties on archaeological sites. What archaeologists typically recover is the hackberry endocarp, the thick white seedcoat from under the under thin fleshy layer of the fruit. The endocarp has a high mineral content: It contains 40-70% aragonite, a crystalline form of calcium carbonate (Wang et al. 1997; Yanovsky et al. 1932). The carbonate helps hackberry endocarps preserve unusually well in the soil. Their organic carbonates make them excellent candidates for dating of the sediments in which they originated. Since the carbonates form over a single growing season, their initial carbonate content is the same as that of carbon dioxide in the atmosphere, and they can be tested for reliability before dating (Wang et al. 1997:342). Hackberry endocarps are surprisingly common in geological and archaeological strata (Wang et al. 1997:337) – but they are not necessarily archaeological in origin. The difficulty for archaeobotanists is determining whether the hackberries present represent the traces of human hackberry use or merely the presence of hackberries on the location where the site sediments originated or where archaeological materials were redeposited. The ubiquity of hackberry seeds across the samples examined (7 of 7 samples) indicates these particular specimens are best interpreted as natural, and possibly ancient, in origin.

The presence of hackberry endocarps at Sayles Adobe indicates that the trees grew nearby at some time(s) in the past, as they do today. Two species of hackberry, spiny hackberry (*Celtis ehrenbergiana*) and sugarberry hackberry (*C. laevigata*) are present in Eagle Nest Canyon. Given their known uses among modern and ancient people, they were probably used by at least some of the site inhabitants. Although the particular remains observed in the samples probably do not represent the archaeological traces of this activity, some discussion of hackberry exploitation is warranted. Ethnographically, hackberry trees were exploited primarily for food (Moerman 1998:147). Navajos used hackberry leaves and branches to make dark brown or red dye. Hackberry fruit can be eaten fresh by using the teeth to scrape the thin layer of flesh off large nutlet. Modern foresters use wet maceration to remove pulp from the seeds, and this process may also have been used in the prehistoric past (Schopmeyer 1974:298). Many accounts of hackberry consumption among Native people indicate that the fruits were ground or crushed in preparation. Comanches, Yavapais, Apaches, Navajos, Dakotas, Meskwakis, Pawnees and Kiowas are all known to have prepared hackberry fruits by grinding, pounding, or crushing (Moerman 1998:147). The resulting paste was shaped into cakes and dried or roasted. This particular use would leave few archaeological traces, but the high calcium carbonate concentration in the hackberry endocarps would have made an excellent source of calcium given proper conditions for calcium absorption (e.g., sufficient magnesium and vitamin D).

### Carbonized (ancient) plant remains

**Leaf bases** and leaf fragments were recovered in all samples examined. Most could be identified only as members of the agave or lily botanical families. Lechuguilla (*Agave lechuguilla*) and yuccas (*Yucca torreyi* and *Y. thompsoniana*) are the common Lower Pecos plants in the agave family. Lily family members in the region include the large desert rosettes beargrass (*Nolina texana,* also called Texas sacahuista) and Texs sotol (*Dasylirion texanum*). Onions (*Allium* spp.) are also in the lily family, and some small fragments identified as Liliaceae leaf bases may represent onion bulbs.

Some leaf base fragments could be identified to genus. Of these, lechuguilla was the most common, present in all five Borrow Pit samples. Beargrass and yucca (Figure 1) were identified in one sample each. Leaf bases of lechuguilla and sotol (if present) are best interpreted as foodstuffs, while the upper leaves are valuable for making cordage, basketry, and other fabrics. Although other parts of beargrass and yucca are edible (stalks, flowers, seeds, fruits), their leaves are less valuable as foods. The presence of carbonized beargrass and yucca leaves is most likely related to their use for cordage, basketry, or thatching. (Local species of thin-leaf yucca and beagrass generally lack marginal teeth, making them more suitable for thatching than sotol, which has thin leaves but also marginal teeth.)

**Seeds**. Seven taxa of small seeds were recovered from four samples. The Feature 2 sample (FN 50435) produced seeds of purslane (*Portulaca* sp.; n=5), a weedy plant with edible greens, grasses (n=3), and three seeds in poor condition that could not be identified.

FN 50673 produced the seed of a strawberry pitaya (*Echinocereus enneacanthus*) and two chenpodium (*Chenopodium* spp.) seeds (Figure 2). One of the chenopodium specimens is incompletely carbonized, dark brown on one surface. It is provisionally accepted as archaeological because uncarbonized chenopodium specimens at the site consisted of seedcoats only. Pitaya and chenopodium seeds likely represent food items in this sample: chenopodium has edible seeds and greens, and strawberry pitaya fruits are not just edible but highly palatable.

FN 50664 produced an additional strawberry pitaya seed along with two other cactus seeds, barrel cactus (*Ferocactus hamatacanthus*) and prickly pear (*Opuntia* sp.) (Figures

3 and 4). Like strawberry pitaya, fruits of barrel cactus and prickly pear are highly palatable. A rush seed (*Juncus* sp.) was also recovered from this sample. Although its use is not clear, it represents a rare wetland plant in the deposits.

Of the Sandbox area samples, only the larger sample produced small seeds. One whole and one fragmentary strawberry pitaya seeds were recovered (Figure 5; Figure 7).

**Herbaceous stems** were recovered from the Feature 2 sample. The fragments were small in diameter (less than 2 mm). Many could be identified as grass (Poaceae) due to hollow stems and the presence of nodes. Other stem fragments may be grass, but they could also be rushes (Juncaceae), sedges (Cyperaceae), or cattails (*Typha* spp.).

Green or wet grasses are sometimes used as packing material in earth ovens, where they add moisture and protect food items. Prickly pear pads are perhaps more commonly used for this purpose in West Texas, but no prickly pear pad fragments or associated parts such as spines were recovered in these samples. Use of grass or other monocot stems seems likely for the cooking event that produced the debris in Feature 2 at Sayles Adobe.

**Wood charcoal** fragments in all samples were characterized as "angular", with the smaller Sandbox area sample intederminate between "angular" and subangular". The wood charcoal is most readily interpreted as fuelwood. As discussed above, wood charcoal fragments were not routinely identified. Wood types were recorded in passing when a clean transverse section was visible. Wood types noted include:

Feature 1: Juniper (*Juniperus* spp.), walnut (*Juglans* spp.), coyotillo (*Karwinskia humboldtiana*), mesquite (*Prosopis* spp.), Texas persimmon (*Diospyros texana*), legume family (Fabaceae), live oak (*Quercus fusiformis*)

Feature 2 (FN50435): White group oak (*Quercus* sect. *Quercus*), Legume family, willow/cottonwood (Salicaceae)

Sandbox (FN 50071): Mesquite, condalia (*Condalia* spp.), ash (*Fraxinus* spp.)

Two wood charcoal taxa merit special attention. Like the rush seed, willow/cottonwood (probably black willow, *Salix nigra*) has higher water requirements than other plants recovered in the samples. It occurs in Eagle Nest Canyon today only on the canyon floor and only within a few hundred meters of the Rio Grande.

The live oak specimen (Figure 6) is interesting because it is uncommon west of Del Rio today, although it is known as far west as Terrell County (Powell 1998, Turner et al. 2003). It does not currently grow in Eagle Nest Canyon, but it occurs in similar environments: mesic limestone canyons that extend far enough from the river that they provide habitats sheltered from frequent floods and associated disturbances. Although the tree would not have been common, the upper stretches of Eagle Nest Canyon could have provided a suitable location for live oak at times in the past, especially during wetter periods. Birds such as woodpeckers and jays would have provided vectors of introduction.

## SUMMARY

The seven samples flotation samples examined to date produced wood charcoal, leaf bases, and grass stems likely associated with earth oven cooking of bases of lechuguilla and possibly beargrass and sotol. Yucca and beargrass leaves may reflect use for cordage, basketry, or thatching. Small seeds of edible plants indicate consumption of cactus fruits, greens, and wild seeds. Upland, canyon slope, and wetland plants are represented in the samples.

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## FIGURE CAPTIONS

**Figure E.1**: Yucca leaf fragment from FN 50656, probably *Yucca thompsoniana*, the thin-leaf yucca that grows in the area today. Specimen is 4.5 mm long.
**Figure E.2**: Chenopodium seed (*Chenopodium* sp.) from FN 50673. Specimen is 0.75 mm at widest diameter.
**Figure E.3**: Prickly pear seed fragment (*Opuntia* sp.) from FN 50664. Specimen is 1.5 mm in vertical measurement.
**Figure E.4**: Barrel cactus seed (*Ferocactus hamatacanthus*) from FN 50664. Specimen is 0.9 mm at widest diameter.
**Figure E.5**: Strawberry pitaya seed (*Echinocereus enneacanthus*) from FN 50071.
**Figure E.6**: Transverse section of live oak wood charcoal (*Quercus fusiformis*) from FN 50673. Specimen is 4.0 mm long in horizontal measurement.
**Figure E.7:** Strawberry pitaya seed fragment (Echinocereus enneacanthus) from FN 50664. Specimen is 1.2 mm in horizontal measurement.

Figure E.1

Figure E.2

Figure E.3

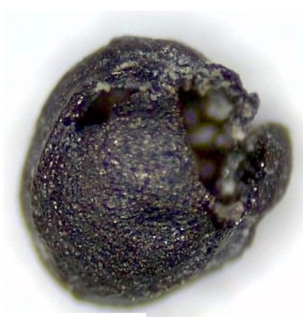

Figure E.4


Figure E.5

Figure E.6

Figure E.7

| Carbonized Plant Remains from Sayles Adobe (41VV2239) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **FN** | **50435** | **50656** | **50664** | **50666** | **50673** | **50071** | **Site Total** |
| Area | Borrow Pit | Borrow Pit | Borrow Pit | Borrow Pit | Borrow Pit | Sand Box | |
| Unit | Q | Rb | Sb | Sb | Rb | H | |
| Strat/Layer | L5(F2) | 2a | 2d | 3c | 4b | L2 | |
| Sample volume (l) | 3.9 | 2 | 2 | 2 | 2 | 3.9 | 11.9 |
| | | | | | | | |
| **Leaf bases and fragments** | | | | | | | |
| Yucca/lechuguilla (Agavaceae) | 8 | 4 | 4 | 10 | 4 | 4 | 32 |
| Desert succulent (Agavaceae/Liliaceae) | 10 | 3 | 5 | 12 | 3 | 1 | 34 |
| Lechuguilla *(Agave lechuguilla)* | 7 | 1 | 1 | 4 | 1 | | 14 |
| Sotol/beargrass (Liliaceae) | | 1 | | | | | 1 |
| Beargrass *(Nolina texana)* | | | | 2 | | | 2 |
| Yucca *(Yucca* spp.) | | 2 | | | | | 2 |
| | | | | | | | |
| **Seeds** | | | | | | | |
| Chenopodium *(Chenopodium* sp.) | | | | | 2* | | 2 |
| Strawberry pitaya *(Echinocereus enneacanthus)* | | | 1 | | 1 | 2 | 2 |
| Barrel cactus *(Ferocactus hamatacanthus)* | | | 1 | | | | 1 |
| Indeterminable | 7 | | | | | | 7 |
| Rush *(Juncus* sp.) | | | 1 | | | | 1 |
| Prickly pear *(Opuntia* sp.) | | | 1 | | | | 1 |
| Grass (Poaceae) | 3 | | | | | | 3 |
| Purslane *(Portulaca* sp.) | 5 | | | | | | 5 |
| | | | | | | | |
| **Stems** | | | | | | | |
| Grass (Poaceae) | 12 | | | | | | 12 |
| Monocot | 5 | | | | | | 5 |
| Indeterminable | | | | | | 1 | |
| | | | | | | | |

| **Wood charcoal** | 787 | 55* | 55 | 95 | 297** | 30* | 1302 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Indeterminable | 18 | 5 | | 5 | 4 | | 32 |
| | | | | | | | |
| *1 semi-carbonized | 862 | 16 | 69 | 128 | 13 | 8 | 1458 |
| **4 semi-carbonized | | | | | | | |

| **Carbonized Plant Remains from Sayles Adobe (41VV2239)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Weights in grams | | | | | | | |
| FN | **50071** | **50435** | **50656** | **50664** | **50666** | **50673** | **Site Total** |
| Area | SB | BP | BP | BP | BP | BP | |
| Unit | H | Q | Rb | Sb | Sb | Rb | |
| Strat/Layer | L2 | L5(F2) | 2a | 2d | 3c | 4b | |
| Sample volume (l) | 3.9 | 3.9 | 2 | 2 | 2 | 2 | 15.8 |
| **Leaf bases and fragments** | | | | | | | |
| Yucca/lechuguilla (Agavaceae) | 0.02 | 0.05 | 0.02 | 0.01 | 0.05 | 0.02 | 0.17 |
| Desert succulent (Agavaceae/Liliaceae) | 0.01 | 0.09 | 0.01 | 0.01 | 0.05 | 0.01 | 0.18 |
| Lechuguilla *(Agave lechuguilla)* | | 0.25 | 0.02 | 0.01 | 0.03 | 0.04 | 0.35 |
| Sotol/beargrass (Liliaceae) | | | 0.01 | | | | 0.01 |
| Beargrass *(Nolina texana)* | | | | | 0.01 | | 0.01 |
| Yucca *(Yucca* spp.) | | | 0.01 | | | | 0.01 |
| **Seeds** | | | | | | | |
| Chenopodium *(Chenopodium* sp.) | | | | | | <0.01* | |
| Strawberry pitaya *(Echinocereus enneacanthus)* | <0.01 | | | <0.01 | | <0.01 | |
| Barrel cactus *(Ferocactus hamatacanthus)* | | | | <0.01 | | | |
| Indeterminable | | <0.01 | | | | | |
| Rush *(Juncus* sp.) | | | | <0.01 | | | |
| Prickly pear *(Opuntia* sp.) | | | | <0.01 | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grass (Poaceae) | | <0.01 | | | | | |
| Purslane *(Portulaca* sp.) | | <0.01 | | | | | |
| **Stems** | | | | | | | |
| Grass (Poaceae) | | 0.02 | | | | | 0.02 |
| Monocot | | 0.01 | | | | | 0.01 |
| Indeterminable | 0.01 | | | | | | |
| **Wood charcoal** | 0.25* | 4.09 | 0.47* | 0.46 | 0.43 | 2.25** | 7.95 |
| Indeterminable | 0.01 | 0.07 | 0.03 | | 0.02 | 0.02 | 0.15 |
| Other material > 2 mm | 2.86 | 2.42 | 0.66 | 2.36 | 2.94 | 1.48 | 12.72 |
| Examined residue < 2 mm | 7.91 | 19.71 | 3.32 | 7.12 | 5.16 | 5.5 | 48.72 |

*some semi-carbonized

**0.03 g semi-carbonized

| **Uncarbonized Remains from Sayles Adobe (41VV2239)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rootlets excluded | | | | | | | |
| X=present | | | | | | | |
| FN | **50071** | **50435** | **50656** | **50664** | **50666** | **50673** | **Number of** |
| Area | SB | BP | BP | BP | BP | BP | **Occurences** |
| Unit | H | Q | Rb | Sb | Sb | Rb | |
| Strat/Layer | L2 | L5(F2) | 2a | 2d | 3c | 4b | |
| Sample volume (l) | 3.9 | 3.9 | 2 | 2 | 2 | 2 | 15.8 |
| | | | | | | | |
| Spiny hackberry seed *(Celtis ehrenbergiana)* | X | X | X | X | X | X | 7 |
| Chenopodium seedcoat *(Chenopodium* sp.) | | X | | X | | X | 3 |
| Mesquite leaf *(Prosopis* sp.) | X | | | | | X | 3 |
| Mesquite endocarp *(Prosopis* sp.) | X | | | | | | 2 |
| Grass seed, panicoid (Panicodae) | | | | | | X | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grass seed (Poaceae) | X | | | | | | 1 |
| Prickly pear seed *(Opuntia* sp.) | X | | | | | | 1 |
| Mallow family seed (Malvaceae) | X | | | | | | 1 |
| Total taxa | 9 | 2 | 1 | 2 | 1 | 4 | |

# APPENDIX F: FAUNAL ANALYSIS

Appendix F presents the faunal analysis of preserved remains completed by zooarchaeologist, Dr. Christopher Jurgens. Dr. Jurgens worked to identify taxa, element assignment, and any additional taphonomic features.

| Field # | Area Unit | Strat/ Layer | Artifact Description | Count | Weight (g) | Jurgens ID | Jurgens Modification Observations |
|---|---|---|---|---|---|---|---|
| 50008 | BP A1 | L4 | Small/medium fragment | 1 | 0.04 | small mammal, indeterminate long bone epiphysis fragment | |
| 50014 | BP A1 | L5 | Small/medium fragments | 1 | <0.1 | Rodentia (small), 1 incisor tooth | |
| 50014 | BP A1 | L5 | Small/medium fragments | 5 | 0.24 | small mammal, 5 indeterminate long bone fragments | |
| 50015 | BP A1 | L6 | Small/medium | 2 | <.01 | small mammal, 2 indeterminate long bone fragments | |
| 50015 | BP A1 | L6 | Small/medium | 1 | 0.53 | Medium mammal, 1 indeterminate long bone diaphysis fragment | |
| 50024 | BP A1B | L1 | Small/Medium fragment | 1 | <.01 | Rodentia (small), proximal metapodial fragment, burned (roasting pattern?) | burned (roasting pattern?) |
| 50032 | BP B | L2 | Small/medium fragment | 3 | 1.9 | cf. Artiodactyla, long bone fragments. 2 are modified by subsistence activities (butchering cutmarks and scrape marks (periosteum removal)) | subsistence activities (butchering cutmarks and scrape marks (periosteum removal)) |
| 50033 | BP B | L3 | Small/medium fragments | 1 | 0.01 | small mammal, indeterminate long bone diaphysis fragment | |
| 50038 | BP B | L4 | Small/medium fragments | 3 | <0.1 | small mammal, 3 indeterminate long bone fragments | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50038 | BP B | L4 | Small/medium fragments | 1 | 0.36 | Medium mammal, 1 indeterminate long bone diaphysis fragment, burned (roasting pattern), longitudinal scrape marks (periosteum removal), oblique cutmarks (defleshing) | burned (roasting pattern), longitudinal scrape marks (periosteum removal), oblique cutmarks (defleshing) |
| 50043 | BP B | L5 | Tooth fragment | 1 | 0.01 | Artiodactyla, tooth fragment | |
| 50047 | BP B | L6 | Small/medium fragments | 2 | 0.13 | small mammal, 2 indeterminate long bone fragments | |
| 50047 | BP B | L6 | Small/medium diagnostics | 1 | 0.3 | small mammal, phalange, carnivore ravaged | |
| 50059 | Porch C | L2 | Small/medium diagnostics | 1 | 0.01 | cf. Sylvilagus spp., mandible, right, condylar process articulation | |
| 50070 | SB H | L2 | Vertebrae | 1 | 0.04 | small mammal, vertebra fragment | |
| 50089 | SB H | L3 | Small/medium fragment - shot in because largish fragment | 1 | 0.19 | Medium mammal, indeterminate long bone diaphysis fragment, carnivore ravaged and heavily weathered | |
| 50082 | SB H | L3 | Small/medium fragments | 7 | 0.31 | small mammal, indeterminate bone fragments | |
| 50082 | SB H | L3 | Small/medium fragments | 1 | <.01 | Osteichthyes, indeterminate bone fragment | |
| 50082 | SB H | L3 | Small/medium fragments | 1 | <0.1 | small mammal, indeterminate long bone diaphysis fragment, | burned (discard pattern) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | burned (discard pattern) | |
| 50082 | SB H | L3 | Jaws and teeth | 1 | 0.01 | cf. Sylvilagus spp., tooth fragment | |
| 50082 | SB H | L3 | Large bone diagnostics; liekly deer tarsal | 1 | 1.84 | cf. Odocoileus spp., phalange II, distal fragment, burned (roasting pattern) | burned (roasting pattern) |
| 50109 | SB I | L2 | Small/medium diagnostics | 1 | 0.04 | cf. Lepus californicus, distal phalange epiphysis | |
| 50109 | SB I | L2 | Small/medium fragments | 1 | 0.01 | small mammal, indeterminate long bone diaphysis fragment | |
| 50110 | BP J | L1 | Small/medium diagnostics | 1 | 0.01 | cf. Sylvilagus spp., metatarsal III, right, proximl fragment, carnivore ravaged | |
| 50110 | BP J | L1 | Small/medium fragments | 7 | 0.82 | Medium mammal, indeterminate long bone fragments, carnivore ravaged | |
| 50115 | BP J | L2 | Small/medium diagnostics | 1 | 1.22 | Medium mammal, indeterminate long bone diaphysis fragment, carnivore ravaged and heavily weathered | |
| 50116 | SB G | L3 | Small/medium diagnostics | 1 | 0.07 | cf. Sylvilagus spp., scapula, left, proximal fragment with glenoid process | |
| 50116 | SB G | L3 | Small/medium diagnostics | 1 | <0.01 | Small mammal, metapodial diaphysis fragment | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50117 | SB I | L3 | Small/medium fragments | 18 | 0.79 | medium mammal, indeterminate bone fragments | |
| 50117 | SB I | L3 | Vertebrae | 1 | 0.06 | small mammal, lumbar vertebra fragment | |
| 50117 | SB I | L3 | Jaws and teeth | 1 | 0.01 | Soricidae, mandible, left, mesial fragment | |
| 50124 | SB G | L4 | Small/medium fragments | 1 | 0.3 | cf. Sylvilagus spp., femur, left, proximal diaphysis fragment, carnivore ravaged | |
| 50124 | SB G | L4 | Small/medium fragments | 1 | <0.1 | Small mammal, axial bone fragment | |
| 50124 | SB G | L4 | Small/medium fragments | 1 | <0.1 | Aves, indeterminate long bone diaphysis fragment, heavily weathered | |
| 50125 | SB I | L4 | Small/medium fragments | 6 | 0.29 | Small mammal, indeterminate long bone fragments | |
| 50175 | SB M | L1 | Small/medium diagnostics | 1 | 0.01 | cf. Sylvilagus spp., metatarsal V, left, carnivore ravaged | |
| 50196 | BP L | L2 | Vertebrae | 1 | 0.08 | Squamata, vertebra fragment | |
| 50245 | BP Q | L2 | Small/medium fragments | 1 | 0.1 | Medium mammal, indeterminate long bone diaphysis fragment | burned (discard pattern) |
| 50245 | BP Q | L2 | Vertebrae | 1 | 0.08 | Squamata, vertebra fragment | calcined (discard pattern) |
| 50316 | BP Sa | L3 | Small/medium diagnostics | 1 | 0.14 | Rodentia (small), cervical vertebra | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50319 | BP Q | L3 | Small/medium diagnostics | 2 | 0.26 | Small mammal, maxilla fragments | |
| 50319 | BP Q | L3 | Large bone fragment | 3 | 0.78 | Medium mammal, indeterminate long bone epiphysis fragments, heavily weathered | |
| 50319 | BP Q | L3 | Small/medium fragments | 7 | 0.2 | Medium mammal, indeterminate bone fragments | burned (discard pattern) |
| 50319 | BP Q | L3 | Small/medium fragments | 20 | 0.6 | Medium mammal, indeterminate long bone fragments | |
| 50320 | BP Sa | L4 | Small/medium fragments | 3 | <0.1 | Small mammal, indeterminate long bone diaphysis fragments | |
| 50320 | BP Sa | L4 | Small/medium fragments | 1 | <0.01 | cf. Sylvilagus spp., tooth fragment | |
| 50320 | BP Sa | L4 | Small/medium diagnostics | 1 | 0.24 | cf. Sylvilagus spp., humerus, right, distal diaphysis fragment, carnivore ravaged, weathered | |
| 50352 | BP Q | L5 | Small/medium diagnostics | 1 | .32 | cf. Sylvilagus spp., tibia, right, distal fragment, heavily weathered | |
| 50356 | BP Q | F2(L5) | Small/medium fragment | 1 | .43 | cf. Sylvilagus spp., femur, left, distal diaphysis fragment, carnivore ravaged | |
| 50439 | BP Q | L6 | Vertebrae | 1 | 0.01 | Ictaluridae, vertebra, anterior abdominal | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50439 | BP Q | L6 | Small/medium fragments | 2 | 0.17 | Medium mammal, indeterminate long bone diaphysis fragment | burned (discard pattern) |
| 50439 | BP Q | L6 | Small/medium fragments | 1 | 0.2 | Lepus californicus, tibia, left, disto-lateral diaphysis fragment | |
| 50455 | BP Sa | 6 | Small medium diagnostics *possible burrow material* | 1 | <.01 | small mammal, rib, proximal articulation | |
| 50455 | BP Sa | 6 | Small medium fragments * possible burrow material* | 3 | 0.12 | small mammal, indeterminate long bone fragments | |
| 50323 | BP Sa | L5 | Small bone fragments | 1 | <0.1 | small mammal, indeterminate long bone epiphysis | |
| 50456 | BP Q | L7 | Small medium fragments | 1 | 0.1 | cf. Sylvilagus spp., tibia, right, proximal fragment w/tibial tuberosity | |
| 50456 | BP Q | L7 | Small medium fragments | 1 | 0.2 | Lepus californicus, scapula, right, glenoid fossa | |
| 50456 | BP Q | L7 | Small medium fragments | 1 | <0.1 | Medium mammal, axial bone fragment | |
| 50456 | BP Q | L7 | Small medium fragments | 1 | <.01 | Medium mammal, indeterminate long bone diaphysis fragment | burned (discard pattern) |
| 50456 | BP Q | L7 | Small medium fragments | 1 | <.01 | Osteichthyes, rib fragment | |
| 50456 | BP Q | L7 | Small/medium diagnostics | 1 | 0.19 | cf. Lepus californicus, phalange II, carnivore tooth mark | |
| | | | | **138** | | | |

## APPENDIX G: MALACOLOGICAL ANALYSIS

Dr. Kenneth M. Brown from the University of Texas conducted a preliminary malacological (snail) analysis (Appendix G) of eight discrete bulk-matrix samples from the Borrow Pit and Sand Box excavation areas (Figure 8.2). The main purpose of this study was to assess the potential for snail recovery at Sayles Adobe from the alluvial sediments and if a full study would be feasible, as well as to compare the present assemblage with what you would expect in similar environments to better understand the climatic conditions through time at the site.

Pilot Sampling of the Snail Fauna at Sayles Adobe

Kenneth M. Brown

## INTRODUCTION

There are perhaps 185 or so species of terrestrial snails native to Texas, and recent research suggests another 60 or so aquatic species. Many of these (perhaps as many as 60% for terrestrial species?) are too small to be captured on quarter-inch archeological field screens (and even for the larger species, many juveniles also fall through field screens). Because land snails cannot travel far to a water source, they are heavily dependent on moisture in their immediate environment. For the smallest species, whose shells are only millimeters long, "immediate environment" means whatever is within a few centimeters. Because of this moisture sensitivity, because they are often abundant enough to quantify, and because their calcareous shells preserve well in most alkaline Texas sediments, they make good paleo-moisture proxies (they are less sensitive to temperature and are less useful for diagnosing past temperatures). Because moisture retention often depends on vegetative cover, snail assemblages may also give some idea of past vegetation changes. Likewise, aquatic snails may give clues to past hydrologic conditions.

In an arid environment like the Lower Pecos, what would we expect a snail fauna (living or subfossil) to look like? We might expect

1. Low specimen densities
2. Restricted species diversity
3. High juvenile mortality
4. An assemblage dominated by the most arid-tolerant species
5. Aquatic snails perhaps few in number, but dominated by species tolerant of desiccation, high temperature and low oxygen levels

And this is exactly what we find at Sayles Adobe (Table G.2, G.3, G.4).

The present study was designed as a preliminary assessment of the potential for snail recovery from the alluvial sediments at Sayles Adobe. In formal studies of this kind, a continuous column of samples (each 5 or 10 cm thick) is usually removed from a representative profile wall. In this case, however, eight widely spaced, discontinuous samples were collected (Fig. G.1). Two were box-shaped samples 20 cm thick ("borrow pit" block), and six were 22-42 cm in thickness ("sandbox" block; Fig. G.2). Because sedimentation was probably fairly rapid at this site, the increased sample thickness probably does not imply a great deal of time-averaging. The samples come from two separate excavation blocks and represent a maximum elevation difference of about 2.9 m. These samples cover about a 2500-year span of the Late Holocene, from about 3167 cal BP at the lowest sample to a point somewhat later than 675 cal BP for the uppermost sample (Tori Pagano, personal communication 2018). This uppermost sample, at about 1275 AD, occurs well into the Medieval Climatic Anomaly. None of these samples came from the mud drapes present at the site; all were from sediments intercalated between the drapes. Because the mud drapes are so thin, collecting a large enough sample probably would have required the excavation of an entire 1 x 1 m unit dedicated to that purpose.

*Lower Pecos Snails: Previous Research, or Lack of It*

Although some of the earliest systematic archeomalacological research in Texas was done as part of the Amistad paleoecological survey (Story and Bryant 1966), snails in the Lower Pecos remain mostly unstudied. Decades of testing and intensive excavation have resulted in almost no information on the subject. The standard method for dealing with snails in the region is to throw them away, uncounted, unidentified, and often not even remarked upon in the field notes. Even when extensive deposits of *Rabdotus* sp. shells are recovered from burned rock middens in open sites or rockshelters, they are usually discarded, often without even reporting their presence in site reports.

Early fieldwork (1958-59) by Leonard and Frye (1962) assessed Pleistocene deposits exposed along the channel of the Pecos River. There are no radiocarbon assays and how the age of the deposits was assessed is not disclosed. Collection involved both hand-picking and wet-sieving, but sieve size, sample size, and number of specimens recovered are not disclosed. The single locality in Val Verde County, near Pandale, yielded only *Rabdotus dealbatus*, *Linisa texasiana* (in contemporary terminology), and *Succinea luteola* (Leonard and Frye

(1962:Fig. 4). Metcalf (1967:Table 1) lists 20 taxa found in recent Rio Grande alluvium upstream from El Paso. Aquatic taxa include three species of *Lymnaea*, *Gyraulus circumstriatus*, *G. parvus*, *Planorbella* sp., *Promenetus umbilicatellus*, and *Physa virgata* (now likely regarded as *Physa acuta*)

Several archeological sites with deep alluvial deposits and long histories located along the Rio Grande or near it have been excavated: Arenosa Shelter, Devil's Rockshelter, the Devil's Mouth site, and Nopal Terrace. These could have provided detailed invertebrate faunal histories tied to the radiocarbon-dated stratigraphy of each site, but the opportunity was lost. Systematic sampling with fine-mesh sieves was apparently done by Elmer Cheatum and his assistants Cuyler Leonard and John Kankrlik (Cheatum 1966), but the number of samples, volumetric size of samples, and number of specimens are not disclosed; intrasite provenience is reported only by stratum. Thus, we are left only with a laundry list of species from Eagle Cave, Bonfire Shelter, Devil's Mouth, and Devil's Rockshelter. In subsequent research on Arenosa Shelter, 30 sediment samples were sieved through nested #10, #18 and #35 mesh sieves (the same sizes used in the present study) to recover microfauna, but apparently no effort was made to recover invertebrates (Dibble 1974:10-13). Many other sites have also been documented in alluvium (Gustavson and Collins 1998:Table 3). Gustavson and Collins investigated the upper five meters of terrace fill at the Amistad site (41 VV 661), downstream from Amistad Dam and reported radiocarbon assays as old as 3900±50 RCYBP (Gustavson and Collins 1998:Table 4), but again, no snail studies were done. Kochel (1980:218, Table 21) sampled a deposit of snails and pelecypods at the Jarratt Ranch on the Devils River, but reports nothing about the snails. A mixed sample ("mostly gastropods") provided an assay of 5610±60 RCYBP, paired with a charcoal assay of 3940±70 RCYBP (uncorrected).

More recently, Raymond Neck (1990) has reported on snails from Skyline Shelter, but because this is a dry rockshelter, it is not comparable to Sayles Adobe. He found a surprising array of aquatic snails (species of *Cochliopina*, *Fossaria*, *Physa*, *Planorbella*, and *Helisoma*, along with peaclams and fingernail clams) on window mesh. Terrestrial taxa (*Rabdotus*, *Linisa*, *Oligyra*, *Metastoma*) are mostly large or medium-bodied taxa. Because of the topographic position of the shelter 30 meters above the Lechuguilla Creek bed, it seems clear that the aquatic taxa were adventive specimens brought in by the human occupants (on driftwood, in drinking water or digestive tracts of fish, etc.).

By far the most useful site for comparison is Bonfire Shelter, located about 0.9 km upcanyon from Sayles Adobe. Even though it is a rockshelter isolated from alluvial deposition, it receives significant colluvial deposition from the upland terrain above the shelter. Microsnails were recovered here from a discontinuous column of sediment samples, and studied by Jim Theler (University of Wisconsin; Byerly *et al.* 2007:134-135, Table 5). A series of 17 samples, mostly one liter in volume, were analyzed. Mesh sizes are listed as "greater than 2 mm" (#10 sieve) and "less than 2 mm," but unfortunately, the minimum mesh size is not specified. Three aquatic snails and an oogonium (?) of *Chara* sp. were recovered, which is somewhat unexpected in non-alluvial deposits. The authors suggest the snails were resident in the shelter, not deposited as clastic material washed over the overhang, but I see no reason to favor this explanation. The fauna could be a mixture of resident and bioclastic specimens.

Although only 15.9 liters of sediment was sieved for snails at Bonfire Shelter, compared to 101.35 liters at Sayles Adobe, a somewhat wider array of taxa was found at Bonfire. Several terrestrial taxa (*Gastrocopta pentodon*, *Vallonia* sp., cf. *Helicodiscus nummus*, *Hawaiia minuscula*, and *Millerelix* cf. *M. mooreana*) and a single physid represent taxa found at Bonfire, but not Sayles Adobe. The Bonfire column extends to the base of Bone Bed 2, but even when only the part that is comparable in age to Sayles Adobe is considered, the taxonomic diversity at Bonfire is still greater. This could be a result of slower depositional rates or better snail habitat at Bonfire, but is probably not a function of the difference in recovery methods, which are similar.

Systematic biological surveys of contemporary Lower Pecos snail faunas are just as neglected as the archeological faunas. In 1991, Richard W. Fullington and Robert Goodloe inventoried the terrestrial and aquatic snails for the Texas Nature Conservancy lands at Independence Creek in Terrell County, about 73 km north-

northwest of Sayles Adobe. They report nine terrestrial natives (plus one introduced species), and five aquatic species, but do not give any specimen counts. They also found slugs and peaclams on property adjacent to the Conservancy tract (Fullington and Goodloe 1991). From Val Verde County, I collected a controlled surface (contemporary) snail sample adjacent to the Little Sotol site in June, 2011, but have not yet processed the sample. Branson (1970:372) collected five aquatic and five terrestrial species (including *Succinea concordialis*) in 1964 from an unspecified location on the Devil's River.

*Sampling, Processing and Recovery Methods*

Eight samples (identified by 5-digit lot numbers assigned in the field) of raw sediment were processed (Table G.1). Average sample volume was 12.7 liters (range, 11.3-15.0 liters). Samples 50268, 50269, and 50271 were collected partly with an auger, and augmented by using a trowel to enlarge the hole into a square box. The others were box samples removed from a profile wall.

At the Texas Archeological Research Lab, the volume of each sample was measured with a graduated 3-liter container. Then the sample was placed in a bucket and covered overnight with tapwater, to which a couple of teaspoons of sodium carbonate  was added as a dispersant (samples had so little clay that this step was probably unnecessary). Each sample was then wet-sieved in the TARL screenwashing facility though a nested series of #10, #18, and #35 geologic sieves (with mesh size = 2 mm, 1 mm, and 0.5 mm respectively. Oversize (18 inch) sieves are used due to the large sample volume. These three size grades were then dried, picked, and packaged separately. The counts from the different size grades can always be combined later in the data spreadsheet, but it is sometimes useful to look at size grading as a measure of the proportion of juveniles, or of specimen breakage, so the three different grades are curated and labeled separately, not combined. A total of 559 snails (MNI, or Minimum Number of Individuals) was recovered, or which only 10 were aquatic.

The sediments from Sayles Adobe are quite fine-grained, and very little residue was retained on the sieves. Only samples 50237 and 50236 have any appreciable amount of coarse clastic debris. When fine-grained sediments are sieved, often most of the residue consists of calcium carbonate concretions or rhizoliths, but this was not the case at Sayles Adobe, which suggests deposition was too rapid for soil-forming processes to prevail. Snails (complete or fragmentary), small animal bones or bone splinters, mussel shell flakes, streamworn pebbles, and microdebitage (flakes, flake fragments, shatter) were saved and counted. Snail shell fragments, charcoal, and hackberry seed fragments were saved and weighed. Weighing (in grams) was done with a Veritas S123 electronic balance accurate to a thousandth of a gram (0.001 g, with a repeatability of 0.0005 g). The balance was recalibrated with a 100 g brass weight every time it was turned on. In some cases, the quantities of charcoal, snail shell or other material recovered were too lightweight to register on the scale, and in these cases, the symbol "T" ( for trace) is entered in the data spreadsheet.

Snails were sorted and identified under magnification (usually no more than about 10X) with a binocular microscope. Most specimens from Sayles Adobe were quite small, especially if juvenile, and many were less than a millimeter in length. Measurements were made with an etched 5 mm microscale ruled in tenths of a millimeter. Anything larger than 5 mm was measured with sliding calipers also ruled in 0.1 mm increments. For conical snails like *Gastrocopta* or *Rabdotus*, shell height (= "length") and diameter are measured; for discoidal snails like *Helicodiscus* or *Gyraulus*, diameter only is measured. Specimens were stored in gelcaps placed in small plastic vials (usually 4 ml), with a paper label listing provenience and identification. All the material classes listed above (charcoal, bone, etc.) were curated this way, not just the snails.

*Notes on Material Classes*

Sediments: Sediments were overwhelmingly calcareous (but lacking pedogenic carbonate). The uppermost sample (50238, at 964.28 m) is the only one containing very small mica flakes, which must indicate backflooding from the Rio Grande. The Rio Grande passes through metamorphic and igneous terrain upstream, while Eagle Nest Creek does not.

Charcoal: Only small amounts of charcoal were recovered. Sample 50237 had the most (1.095 g); weights for the rest ranged from only a trace to 0.950 g. Nearly all the charcoal appears to be wood charcoal. Two uncharred *Opuntia* seeds were recovered from the #10 sieve in sample 50268. These must represent contamination of some sort. Two possible charred seeds were found in sample 50208 (#35 sieve). In the Lower Pecos and west Texas in general, small pieces of charcoal with a melted, glassy surface luster are sometimes recovered. These derive from resinous plants (mesquite, juniper, or any of the acacias) that have burned. Examples were found in sample 50268 (#35 sieve, Fig. G.3), 50269 (#18 sieve), sample 50271 (#35 sieve). Some small cylindrical pieces that may represent spines from some straight-spined species of cactus were found in samples 50208 (#35) and 50271 (#35).

Hackberry seeds: These have been found in nearly every snail study in Texas using fine mesh methods. They are part of the normal seed rain in the soil everywhere and are probably not cultural, although sometimes rodent caches are recovered. In the eastern part of the state, they are probably mostly from sugar hackberry; here, probably from spiny hackberry (*Celtis pallida*). Only small amounts were found (0.266 g in sample 50237, none at all in 50268 and 50269).

Microdebitage: While flakes of any size could potentially have been recovered in the snail samples, for the most part only very small microflakes or fragments were recovered. Most were found in samples 50237, 50236, and 50207, in the Borrow Pit. Three very small pieces of possible black obsidian shatter were found in sample 50238 (#35 sieve). Alternatively, they might be vitreous charcoal; these need to be examined petrographically to determine if they are really obsidian. Obsidian from the Cerro Toledo Rhyolite source in New Mexico has been found at Arenosa Shelter (Hester *et al.* 1991).

Streamworn pebbles: Six small streamworn pebbles were found in sample 50207 (#10). These are sometimes found in Lower Pecos shelters, in contexts suggesting they were introduced as contamination in drinking water, not as stream-deposited bedload material.

Mussel shell flakes: These are very small, recovered from the #18 sieve in only two samples, 50237 and 50271.

Animal bone: Bone is quite variable, ranging from 139 specimens in sample 50237 to none at all in samples 50238, 50208, and 50268. It is most abundant in the same three samples that had most of the microdebitage (50237, 50236, and 50207), and these two debris classes covary closely. No bone fragments demonstrably from large or medium-sized animals appear to be present. Most of the fragments are very small splinters that are probably from small vertebrates, and many of them appear badly weathered, or in some cases, digested. Calcining or heat discoloration is very rare. A few elements appear identifiable (Fig. G.3): a lizard dentary fragment, a small mammal long bone fragment, several small rodent incisor fragments, two small snake vertebrae, and one small fish vertebra.
Snail shell fragments: Picking all the snail shell fragments out of each sample allows for comparison with counts of complete specimens. It is then possible to estimate whether low specimen counts in any one sample are due to excessive breakage. In the Sayles Adobe samples, the snail specimen counts show only a weak negative correlation to the fragment weights, but one sample (50207) has relatively low counts and high fragment weight, suggesting excessive breakage might have occurred in this sample. Because large and medium-bodied species are almost wholly absent from these samples, the milligram amounts of broken shell are derived almost entirely from microsnails.

OVERVIEW OF THE SAYLES ADOBE SNAIL FAUNA

Specimen density in the Sayles Adobe sediments is fairly low, about 5.51 specimens per liter. Elsewhere in Texas where comparable methods have been used, specimen density most often ranges from about 10-130 specimens per liter. The Genevieve Lykes Duncan site in the desert terrain of Brewster County produced only about 2 sp/l (author's unpublished data), but at the opposite end of the spectrum, the point bar, overbank and cienega deposits at Lubbock Lake yielded a density of 433 sp/l (Pierce 1987). Theler's samples from Bonfire Shelter represent a density of about 15.7 sp/l. The depositional rate in the upper part of the Bonfire section (Zone 3) is only 0.33 mm/year, (Robinson 1997:Fig. 3) compared to about 1.15 mm/year for the part of the Sayles Adobe section represented in this study, so the specimen counts are probably less diluted than at Sayles Adobe.

Low specimen density could be a result of poor habitat quality, the diluting effect of rapid sediment deposition, or both.

Low taxonomic diversity is usually an even better indicator of drought stress. There are only five or six terrestrial taxa (counting the Succineidae) and perhaps two aquatic taxa. A very small embryo in sample 50238 and a very small columellar fragment in sample 50237 are both assumed to represent at least one unidentified species of planorbid other than *Gyraulus parvus*. Thus, there are probably at most seven taxa represented.

Sites in Texas where fine-mesh sieving has been done have produced widely varying numbers of species, depending on mesh size, volume of samples, diligence of the investigator, and the original habitat quality. In Oklahoma and the eastern part of Texas, archeological and paleontological sites generally produce two dozen or more taxa. The Lubbock Lake site (46 taxa plus sphaeriid clams), Rex Rodgers (44 taxa), Aubrey (40 taxa), and Plainview sites (38 taxa plus peaclams and fingernail clams) are notable high scorers in Texas. Bonfire Shelter produced a minimum of 11 taxa (Byerly *et al.* 2007:Table 5).

Another characteristic of the Sayles Adobe fauna is the predominance of very small specimens. Except for one *Rabdotus* sp. adult in sample 50236, three juveniles, and nine apex fragments, there are no other large-bodied or medium-bodied taxa. Furthermore, there is a high proportion of juveniles, which suggests high juvenile mortality. In most Texas archeological samples, the #18 sieve (1 mm mesh) captures most of the informative specimens, but in the Sayles Adobe samples, the #10 sieve produced only 6.45% and the #18 sieve 12.72% of the specimens. The smallest sieve, #35, produced 80.82% of the specimens. Many of these are only fractions of a millimeter in size. There is nothing to indicate this signifies size-sorting during alluvial deposition. High juvenile mortality probably indicates drought stress.

The ten aquatic specimens recovered represent only 2% of the total snail counts. This is about the same proportion as the aquatic taxa from the alluvial bench deposits at Berger Bluff (Goliad County), but other alluvial sequences have higher proportions. At the Vara Daniel site (Travis County), about 8% are aquatic; at the Fish Creek Slough site (Dallas County), over 11% are aquatic (including peaclams and limpets). From pilot sampling at the Buckner Ranch site (Bee County), about 61% are aquatic (including peaclams and fingernail clams). These are all alluvial samples from sites next to active streams in different parts of Texas, ranging in age from Paleoindian to Protohistoric, but it is clear that the proportion of the fauna that is aquatic can vary widely. The suitability of the aquatic habitat for sustaining snail populations, the frequency of overbank flooding, and the height of the floodplain above normal base flow are probably just some of the factors determining how many aquatic snails end up buried in terrace sediments. The three Bonfire Shelter aquatic specimens identified by Theler amount to only 0.38% of the total count, but from the site's topographic position, it seems clear that these were not deposited by flooding. As the Skyline Shelter example demonstrates, aquatic snails can be introduced by humans as well as by flooding.

The proportion of aquatic snails in the Sayles Adobe collection is clearly on the low end of what might be expected, and it seems lower than would be expected if the snails were deposited by backflooding from the Rio Grande. The fact that the surface of the terrace sits nearly 11 meters above the rock-floored channel of Eagle Nest Creek may help to explain why aquatic snails are so rare here. Cheatum's (1966) laundry lists of species from Devil's Rockshelter and the Devil's Mouth site give some idea of the kinds of aquatic snails that might be expected in nearby Rio Grande sediments, but the species names and taxonomic groupings have changed since 1966. The Devil's Mouth site has about six aquatic snails, plus peaclams. Besides *Gyraulus parvus*, also present are *Helisoma anceps*, *Helisoma trivolvis* (now *Planorbella trivolvis*); two species of *Physa* (*anatina* and *gryrina*) that would now probably both be considered *Physa acuta*, "*Planorbis* sp.," (now probably regarded as some species of *Gyraulus*), and *Tropicorbis obstructus* (now probably *Biomphalaria havanensis?*). Devil's Rockshelter has three taxa, *Durangonella* sp. (*Durangonella coahuilae* is a poorly-known hydrobiid species native to Mexico) *Helisoma trivolvis* (=*Planorbella trivolvis*) and *Physa anatina* (=*Physa acuta*), plus one freshwater limpet species and one fingernail clam species.

The terrestrial assemblage from Sayles Adobe is clearly very arid-adapted. Although snails in general do not do well in drought conditions, the species present here are among the most drought-resistant Texas natives and are commonly found in open, sparsely vegetated areas. In fact, this xerophile assemblage is very similar to that from a sample column spanning the entire Holocene at the Genevieve Lykes Duncan site (41 BS 2615) in Brewster County, 200 km to the west (author's unpublished data). Annual precipitation at Langtry under the current climatic regime is about 37.26 cm/year (based on 1981-200 normals) with 32% occurring in the summer; on the O2 Ranch, where Genevieve Lykes Duncan is located, it was about 36 cm in 1914-1928, and 42 cm in 2015-2016.

SPECIES ACCOUNTS: TERRESTRIAL TAXA

*Gastrocopta pellucida* adults (n = 214; Fig. G.6, A)

*Gastrocopta* sp. juveniles (n = 151)

*Gastrocopta pellucida* is the most abundant species. There are also many embryonic-sized *Gastrocopta* that lack species-diagnostic characters, but because *G. pellucida* appears to be the only species present, can safely be assumed to be *G. pellucida* juveniles. Together, the combined adults and juveniles make up 65.41% of all the snails, terrestrial or aquatic. All of the juveniles except one were recovered from the #35 (0.5 mm mesh) sieve and are less than a millimeter across, and they make up 41% of the *Gastrocopta* count. This suggests fairly high juvenile mortality. Most  of the adults were also recovered from the #35 sieve. Many of the adults have snapped off apices, and a dozen apex fragments were also recovered. Most of this species was recovered from samples 50238, 50237, and 50208. It is among the smallest of the *Gastrocopta* species in Texas. The Sayles Adobe specimens have a mean shell height of 1.99±0.17 mm (range, 1.5-2.3, n = 150 measurable) and a mean diameter of 0.83±0.06 mm (range, 0.7-1.0, n = 197 measurable). The mean ratio of diameter to height is 0.417±0.036 (range, 0.348-0.533). Cheatum and Fullington (1973:17) list a mean height of 2.1 mm (range, 1.9-2.6) and diameter of 0.8-0.9 mm.

*Gastrocopta pellucida* is one of the most common species found in samples from Texas archeological sites. It is found in dry, open areas, especially in grass roots, sometimes with scattered shrubs or trees. It was the most abundant species (almost 6000 specimens) found in the Southern Plains Gastropod Survey, which was run along a 400-mile long east-west transect across Oklahoma, and was especially common in rock ledges and thickly grassed mesa tops, occurring also in riparian woodlands and wooded dunes (Wyckoff, Theler and Carter 1997:35). In New Mexico, it occurs "on slopes and bajadas under shelter such as large stones, fallen yucca stems, or caudices of sotol" (Metcalf and Smartt 1997:32). This is a subtropical snail, distributed from the West Indies across Florida, Texas and Oklahoma, and into the Southwest, as far north as South Dakota, Colorado and Utah and as far south as Guatemala, Panama, Nicaragua and Ecuador. The distribution shown in Nekola and Coles (2010:Fig. 9) is spotty, probably as a result of underreporting.

Succineidae adults (n= 3)

Succineidae juveniles (n = 113, Fig. G.5, C))

The Succineidae are a family of "amber snails" including several genera (*Oxyloma*, *Catinella*, *Succinea*) and species that generally cannot be identified except from soft tissue. In most species, adult shell height is a centimeter or more, but most of the Sayles Adobe specimens are much smaller juveniles. The chief exceptions are a basal fragment from sample 50237, a spire from 50207, and a complete specimen (height. 10.5 mm, diameter 6.2 mm) from 50208. Most of the juveniles (81%) came from the #18 and #35 sieves, with shell height ranging from about 1.1-9.6 mm. Succineids have very thin shells and aperture damage is frequent, so this may affect the size distribution in archeological samples.

Leonard and Frye (1962) identified succineids from the Pandale area as *Succinea luteola*. (often rendered as *Calcisuccinea luteola* in current taxonomy) Franzen (1982:84) identified specimens from Langtry as *Succinea avara*, but the taxonomy of succineids from the Texas-Mexico borderlands is convoluted, and these names might be considered obsolete now. A new DNA-based study of borderlands succineids would probably completely upend all the existing classifications. Cheatum (1966:239) identified succineids from Zone 1 at Bonfire Shelter as *Catinella vermeta*, which is plausible but perhaps due for review.

Most species of succineids seem to be wetland snails, but there is at least one species, or perhaps more, found in dry upland habitats in the borderlands region. One of these is *Calcisuccinea luteola*, already mentioned; Pilsbry (1948:828. Fig. 450f) lists a shell height for one of these from "high land west of Devil's River" as 12.5 mm. Branson (1963:81) lists shell heights of 8.4-15.0 mm and diameter 4.4-7.6 mm for *S. luteola* from Oklahoma. Another is *Succinea solastra*, as defined by Hubricht (1961:30-32), with a shell height ranging from 9.5 to 16.0 mm (for distribution, see Hubricht 1985:Map 130; Naranjo-García and Fahy 2010:Fig. 4; Correa Sandoval 2003:Table 3). However, Metcalf and Smartt (1997) do not recognize this as a valid species. They summarize the situation as follows:

"Ambiguities abound, but what is quite clear is that there is at least one succineid that is common at the lower elevations of southern New Mexico and Trans-Pecos Texas. It seems likely that only one xeric-tolerant species is represented. The name [*Succinea*] *grosvenori* is suggested here out of deference to custom, but it is also clear that this succineid deserves further study" (Metcalf and Smartt 1997:49).

On July 1, 2010, I made a small surface collection of recently dead snails from the limestone tableland slightly above and adjacent to the Javelina Heights site (41 VV 2005). The area has bare limestone, very thin pockets of soil in shallow depressions in the rock, and scattered vegetation (thin grass, lechuguilla, broad-leaved yucca, various acacias, and so forth), Included are three juvenile succineids and six adults (height ranging from 10.9 to 14.0 mm). These cannot be assigned a species name, but are clearly examples of the xeric-adapted upland species inhabiting the area. It seems likely that the Sayles Adobe specimens are the same species, but with almost no intact adults to compare with those from Javelina Heights, it is impossible to be certain. Compared to the Javelina Heights succineids, the lectotype of *Succinea grosvenori* as described by Metcalf (2002) is broader, with a less acute spire.

The shells from wetland-dwelling species of succineids have proven to be reliable for AMS dating because these snails apparently do not ingest much dead carbon from carbonate terrain, but the xeric-adapted upland species might be different. As far as I know, no one has assessed these yet. Succineids consume living and dead plants, fungi, and particularly for the wetland varieties, green algae and diatoms.

*Helicodiscus singleyanus* (= *Lucilla singleyana*) (n = 37, Fig. G.6, B)

These small, arid-adapted discoidal snails were found on the #18 and #35 sieves. They are land snails, but the empty shells will float readily in water and they are common in drift samples. According to Schikov (2017:171), they can withstand up to 72 hours of submergence. Distribution is irregular; they are abundant in samples 50238 and 50208, but entirely absent in 50236, 50207, 50269 and 50271. The mean diameter is larger (1.38±0.52 mm, n = 21) in sample 50208 than in sample 50238 (0.98±0.39 mm, n = 13). Perhaps this indicates increasing juvenile mortality over time. For all the samples combined, mean diameter is 1.23±0.52 mm (range, 0.6-2.6 mm; n = 37).

Different authorities list somewhat different typical diameters: 2-3 mm (Burch 1962:79); 2.4 mm (Pilsbry 1948:636); 2.5 mm (Leonard 1959:133); 2.4-3.0 mm (Dourson 2010:87). These are presumably typical diameters for adults, but archeological samples generally include large numbers of juveniles. Specimens from the Genevieve Lykes Duncan site in Brewster County are similarly sized (1.19±0.39 mm, n = 206 measurable; author's unpublished data). Because adults are similar in morphology to juveniles, there is no well-defined diameter beyond which a specimen can be said to be an adult. This species can be confused with *Helicodiscus* (*Lucilla*) *inermis* or with *Hawaiia minuscula*, which are similar in appearance. One of the Sayles Adobe specimens has the slightly more elevated spire characteristic of *Hawaiia*, however. Dourson (2010:86) provides a convenient guide for parsing these species.

Classified as *Lucilla singleyana* in much of the recent literature, this is one of the most common species recovered in Texas archeological samples. It was abundant at Bonfire Shelter, where it is absent below sample 4 (Byerly *et al*. 2007:Fig. 7, Table 5). Habitat preferences for this species are not very well documented because it is so inconspicuous. In the Southern Plains Gastropod Survey across Oklahoma, it ranked sixth in frequency and had the highest densities (83 per square meter) on a mesa top and in rock ledge areas; it also occurred on toeslopes, riparian woodland, and pastures, but was absent from dunes (Wyckoff, Theler and Carter 1997:Table 10).

According to Metcalf and Smartt (1997:40)

"It is found commonly under rocks or in leaf litter below the scarp of the Ogallala Caprock in eastern New Mexico. It occurs in rock talus along canyon walls and hillslopes of the arid lower mountains of the south-central and southwestern parts of the state. *Helicodiscus singleyanus* is a common fossil in both Pleistocene and Holocene deposits of river and arroyo floodplains in southern New Mexico."

Oddly enough, some of the best and most recent biological profiles of this species come from eastern Europe, where it is often regarded as invasive from the New World, introduced on houseplants, although Alexandrowicz (2010:90) claims it is native to Austria and Slovakia, becoming extinct sometime in the Pleistocene and only reintroduced in the 1940s. Either way, it is now widely distributed in Europe (Alexandrowicz 2010:Table 2; Horsák *et al*. 2009). Specimens from separate populations in Russia and the Caucasus measure 2.55±0.14 and 2.12±0.16 mm in diameter (Schikov 2017:Table 1). Three aggregated populations from Poland measure 1.97±0.107 mm in diameter (Alexandrowicz 2010:Table 1).

In North America, living populations of this species are found all the way from Michigan and Pennsylvania in the north to at least as far south as Sonora and Oaxaca in Mexico, suggesting it is not very temperature-sensitive. According to Schikov (2017), these snails live in leaf litter and soil, burrowing up to 50 cm below the surface in earthworm tunnels, feeding on decaying live plants, on rootlets and seeds.

*Rabdotus* sp. (MNI = 9?; 1 adult, 3 juveniles, plus spires of indeterminate age)

There are very few examples of *Rabdotus*, all coming from just three samples (50237, 50236, and 50207). The single complete adult may be *Rabdotus dealbatus*, although identification is more assured when large groups of shells are available for study. The snail shell fragments from sample 50207 are mostly from adult *Rabdotu*s. One is calcined, and one or two have beige-colored interiors that may indicate the presence of *Rabdotus alternatus*, so there may be more than one species of *Rabdotus* present, but the evidence is inconclusive.

The description of Fullington and Pratt (1974:17) under *Rabdotus dealbatus ragsdalei* might apply here, although this subspecies is not necessarily present: "...characteristically an inhabitant of broken, rocky terrain, usually on limestone, where it seeks diurnal shelter under rocks and logs in low, open oak and juniper woodland. In the desert grassland of the Pecos River highlands it is found among the dead leaves thatching the trunks of arborescent yuccas as well as under fallen yucca stems and rocks."

*Pupoides albilabris* adults (n = 6, Fig. G.5, B)

This adaptable snail is distinctive and not prone to misidentification. All except one were found in the #18 sieve, and they occur as single specimens equably distributed across six of the eight samples. In the Southern Plains Gastropod Survey, this species is the most commonly encountered, occurring on all landform types (Wyckoff, Theler and Carter 1997:32), but in low numbers. In New Mexico, it "...may be found in brushy areas under stones or in leaf litter. In the southern part of the state, it may occur under stems of dead yuccas and dead, detached caudices of sotol" (Metcalf and Smartt 1997:27). This species can clearly tolerate considerable aridity, but it can also tolerate damp conditions and occurs eastward to Florida, the Caribbean, and along the Atlantic coast as far north as Vermont (Hubricht 1985:Map 38).

SPECIES ACCOUNTS: AQUATIC TAXA

cf. *Gyraulus parvus* (n= 8, Fig. G.5, A)

This small planorbid snail was found in only two samples. Seven were found in sample 50208, and one in 50236. They are all small examples, probably mostly juveniles (?). The mean diameter is only 1.41±0.43 mm (range, 0.0-2.2 mm, n = 8). Information on the typical diameter of this species is sparse. Fullington (1978:189) says only that the maximum diameter is 5 mm. Other sources list mean diameters ranging from 2.23 to 3.52 mm. Eckblad (1971:Fig. 3) lists diameters ranging from 1 to 3 mm. Laman, Daniell and Blankespoor (1984:Table 1) list diameters for 5635 specimens collected over three years in Michigan, yielding a mean diameter of 2.60 mm (range, 1-7 mm), but apparently they measured no specimens smaller than 1 mm.

The Sayles Adobe specimens are atypical for *Gyraulus parvus* because they do not have deflected apertures. Instead, the aperture is symmetrical and in line with the plane of the body (similar to the much larger species *Planorbella trivolvis*), so it is possible that these might actually be some other species of *Gyraulus*. As Fullington (1978:191-191) points out, differentiating the species is difficult. *Gyraulus arizonensis* has also been reported in south Texas and the Big Bend (these are said to be 1.1-3.2 mm in diameter; Branson 1960:37). However, I am not sure that current taxonomy still recognizes these as a valid species. *Gyraulus parvus* is a very widespread snail, occupying all of the continental US, Canada, and extending into Mexico and the Caribbean.

According to Fullington (1978:190),

> "*G. parvus* in Texas was found more often in ponds and stream backwaters, particularly where *Potamogeton* and *Ceratophyllum* were abundant and was almost on the vegetation. In central and east Texas, it was common where streams were slow flowing and choked with submerged vegetation."

Most of the accounts of this species agree that it has a decided preference for aquatic vegetation, such as filamentous green algae, cattails, or submerged grass or tree leaves. One study of aquatic vegetation in a Wisconsin lake found that *Gyraulus parvus* was 48 times more abundant below *Ceratophyllum* beds than in unvegetated areas (Beckett, Aartila and Miller 1992:81). These snails have been found alive after over two months stranded in damp sediment under algal mats in a dried-up pond in Illinois. The propensity of this species to live in or under algal mats might explain their introduction to a campsite if dried algal mats were collected for use as tinder in fire starts, or as padding (A. T. Jackson recovered dried *Cladophora* algae from Fate Bell Shelter; letter of Volney Jones to J. E. Pearce, January 14, 1935, on file at TARL). Alternatively, they might have been collected as contaminants in drinking water, or they might have been deposited when floodwaters covered the site. Cheatum (1966:234-236) recognized *G. parvus* from strata 9, 11, and 14 at the Devil's Mouth site.

Eagle Nest Creek has a fairly small, rocky limestone catchment and heads only about 7.3 km to the north. In the current climatic regime, the stretch of creek below the site sometimes has a small stream of groundwater emerging upstream and flowing over mostly sandy and gravel sediment. Farther upstream, the canyon is rock-floored with discontinuous gravel bars and fairly small bedrock tinajas. These habitats do not correspond very closely to the algae-choked sluggish streams with mud bottoms where *Gyraulus* is usually found, but this snail is very adaptable and could perhaps live in such habitats. It is found in isolated, closed water bodies like playa lakes in the Texas panhandle. Theler recovered single juvenile *Gyraulus* sp. shells from two samples at Bonfire Shelter, adjacent to the rock-floored part of the canyon (Byerly *et al*. 2007: Table 5). The appearance of small numbers of aquatic snails in rockshelters like Skyline Shelter or Bonfire Shelter (where they could not possibly have been deposited by floodwaters) is provocative. *Gyraulus parvus* is a preferred prey species for crawdads (Brown 1998), and we know that crawdads were collected by the inhabitants of Baker Cave, because crawdad exoskeleton fragments were recovered in excavations there (author's unpublished data). Some aquatic snails might have been introduced in the digestive tracts of fish, turtles, or crawdads.

Eckblad (1973: Table VI) estimated densities of *G. parvus* in Fall Creek at Ithaca, New York, ranging all the way from 4 individuals/m$^2$ (in October) to 287 individuals/m$^2$ (in June). Sowards (2012:14, Table 2) found the species mostly absent in southeast Kansas, but with a density of 8.7 individuals/m² at one locality in the Elk River.

Planorbidae, unidentified juveniles (n = 2)

Two small planorbids were found in the #35 sieve that appear to be different from *Gyraulus parvus* but cannot be identified. A very small embryo with a diameter of 0.9 mm was found in sample 50238; it could represent an embryonic *Planorbella trivolvis*, *Helisoma anceps*, or something similar. In sample 50237, a small columellar fragment 1.2 mm in diameter might be from the same sort of species. Although these cannot be identified, they suggest at least one other kind of planorbid quatic snail might have been present.

SUMMARY AND CONCLUSIONS

We can make the following observations about the pilot samples from Sayles Adobe:

1. Specimen density is low; this could be because

    a. Depositional rates were high, diluting the specimen counts, or

    b. Habitat quality was poor, or

    c. Both are true (perhaps the most plausible explanation)

2. Taxonomic diversity is low (Fig. G.7); this is usually a very good indicator of stressful environments and is less likely to be affected by depositional rates. Even if there are two species of *Rabdotus* and two species of Planorbidae present, there are at most eight species present.

3. For the land snails *Gastrocopta pellucida*, *Helicodiscus singleyanus*, and especially the Succineidae, and for the aquatic snail *Gyraulus parvus*, specimens smaller than average are the rule. These are evidently juveniles, which suggests significant juvenile mortality across most taxa. Either sediment deposition mostly occurred early in the spring, after hatching but before maturity, or else the climate was so arid that large numbers of snails died prematurely. *Pupoides albilabris* is the only species represented entirely by adults.

4. The terrestrial component consists of arid-adapted, resilient, eurytopic species. Eurytopic organisms are those capable of adapting to a wide range of

environmental conditions. Likewise, the one aquatic species identified, *G. parvus*, is also tolerant of poorly oxygenated, sluggish, vegetation-choked streams, perhaps with unfavorable water quality or temperature. All of these snails are habitat generalists, and accordingly, they tend to have very broad continental distributions. The Sayles Adobe assemblage is very similar to that from the Genevieve Lykes Duncan site, located in an even more arid environment far to the west in Brewster County (author's unpublished data, from a sample column spanning the entire Holocene).

Resilient, adaptable habitat generalists are probably not very sensitive indicators of environmental change. Rare species that are habitat-specific, usually occurring in small numbers, may often carry the biggest payload of climate change information, but none of those were found at Sayles Adobe. Nevertheless, the xerophile snail fauna found here indicates an arid, stressful environment much like the present one. If there are any mesic events encompassed by the 3167- 675 cal BP span of the pilot samples, they must have occurred in unsampled intervals. The *Gastrocopta pellucida*, *Pupoides albilabris*, and Succineidae from the Southern Plains Gastropod Survey were found on various associations of C3, C4, and CAM plants in Oklahoma, and they have generally similar $^{13}$C isotopic mean values for shell carbonate: *G. pellucida*, -5.99 ‰ (range, -1.60 to -10.60 ‰, n = 27); *P. albilabris*, -4.77 ‰ (range, -2.10 to -9.30 ‰, n = 9); and Succineidae, -5.67 ‰ (range, -4.60 to -6.50 ‰, but note these succineids are probably not the same species as found at Sayles Adobe; Balakrishnan *et al*. 2005:Appendix A). Shell carbonate isotope values, however, are always offset considerably from the values for local vegetation and do not tell us much about what was growing in the area. To assess that, we need values for shell organic matter.

Carbon isotopes from the Sayles Adobe sediment sample column are consistently in the C3 range, averaging about -23‰ (Tori Pagano, personal communication 2018) and are quite uniform over the entire sample column. This uniformity is consistent with the uniformity in assemblage composition over the same period. Goodfriend and Ellis (2000) measured isotope values from Hinds Cave *Rabdotus alternatus* and found that the values for shell carbonate and shell organic matter differ radically. Organic isotope values for the time range comparable to the Sayles Adobe pilot samples declined from about -15‰ to -18‰ (Goodfriend and Ellis 2000:Fig. 10).

5. The Borrow Pit has most of the aquatic snails, despite being farther from the creek. Although peaclams and fingernail clams are often recovered from fine-mesh sampling of alluvial sites adjacent to creeks, none were found at Sayles Adobe. Peaclams are found on mud or sand bottoms, often in deep water. Fingernail clams are found on various bottom types in perennial water bodies. Perhaps their absence here tells us something about local hydrology, or perhaps it just indicates inadequate sampling.

6. There are no obvious stratigraphic trends in assemblage composition. The same xerophile species appear throughout this discontinuous set of samples. All material classes (including snails) tend to be somewhat more abundant in the uppermost samples, regardless of excavation block. In the Sandbox samples, snail counts increase toward the top of the sequence, despite the fact that depositional rates also appear to increase in the upper part of the profile. Probable cultural inclusions (bone, charcoal, and possible microdebitage) are most abundant in sample 50237, which can be seen just above the darker zone with burned rock in Figure G.2. Cultural inclusions are positively correlated with each other. Snail counts show weak negative correlations with cultural inclusions. The snail counts also show weak negative correlation with snail shell fragment weight, which must mean that shell breakage has had relatively little effect on the specimen counts.

The Devil's Mouth site offers an interesting comparison to Sayles Adobe. Cheatum (1966:231-236) recognized an average of about six snail or peaclam taxa across all the strata in Area A (range, 2-10), but strata 9 and 4 both have 10 taxa. Stratum 9 has an assay of 2790±80 RCYBP, or roughly 2900 cal BP (CALIB 7.10, IntCal13 database), plus Montell, Langtry, Shumla, and other points (Sorrow 1968:46) from the Cibola Period. Stratum 4 has no assays, but has Ensor and Frio points, characteristic of the Blue Hills Period (2300-1300 cal BP). Based on their analysis of pollen samples from Devil's Mouth, Bryant and Larson (1968:65) state

"For a short time during the deposition of strata 8-9 (*ca*. 2,800 B.P.) the climate in the Amistad region may have approached mesic conditions. The fossil pollen from this interval indicates a sharp rise in pine, grass and sedge pollen and a general decrease in *Ephedra* and *Prosopis* pollen. This return to more mesic conditions was short lived, for subsequent pollen deposition indicates xeric conditions."

If this postulated mesic period is registered in any of the Sayles Adobe snail samples, it might be sample 50208, because that one has larger snail counts, but the faunal composition is no different from the other samples. Linear age-depth modeling suggests this sample might date around 3000-3100 cal BP (Tori Pagano, personal communication 2018). If the Lower Pecos region really did experience a slightly wetter interval around 2900-3000 uncal BP, a few more mesic-adapted snail species might be expected to have appeared in sample 50208, but as it happens, this is not the case.

SUGGESTIONS FOR FUTURE PROJECTS

This project was intended as a pilot study, and as such, it had fairly limited goals. Were there microsnails preserved in the Sayles Adobe sands? What kinds were present? And did they carry enough of a paleoenvironmental payload to justify more extensive studies?

These pilot samples were not expected to provide a thorough paleoenvironmental reconstruction for the site, but there were a couple of things that could have been done differently to improve the results. The Borrow Pit samples are closer to the talus slope, higher up, and in an area clearly affected by occupation. The Sandbox samples are farther away, deeper in the excavation, and in an area less affected by occupation. The two assemblages are different, but it is unclear if horizontal positioning, depth, sediment accretion rates, or human activity (such as brush clearing) account for these differences. If all eight samples (even though discontinuous) had been taken from a single wall, some of these variables could have been ruled out.

It would also have been useful to find some way to sample at least a couple of the mud drapes, to see if these might yield greater numbers of aquatic snails, although as mentioned earlier, this might have required a dedicated unit just for this purpose.

ACKNOWLEDGMENTS

Thanks to Tori Pagano and Steve Black for allowing me to sample the Sayles Adobe site. Thanks to John Karges (Texas Nature Conservancy) for providing a copy of the Diamond Y and Independence Creek report. And especially, thanks to Tori for collecting samples, answering questions, and not administering a severe beating after I ruined one of her geoarchaeology column samples.

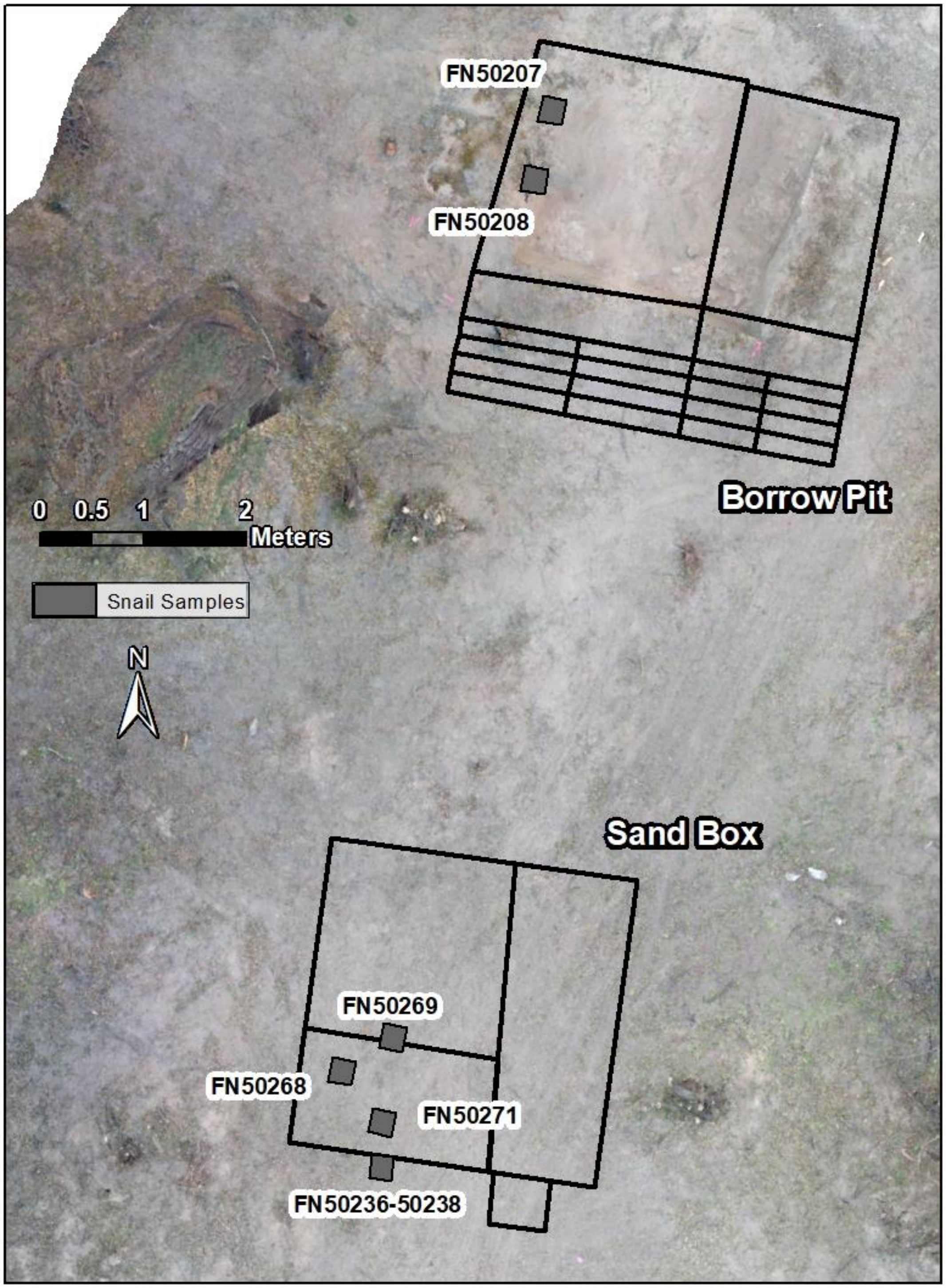


Figure G.1. Location of snail pilot samples.


Figure G.2. Location of samples in south profile wall of the Sandbox, looking south.

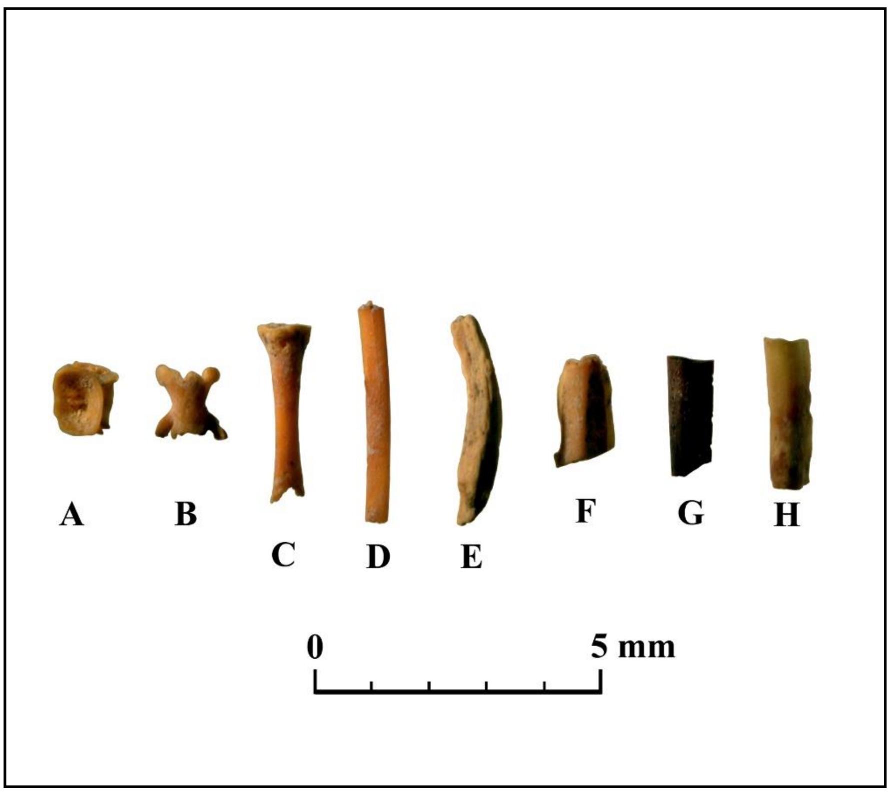


Figure G.3. Selected examples of microvertebrate bone from pilot sample 50237, #35 (0.5 mm ) sieve. A, fish vertebra; B, snake vertebra; C, long bone with unfused epiphysis; D, rib fragment (?); F, tooth enamel fragment; G-H, unidentified fragments.

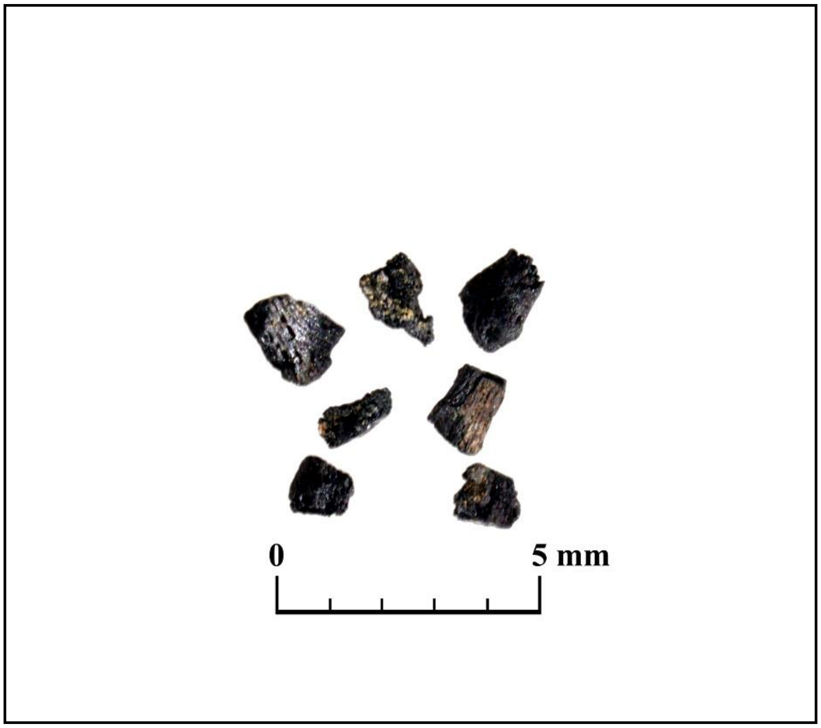


Figure G.4. Charcoal particles from pilot sample 50268, #35 (0.5 mm) sieve. Some of these have vitreous luster, probably from resinous plants.

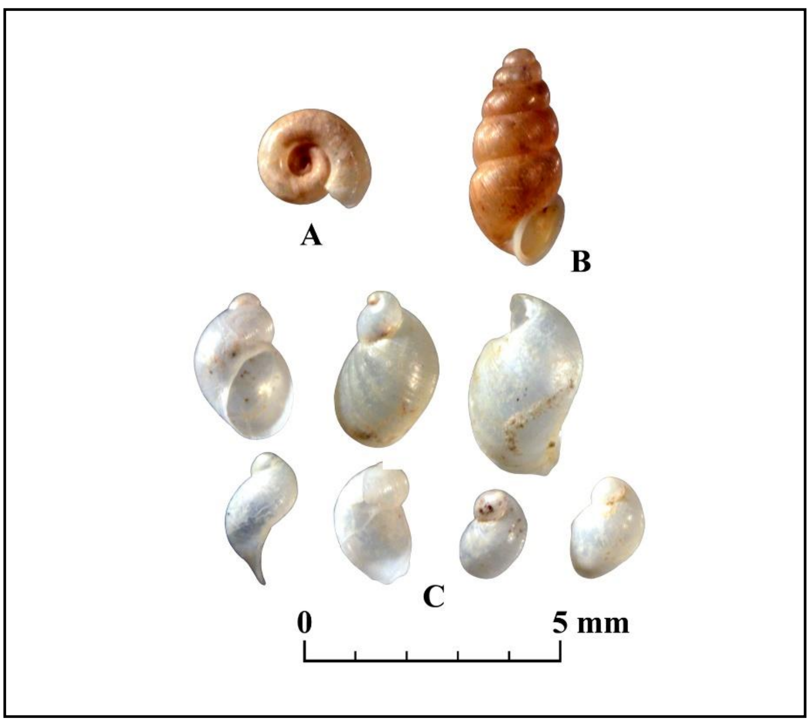


Figure G.5. Selected examples of snails from pilot sample 50268, #18 (2 mm) sieve); A, *Gyraulus parvus*; B, *Pupoides albilabris*; C, several examples of juvenile Succineidae.

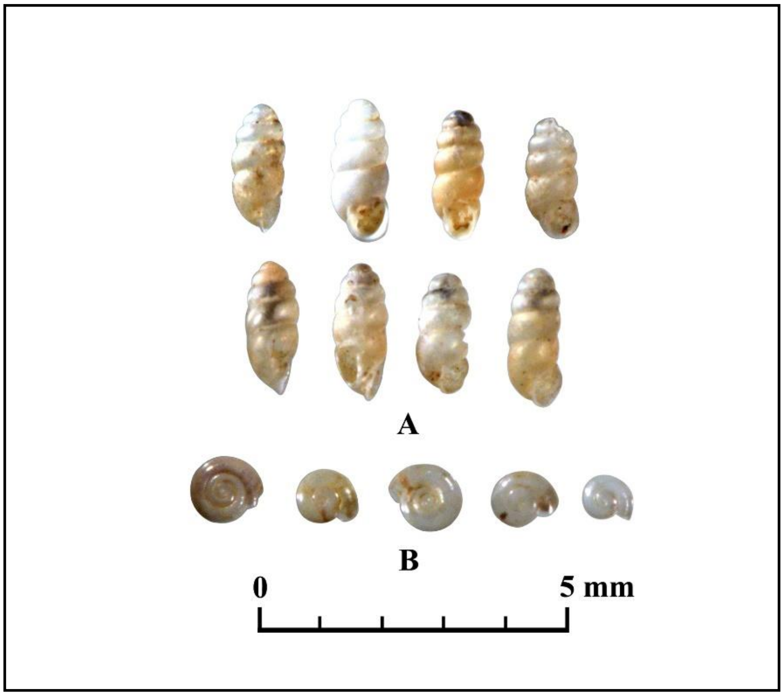


Figure G.6. Selected examples of snails from pilot sample 50238, #35 (0.5 mm) sieve). A, *Gastrocopta pellucida* adults; B, *Helicodiscus singleyanus* (or *Lucilla singleyana*), perhaps all juveniles (?).

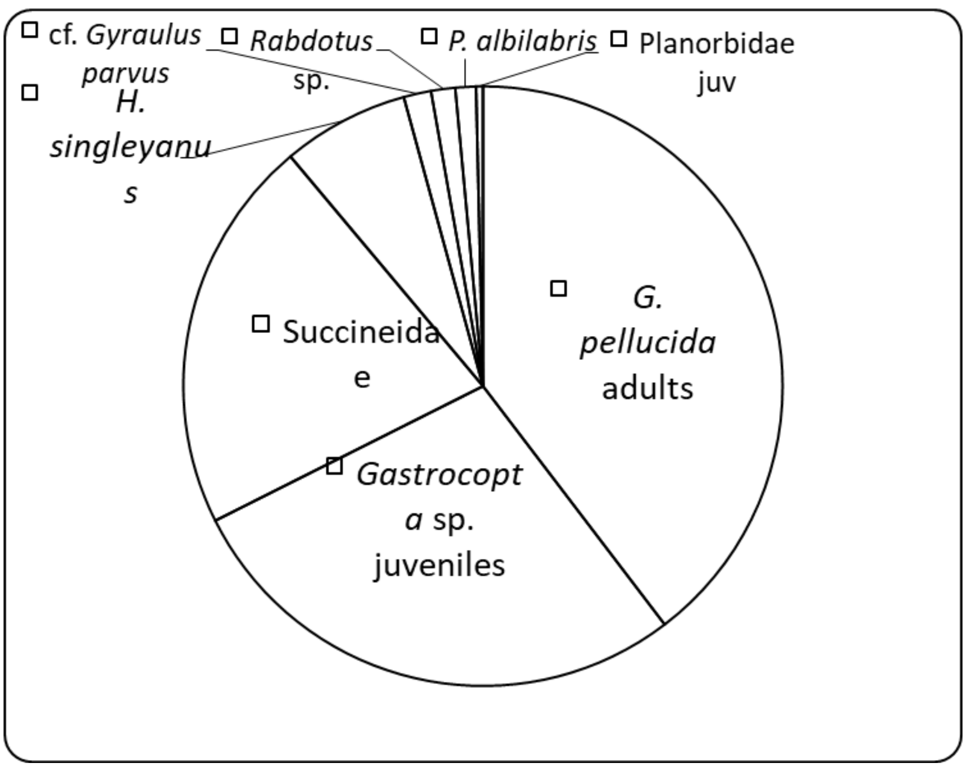


Figure G.7. Taxonomic representation (by specimen counts) for all eight samples combined.

Table G.1: Snail Pilot Sample Data

Borrow Pit Samples

| Sample number | North (m) | East (m) | Elevation (m) | Thickness (cm) | Volume (liters) |
|---|---|---|---|---|---|
| 50207 | 5029.557 | 3103.348 | 962.387 | 20 | 12.00 |
| 50208 | 5028.969 | 3103.325 | 962.117 | 20 | 11.30 |

Sandbox Samples

| Sample number | North (m) | East (m) | Elevation (m) | Thickness (cm) | Volume (liters) |
|---|---|---|---|---|---|
| 50238 | 5019.284 | 3102.223 | 964.276 | 25 | 11.85 |
| 50237 | 5019.339 | 3102.209 | 963.602 | 24 | 12.00 |
| 50236 | 5019.452 | 3102.223 | 962.980 | 22 | 11.70 |
| 50268 | 5020.667 | 3102.589 | 962.353 | 34 | 15.00 |
| 50269 | 5019.761 | 3102.529 | 962.342 | 35 | 15.00 |
| 50271 | 5019.816 | 3101.896 | 961.401 | 42 | 12.50 |

Table G.2: Borrow Pit Samples

| **Lot number of sample:** | 50207 #10 sieve | 50207 #18 sieve | 50207 #35 sieve | 50208 #10 sieve | 50208 #18 sieve | 50208 #35 sieve |
|---|---|---|---|---|---|---|
| *Gastrocopta pellucida* adults | | 5 | | | | 68 |
| *Gastrocopta* sp. juveniles | | | | | | 20 |
| *Gastrocopta* sp. apex fragments | | 1 | | | | 6 |
| *Helicodiscus singleyanus* | | | | | 7 | 14 |
| *Pupoides albilabris* | | | | | 1 | |
| *Rabdotus* sp adult | | | | | | |
| *Rabdotus* sp. juveniles | 1 | | | | | |
| *Rabdotus* sp. apex fragments | 6 | | | | | |
| Succineidae adult | 1 | | | 1 | | |
| Succineidae juveniles | 2 | 7 | 9 | | 6 | 8 |
| Planorbidae juveniles | | | | | | |
| cf. *Gyraulus parvus* | | | | | 2 | 5 |
| Snail shell fragment weight | 1.942 | 0.237 | 0.224 | 0.053 | 0.174 | 0.468 |
| Charcoal weight | 0.031 | 0.037 | 0.111 | 0.011 | 0.029 | 0.011 |
| Hackberry seed fragment weight | 0.037 | 0.036 | 0.023 | T | | |
| Bone count | 3 | 45 | 44 | | | |
| Microdebitage count | 13 | 17 | | | | |
| Streamworn pebble count | 6 | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mussel shell flake count | | | | | | |
| Sample volume (liters) | | 12 | | | 11.3 | |
| Sample thickness (cm) | | 20 | | | 20 | |
| Sample elevation (m) | | 962.39 | | | 962.12 | |
| Column totals: | 10 | 13 | 9 | 1 | 16 | 121 |
| Sample totals: | | | **32** | | | **138** |

Table G.3: Sandbox Samples, Part 1

| **Lot number of sample:** | 50238 | 50238 | 50238 | 50237 | 50237 | 50237 | 50236 | 50236 | 50236 |
|---|---|---|---|---|---|---|---|---|---|
| | #10 sieve | #18 sieve | #35 sieve | #10 sieve | #18 sieve | #35 sieve | #10 sieve | #18 sieve | #35 sieve |
| *Gastrocopta pellucida* adults | | | 57 | | | 39 | | | 12 |
| *Gastrocopta* sp. juveniles | | | 74 | | 1 | 23 | | | 9 |
| *Gastrocopta* sp. apex fragments | | | | | | | | | |
| *Helicodiscus singleyanus* | | 1 | 12 | | | 2 | | | |
| *Pupoides albilabris* | | | | | 1 | | | 1 | |
| *Rabdotus* sp adult | | | | | | | 1 | | |
| *Rabdotus* sp. juveniles | | | | | | 1 | 1 | | |
| *Rabdotus* sp. apex fragments | | | | 3 | | | | | |
| Succineidae adult | | | | 1 | | | | | |
| Succineidae juveniles | | 1 | 1 | 7 | 9 | 6 | 6 | 7 | 9 |
| Planorbidae juveniles | | | 1 | | | 1 | | | |
| cf. *Gyraulus parvus* | | | | | | | | 1 | |
| Snail shell fragment weight | 0.022 | 0.011 | T | 0.808 | 0.277 | 0.059 | 0.339 | 0.07 | 0.043 |
| Charcoal weight | | 0.025 | 0.013 | 1.095 | | | 0.197 | 0.44 | 0.313 |
| Hackberry seed fragment weight | 0.033 | 0.013 | T | 0.182 | 0.076 | 0.008 | 0.092 | 0.046 | 0.012 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bone count | | | | 4 | 25 | 110 | | 2 | 4 |
| Microdebitage count | | | | 6 | 11 | 2 | 2 | 3 | 2 |
| Streamworn pebble count | | | | | | | | | |
| Mussel shell flake count | | | | | 1 | | | | |
| Sample volume (liters) | | 11.85 | | | 12 | | | 11.7 | |
| Sample thickness (cm) | | 25 | | | 24 | | | 22 | |
| Sample elevation (m) | | 964.28 | | | 963.60 | | | 962.98 | |
| Column totals: | 0 | 2 | 145 | 11 | 11 | 72 | 8 | 9 | 30 |
| Sample totals: | | | **147** | | | **94** | | | **47** |

Table G.4: Sandbox Samples, Part 2

| **Lot number of sample:** | 50268 #10 sieve | 50268 #18 sieve | 50268 #35 sieve | 50269 #10 sieve | 50269 #18 sieve | 50269 #35 sieve | 50271 #10 sieve | 50271 #18 sieve | 50271 #35 sieve | **totals** |
|---|---|---|---|---|---|---|---|---|---|---|
| *Gastrocopta pellucida* adults | | | 16 | | | 7 | | | 10 | 214 |
| *Gastrocopta* sp. juveniles | | | 6 | | | 9 | | | 9 | 151 |
| *Gastrocopta* sp. apex fragments | | | | | | | | | 5 | 12 |
| *Helicodiscus singleyanus* | | 1 | | | | | | | | 37 |
| *Pupoides albilabris* | 1 | | | | 1 | | | 1 | | 6 |
| *Rabdotus* sp adult | | | | | | | | | | 1 |
| *Rabdotus* sp. juveniles | | | | | | | | | | 3 |
| *Rabdotus* sp. apex fragments | | | | | | | | | | 9 |
| Succineidae adult | | | | | | | | | | 2 |
| Succineidae juveniles | 4 | 7 | 4 | 2 | 6 | 3 | | 4 | 5 | 113 |
| Planorbidae juveniles | | | | | | | | | | 2 |
| cf. *Gyraulus parvus* | | | | | | | | | | 8 |
| Snail shell fragment weight | T | 0.028 | 0.027 | T | T | 0.02 | T | 0.011 | 0.014 | |
| Charcoal weight | | T | T | T | T | T | | 0.023 | 0.016 | |
| Hackberry seed fragment weight | | | | 0.019 | T | | | 0.018 | | |
| Bone count | | | | | 1 | | | 3 | | 241 |
| Microdebitage count | | | | 1 | | | 1 | | | 58 |
| Streamworn pebble count | | | | | | | | | | 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mussel shell flake count | | | | | | | | 1 | | 2 |
| Sample volume (liters) | | 15 | | | 15 | | | 12.5 | | 101.3 5 |
| Sample thickness (cm) | | 34 | | | 35 | | | 42 | | |
| Sample elevation (m) | | 963.3 5 | | | 962.3 4 | | | 961.4 0 | | |

Column totals: 5 8 26 2 7 19
0 5 29 559
Sample totals: **19** **28**
**34**

NOTE: Row totals are for Table G2,G 3 and G4 combined.

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# APPENDIX H: SITE ASSEMBLAGES

Appendix H shows the general provenience, artifact type, and count data for all materials collected from Sayles Adobe. H.1 presents the macroartifact assemblage; H.2 presents the microartifact assemblage; H.3 presents the rock sort data.

**Table H.1a:** Cultural material collected from all Borrow Pit excavations.

| Unit | Unit-Layer | Artifact Name | Artifact Material | Count |
|---|---|---|---|---|
| Secondary Units | B.L2 | Debitage | Chert | 6 |
| | B.L2 | Faunal Remains | Bone | 3 |
| | B.L3 | Flake | Chert | 1 |
| | B.L3 | Manuport | Limestone | 1 |
| | B.L3 | Ground Stone | Limestone | 1 |
| | B.L3 | Debitage | Chert & Igneous | 20 |
| | B.L3 | Faunal Remains | Bone | 1 |
| | B.L4 | Biface | Chert | 1 |
| | B.L4 | Flake | Chert | 2 |
| | B.L4 | Modified Flake | Chert | 1 |
| | B.L4 | Debitage | Chert & Igneous | 151 |
| | B.L4 | Faunal Remains | Bone | 4 |
| | B.L5 | Flake | Chert | 1 |
| | B.L5 | Manuport | Limestone | 1 |
| | B.L5 | Modified Flake | Chert | 2 |
| | B.L5 | Biface | Chert | 2 |
| | B.L5 | Ocher | Mineral | 1 |
| | B.L5 | Debitage | Chert & Igneous | 124 |
| | B.L5 | Faunal Remains | Bone | 1 |
| | B.L5 | Faunal Remains | Mussel Shell | -- |
| | B.L6 | Flake | Chert | 1 |
| | B.L6 | Flake Tool | Chert | 2 |
| | B.L6 | Manuport | Limestone | 1 |
| | B.L6 | Biface | Chert | 1 |
| | B.L6 | Debitage | Chert & Igneous | 109 |
| | B.L6 | Faunal Remains | Bone | 3 |
| | D.L2 | Mineral | Hematite | 1 |
| | D.L2 | Chert Chunk | Chert | 1 |
| | D.L2 | Debitage | Chert & Igneous | 45 |
| | D.L3 | Flake | Chert | 1 |
| | D.L3 | Debitage | Chert & Igneous | 18 |
| | D.L4 | Chert Chunk | Chert | 1 |
| | D.L4 | Debitage | Chert | 7 |
| | J.L1 | Manuport | Igneous & Limestone | 2 |
| | J.L1 | Debitage | Chert & Igneous | 40 |
| | J.L1 | Faunal Remains | Bone | 8 |
| | J.L2 | Debitage | Chert & Igneous | 22 |
| | J.L2 | Faunal Remains | Bone | 1 |
| | K.L1 | Debitage | Chert | 60 |
| | K.L2 | Manuport | Limestone | 1 |
| | K.L2 | Debitage | Chert & Igneous | 16 |
| | L.L1 | Projectile Point | Chert | 1 |

| | | | | |
|---|---|---|---|---|
| | L.L1 | Modified Flake | Chert | 1 |
| | L.L1 | Manuport | Limestone | 1 |
| | L.L1 | Debitage | Chert & Igneous | 30 |
| | L.L2 | Debitage | Chert | 20 |
| | L.L2 | Faunal Remains | Bone | 1 |
| | L.L3 | Debitage | Chert | 25 |
| | L.L4 | Modified Flake | Chert | 1 |
| | L.L4 | Debitage | Chert | 32 |
| | L.L5 | Debitage | Chert | 30 |
| | L.L6 | Debitage | Chert | 6 |
| | P.L1 | Manuport | Limestone | 1 |
| | P.L1 | Flake | Chert | 1 |
| | P.L1 | Debitage | Chert | 1 |
| Final Expansion & Feature Excavations | Q.L1 | Debitage | Chert | 7 |
| | Q.L2 | Flake | Chert | 2 |
| | Q.L2 | Manuport | Limestone | 2 |
| | Q.L2 | Debitage | Chert & Igneous | 132 |
| | Q.L2 | Faunal Remains | Bone | 4 |
| | Q.L3 | Modified Flake | Chert | 2 |
| | Q.L3 | Biface | Chert | 1 |
| | Q.L3 | Core | Chert | 1 |
| | Q.L3 | Manuport | Limestone | 1 |
| | Q.L3 | Debitage | Chert & Igneous | 174 |
| | Q.L3 | Faunal Remains | Bone | 31 |
| | Q.L3 | Faunal Remains | Mussel Shell | 1 |
| | Q.L4 | Modified Flake | Chert & Igneous | 2 |
| | Q.L4 | Uniface | Chert | 1 |
| | Q.L4 | Flake Tool | Chert | 1 |
| | Q.L4 | Debitage | Chert & Igneous | 32 |
| | Q.L5 | Projectile Point | Chert | 1 |
| | Q.L5 | Debitage | Chert & Igneous | 51 |
| | Q.L5 | Faunal Remains | Bone | 2 |
| | Q.L5 | Faunal Remains | Mussel Shell | -- |
| | Q.L5 | Manuport | Limestone & Igneous | 4 |
| | Q.F2(L5) | Modified Flake | Chert | 1 |
| | Q.F2(L5) | Debitage | Chert & Igneous | 10 |
| | Q.L6 | Uniface | Chert | 1 |
| | Q.L6 | Modified Flake | Chert | 1 |
| | Q.L6 | Debitage | Chert & Igneous | 53 |
| | Q.L6 | Faunal Remains | Bone | 6 |
| | Q.L7 | Faunal Remains | Mussel Shell | 1 |
| | Q.L7 | Modified Flake | Chert & Igneous | 4 |
| | Q.L7 | Biface | Chert | 1 |
| | Q.L7 | Debitage | Chert & Igneous | 58 |

| | | | | |
|---|---|---|---|---|
| | Q.L7 | Flake | Chert | 1 |
| | Q.L7 | Faunal Remains | Bone | 1 |
| | Ra.L1 | Debitage | Chert | 1 |
| | Ra.L2 | Biface | Chert | 1 |
| | Ra.L2 | Debitage | Chert | 14 |
| | Ra.L3 | Biface | Chert | 1 |
| | Ra.L3 | Debitage | Chert/Igneous | 56 |
| | Ra.L5 | Core Fragment | Chert | 1 |
| | Ra.L5 | Manuport | Limestone | 1 |
| | Ra.L5 | Debitage | Chert/Igneous | 27 |
| | Ra.L6 | Debitage | Chert/Igneous | 32 |
| | Ra.L6 | Core Fragment | Chert | 1 |
| | Rb.Slice 1b | Groundstone | Basalt | 1 |
| | Rb.Slice 1b | Manuport | Limestone | 1 |
| | Rb.Slice 1b | Modified Flake | Chert | 1 |
| | Rb.Slice 1b | Debitage | Chert | 2 |
| | Rb.Slice 2b | Modified Flake | Limestone | 1 |
| | Rb.Slice 2b | Flake | Igenous | 1 |
| | Rb.Slice 2b | Faunal Remains | Bone | 1 |
| | Rb.Slice3b | Manuport | Limestone | 1 |
| | Rb.Slice3b | Biface Fragment | Chert | 1 |
| | Rb.Slice3b | Core Fragment | Chert | 1 |
| | Rb.Slice 4a | Groundstone | Basalt | 1 |
| | Rb.Slice 4a | Flake | Chert | 1 |
| | Sa.L1 | Debitage | Chert & Igneous | 19 |
| | Sa.L2 | Debitage | Chert & Igneous | 4 |
| | Sa.L3 | Manuport | Igneous | 1 |
| | Sa.L3 | Debitage | Chert | 16 |
| | Sa.L3 | Faunal Remains | Bone | 1 |
| | Sa.L4 | Debitage | Chert & Igneous | 20 |
| | Sa.L4 | Faunal Remains | Bone | 4 |
| | Sa.L4 | Modified Flake | Chert | 1 |
| | Sa.L4 | Faunal Remains | Bone | 1 |
| | Sa.L5 | Manuport | Igneous | 1 |
| | Sa.L5 | Debitage | Chert | 6 |
| | Sa.L5 | Faunal Remains | Bone | 2 |
| | Sa.L6 | Debitage | Chert | 16 |
| | Sa.L6 | Faunal Remains | Bone | 4 |
| | Sb.Slice 1d | Core Fragment | Chert | 1 |
| | Sb.Slice 2d | Uniface | Chert | 1 |
| | Sb.Slice 4c | Debitage | Chert | 2 |

**Table H.1b:** Cultural Materials Recovered from the Sand Box

| Unit | Layer | Artifact Name | Artifact Material | Count |
|---|---|---|---|---|
| F | L2 | Biface | Chert | 1 |
| F | L2 | Modified Flake | Chert | 1 |
| F | L2 | Manuport | Limestone | 1 |
| F | L2 | Debitage | Chert & Igneous | 52 |
| F | L3 | Debitage | Chert & Igneous | 39 |
| F | L4 | Biface | Chert | 1 |
| F | L4 | Faunal Remains | Mussel Shell | 1 |
| F | L4 | Debitage | Chert | 22 |
| G | L1 | Debitage | Chert & Igneous | 21 |
| G | L2 | Manuport | Limestone | 2 |
| G | L2 | Debitage | Chert & Igneous | 45 |
| G | L3 | Core | Chert | 1 |
| G | L3 | Manuport | Limestone | 1 |
| G | L3 | Debitage | Chert & Igneous | 14 |
| G | L3 | Faunal Remains | Bone | 2 |
| G | L4 | Modified Flake | Chert | 2 |
| G | L4 | Biface | Chert | 1 |
| G | L4 | Debitage | Chert & Igneous | 22 |
| G | L4 | Faunal Remains | Bone | 3 |
| G | L5 | Debitage | Chert | 5 |
| H | L1 | Flake | Chert | 1 |
| H | L1 | Debitage | Chert & Igneous | 4 |
| H | L2 | Flake | Chert | 5 |
| H | L2 | Chert Chunk | Chert | 1 |
| H | L2 | Core | Chert | 1 |
| H | L2 | Debitage | Chert | 99 |
| H | L2 | Faunal Remains | Bone | 1 |
| H | L2 | Faunal Remains | Snail Shell | 2 |
| H | L3 | Flake Tool | Chert | 1 |
| H | L3 | Biface | Chert | 1 |
| H | L3 | Manuport | Limestone | 1 |
| H | L3 | Core | Chert | 1 |
| H | L3 | Modified Flake | Chert | 3 |
| H | L3 | Projectile Point | Chert | 1 |
| H | L3 | Debitage | Chert & Igneous | 77 |
| H | L3 | Faunal Remains | Bone | 12 |
| H | L5 | Biface | Chert | 1 |
| H | L5 | Modified Flake | Chert | 1 |
| H | L5 | Biface | Chert | 1 |
| H | L5 | Debitage | Chert | 22 |
| H | L6 | Debitage | Chert | 14 |

| | | | | |
|---|---|---|---|---|
| I | L1 | Modified Flake | Chert | 2 |
| I | L1 | Debitage | Chert & Igneous | 22 |
| I | L2 | Biface | Chert | 1 |
| I | L2 | Debitage | Chert & Igneous | 112 |
| I | L2 | Faunal Remains | Bone | 2 |
| I | L3 | Manuport | Limestone | 1 |
| I | L3 | Faunal Remains | Bone | 20 |
| I | L4 | Biface | Chert | 1 |
| I | L4 | Modified Flake | Chert | 1 |
| I | L4 | Debitage | Chert & Igneous | 75 |
| I | L4 | Faunal Remains | Bone | 6 |
| I | L5 | Debitage | Chert | 8 |
| M | L1 | Debitage | Chert | 1 |
| M | L1 | Faunal Remains | Bone | 1 |
| M | L2 | Debitage | Chert & Igneous | 9 |
| N | L1 | Debitage | Chert & Igneous | 14 |
| N | L2 | Core | Chert | 1 |
| N | L2 | Debitage | Chert | 8 |
| N | L3 | Debitage | Chert | 8 |
| N | L4 | Debitage | Chert | 23 |
| O | L1 | Debitage | Chert & Igneous | 20 |
| O | L2 | Biface | Chert | 1 |
| O | L2 | Debitage | Chert & Igneous | 22 |
| O | L3 | Debitage | Chert & Igneous | 28 |
| O | L4 | Manuport | Limestone | 1 |
| O | L4 | Debitage | Chert | 18 |
| O | L5 | Debitage | Igneous | 1 |
| O | L6 | Debitage | Chert | 2 |
| O | L8 | Debitage | Chert | 11 |

Table H.2: Microartifact counts with volume of material excavated and depths.

| | | **2mm Sort** | | | | **1mm Sort** | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Depth (cm)** | **Volume (L)** | **Debitage** | **Charcoal** | **FCR** | **Faunal** | **Debitage** | **Charcoal** | **FCR** | **Faunal** |
| 5 | 8.25 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 |
| 10 | 7.26 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 15 | 7.55 | 0 | 1 | 2 | 0 | 0 | 12 | 4 | 1 |
| 20 | 4.95 | 0 | 1 | 2 | 0 | 0 | 11 | 3 | 0 |
| 26 | 7.95 | 1 | 2 | 0 | 0 | 0 | 30 | 11 | 1 |
| 31 | 5.95 | 0 | 0 | 1 | 0 | 0 | 13 | 7 | 1 |
| 38 | 6.10 | 0 | 2 | 2 | 0 | 1 | 15 | 6 | 0 |
| 44 | 6.70 | 0 | 2 | 7 | 0 | 0 | 23 | 14 | 1 |
| 50 | 7.10 | 0 | 7 | 2 | 0 | 0 | 20 | 8 | 2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 54 | 8.15 | 0 | 3 | 0 | 0 | 1 | 27 | 2 | 0 |
| 58 | 8.74 | 0 | 0 | 3 | 2 | 0 | 17 | 3 | 0 |
| 61 | 6.73 | 0 | 0 | 1 | 0 | 0 | 13 | 1 | 0 |
| 65 | 8.20 | 0 | 1 | 1 | 0 | 0 | 23 | 2 | 0 |
| 68 | 8.45 | 0 | 0 | 1 | 0 | 0 | 18 | 1 | 0 |
| 72 | 9.40 | 0 | 3 | 2 | 0 | 0 | 13 | 0 | 0 |
| 76 | 10.40 | 1 | 2 | 1 | 0 | 0 | 20 | 5 | 1 |
| 80 | 10.60 | 0 | 3 | 4 | 1 | 0 | 18 | 13 | 0 |
| 84 | 5.25 | 0 | 3 | 0 | 0 | 1 | 20 | 10 | 0 |
| 87 | 2.20 | 0 | 13 | 16 | 0 | 0 | 147 | 155 | 4 |
| 90 | 5.00 | 5 | 49 | 304 | 1 | 6 | 200 | 97 | 17 |
| 95 | 8.40 | 17 | 154 | 620 | 13 | 5 | 246 | 194 | 24 |
| 100 | 8.8 | 19 | 276 | 654 | 9 | 4 | 500 | 319 | 26 |
| 105 | 9.65 | 11 | 372 | 673 | 19 | 11 | 603 | 366 | 43 |
| 110 | 8.65 | 7 | 316 | 524 | 5 | 11 | 531 | 250 | 18 |
| 115 | 9.40 | 8 | 355 | 370 | 5 | 3 | 288 | 190 | 17 |
| 120 | 10.80 | 3 | 72 | 82 | 5 | 3 | 630 | 159 | 20 |
| 125 | 9.30 | 4 | 222 | 176 | 7 | 0 | 315 | 118 | 22 |
| 130 | 9.85 | 4 | 100 | 123 | 4 | 0 | 214 | 63 | 14 |
| 134 | 10.00 | 8 | 231 | 111 | 10 | 1 | 183 | 65 | 6 |
| 138 | 10.55 | 1 | 20 | 22 | 0 | 2 | 213 | 131 | 21 |
| 142 | 7.60 | 1 | 11 | 8 | 0 | 2 | 116 | 32 | 2 |
| 147 | 7.20 | 9 | 148 | 194 | 5 | 1 | 357 | 123 | 10 |
| 152 | 7.40 | 8 | 169 | 215 | 3 | 4 | 388 | 172 | 25 |
| 157 | 7.70 | 5 | 84 | 101 | 2 | 3 | 239 | 31 | 14 |
| 162 | 7.00 | 1 | 39 | 44 | 2 | 2 | 217 | 76 | 11 |
| 167 | 7.50 | 1 | 132 | 105 | 5 | 3 | 610 | 136 | 50 |
| 172 | 7.10 | 6 | 262 | 130 | 9 | 0 | 429 | 129 | 20 |
| 177 | 6.80 | 5 | 150 | 116 | 4 | 2 | 395 | 97 | 12 |
| 182 | 6.80 | 2 | 80 | 53 | 1 | 1 | 276 | 56 | 7 |
| 186 | 6.40 | 1 | 18 | 29 | 4 | 0 | 162 | 81 | 6 |
| 190 | 5.65 | 0 | 14 | 19 | 1 | 0 | 108 | 57 | 9 |
| 194 | 6.00 | 1 | 7 | 30 | 1 | 0 | 99 | 87 | 10 |
| 198 | 6.00 | 0 | 14 | 23 | 0 | 0 | 61 | 119 | 2 |
| 202 | 6.20 | 4 | 19 | 35 | 0 | 7 | 152 | 188 | 2 |
| 207 | 6.15 | 3 | 4 | 43 | 0 | 2 | 52 | 143 | 14 |
| 211 | 6.10 | 0 | 7 | 48 | 0 | 2 | 86 | 145 | 12 |
| 215 | 6.85 | 2 | 9 | 35 | 1 | 7 | 0 | 0 | 37 |
| 220 | 6.65 | 3 | 23 | 36 | 1 | 0 | 133 | 122 | 33 |
| 226 | 6.85 | 5 | 10 | 36 | 0 | 0 | 69 | 107 | 22 |
| 229 | 7.16 | 4 | 6 | 29 | 2 | 4 | 47 | 115 | 13 |
| 233 | 6.85 | 3 | 12 | 39 | 0 | 4 | 89 | 106 | 0 |
| 238 | 6.90 | 0 | 7 | 30 | 0 | 4 | 68 | 82 | 2 |
| 243 | 6.79 | 1 | 6 | 31 | 0 | 3 | 39 | 109 | 3 |
| 248 | 3.75 | 2 | 2 | 15 | 0 | 1 | 48 | 44 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 253 | 3.90 | 0 | 5 | 9 | 0 | 1 | 35 | 36 | 0 |
| 257 | 7.05 | 2 | 15 | 8 | 0 | 0 | 114 | 33 | 4 |
| 261 | 80 | 0 | 7 | 15 | 1 | 1 | 66 | 56 | 3 |
| 265.5 | 7.5 | 0 | 0 | 2 | 0 | 0 | 7 | 10 | 1 |
| 268.5 | 2.5 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 271 | 3.60 | 0 | 0 | 2 | 0 | 0 | 0 | 5 | 0 |
| 276.5 | 6.2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 |
| 280 | 5.13 | 0 | 1 | 0 | 0 | 1 | 47 | 14 | 0 |
| 283 | 6.41 | 2 | 9 | 2 | 0 | 1 | 28 | 15 | 0 |
| 288 | 3.06 | 0 | 0 | 12 | 0 | 0 | 6 | 6 | 0 |
| 290 | 6.10 | 0 | 36 | 37 | 1 | 0 | 208 | 22 | 1 |
| 295 | 7.40 | 0 | 7 | 7 | 0 | 0 | 125 | 17 | 0 |
| 300 | 7.81 | 0 | 2 | 10 | 1 | 0 | 28 | 10 | 0 |
| 305 | 80 | 0 | 1 | 10 | 0 | 0 | 20 | 15 | 0 |
| 313 | 6.43 | 0 | 6 | 4 | 0 | 0 | 9 | 7 | 0 |
| 315 | 2.50 | 0 | 0 | 3 | 0 | 0 | 0 | 8 | 2 |
| 320 | 5.55 | 0 | 0 | 2 | 0 | 0 | 8 | 7 | 0 |
| 324 | 8.60 | 0 | 0 | 6 | 1 | 0 | 4 | 14 | 0 |
| 329 | 8.50 | 0 | 1 | 7 | 0 | 0 | 6 | 18 | 0 |
| 333 | 9.25 | 1 | 0 | 11 | 0 | 0 | 5 | 13 | 0 |
| 338 | 10.00 | 0 | 0 | 6 | 0 | 0 | 3 | 17 | 0 |
| 343 | 7.90 | 0 | 0 | 6 | 0 | 0 | 2 | 12 | 0 |
| 345 | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 350 | 9.75 | 5 | 0 | 48 | 0 | 2 | 7 | 50 | 1 |
| 355 | 11.10 | 0 | 1 | 6 | 0 | 2 | 3 | 55 | 0 |
| 360 | 10.75 | 14 | 0 | 53 | 0 | 0 | 38 | 139 | 1 |
| 365 | 10.20 | 3 | 20 | 85 | 12 | 0 | 19 | 41 | 0 |
| 372 | 9.35 | 1 | 0 | 29 | 0 | 0 | 49 | 39 | 0 |
| 377 | 10.80 | 2 | 0 | 46 | 0 | 1 | 17 | 25 | 0 |

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