THE HOLE STORY: UNDERSTANDING GROUND STONE BEDROCK FEATURE VARIATION IN THE LOWER PECOS CANYONLANDS

by

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DEDICATION

This thesis is dedicated to my mentor and constant source of inspiration, Carolyn E. Boyd.

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ABSTRACT

Ground stone bedrock features are common at archaeological sites in the Lower Pecos Canyonlands of southwest Texas. These features are human-made holes pecked, ground, or worn into bedrock or large boulders, and were used for a variety of processing activities by the indigenous peoples. Although archaeologists in the region have informally recognized different "types" of ground stone bedrock features (e.g., slicks, grinding facets, deep mortars), there have been no dedicated studies of bedrock features. Due to their widespread occurrence in the region, bedrock features represent an untapped research avenue regarding the lifeways of Lower Pecos hunter-gatherers. Therefore, to gain a better understanding of these understudied features I mapped, documented, and analyzed 824 bedrock features at ten sites across the region.

Using Structure from Motion (SfM) photogrammetry, I collected high-resolution three-dimensional data of bedrock features. Measurements (length, width, and depth) for each feature were calculated from the 3D data in ArcGIS. These quantitative, metric data were analyzed for feature variation at individual sites, and then compared between sites to determine any differences. Results showed the metric distribution is not significantly different between the sites. Feature data were then combined into sub-regional groups (Pecos River, Devils River, Eagle Nest Canyon and 41VV75), and metric differences compared based on the geographic location. The analysis showed no significant

differences between the sub-regional groups. In order to better characterize the data and understand the range of morphological variation in the entire data set, a cluster analysis was conducted. This analysis resulted in definition of four distinct clusters characterized in regards to their metric attributes.

To further analyze the four clusters and how they might differ, I analyzed the use-wear patterns within each cluster. This analysis suggested that two clusters (Clusters 1 and 3) were mostly shallow, general-use features, while the other two clusters (Clusters 2 and 4) were deep, specialized features. Both Cluster 2 (conical mortars) and Cluster 4 (cylindrical mortars) represent features that required a substantial time and energy investment to create. Further, based on the use-wear patterns, features in Clusters 2 and 4 were intentionally manufactured to a specific shape for a specific purpose. In contrast, features in Clusters 1 and 3 were initially manufactured for ease of use, and subsequent use appears to have minimally modified the surface. The findings of the use-wear analysis are supported by ethnographic accounts of how shallow and deep bedrock features were used.

This study represents an initial exploration of bedrock features in the Lower Pecos Canyonlands. More research with a larger sample of bedrock features is needed to refine and test the hypothesized clusters and functions put forth in this thesis, as well as create a formalized typology.

I. AN INTRODUCTION TO GROUND STONE BEDROCK FEATURES IN THE LOWER PECOS CANYONLANDS

Across the Lower Pecos Canyonlands of southwest Texas are thousands of human-made holes pecked, ground, or worn into the limestone bedrock in rockshelters and on the uplands. These holes have been called many names such as mortars, grinding facets, and slicks, and were likely utilized for a variety of processing activities. Ground stone bedrock features are a widespread, yet understudied tool set within the Lower Pecos. Herein, the term "bedrock features" will be used as shorthand to refer to all permanent grinding or pounding features set in bedrock or large boulders that cannot be moved[1]. Archaeologists typically categorize these features by morphology and the perceived type of activity (e.g., pounding, reciprocal grinding, circular grinding, etc.). For example, grinding facets are shallow basins likely used to grind foods with a back and forth or circular grinding motion. Mortars are deep holes that were utilized for crushing or pounding, probably using straight up and down motions or possibly rotary or circular motions in some instances. Lastly, "slicked" areas are flat surfaces that have a shiny, smooth appearance and their function is unknown. The highly polished surface could be the result of multiple activities such as polishing hides or another activity that might include oily substances. These ad hoc categories, or perceived "types," have been created without rigorous analysis of any bedrock features in the region. The goal of this thesis is two-fold: 1) to better understand the morphological variation of bedrock features and

[1] Other grinding technologies are found in the region such as metates, which are shaped portable grinding surfaces that are typically ovoid in morphology with one grinding area per stone (e.g., Dibble 1967; Martin 1933; Ross 1965). However, metates are greatly outnumbered by the thousands of permanent grinding or pounding features set in bedrock across the region.

two-fold: 1) to better understand the morphological variation of bedrock features and create the first regional typology; and 2) to advance hypotheses about the roles bedrock features played for Lower Pecos foragers. The hypotheses will be based on multiple lines of evidence including ethnographic information, use-wear analyses, morphological statistics, and theoretical discussions of how hunter-gatherers produced and utilized ground stone technology.

The Lower Pecos and Bedrock Features

The Lower Pecos Canyonlands is a unique region housing an impressive culture history extending over the past 13,000 years (Dering 2002:3.1; Turpin 2004). The boundaries for the region are defined by Turpin (2012:Figure 1) as encompassing the known occurrence of Pecos River style pictographs, which extends approximately 150 km south and 50 km north, east, and west of the Rio Grande-Pecos River confluence (Figure 1.1). Prehistoric groups utilized the entire Lower Pecos landscape, taking advantage of rockshelters carved out of the Cretaceous limestone in rugged canyons (e.g., Dibble and Prewitt 1967; Rodriguez 2015; Ross 1965) as well as upland areas and stream terraces (e.g., Basham 2015; Campbell 2012; Koenig 2012; McClurkan 1968; Roberts and Alvarado 2012; Saunders 1986, 1992). Environmentally, the Lower Pecos is situated at the intersection of three biotic provinces: the Balconian, the Tamulipan, and the Chihuahuan (Blair 1950:98) (Figure 1.2). Each of these provinces has their own characteristic flora ranging from juniper-oak savannah to mesquite-acacia savannah to a sotol-lechuguilla-creosote savannah (Dering 2002: Figure 2.2). This broad ecotone allowed prehistoric peoples to harvest a variety of resources within a relatively small area, including many plants that likely required processing in bedrock features such as mesquite (*Prosopis glandulosa*), little leaf walnut (*Juglans microcarpa*), prickly pear cacti (*Oppuntia* spp.), lechuguilla (*Agave lechuguilla*), sotol (*Dasylirion texanum*), yuccas (*Yucca* spp.), and various acorn-bearing oaks (*Quercus* spp.).

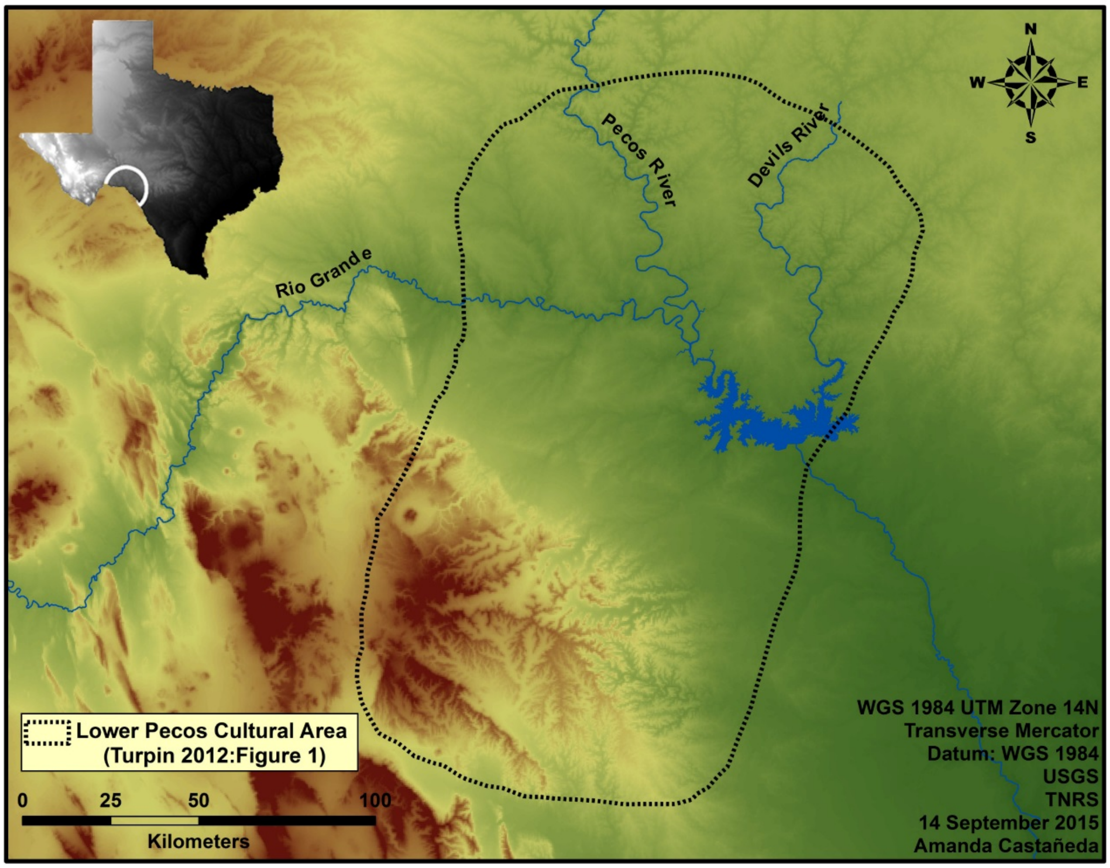


Figure 1.1. Location of the Lower Pecos Canyonlands with Turpin's (2012) cultural boundary shown. Adapted from Turpin (2012:Figure 1).

The Lower Pecos region was inhabited from at least the Late Pleistocene (>12,000-9,000 RCYBP) through Historic times (Turpin 2004); however, it is unknown when bedrock features were used. Currently, there are no direct dating methods for bedrock features and it is possible, even likely, that they were used over lengthy spans of time. Even when bedrock features are found in excavated contexts (e.g., Pearce and

Jackson 1933), it is tenuous to date the use of the feature using the sediment found inside because materials from different time periods can become easily trapped and mixed in these holes. Once a bedrock feature is in place, any sediment or debris from subsequent use of the area can fall in the hole, making it difficult to determine which deposits are associated with the actual use of the feature. There appears to be no archaeological evidence that ground stone bedrock features were utilized during the Paleoindian period. At some sites, bedrock features have been found buried in rock shelters deposits that date to various times in the Archaic period (e.g., Collins 1969; Pearce and Jackson 1933). The use of bedrock features likely extends from the at least as early as the Middle Archaic to Late Prehistoric periods, coinciding with greater exploitation of wild plant foods, particularly agave and sotol baked in earth ovens (Dering 2007; Turpin 2004).

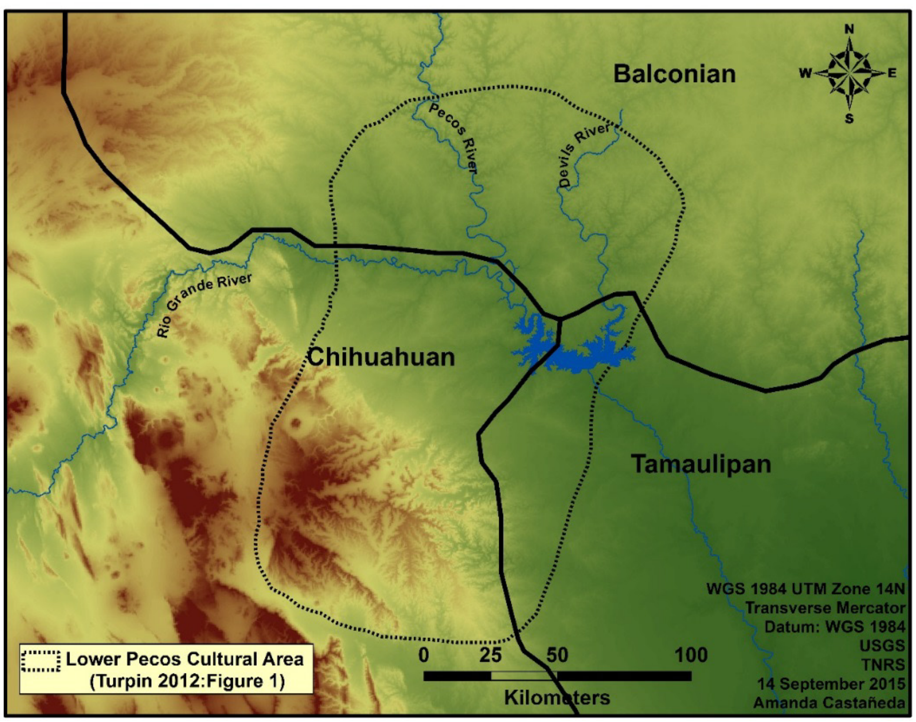


Figure 1.2. Location of the Tamaulipan, Chihuahuan, and Balconian environmental zones in relation to the Lower Pecos cultural boundary. Adapted from Dering (2002:Figure 2.5).

Analysis of Bedrock Features in the Lower Pecos

Due to the arid environment, perishable artifacts and fragile features are often well-preserved within the region's dry rockshelters. This preservation has allowed archaeologists to conduct analyses on a wide variety of material culture not preserved in other areas (e.g., McGregor 1992). Although bedrock features often occur in Lower Pecos rockshelter sites, research in the region has largely ignored this part of the archaeological record and has mostly focused on the recovery of perishable artifacts and recording the various styles of vibrant pictographs (e.g., Boyd 2003, Dibble and Lorrain 1968; Jackson 1938, Kirkland and Newcomb 1967, Martin 1933; Parsons 1965; Turpin 2004).

To date, bedrock features have been recorded at 308 of 2,202 known sites in the Lower Pecos (Figure 1.3). This is obviously a gross underrepresentation due to the fact

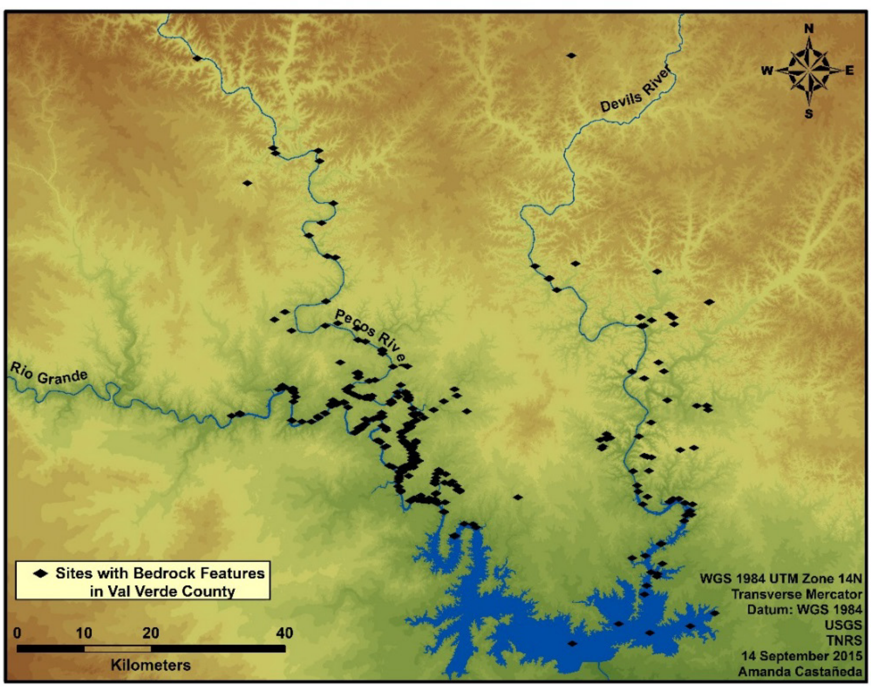


Figure 1.3. All recorded sites in Val Verde County with bedrock features. Data collected from the Texas Archeological Sites Atlas and the Texas Historical Commission in April 2014.

that only relatively small portions of the region have been surveyed and due to the inconsistent reporting of bedrock features on site forms. Nonetheless, these features have a commanding presence across the landscape and undoubtedly played important roles in the lives of Lower Pecos hunter-gatherers. This study is intended as a first step in understanding Lower Pecos bedrock features by employing a systematic documentation methodology and providing new data on the variation of bedrock feature morphology and use-wear patterns between and within sites.

For this project, I recorded attribute and metric data for 824 individual bedrock features at ten different sites (Figure 1.4) using a combination of Structure from Motion Photogrammetry (SfM) and traditional field documentation methods. SfM has become an increasingly popular method to record archaeological features due to its ease of use and extreme accuracy. This method includes taking a series of overlapping photos to create a high resolution 3-dimensional (3D) model. I fully describe and explain SfM procedures in Chapter 4. I conducted field work during 2014 and 2015 with the help of numerous volunteers. During this time we mapped and recorded basic attributes on all bedrock features at the studied sites. Additionally, macroscopic use-wear attributes were recorded to study of how the features were last used and infer what types of materials may have been processed. After field work was completed, I analyzed bedrock feature in ArcGIS to obtain measurements such as length, width, and depth.

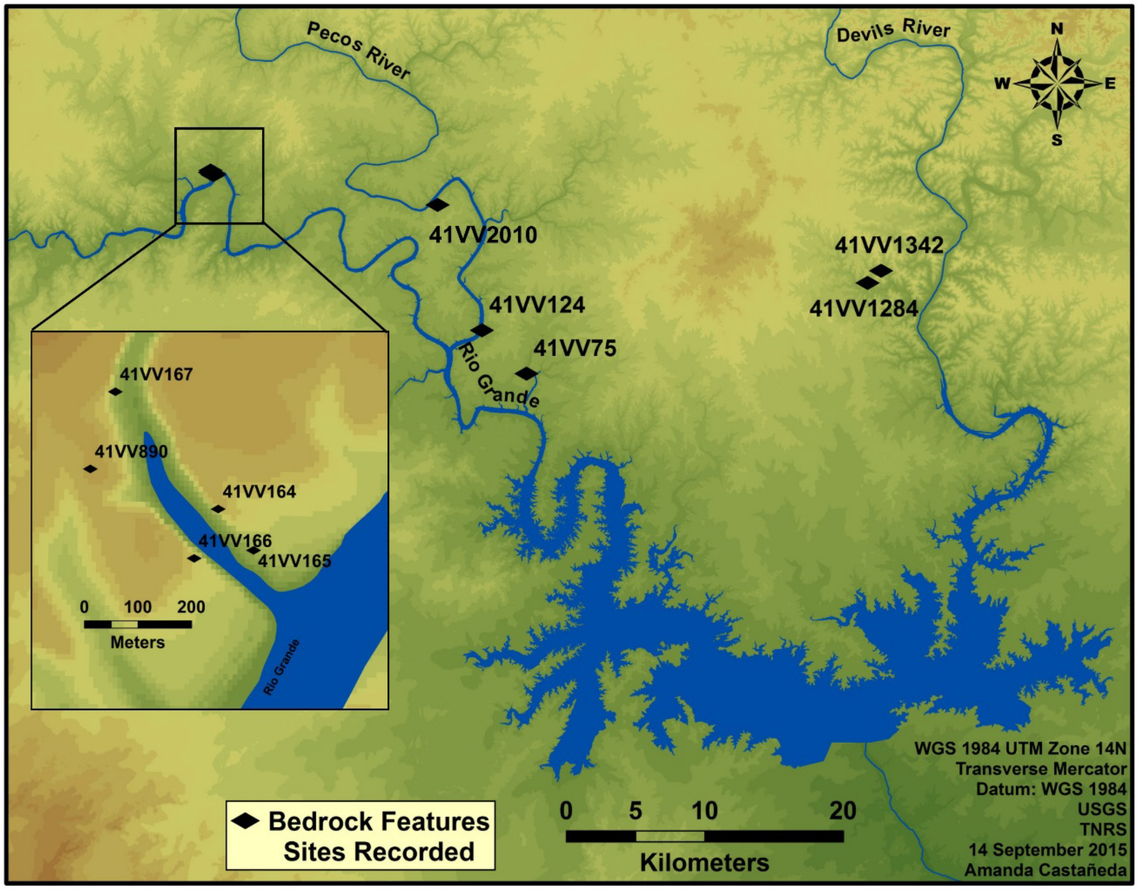


Figure 1.4. Locations of the ten sites recorded for this project.

In order to determine the common variations or representative types of bedrock features, I characterized the metric data for bedrock feature depth, length, and width across all sites. Then I used cluster analyses to examine the variation in the full data set and identify any existing groups of similar features. These groups were tested for significance using discriminant function analyses and Kruskal-Wallis analysis of variance tests. Lastly, the statistical analysis results are discussed in light of ethnographic accounts of ground stone use, use-wear analyses, and theories of hunter gatherer tool use. The question of bedrock feature ontogeny is also discussed; did features develop through time and use, or were they intentionally manufactured to a specific shape? This discussion helps shed light on how these features fit into the lifeways of mobile, foraging peoples.

Overall, I seek to provide insights into research questions about diet and subsistence and create a baseline dataset for a more in-depth study of resource use and technological adaptation of Lower Pecos hunter gatherers.

Thesis Organization

This thesis is divided into eight chapters. Chapter 2 provides a background of previous research conducted on bedrock features, both in the Lower Pecos and in other regions such as California where the majority of published North American bedrock feature studies have been conducted heretofore. In Chapter 3, ethnographic accounts of ground stone and bedrock feature use are discussed. Ethnographic information is reviewed from groups who utilize similar arid-land plant resources as an analogy for Lower Pecos hunter gatherers. Chapter 4 explains the various field recording methodologies and GIS analyses conducted. The sites and recorded bedrock features are described in Chapter 5. This includes discussion of the location and frequency of bedrock feature areas within each recorded site. In Chapter 6, I characterize the bedrock feature metric data for each site, sub-regional groupings, and the region overall. Cluster analyses are used to examine the data and in an attempt to tease out “types” from the quantitative measurements. Chapter 7 presents the implications of the analysis results and provides a discussion about how these relate to use-wear analyses, ethnographic accounts, and manufacture and use of technology. Finally, Chapter 8 provides conclusions and suggests avenues for future research on ground stone bedrock features in the Lower Pecos. Appendix A provides terminology definitions for both the general attributes and use-wear characteristics used in this study. The attribute data, metric data and use-wear patterns recorded for each bedrock feature are presented in tables in Appendix B. Finally, Appendix C contains tables indicating which bedrock features belong to each group that resulted from the cluster analysis.

II. BEDROCK FEATURE RESEARCH AND THEORY

The term ground stone is a somewhat ambiguous name applied to a wide variety of artifacts and features recorded at archaeological sites across the world. Archaeologists categorize artifacts as ground stone for two different reasons: 1) the artifact or feature is a tool utilized during the act of grinding, therefore making a product "ground" (c.f., Adams 1993:331); or 2) the artifact is an object made of stone that is ground down to produce the final shape or form, such as a carved stone bowl or stone celt (Turner and Hester 1999:296). Ground stone tools often fit into both of these categories. For example, a trough metate is a specifically carved and shaped grinding surface that was used for maize processing in the American Southwest. Ground stone artifacts and features are extremely widespread throughout North America and across the world, and are most frequently considered a technology related to subsistence. Archaeologists have also studied ground stone technology to address broader topics such as site occupation (e.g., Schlanger 1991), organization of technology (e.g., Hard et al 1996; Hayden 1987; Mauldin 1993; Smith et al. 2010), mortuary or ritual practices (e.g., Koerper 2006; Rowan and Ebeling 2008), and social organizations of tasks (e.g., Jackson 1991; Jones 1996).

This chapter discusses previous research on bedrock features, both in the Lower Pecos and in other regions where ground stone is better researched. Most of the extant research on ground stone in the Lower Pecos comes in the form of artifact and feature descriptions in excavation reports. Although useful, most reports lack substantive research value beyond stating which ground stone tools were found at each site.

Analyzing ground stone tools has never been the main objective of a research project in the Lower Pecos. Therefore, the latter part of this chapter will summarize a variety of approaches to bedrock feature research from across the world. This background is not intended to be an exhaustive summary of ground stone research, as there are many more studies than are discussed here, particularly concerning portable ground stone tools.

Even fewer studies have taken on the subject of permanent bedrock features. These features have been used as a proxy for answering questions related to length of occupation and what foods were processed, but a major question that must be considered is how the features ended up as we see them today. There are two different and opposing ideas in this regard: 1) bedrock features get deeper through longer periods of use, or in other words, they develop; or 2) bedrock features are manufactured to a particular depth or shape for a specific purpose. Depending on which of these avenues a researcher uses, differing interpretations of bedrock features emerge. These topics and theories on ground stone bedrock features represent an important background for my research and have implications for future avenues of research on Lower Pecos bedrock features.

Bedrock Feature Research in the Lower Pecos Canyonlands

As mentioned, Lower Pecos bedrock feature research is sorely lacking. Therefore, this section highlights regional research that holds relevance to the overall topic of bedrock features. Bedrock feature technology is a two-part system. While my research is focused on the lower surface in which the material is processed, there also had to be an implement that was used to complete the crushing or grinding task. Stone manos (smooth stones used for crushing or grinding materials), stone pestles (shaped, cylindrical stones used to crush or pound materials), and wooden pestles (shaped, carved branches used to crush or pound materials) were all utilized in the Lower Pecos and are vital to the success of the technology. Thus, this section includes previous research on both bedrock features and some portable ground stone implements in the Lower Pecos.

Most of the early excavation reports documented the number and general description of ground stone artifacts, mostly hand stones ("manos"), recovered from excavation (e.g., Dibble 1967; Dibble and Prewitt 1967; Epstein 1963; Johnson 1961; Ross 1965). A few reports took it a step further and analyzed the artifacts by placing the hand stones into categories based on their attributes and hypothesizing about the function of each specimen (Alexander 1974; Nunley et al. 1965). Martin (1933) and Dibble (1967) commented on the bedrock mortars and grinding slabs present in the Shumla Caves and Arenosa, respectively, and wondered at the lack of stone pestles. Wooden pestles and mortars have been found in the region and were likely heavily utilized as opposed to stone pestles (Collins and Hester 1968; Prewitt et al. 1981).

Pearce and Jackson (1933) were the first to discuss bedrock features in a meaningful way through their report of excavations undertaken at Fate Bell rockshelter. While they briefly mention the visible bedrock feature surfaces, the report provides more detail about the buried bedrock mortars encountered during excavations (Pearce and Jackson 1933:41-42). Four mortar holes were discovered, ranging from 12 to 18 centimeters in depth, and were filled with mixed midden material and ashy sediment. Further, Hole No. 3 had a broken stone pestle wedged in the bottom and Hole No. 4 had approximately one quart of crushed walnut detritus. Pearce and Jackson (1933) used the depth of the features and the amount of deposits covering them to suggest a long period of occupation for Fate Bell rockshelter. From a similar context at the Perry Calk site, Collins (1969:15-16) collected materials from four buried mortars and recovered large amounts of mesquite (*Prosopis glandulosa*) and prickly pear seeds (*Oppuntia* spp.), although he did not indicate if they were crushed or whole.

The most in-depth study on bedrock features was Maslowski's 1978 dissertation on investigations at Moorehead Cave on the Pecos River. He was the first and only archaeologist in the region to discuss criteria for identifying a feature as a specific "type." For his purposes, a "grinding facet" had a maximum depth of 5 cm or less, and a "mortar" was greater than 5 cm in depth (Maslowski 1978:129). While assessing the morphology of the mortars, Maslowski found most of the openings were ovoid and hypothesized a rocking motion was likely used to create the holes, rather than strictly a circular movement. Maslowski (1978:134) also tried to assign relative ages to metates found in association with Early Barbed and Martindale points which date to the Early Archaic (Turner and Hester 1999:151).

Overall, and especially in more recent Lower Pecos studies, archaeologists simply make general observations regarding presence of bedrock features. For example, Shafer (1988:38) provides three observations about this type of feature, "mortar holes are common to the area, they sometimes occur in groups of over 100 individual features, and they are assumed to be associated with processing desert succulents which have been baked in earth ovens." Although no in-depth residue studies of bedrock features have been completed in support of this assumption, it is reasonable to surmise that these features might be tied to the staple resources of the region: lechuguilla (*Agave lechuguilla*) and sotol (*Dasylirion texanum*).

Lower Pecos Ground Stone Use and Diet

The second facet of Lower Pecos archaeology which has discussed bedrock features is coprolite research. Desiccated human excrement (also known as paleofeces) provides secondary evidence for ground stone use through the presence or absence of grit or crushed plant remains within coprolited. If seeds or nuts were crushed and broken prior to being ingested, evidence for how the plants were processed would be preserved in the excrement. According to Sobolik (1991), the most common seed, nut, and pod remains found in coprolites are various species of acacia (*Acacia berlandieri, A. greggii, A. rigidula,* and *A. roemeriana*), hackberry (*Celtis palida* and *C. reticulata*), Texas persimmon (*Diospyros texana*), acorn (*Quercus* spp.), Texas walnut (*Juglans microcarpa*), Texas mountain laurel (*Sophora secundiflora*), mesquite (*Prosopis* spp.), prickly pear (*Opuntia* spp.), and Mexican Buckeye (*Ungnadia speciosa*). Williams-Dean (1978) and Sobolik (1991) reported Texas walnut, juniper (*Juniperus ashei*), and prickly pear seeds crushed within coprolites, and assumed the crushing to be from processing activities with ground stone. However, in many coprolites the walnut shells were still large fragments and looked as if they were barely cracked before being consumed (Williams-Dean 1978:183). Other coprolite studies found little evidence for ground foods (Bryant and Williams-Dean 1975; Reinhard 1992; Sobolik 1988; Williams-Dean 1978). This is perhaps due to the fact that the majority of the coprolites studied came from sites with few bedrock features (e.g., Hinds Cave, Baker Cave, and Parida Shelter) (Edwards, 1990; Sobolik 1989; Stock 1983; Williams-Dean 1978). An exception to this pattern is at Conejo Shelter, which has numerous bedrock mortars and large amounts of seed, nut, and pod remains were found in the coprolites; however, the study (Sobolik 1991) does not infer the method(s) of processing. In a different study examining Hinds and Baker Cave coprolite residue for sources of dental microwear, Danielson and Reinhard (1998) found no evidence of grit in the specimens. That said, the current coprolite studies are not necessarily a representative sample for how the regional diet was processed or cooked. As paleofeces studies in this region continue, coprolites from sites with numerous bedrock features should be targeted to look for specific evidence of ground stone processing.

Bedrock Feature Research and Theories from Other Regions

As mentioned in the previous chapter, ground stone artifacts and ground stone bedrock features have the potential to inform multiple facets of archaeological research. Research on ground stone in and of itself has focused on developing a life-history model, which aims to describe and understand the stages a tool has gone through, from raw material procurement to discard (Dubreuil and Savage 2014: Figure 1). This is similar to the *chaîne opératoire* created for chipped stone lithic tools (Sellet 1993:106). Each use stage can then tie into a larger archaeological question such as analyzing trade routes via sourcing raw materials or collecting residues to determine what was being processed. While a majority of this life-history research has analyzed portable grinding implements such as manos, metates, and grinding slabs (e.g., Gorecki et al. 1997; Mauldin 1993;

Schlanger 1991), there are several pertinent bedrock feature studies that warrant discussion.

Bedrock Features- Manufacture vs. Development Theory

The question of form is the most common research theme for bedrock features across the world. Similar to the present study, most projects try to determine the morphological variation of the bedrock features types, then attempt to understand how these types functioned in their specific region. Recent work recording Natufian bedrock features at multiple sites in Israel is a prime example (Nadel and Lengyel 2009; Nadel et al. 2009). These projects recorded over 100 bedrock features at two sites and established 11 different types of features. The criteria for these types included depth, the shape of the feature's opening, and a description of the profile shape (e.g., bowl-like, funnel-like). It was concluded that some of these types were undoubtedly used for food processing, while others appeared to have different functions such as accompanying burials as grave goods or acting as a place for caching items (Nadel and Langyel 2009:45). While this classification scheme may be a result of the classic "lumpers" vs. "splitters" dichotomy, of which they were the latter, their results point to an unresolved topic in bedrock feature research. That is, do bedrock features develop through time and use, or are they the product of intentional manufacture?

Traditionally, and in many current studies, the variability in shape and depth of bedrock features has been associated with how long a feature has been utilized. This notion is seen in Bennyhoff's (1956) early study of bedrock mortars in Yosemite. In this case the mortar depth was used as an indicator for occupational intensity. In fact, some ethnographic accounts have stated that, "when a cup becomes too deep, a new one was started a few feet away" (Barrett and Gifford 1990:203). To the same end, across the Pacific Ocean in Australia, Gorecki et al. (1997) demonstrated that a previously established morphological and functional typology of portable grinding stones held no real value. In this case, Smith (1985) had separated what he called "flat, expedient grinding slabs" and "shallow-grooved millstones" into two different functional classes. The grooved millstone was said to have been used for seed processing and was manufactured specifically for this activity, while the flat grinding slabs were utilized for a variety of other wild food items. In contrast, Gorecki et al. (1997) found that aboriginal peoples preferred flatter surfaces and they considered a deep one to be exhausted. Further, the depth of the groove was shown to be a product of the availability of raw material (Gorecki et al. 1997:143). In other words, if raw materials were scarce, a grinding slab would be used longer and a groove would be worn into the surface. It should also be noted that non-portable grinding patches (i.e., subtle bedrock features) were found in these regions as well and the majority of which were less than 1 cm deep.

While the above ideas seem to make logical sense, other archaeologists propose that bedrock feature morphology is not the result of use and age. Rather, the various shapes and depths that we see in the archeological record are a product of intentional manufacture for a specific purpose. This idea was first brought to light by McCarthy et al.'s (1985) pivotal study conducted on bedrock features in the southern Sierra Nevada region. They used a "consultant model" with Mono individuals who identified four different "types" of bedrock features that were all used for different purposes: slicks, starter mortars, finishing mortars, and seed mortars (McCarthy et al. 1985:342). These categories were largely dependent on the depth of the feature in question. "Slicks" were very ephemeral features that were basically flat surfaces to grind a variety of foods on, such as manzanita berries. "Starter" mortars were 0-5.5 cm in depth and were utilized during the first stages of acorn processing. "Finishing" mortars were used for the second half of processing acorns and were 5.5-9.5 cm deep. "Seed" mortars are the deepest features at a depth of more than 9.5 cm and they were used for small food items such as seeds that could fly out of shallower mortars. The Mono consultants also pointed out that if a mortar got too deep, the acorn flour would turn to a hard oily ball that was not only difficult to remove from the hole, but was also inedible. With these designations and the consultant's comments about "making mortars," McCarthy et al. (1985:332) felt the depth of a feature accurately reflected the function or purpose of the mortar.

While the McCarthy et al. (1985:343) study states that the question of manufacture vs. development likely cannot ever be definitively resolved, they also point out that deep mortars have vital roles in food processing and the idea of "incipient" mortars is not useful since the Mono consultants did not consider very shallow features to be productive. These ideas have changed how archaeologists view bedrock features, particularly for researchers in the Sierra Nevada. Leftwich (2010) used the McCarthy et al. study as the cornerstone of his dissertation project evaluating the morphology and location of 2,654 mortars. He classified sites as either processing stations, temporary camps, subsidiary camps, or principal camps according to the number of mortars present (Leftwich 2010:151-155). Then, by looking at the distribution of the bedrock mortar morphologies within and between sites and using optimal foraging theories, he made connections to prehistoric behaviors regarding subsistence, settlement, decision-making and mobility in the north-central Sierra Nevada.

Employing other methods, Buonasera (2012; 2015) uses experimental procedures and optimality models to show how dedicating a short manufacture period to features can increase the efficiency of the grinding activity. Her experiments were designed to reflect seed processing for short term use but the results are notable for all questions regarding bedrock feature use and manufacture. When using sandstone, it only took 1.6 hours of processing for a manufactured shallow basin to become more efficient (Buonasera 2015:340). Buonasera (2015:340) discusses several factors which likely result in the increased efficiency:

> First, shaping makes the overall topography more even than an unshaped surface by bringing the high points into the same plane. This overall leveling of topographic highs can increase the effective surface area by allowing a greater portion of the upper and lower stones to be in contact during grinding. Second, pecking helps to roughen or "sharpen" the grinding surface. Third, creation of a shallow basin helps retain material on the grinding surface.

Though Buonasera's work is tailored to specific conditions, these types of experiments and theoretical modeling hold promise for better understanding how bedrock features develop or are created through manufacture.

As seen above, there is currently no consensus on how bedrock features end up looking as they do today in the archaeological record. However, both of the previously mentioned factions provide theories as a framework to test against bedrock features in other areas. In this thesis, both sides will be considered to help interpret the Lower Pecos bedrock feature morphological data.

Use-wear Studies on Ground Stone Technology

Another blossoming area of research is the application of use-wear studies on ground stone tool surfaces (e.g., Adams 1988, 2002; Dubreuil 2004; Hamon 2008; Wright 1993). The purpose of these studies are similar to other use-wear analyses on chipped stone tools—to make inferences about the function of the tool in question. Like chipped stone tools, ground stone artifacts and features were used in a variety of ways and archaeologists must recognize the question of function is not a straight forward research topic. The overly simplistic model of "form equals function" should no longer be acceptable in a rigorous study of any stone tool category. Often, one ground stone tool was utilized for multiple purposes (e.g., a hand stone being used as a mano *and* a hammer stone) or perhaps used for multiple resources (e.g., a mano used to process meat, grass seeds, and pecans). In order to fully understand function and the different life history stages of a ground stone tool, use-wear approaches are absolutely crucial (Dubreuil and Savage 2014).

Use-wear analysis can be carried out at a range of magnification scales, from un-aided eye to high power microscopic observations, but should always be compared against a "background sample," an unmodified natural surface (Dubreuil and Savage 2014). The general idea behind ground stone use-wear studies is to evaluate the surface topography of the stone for evidence of various wear mechanisms (Adams 2002: 28-29, 2014; Adams et al. 2009). Wear is defined as "the progressive loss of substance from the surface of a stone item as a result of the relative motion between it and another surface" (Adams 2002:25). Wear patterns can elucidate what types of items were processed and the associated motions or actions used with the tool. Defined wear patterns include adhesive wear, fatigue wear, abrasive wear, and tribochemical wear (Adams 2002:29-33). Adhesive wear is characterized by small particles that become dislodged as surfaces move across one another and stick to the opposing surface. This kind of wear may take a long time to build up, such as skin oil creating shiny spots on a mano where it is held. Adhesive wear can be destroyed by another wear pattern—fatigue wear. Fatigue wear occurs through the crushing and fracturing of rock grains by pressure, such as pecking a metate to roughen the surface. The third type of wear, abrasive wear, occurs when loosened particles from adhesive and fatigue wear become abrasive agents as one surface moves across another. This type of wear can create scratches, gouges, and can level the topography of the surface. The final type, tribochemical wear, describes the reaction products such as films or oxides that build up to create a sheen or polish on the surface. One consideration to keep in mind is that all of these wear patterns can affect or remove another when the same surface is used. In other words, we are not able to determine every function the surface may have had but we are able to assess long term, repeated actions that occurred on ground stone implements.

III. ETHNOGRAPHIC REVIEW OF BEDROCK FEATURE AND GROUND STONE TECHNOLOGIES

Ethnographic literature provides many ideas for archaeologists to develop hypotheses and test against material culture against. Ethnographic accounts from a region can be incredibly eye-opening as to how or why a technology was used. However, the cultural identities of the prehistoric hunter-gatherers who once inhabited the Lower Pecos are not known. Throughout the seventeenth and eighteenth centuries, multiple native groups were recorded with the area in and around the Lower Pecos Canyonlands, although none are well documented and currently it is unknown which groups were present in the Lower Pecos before the Historic period (Kenmotsu and Wade 2002:Table 2). In the seventeenth century, the groups most commonly associated with the Lower Pecos were the Mescalero and Lipan Apache (Kenmotsu and Wade 2002:79). While the Apache were spread throughout the southwestern Edwards Plateau and Trans-Pecos regions, their presence along the lower parts of the Pecos River are well documented (Kenmotsu and Wade 2002:81). Other groups such as the Kiowa, Cherokee, and Comanche also utilized the area sporadically for the river crossings on the Rio Grande and the region’s resources, both faunal (e.g., bison) and botanical (e.g., peyote) (Boyd 1998:325; Kenmotsu and Wade 2002).

Due to the lack of data regarding the native groups seen in the Lower Pecos when Europeans first arrived, I reviewed ethnographic data regarding ground stone use from groups with similar lifeways (e.g., foraging) and groups who lived in similar ecological settings (e.g., arid northern Mexico). The majority of ethnographic data on ground stone use are observations about food processing and subsistence. Yet, ethnographers rarely go into detail about the exact motions or small nuances of the task. Most of the information is limited to descriptions of the food gathering and processing activity as a whole.

The first section on this chapter focuses on ethnographic information about processing wild plants in Northern Mexico and the American Southwest. While agricultural groups heavily utilized ground stone for processing cultigens, this will not be discussed at length. Second, ethnographic accounts from native groups in Mexico reviews the use of ground stone in the process of making alcoholic drinks. Finally, numerous accounts from Mexico, the American Southwest, and California discuss ground stone use to pound special leaves and herbs for ailment and injury treatments or in relation to specific rituals and mortuary associations. Through these diverse accounts, the impressive breadth and depth of ground stone use and how these might relate to the Lower Pecos can be better understood.

Ground Stone in Northern Mexico and the American Southwest

Even though today a political border separates groups who lived in Northern Mexico and the American Southwest, the subsistence practices of these groups were very similar because plant resources were relatively uniform throughout the entire region (e.g., Bruman 2000; Felger 1977). This section discusses mesquite (*Prosopis glandulosa*) and agaves (*Agavaceae* spp.), two of the primary plants explicitly described being processed with ground stone in many of the ethnographies cited below. A few other plants and animals will also be discussed if they were mentioned specifically to be processed with ground stone.

Ground Stone Use in Mesquite Processing

Bell and Castetter (1937:24) considered mesquite to be one of the most important food staples of Mexico and the Southwest which by extension means that bedrock mortars and other grinding implements were extremely important to native groups in this region. Some of the best ethnographic accounts of processing mesquite come from early Spanish expeditions. Cabeza de Vaca (Krieger 2002:212) describes trading for large quantities of mesquite flour, and Castañeda of the Coronado expedition encountered the Cáhita making mesquite cakes (Bell and Castetter 1937:15). According to Hodgson (2001:178), mesquite was considered the "staple of life" for the Mohave, Quechan, Cocopa, and Cahuilla and was used extensively by the Havasupai, Diegeuño, Hiá ceḍ, O'odham, Seri, Cáhita (today the Yaqui and Mayo), Pima, Bajo, and Eudeve. Bell and Castetter (1937:14) notes bedrock mortars are prevalent in regions where native groups are dependent on mesquite for part of the year (see Felger 1977: Figure 8.2).

The Seri of northwestern Mexico heavily depended on mesquite as a food resource and also integrated the plant into larger cultural practices (Felger and Moser 1971). For example, the start of the new year for the Seri began when the mesquite pods became fully ripe and the world could be renewed again (Felger and Moser 1971:57). Since most other ethnographic accounts about ground stone and mesquite processing are relatively simple and vague, the full Seri system of mesquite processing is related below to provide holistic context of the activity. In regards to processing mesquite with ground stone, the Seri would most commonly collect fully ripened, dry, fallen pods, which have the highest mesocarp carbohydrate content, and pound them in stone mortars with a wooden pestle (Felger 1977:156). Bell and Castetter (1937:24) also noted many groups preferred a wooden pestle because the crushed pods would not stick to it as much as a stone pestle. After the mesquite pods were pounded, the Seri chewed the mush and swallowed the juice (Felger 1977). Another common method was to toast the pods first, which is said to aid in the pulverization once they are in the mortar. Some groups used parching trays and coals, but the Seri used a unique method of roasting the mesquite pods in hot sand and then transporting them to a mortar.

Felger (1977) indicates women were the major mesquite processors, and several women would work together at their mortars at one time. One Seri woman, Ramona Casonova, was able to identify the mortars which once belonged to her mother and aunt (Felger and Moser 1971:Figure 1). Once the pods were sufficiently mashed, the women placed them into a basket and put the pestle across the mortar opening. They would then gently tap the basket against the pestle while winnowing the flour from the mesocarp, the middle shell, and it would fall back into the mortar hole. The seeds and stony endocarp stay in the basket and get set aside for later processing. The flour in the mortar then gets winnowed again until it is considered pure, and either gets set aside in a pottery vessel or is combined with water to make dough formed into small cakes which are set in the sun to dry. It is estimated that two women could produce up to 40 kg of mesquite flour a day (Felger 1977:158). After the first separation is finished, the hard endocarp, originally set aside, is broken with a second pounding and the inner seed is released. This product is winnowed again to separate out the seeds, which are in turn ground on a metate with a stone mano. Hayden (1969) conducted experiments and found mesquite seeds to be too hard to pound with a wooden pestle. Instead, both implements must be made of stone to create a meal from seed. Felger (1977) noted that grinding the seeds was a hard process and expended a significant amount of energy.

In the same general region, Felger (1977) described the archaeological remains of the Amargosan-Pinacateño people who occupied the Pinacate lava fields in extreme northwest Sonora. They developed an innovative grinding technology called the "gyratory crusher," (Figure 3.1) which allowed them to easily crush large amounts of mesquite and obtain the seeds without much effort. This technology has been found at archaeological sites dating between AD 1100-1200 in the region (Hayden 1969:159). The gyratory crusher was a large slab of rock which had a mortar hole punching all the way through the bottom. A large wooden pestle with a small extension on the distal end could then fit through the hole and be rotated around it. While one person was rotating the pestle, another would feed mesquite pods into the hole. Hayden (1969) explains that the easiest way to use this technology would have been to prop the slab up on other rocks and place a basket underneath to catch the material which would then be winnowed.

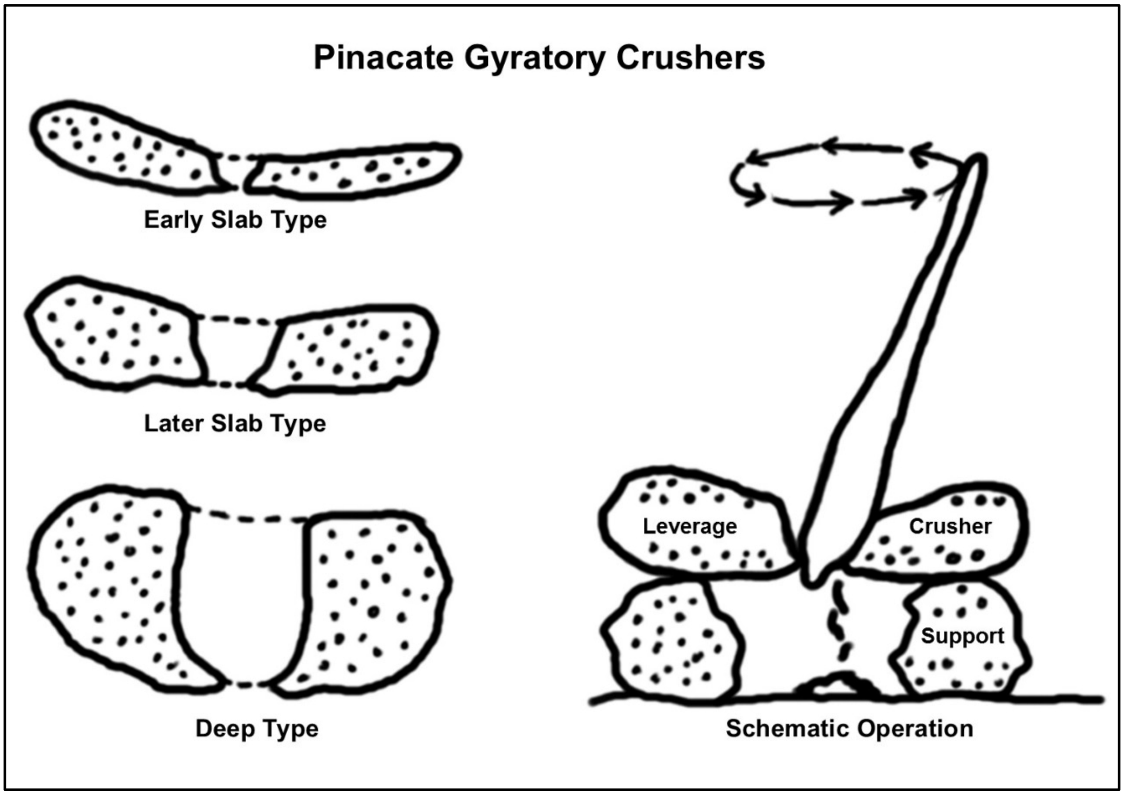


Figure 3.1. Illustration of Pinacate gyratory crushers showing the various types and how the technology operates. Redrawn from Hayden (1969:Figure 1).

In regard to both mortars and metates being used during mesquite processing, Hayden (1969) and Castetter and Bell (1942) both claim Papago informants said mesquite was pounded at communal sites near the gathering area, and the roughly crushed material was taken back to camp to grind it into *pechita*, or flour, on individually owned metates. Other accounts (Castetter and Underhill 1935) reveal that native groups would pound mesquite in a mortar at the start of the process because they are too sticky to grind on a slab like other seeds. Kniffen and MacGregor (1935) reported that the Walapai of northwestern Arizona used a low stone mortar to pound mesquite. The meal was then mixed with water to form a sweet drink or made into loaves and saved for later. The Southern Paiute collected green pods and pounded them to a pulp in a stone mortar to make a drink (Hodgson 2001). Wooden mortars were often used to process mesquite by the Shoshone (Hodgson 2001), the Pima (Rea 1997), and numerous other groups.

In contrast to all other accounts, Castetter and Opler (1936) reported the Apache used a metate instead of a mortar to process mesquite. It is possible the use of a metate occurred later in the process when just the hard seeds remained, but the report is not clear. Further, Castetter and Underhill (1935) discussed the Papago using a metate to grind the clear-white, gum-like secretion from mesquite branches. This was either mixed with Saguaro syrup and eaten like a jelly, or mixed with a variety of ground cactus seeds, then boiled and hardened into a candy. Various other ethnographies discuss processing mesquite with ground stone in an ambiguous way by not specifying the exact tools used to grind the pods (Hodgson 2001; Krieger 2002).

Ground Stone Use in Agave Processing

Baking various species of agave in earth ovens is a widespread practice throughout Mexico and the Southwest. When discussing agave processing, Bruman (2000) states pounded fleshy leaves are left to dry in the sun after baking the agave in an oven. He does not state how the leaves were pounded, but it is likely ground stone was involved. The Western Tarahumara of Chihuahua utilized metates to ground roasted mescal periodically while the meat of the plant was drying so it could be preserved for up to six months (Parsons and Parsons 1990). They also used a specialized flat, square ground stone “knife” with a dull edge which was used to scrape the leaves of the agave after it came out of the oven (Parsons and Parsons 1990:300). The blunt edge would separate the pulp from the leaf without cutting the fibers so they could be utilized later.

This particular ground stone implement is said to have been utilized all over Mexico (Parsons and Parsons 1990:300). East of the Tarahumara in the present day state of Coahuila, Spaniard Alonso de León reported the natives chewing and sucking on freshly baked agave leaves, and then tossing them on the ground (Taylor 1972:173-174). Later when the natives became hungry again they would retrieve the leaves, grind them in a mortar, and eat the mush. Taylor (1972) says wooden mortars were mentioned, but de León only saw mortars in large rocks or bedrock.

On the Pecos River, Frank Buckelew (1911), a Caucasian boy who was a Lipan Apache captive, described baking sotol bulbs in an earth oven and then letting the bulbs dry thoroughly. Once they were dry, the leaves were torn off and were put into large holes in rocks or logs and ground into a white flour-type substance with a large wooden pestle. Moving westward, the Havasupai of northern Arizona mashed the agave leaves into a cake after they were done baking—the pounding implements are not specified (Spier 1928). Similar behaviors were recorded for the Walapai of northwest Arizona, however, Kniffen and MacGregor (1935) do specify the use of a metate. The final ethnographic observation of ground stone use in agave processing is of the Tepehuan in north-central Mexico by Pennington (1969:100-101). The Tepehuan would crush the baked mescal on metates until the fibrous matter was easily separated from the edible portion. The pulp was then added to a favorite dish called *esquiate*, which is a variety of plant leaves, seeds, fruits, and wild chiles which are all mashed—not ground—on the metate. Pennington makes a point to describe how the Tepehuan prepared the food on the metate using a light pounding motion rather than long strokes across the metate to grind the food. He describes the metates as legless that would sometimes be placed on a stand for easier use. Some of the Tepehuan houses were said to have different metates reserved for specialized activities – grinding corn or corn dishes, grinding chiles, and mashing corn sprouts to make an alcoholic beverage.

Ground Stone Use for Other Foods

Ethnographers have recorded the use of ground stone to process many different seeds and herbed plants throughout the year. The Pima of southern Arizona ground pickleweed seeds, amaranth, and saguaro seeds on a metate with a stone mano (Rea 1997). The resulting fine meal would then either be eaten dry or as a *pinole* (gruel). It was observed that both the Pima (Rea 1997) and the Papago (Castetter and Underhill 1935) boiled, dried, and then ground banana yucca (*Yucca baccata)* fruits on a metate. In addition, the Papago would parch, and then sun dry seeds from amaranth and tansy mustard plants. These seeds were stored and later ground into flour when they were ready to be used. North of the Pima and Papago, the Walapai utilized metates for corn, piñon cones, and yucca fruit (Kniffen and MacGregor 1935). Additionally, piñon nuts were cracked on a flat rock and then saved to make a soup or ground into a paste at a later time. Squawberries were also gathered, stored, and pounded in a mortar with water to make a paste and then mixed with more water to make a sweet drink. Rea (1997) recorded stories from modern Tohono O'odham of southern Arizona who used mortars to grind paloverde pods and used the meal to create a sweet drink. Moving east, the Chiricahua Apache of southwest New Mexico would begin to gather seeds around midsummer and ground them on a metate with a stone mano to produce flour used to make bread (Opler 1941:359). The Chiricahua were said to pulverize any food on a metate needing to be preserved.

Cabeza de Vaca encountered a group of natives south of the Rio Grande who ate only “powdered straw” or *polvos de paja* (straw, grass, chaff, or husks from corn cobs) (Krieger 2002:224). While de Vaca seemed to think the substance was corn, Foster (2008) believes the powdered food was more likely derived from amaranth. Either way, the plant must have been pulverized and pounded into flour, likely by ground stone. Cabeza de Vaca also encountered a group of natives as he moved west into the mountains of northern Mexico who took advantage of the pine nut harvest (Krieger 2002:68). The natives ground the nuts while still green to create little piñon balls. Alternatively, once the pine nuts became ripe they were ground with their shells on and eaten like a powder. The ground stone technology used in this process was not specified.

In addition to grinding and pounding plant foods, multiple ethnographies show that grinding implements were used relatively often to help process animal meat. Kniffen and MacGregor (1935) recorded Walapai grinding deer meat together with piñon nuts for additional flavoring, and meat was pounded intermittently during the drying process. Similarly, the Chiricahua women pounded deer meat, then hung it to dry (Opler 1941). Also in New Mexico, Hopi informants reported using handstones frequently during the defleshing and/or dehairing processes for hides (Adams 1988). Adams tested and confirmed this statement by comparing use-wear on archaeological specimens to handstones used in archaeological experiments.

In summary, throughout northern Mexico and the American Southwest, various types of ground stone tools were used in a variety of food processing activities. Although most of the ethnographies related information about major food staples, such as agave and mesquite, they also demonstrate ground stone use for processing less important plant resources in the area, as well as animal tissue. Further, different ground stone implements such as bedrock mortars, metates, handstones, and pestles were all utilized, sometimes in succession, depending on the resource being processed.

Ground Stone Use in Beverage Fermentation

Ground stone technologies utilized in making prehistoric alcoholic drinks could technically fall under the category of food processing since the same plants are involved. However, alcohol was usually considered sacred and used in a ritualized context (e.g., Bruman 2000), and is therefore considered separately here. Known instances of agave brewing mostly occurred in northwest and central Mexico with the use of ceramic vessels (Bruman 2000:Map 2). However, Gonzales de las Casas observed southern Chichimeca groups fermenting drinks in watertight baskets (Bruman 2000:48). This observation suggests that other more mobile groups who did not utilize ceramic technology may have also practiced fermentation in other kinds of containers.

The process of making a fermented agave-juice drink is best documented for the Tarahumara of Chihuahua. Bennett and Zing (1935) and Bye (1975) (cited in Bruman 2000; Parsons and Parsons 1990) both observed Tarahumara putting cooked agave leaves into a hollow rock and pounding with an oak mallet or pestle. Once the agave mass was well pounded, it was placed upon a wooden frame positioned above the mortar and squeezed so the juice would drain back into the mortar hole (Bruman 2000:22). The account in Parsons and Parsons (1990) suggests the Tarahumara would collect the juice in a ceramic vessel and then heat it to continue the fermentation process. Conversely, Lumholtz (2011[1903]) described maguey wine being made by leaving baked stalks in a rock depression with water in it and no cover above it. The root of a *frijolillo* (mountain laurel) would then be added to ferment the juice. Bruman (2000: Figure 10) shows *pozos,* or fermentation pits, that are deep holes pecked into bedrock near Nayarit that may have been used for fermenting agave. Bruman (2000) suggests this same process was likely used to make prehistoric sotol wine as well. Felger (1977) and Bruman (2000) both reference the Seri pounding mesquite in bedrock mortars to create an alcoholic drink for the men. This was also done by the Cahuilla of southern California who would dry the mesquite pods to preserve them and make an alcoholic drink all summer long (Felger 1977:162).

Ground Stone Use in Medicinal and Ritual Contexts

Ground stone implements are very practical tools, and they played multiple roles in medicinal settings as well. Manos, pestles, metates, and mortars can be used to effectively pound or grind leaves and herbs to be used for ailments. The Pima pounded the root of a Screwbean tree in a mortar, let it dry, and then ground it even finer on a metate to make a paste used to heal wounds (Rea 1997:183). The Pima also processed Quail plant in the same way to make another kind of salve for wounds. The Papago used a variety of herb concoctions to treat different ailments; these plants were collected in season, dried, and then ground in a special mortar when needed (Castetter and Underhill 1935:64). This account alludes to an important consideration: although ground stone is a very efficient technology to complete the task of making medicines, the Papago had a "special" mortar reserved for this purpose.

It seems reasonable to argue that the ground stone items used in association with sacred or ritual products take on extra meaning or significance, especially in ceremonial contexts. For example the Luiseño of southern California had a finely made, decorated stone bowl mortar which was only used during the Toloache ceremony, and was not allowed to be used in everyday activities (Kroeber 1976:656). Further, the Luiseño used a finely shaped pestle, as opposed to a natural cobble, to pound datura leaves in the special mortar to make the Toloache drink (Kroeber 1976:653). Other groups such as the Maidu sprinkled secret society initiates with meal pounded in a ritual mortar during ceremonies (Kroeber 1976:414). Similarly, when unsuccessful during a deer hunt, Miwok men bathed themselves with the root of wild sunflowers which had been pounded in a mortar (Barrett and Gifford 1990:178).

Groups outside of California also used ground stone in ritual contexts. In northern Mexico, the Tarahumara were observed grinding peyote plants on a metate with water (Lumhotlz [1903]2011:364). This process required assistants who were tasked with preventing liquid from falling on the floor, lest any of the sacred material be wasted. Based on the ethnographic record, ground stone implements often times would assume specialized purposes not directly related to food processing. However, beyond ceremonial items being processed using ground stone, it is possible within many groups the ground stone implements themselves took on added meaning.

Adams (2008) discusses the possibility of ritually "killing" a metate or mortar when its use-life has come to an end. Supporting this hypothesis, many archaeological specimens have been found with intentional breaks or holes in the middle of the grinding surface. Ethnographically, when a Walapai woman dies, her food processing mortar is either destroyed or buried with her (Adams 2008:224). There are also ethnographic accounts describing the intimate relationship between Pomo female puberty rights and ground stone use (Parkman 1994). During a puberty ritual, a Pomo girl was confined for a determined length of time. After her last day of confinement, she would make her "food milling appearance," and would pound acorns for an entire day, at the end of which she was considered a woman (Parkman 1994:27). Additionally, Kroeber (1976:302) noted the Shasta feared portable bowl mortars since they housed spirits, and only female shamans could use them. The seemingly inherent connection between women and ground stone is an aspect of study worth more attention. Some archaeologists (e.g., Koerper 2006; Mithen et al. 2005) suggest there is reproductive or sexual symbolism inherent in ground stone activities. Buonasera (2013) argues fertility metaphors can be seen in the shape of the implements, motions used, and the creation of a product. Further, she provides instances of infants buried in mortars, metates placed over the heads of deceased adults, and phallic-like pestles placed between the legs in burials around the San Francisco Bay area (Bounasera 2013:205). Fertility metaphors could help explain why ground stone was tied to women more strongly than men, as females are typically associated with reproduction and birthing.

Finally, there are several ethnographic accounts of ground stone technologies being incorporated into myths within multiple native Californian groups. Parkman

(1993:93) suggests creating small holes in boulders and bedrock recreates the sound of thunder, therefore calling in storms. This hypothesis is supported by multiple California creation myths in which stones and thunder are often associated with one another. One Cahto story says the sky was made of stone in the beginning, but large claps of thunder shook it apart (Parkman 1993:92). According to the Mattole, thunder was a blueish disk-shaped stone moving around in the clouds (Parkman 1993:92). Further associating rock pounding with bringing rain, the Shasta believe the creator used a stone to bore a hole in the primordial sky so the rain could fall to the earth (Parkman 1993:95). Finally, the Kashaya Pomo built brush shelters over mortar locations so the sound of pounding ground stone could not reach the sky to call the rains (Parkman 1993:97). This belief has primarily been recorded in California, however it is possible this idea was more widespread as many rain shrines in New Mexico are located at sites with bedrock mortars (Parkman 1993:95).

The above ethnographic accounts provide evidence of ground stone use in activities which have nothing to do with producing an edible or consumable product just for the sake of subsistence. Additionally, the grinding implements inherit sacred and symbolic connotations when used in ceremonial contexts. Further, ground stone technologies may have had archaeologically invisible associations such as fertility or weather metaphors. These medicinal and ritual aspects should all be considered in ground stone analyses.

Final Implications for Lower Pecos Ground Stone Technology

Based on the ethnographic information described above, bedrock mortars and other ground stone artifacts in the Lower Pecos were likely utilized in a variety of food processing, fermenting, and ritualistic contexts. Both agave and mesquite are prevalent prehistoric food resources in the Lower Pecos (Dering 2002) and Buckelew's (2010) account already provides support for ground stone processing of baked sotol in the region. As for the ritual use of ground stone in the Lower Pecos, although they have been documented in mortuary contexts, there has been little done to explore this possibility.

Along with the ethnographic accounts presented above, numerous ethnoarchaeological, and experimental studies have underscored the importance of avoiding oversimplification of ground stone tools. Early ethnographers observed indigenous people using ground stone for a variety of activities, mundane and sacred, and these should all be considered when conducting analyses and making hypotheses about the ways ground stone was used in prehistory. These accounts will be revisited in Chapter 7 when discussing the morphological variation of Lower Pecos bedrock features.

IV. FIELD AND LAB METHODOLOGY FOR RECORDING LOWER PECOS BEDROCK FEATURES

Data has been collected on bedrock features in many different ways, and currently there is no standardized procedure to record this kind of feature. There are certainly good models to use (see Adams 2002; Dills 1975; McCarthy et al. 1985; Wallace et al. 1983), some of which will be discussed below, but many projects use bits and pieces of established methods to fit their research needs. Typical recording methods involve gathering all quantitative and qualitative observations while in the field, which can be extremely tedious and time consuming. Measurements often consist of length and width taken across the opening of the feature and the depth measured down from a ruler lying flat across the opening. To record volume, McCarthy et al. (1985:323) used lead shot or lentils to fill up mortars and then measured the amount in a heavy plastic graduated cylinder. Others have used the volume formula for a parabaloid (½ $(\text{radius})^2$ x height) as a suitable approximate measurement (Leftwich 2010:143). Qualitative attributes recorded might include any or all of the following information: opening/mouth shape, profile shape, condition of the feature, any adjacent features sharing rims, inclination of the feature, etc. All of these data are then used to help the researchers sort the features out into morphological types.

As discussed in Chapter 1, ground stone bedrock features have been called an assortment of names without much regard to consistency across regions. Around the world they have been called mortars, cups, incipient mortars, slicks, grinding spots, grinding facets, bedrock metates, starter mortars, finishing mortars, seed mortars, and more (Leftwich 2010). Typically the terminology is based on the general morphology of the feature, particularly depth, although some have used a consultant ethnographic model for classification purposes (McCarthy et al. 1985). These terms are relatively subjective. This might seem trivial, but if we want to continue to push the boundaries of how much bedrock features can tell us about larger archaeological questions, as mentioned in Chapter 2, we need to try to make a concerted effort to employ methodological and terminological consistency across a region.

Thus, one of my goals is to develop an efficient and accurate way of recording bedrock features that allows for an objective statistical analysis to split features into types. In other words, I try to let the data speak for itself, as opposed to creating type names and placing features into those categories based on my subjective judgement. In order to do this I used Structure from Motion photogrammetry (SfM) to create 3-dimensional (3D) models of bedrock features. This method is increasingly used for recording archaeological features (e.g., Douglass et al. 2015; Koenig et al. 2015; Willis et al. 2015), and has been shown to be extremely fruitful for documenting bedrock features (Nadel et al. 2015).

SfM involves taking a series of overlapping photographs of the subject matter, and then loading the photographs into a specialized software like AgiSoft Photoscan. The computer software then aligns the photos and creates a mesh of the subject's surface that will become a 3D model. These 3D models are able to produce sub-millimeter resolution digital elevation models that can be analyzed in a Geographic Information Systems software such as ArcGIS. From there, measurements can be acquired to conduct tests such as cluster analyses to determine the variation of the sample. This is not to say statistical analyses cannot be run on measurements that are hand collected in the field. However, SfM creates an extremely high resolution product that also allows for less time in the field, more accurate maps, and 3D visualization of the bedrock features. My results (e.g., the Lower Pecos bedrock feature typology, presented in Chapter 6) will not necessarily hold value for other regions in regards to a comparative data set; however, the SfM method is relatively easy and can be adapted to any area to examine the variability of bedrock features.

Sampling Strategy

In order to create a typology of bedrock features, a significant sample of features needed to be thoroughly documented. I evaluated 824 bedrock features at 10 sites across the Lower Pecos. Ideally, the sites would be evenly distributed across the region to sample features in differing topographic settings and river drainages. However, pre-established landowner relations and the logistical support of on-going projects largely determined which sites were chosen (Figure 4.1). For example, the ASWT project is currently conducting work in Eagle Nest Canyon, so I chose to record five sites in the immediate vicinity: 41VV164, 41VV165, 41VV166, 41VV167, and 41VV890. The sites within Eagle Nest Canyon are located in the larger drainage basin of the Rio Grande River, in the westernmost part of the region. Three of the sites located in the center of the region are surrounding the confluence area of the Pecos and Rio Grande rivers: 41VV2010, 41VV124, and 41VV75. The furthest east sites recorded are located just west of the Devils River in the Dead Man's Creek drainage: 41VV1342 and 41VV1284.

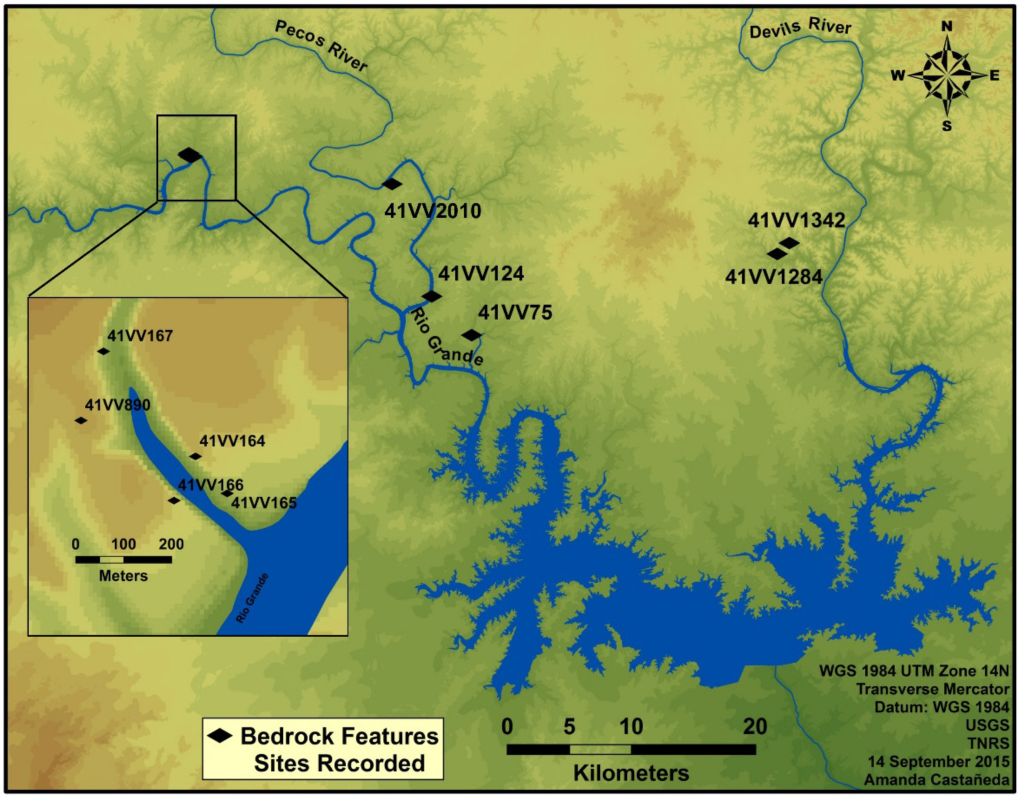


Figure 4.1. Ten sites recorded for this thesis, spread out across the region along the three major rivers.

Most of the sites recorded for this study are within 1 km of a major river (all are within 5 km of a major river), and this is recognized as a bias in this project. Although most of the survey in the region has been restricted to a 10 kilometer distance from a major river (Koenig 2012: Figure 7.12), the major regional surveys that have encroached upon the uplands have not found large numbers of bedrock features at the recorded sites (Koenig 2012; Marmaduke and Whitsett 1975; Saunders 1986, 1992; Turpin and Davis 1993). It is possible that bedrock features occur in the uplands more than we now recognize. Further, it is also possible bedrock feature morphologies in the uplands are decidedly different than features located in canyon environments. Clearly, more survey and upland bedrock feature documentation is needed to investigate these suspicions. The following sections discuss the alternating field and lab procedures for this project.

Initial Site Visit: Mapping Bedrock Features

As mentioned, I utilized SfM to map each of the features at all 10 sites recorded. All of the sites had multiple bedrock feature surfaces which were not continuous; thus, each surface received an individual area designation that included the site number and an arbitrary letter name starting with "A" (e.g., 41VV0165_Area A, 41VV0165_Area B, etc.). The process of separating individual areas from one another was not intended to make any sort of statement about whether these areas were used simultaneously, rather this was done to make the recording process simpler and better organized. Additionally, creating a 3D model of a smaller continuous area yields higher resolution data than creating a single model of two separate areas and the 10 meters of ground which may separate them. In order to capture the relationship of a bedrock feature area to each other in the site, a site map was created and bedrock feature areas were plotted for each site. When time allowed, a SfM model of the entire site was created. If a SfM site map could not be created, I utilized traditional pace and compass techniques to make a sketch site map. Observations about the general description of the site, associated cultural components, and surrounding natural environment were also recorded.

Before starting photography at each site, the immediate area around or covering the bedrock features were cleared of all vegetation so the 3D model software could build precise models of only the features. The typical cleaning method was clipping away overhanging vegetation, loosening any surficial dirt with a soft bristle brush, and using a Makita portable leaf blower to remove any remaining dust (Figure 4.2). Windblown deposits often collected in the shallower features and in all of the deeper bedrock mortars had at least a few centimeters of sediment in them. The deep features were completely dug out with “soft” tools such as bamboo splints to prevent creating any marks on the walls of the feature. The only features that were not excavated were five deep bedrock mortars located well underneath the overhang at 41VV75. These features have the potential to have in situ deposits and the remnant sediment was left intact at the landowner’s request (Seminole Canyon State Park and Historic Site).

Figure 4.2. Examples of various cleaning methods. (a) and (b) Volunteers using soft brushes and bamboo splits to clear away overlying sediment; (c) The author using the Makita blower for finishing touches.

After designating feature areas across a site and adequately cleaning the features, I used a Canon EOS Rebel T3i digital camera to take a series of overlapping photos across the bedrock feature surface in each area. While conducting the SfM photography, I sought a 30% overlap in each direction for each successive photo. Since the main method of recording these features is through photography, some lighting and weather conditions affected the fieldwork. SfM photography works best when the light is consistent across the entire surface being photographed. The most ideal lighting conditions are from overcast skies when the light is diffuse and even. Although this fortuitous condition occurred on occasion, photography was mainly completed while all of the features were covered by the shade of the rockshelter or a tarp being held by a volunteer. Photographs were tracked using a simple photography log form (Figure 4.3).

BRF PHOTO LOG FORM Page ___ of ___

Area/Locus	Camera	Photo Range	Subject	Photographer

Figure 4.3. Photography log form used to keep track of all photographs collected on site.

An advantage of using the SfM method is the ability to add scale and georeference the modeled surface in order to facilitate analyses in Geographic Information Systems (GIS) software. To do this, I added ground control points (GCPs) to each area of bedrock features. GCPs are known points tied to a Cartesian coordinate system, such as a site grid, that allow for the 3D model to be spatially referenced and provide an accurate scale. At least three GCPs were needed per area to get accurate locational data, although I added more if possible. Placing GCP's is a simple process of picking locations which are easily recognizable in multiple photographs and from text descriptions. For example, a good location for a GCP would be a unique hole or crack in the limestone substrate. Each GCP received a number (e.g., GCP001) and multiple photographs showing overall location and close up detail of the point. When a total data station (TDS) was available for use, and the site had an established grid system, I used this technology to assign coordinates to each GCP. If access to a TDS was not feasible, I set up a reference measurement system at each bedrock feature area using a builder's square—a steel ruler with a right angle (Figure 4.4).

When using a builder's square to reference a bedrock feature, I set the ruler on or adjacent to the area and then photographed the ruler using the SfM method. The horizontal and vertical "arms" of the ruler act as X and Y axes. In order to add the third dimension, elevation (Z), I added bubble levels onto each arm of the ruler. Rocks or other small items were placed under the ends and the right-angle of the ruler until both bubble levels were centered and the entire ruler was at the same elevation. This step ensures the elevation measurements will be accurate across the entire model since the 3D positions of the GCPs will be linked to the builder's square position. Once the ruler was photographed, I moved it away from the area and photographed the bedrock features separately. After the 3D model was finished processing in Photoscan, I placed GCPs on the ruler's markings to reference the model in 3D space. Using the builder's square method provides the ability to easily and accurately reference SfM models, regardless of physical site location, time, or access to a TDS.

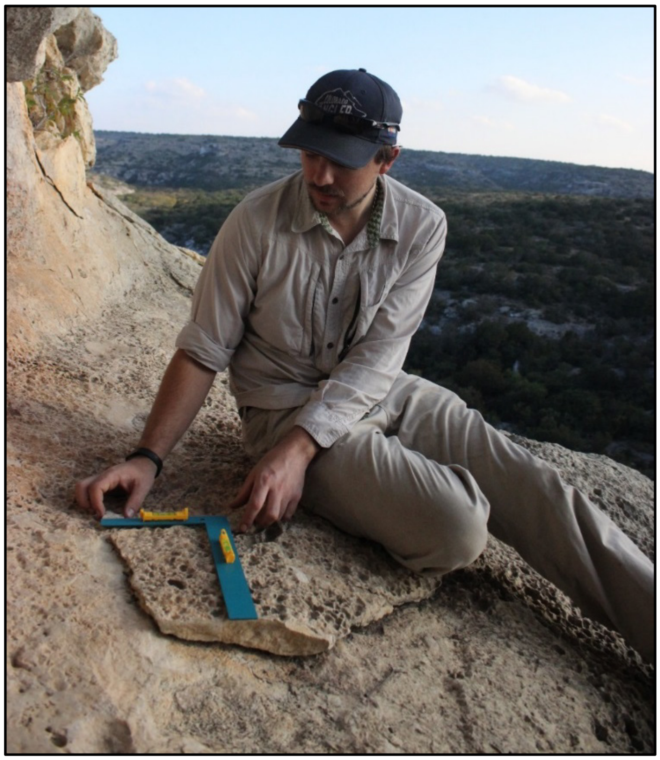


Figure 4.4. Volunteer, Charles Koenig, setting up the builder's square prior to SfM photography.

Overall, SfM proved to be an expedient and accurate way to map bedrock features. The only issue encountered was with very deep mortars that were dark towards the bottom. In these instances, I was not able to photograph all the way down inside the shaft. Even with the aid of the flash on the camera and extra lighting from above, the photos of the bedrock feature's deep portions were not in focus, which greatly hinders the photogrammetry software's ability to stitch the photos together. An innovated solution to this problem was created by Mark Willis for the documentation of deep Natufian bedrock mortars in Israel (See Nadel et al. 2015). Willis used a small remote-operated point and shoot camera and lowered it down the hole to take SfM photographs as normal. This method appears to yield excellent results, but could not be implemented in this study and represents an avenue for follow-up research focusing specifically on deep bedrock mortars.

Initial Laboratory Procedures: Creating 3D Models and Feature Maps

Once back from the field, I downloaded the photographs and gave them consistent names so they could be easily grouped into corresponding folders and readily identified (e.g., 41VV0165_SfM_AreaA_4569). I then processed each set of SfM photographs in Agisoft Photoscan to create a 3D model of the bedrock feature surfaces. After the 3D surface is rendered, I exported a digital elevation model (DEM) and an orthophoto for use and analysis in ArcGIS. I used the DEM and orthophoto to create feature maps of all areas within a site, which I then printed for use in the field. The DEM and the orthophoto are useful for two different purposes in this process. The orthophoto allows for a photographic texture to be shown on the 3D model, making visualization of the features very easy. The DEM layer underlying the orthophoto supplies the X, Y, and Z coordinate data needed for precise measurements (Figure 4.5). Further, the DEM allowed numerous tools to be used in GIS that made the individual bedrock features stand out. I found the “slope” tool in GIS aided greatly in identifying subtle bedrock features on the DEM (Figure 4.6).

Unless the area modeled was very large, I was usually able to process the 3D models in the evening to have a feature map ready for the next field day. The smallest 3D models I processed consisted of approximately 50 photographs, while the largest models had just over 350 photographs. However, since my methods required some back and forth from the field to the lab between the steps, extra planning and logistical forethought was essential to make the most of my time. For example, I might spend an entire day photographing different areas at a site and then use the entire next day in the lab to finish processing the models and readying the maps. I was fortunate to have access to the ASWT field lab with computers, printers, and chargers during my field research.

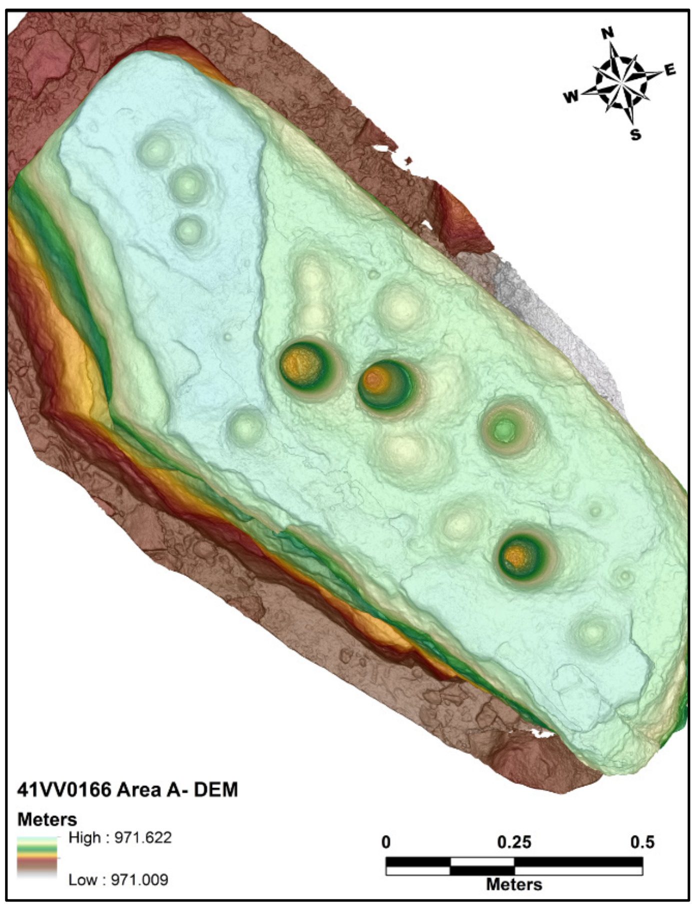


Figure 4.5. Example of digital elevation model (DEM) map.

Figure 4.6. Example of feature maps with orthophoto (left) and slope tool in GIS (right).

Secondary Field Visit: Attribute and Use-wear Data Documentation

Once a variety of enhanced and original orthophoto field maps were printed, I took them into the field to complete on-site attribute data collection. The first step in the process was to identify all of the bedrock features and assign a unique identification number that included the site number, area designation, and the assigned feature number. For example, at site 41VV75, I designated the first feature recorded in area A as 41VV75_A001. As the features were identified, I outlined the extent of each feature on the map to the best of my ability and identified the placement for the length and width measurements (Figure 4.7). Many researchers have noted the difficulty in determining the edges of bedrock features, which then affects the final measurements (McCarthy et al. 1985; Wallace et al. 1983) However, this step was crucial as it would aid me in gathering accurate measurements off of the 3D models in the lab. Even as technologies develop to increase the accuracy of measurement collection, it will still be important for on-site inspection of bedrock features. There are many small nuances that are missed in a photograph and it is best if these methodologies can be used in tandem.

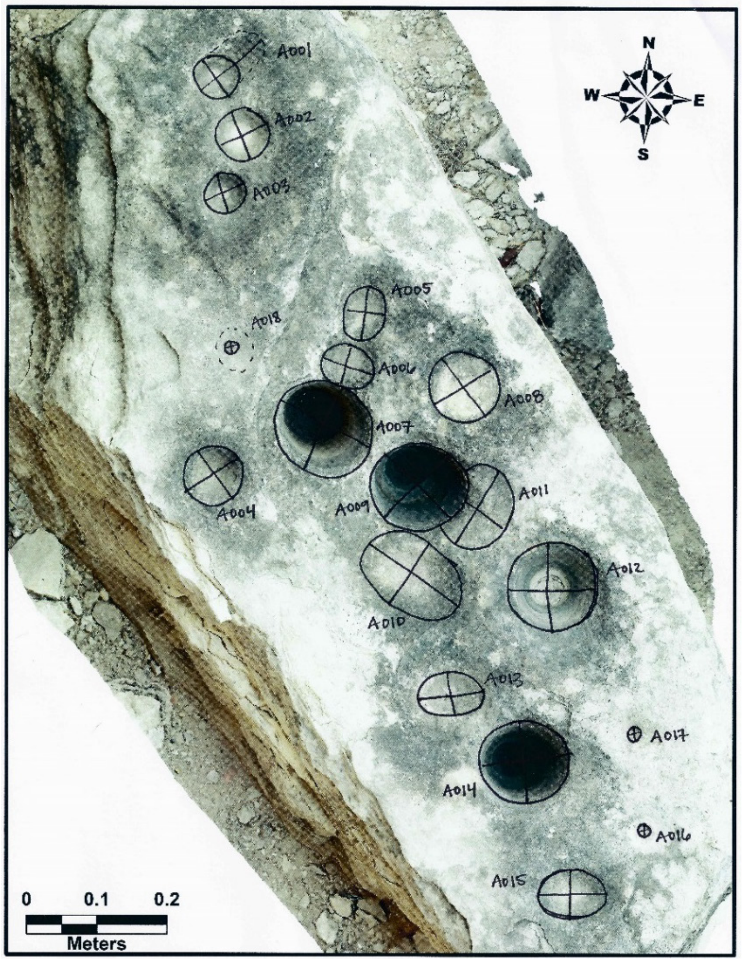


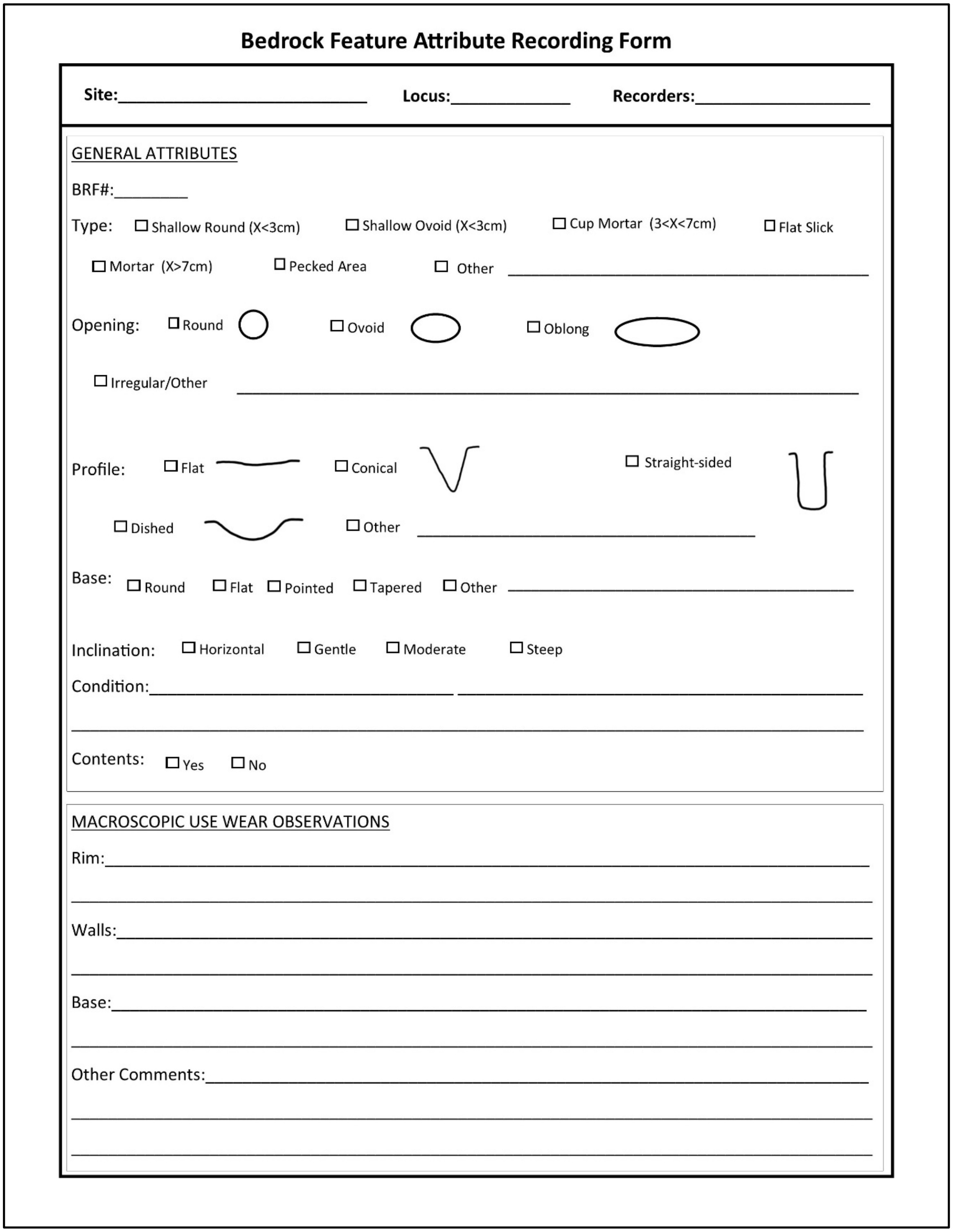
Figure 4.7. Printed feature map used in the field to identify features and indicate where measurements should be taken.

After feature identification, I recorded a series of morphological attributes such as a tentative morphological type, opening shape, profile shape, base shape, the inclination of the feature, the condition, and whether the feature had any contents within it (Figure 4.8). Definitions and qualifications for the terminology used in this project is presented in

Appendix A. As mentioned, these assessments are sometimes fairly subjective and often times I felt conflicted if the feature did not fit nicely into one of the previously established categories, such as a feature opening being somewhere between perfectly round and ovoid. Although this attribute data may seem contradictory to the goal of my project, I collected it to get a better feel for each of the features and also to act as a comparative data set to test against the purely quantitative results that I generated in GIS. Of note, I focused my documentation efforts on the variety of bedrock feature concavities and did not include "slicked" areas in my analysis. I noted the presence of slicked surfaces if they were present but did not collect any detailed information regarding their size or attributes.

In addition to basic morphological data, I recorded macroscopic use-wear observations on the majority of the bedrock features to gain a better understanding of the function of each feature. For this project, I evaluated use-wear through touch and the un-aided eye (~1-5cm scale) with help from a LED light panel to illuminate the macroscopic character of the limestone substrate. Macroscopic observation, using the un-aided eye, can reveal information about the kinetic motions used and the working part(s) of a tool. Further, the manner of how force is applied to the tool, the direction of the force, and the type of contact can all be analyzed at this scale (Leroi-Gourhan 1971).

In regards to ground stone bedrock features, differential use-wear across the surface of a feature can show what type of activity happened most recently. Is the surface pecked and rugged, or is it completely smooth to the touch? These conditions tell different stories about what happened last with that particular feature. When making use-wear observations, the objective is to observe traits about the macrotopography, or the high and low points. One of the first characteristics that I looked for was intentional pecking which is apparent by the overall patterning of high and low points. There should be a relative uniformity in size, spacing, and depth of the peck marks. If this trait is present, it can be inferred that the surface was intentionally roughened to aid in the processing task. Next, I inspected the high points for any use that occurred after the surface was pecked. Typical wear patterns include leveling, the tips of the high points are sheared off, and rounding, the edges of the high points are smoothed and rounded (Figure 4.9). Each of these wear patterns has a generalized correlation with the type of substance processed (Dubreuil 2004). Surfaces that have levelled high points with abrupt edges are typical indicators of stone-on-stone contact. This is usually the result of an abrasive mechanism such as shaping another object or when a very thin layer of intermediate material is used. It is also possible some materials such as ochre or nuts can lead to "plateaus" since there are more abrasive bits in those materials. In contrast, rounding of the high points occurs when a soft substance such as hide, meat, or vegetable is processed. Other types of wear patterns include macroscopically visible striations, gouges, or sheen. In this study, use-wear observations were collected for the rim, walls, and base of each feature (Figure 4.8).



Bedrock Feature Attribute Recording Form

Site:________________ **Locus:**__________ **Recorders:**______________

GENERAL ATTRIBUTES

BRF#:________

Type: ☐ Shallow Round (X<3cm) ☐ Shallow Ovoid (X<3cm) ☐ Cup Mortar (3<X<7cm) ☐ Flat Slick

☐ Mortar (X>7cm) ☐ Pecked Area ☐ Other ________________

Opening: ☐ Round ☐ Ovoid ☐ Oblong

☐ Irregular/Other ________________

Profile: ☐ Flat ☐ Conical ☐ Straight-sided

☐ Dished ☐ Other ________________

Base: ☐ Round ☐ Flat ☐ Pointed ☐ Tapered ☐ Other ________________

Inclination: ☐ Horizontal ☐ Gentle ☐ Moderate ☐ Steep

Condition:________________

Contents: ☐ Yes ☐ No

MACROSCOPIC USE WEAR OBSERVATIONS

Rim:________________

Walls:________________

Base:________________

Other Comments:________________

Figure 4.8. Bedrock feature recording form used to collect general attribute data and use-wear observations for each feature.

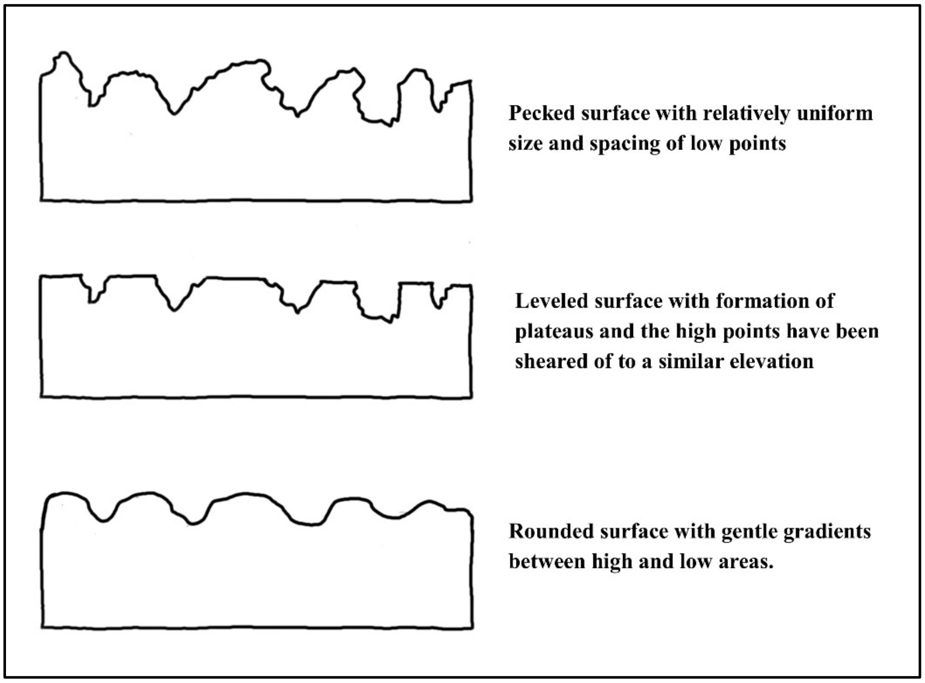


Figure 4.9. Illustrated examples of various use-wear characteristics. Figure redrawn from Dubreuil (2004:Figure 1).

Final Lab Analyses: Obtaining Measurements from ArcGIS

The final step in the documentation process was to update the feature maps with the newly identified features and gather measurements using ArcGIS. First, I created a point shapefile, placed a point in the center of each feature, and labeled them with the correct feature numbers (Figure 4.10a). Next, I created another shapefile consisting of polylines and drew two lines over the top of each feature, these would become the length and width measurements (Figure 4.10b). I tried to keep the lines perpendicular to each other as much as possible but I also used my notes from the field as mentioned above. If a feature was oddly shaped, the longest axis and the shortest were not always perfectly situated at right angles to each other. Using the "calculating geometry" function in ArcGIS, I determined the length of each line and exported this data to a Microsoft Excel spreadsheet. Another piece of data acquired through the axis measurements was a length-width ratio which gives an approximation of how circular or elongated a feature is. In this case, I divided the longer axis by the shorter axis to obtain the ratio. If a ratio is 1.0 or very close to it, the opening is more circular. As the ratio increases, the feature becomes longer and narrower (e.g., ovoid or oblong).

In order to calculate depth, I used the "interpolate shape" function in ArcGIS. Essentially, this function creates points along the length of the polyline and assigns an "X" and "Z" coordinate for each point. This data can then be exported for each feature as a text file and imported into Microsoft Excel. Once in Excel, the data was sorted by the depth value from largest to smallest and the maximum depth was calculated. It should also be noted that I obtained depth measurements for the very deep features while in the field since the SfM program could not model the surface all the way down the shaft. Further, I did not remove the deposits in some of the deepest features due to landowner restraints or difficulty in removing them so these should be considered minimum depth measurements.

All of these measurements were then used to characterize bedrock features at each site and across the region. Further, these data were used in various statistical analyses to better understand the variation in bedrock feature morphology. These descriptions and tests are presented in Chapter 6.

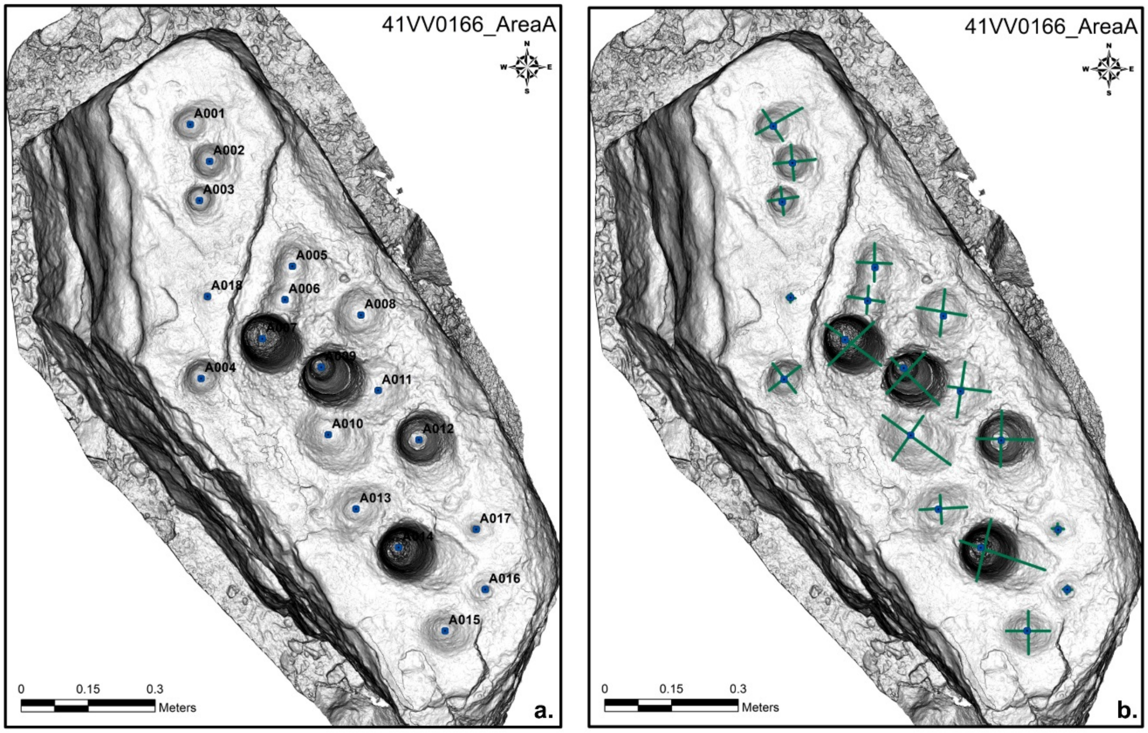


Figure 4.10. (a) Feature map with ID numbers assigned to each bedrock feature; (b) Poly lines drawn across each axis in GIS to obtain measurements.

V. BEDROCK FEATURE DOCUMENTATION RESULTS

Field work was conducted between June 2014 and March 2015 at 10 different sites with assistance from several volunteers. As mentioned in Chapter 4, the sites were chosen in an attempt to analyze bedrock features (BRF) from varied areas of the region and within different major river drainages—the Rio Grande, the Devils, and the Pecos Rivers (see Figure 4.1). This chapter summarizes the location and character of the ten recorded sites and describes the bedrock feature areas within each site. Each permanent area and portable ground stone feature slab has two corresponding maps: an orthophoto showing feature numbers and an orthophoto presenting outlines of each feature. Additional information in the form of qualitative attributes, use-wear data, and metric data are presented in tables for each feature in Appendix B. This data will be summarized generally in the discussion of each area and the definitions for the terminology used are presented in Appendix A.

Sites within the Rio Grande Drainage

Although all of the sites are located in the greater Rio Grande Drainage basin, six sites are located within canyons that empty directly into the Rio Grande River. Five of the sites are situated in Eagle Nest Canyon and one in Seminole Canyon (Figure 5.1). The five sites in Eagle Nest Canyon will be discussed first.

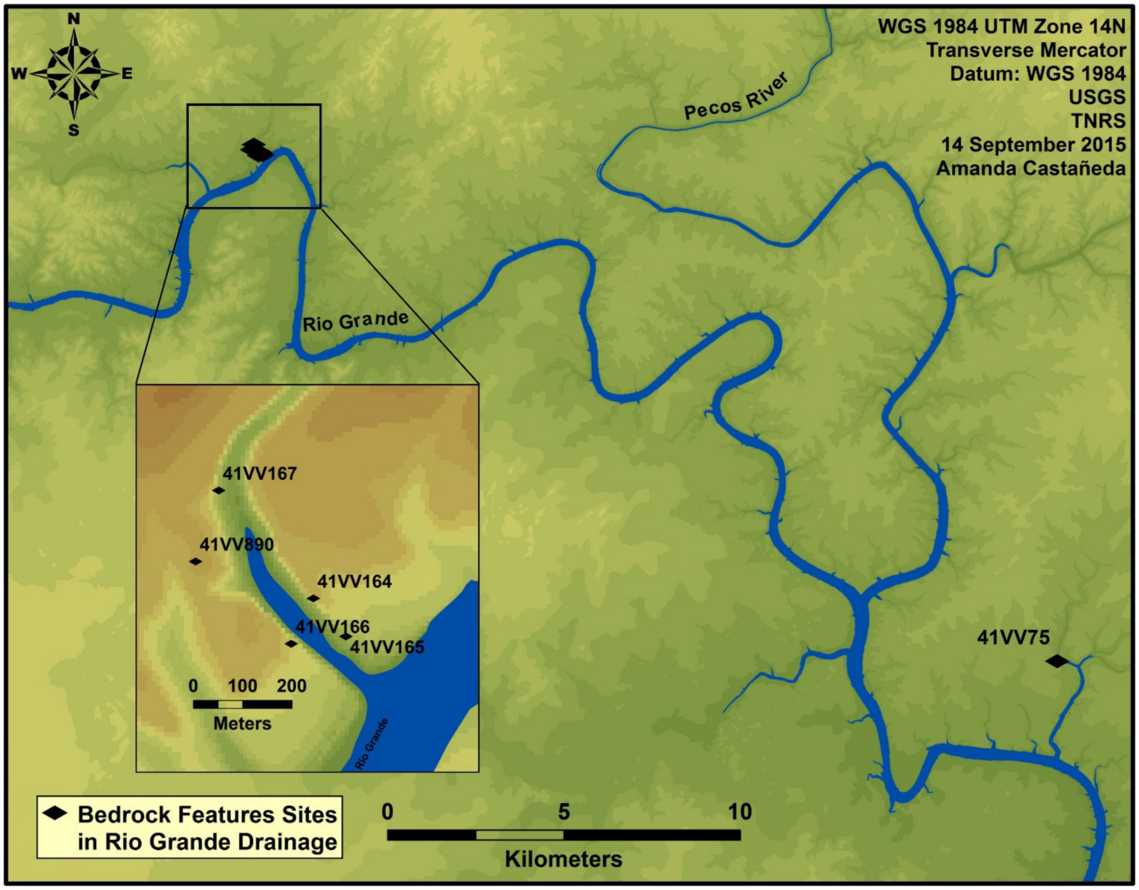


Figure 5.1. Bedrock feature sites recorded within the Rio Grande drainage system.

41VV164 – Kelley Cave

Kelley Cave is a dry rockshelter located on the eastern wall of Eagle Nest Canyon, approximately 300 meters upstream from the Rio Grande River (Figure 5.1). The site contains a small, poorly preserved panel of Pecos River style pictographs, a large burned rock talus, and well preserved deposits spanning Late Prehistoric to Paleoindian time periods (Rodriguez 2015). There are at least five permanent bedrock feature areas (Figure 5.2) and one portable slab with a total of 27 ground stone bedrock features located throughout the site (Figure 5.3). Table App B.1 provides the qualitative attribute data and use-wear observations collected for BRFs at Kelley Cave and metric data are provided in Table App B.2.

Figure 5.2. Permanent ground stone bedrock feature areas at Kelley Cave. (a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

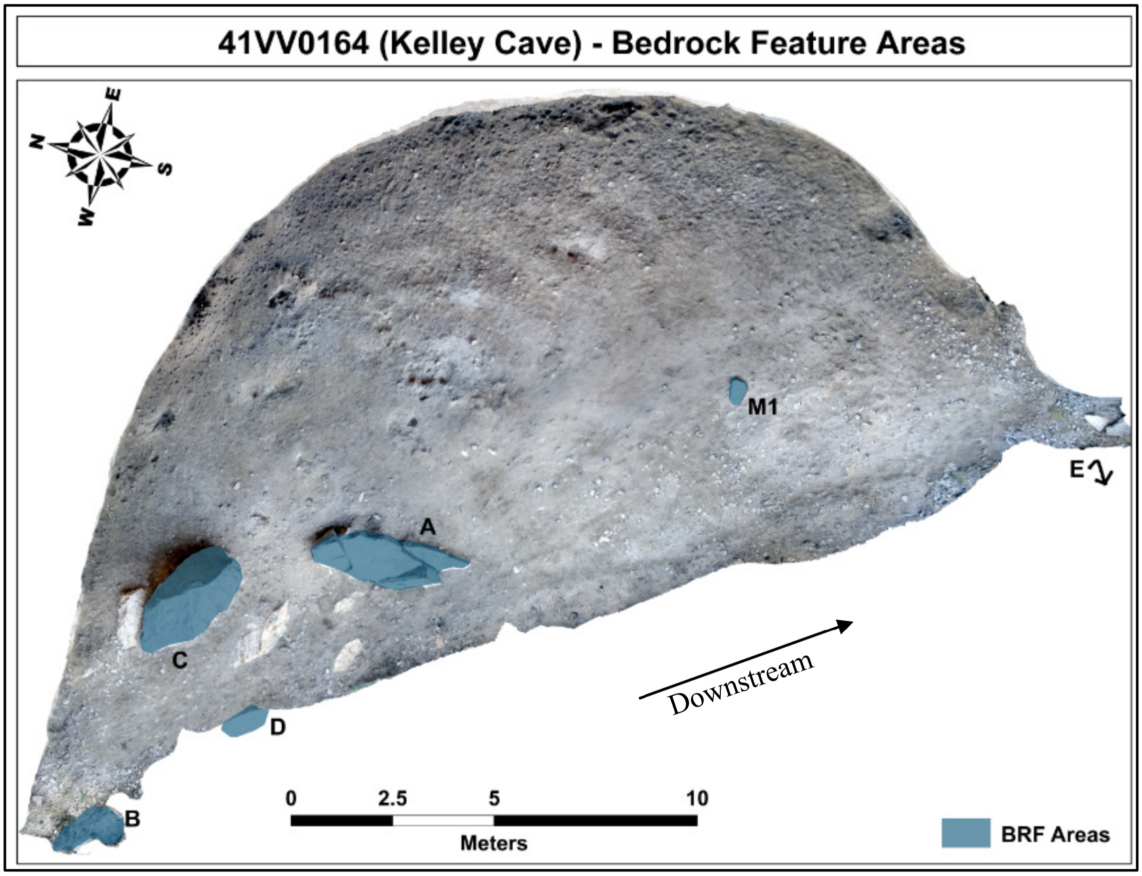


Figure 5.3. Plan view site map of Kelley Cave showing the permanent bedrock feature areas and the moveable slab.

Area A (Figures 5.2a, 5.4, and 5.5) is a roof-fall boulder that is broken into multiple pieces with six inclined BRFs in three clusters. The clusters consist of three, two, and one feature(s) each. Four of the features are fairly shallow with gentle profiles, while another is deeper but still with a gentle wall slope. The last feature (A006) is particularly interesting since it appears to represent the beginnings of a work station. It is a small circular area with extremely rugged peck marks that suggest it was never utilized. The remainder of the features all have evidence of use as the high points are mostly leveled and some have sheen. This boulder also has incised groove marks on the flat face of the rock, but not in direct association with the bedrock features.

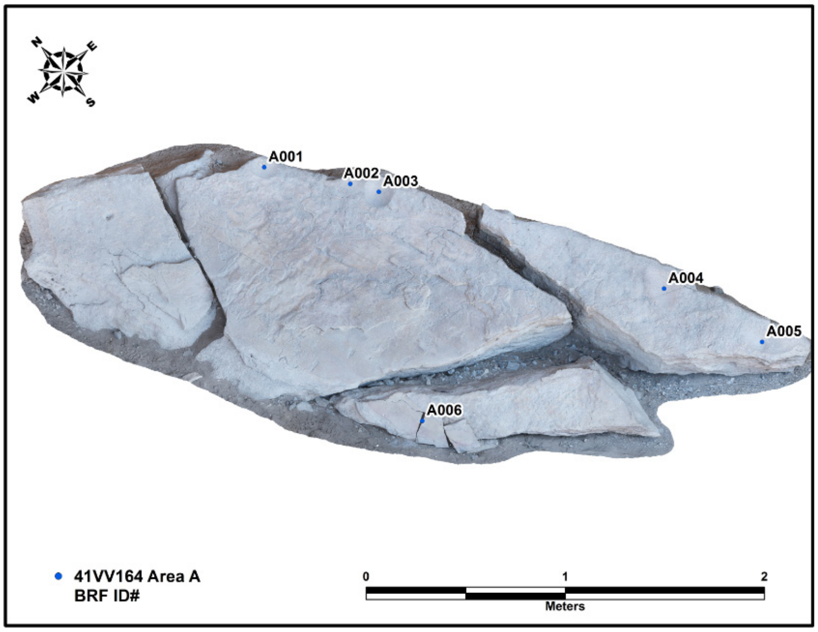


Figure 5.4. Kelley Cave, Area A feature map with ID points.

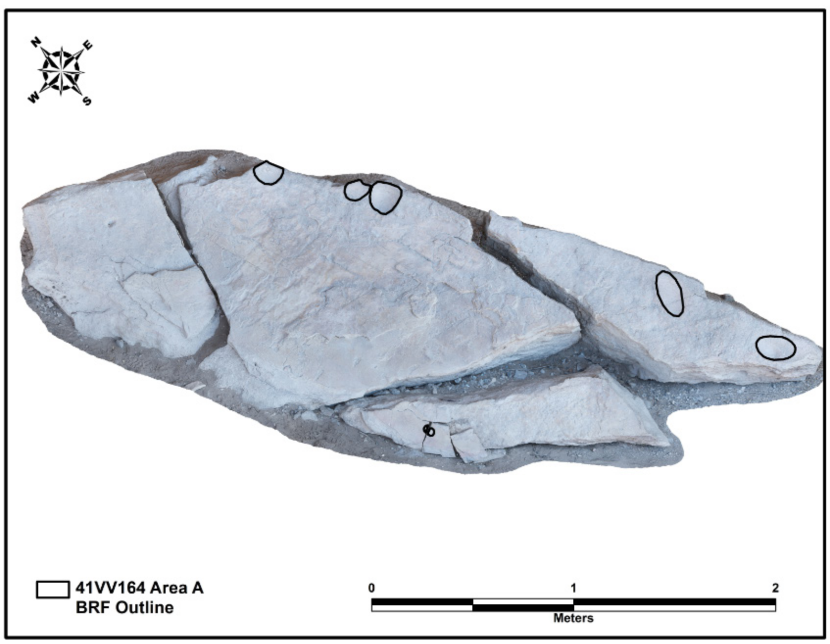


Figure 5.5. Kelley Cave, Area A feature map with feature outlines.

Area B (Figures 5.2b, 5.6, and 5.7) is located at the furthest upstream area of the site and has four BRFs. This rock is also likely a roof-fall boulder and is very weathered due to its location just outside of the dripline. Therefore, use-wear observations were not made on these features. All of these features are fairly deep with two of them having gently sloping walls while the other two are more bowl-shaped in profile.

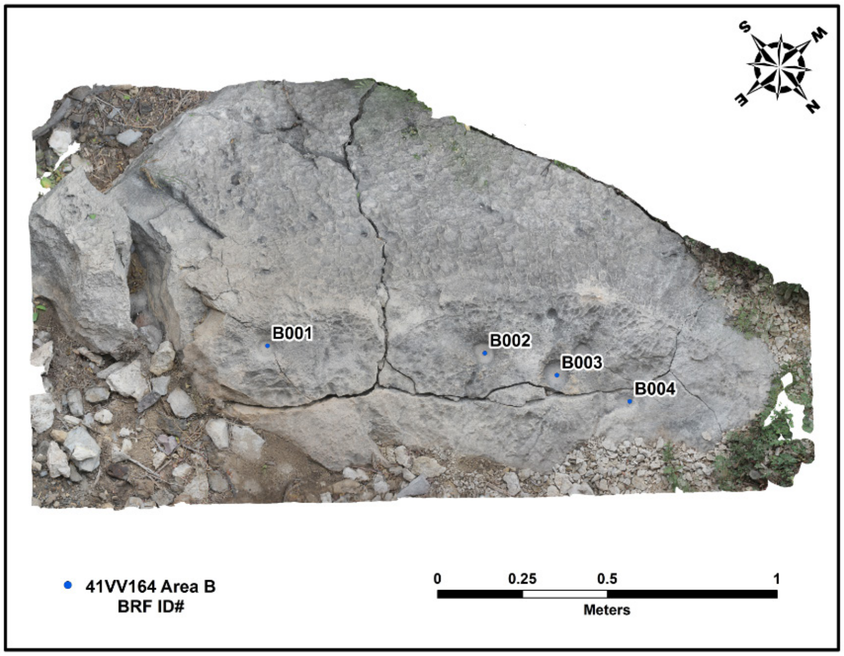


Figure 5.6. Kelley Cave, Area B feature map with ID points.

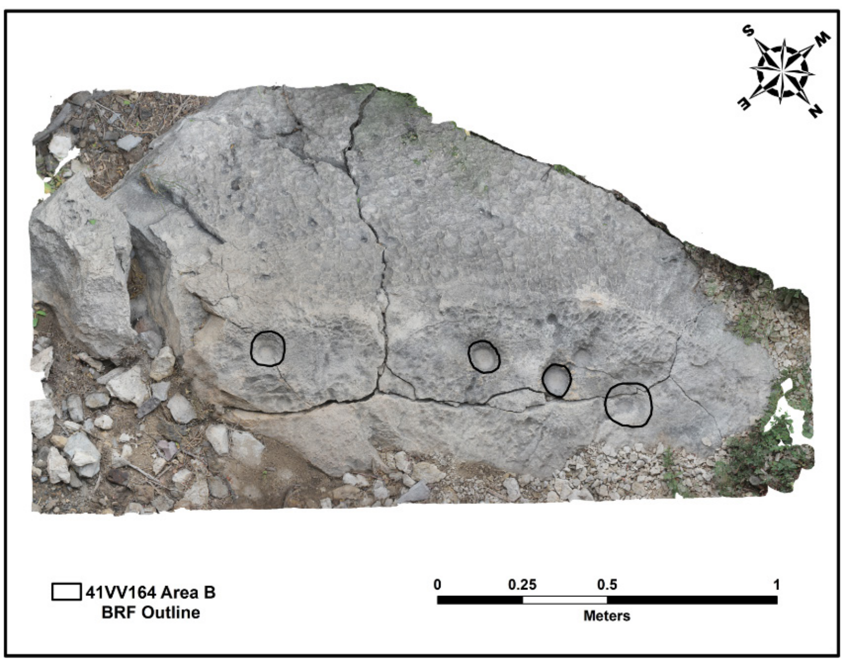


Figure 5.7. Kelley Cave, Area B feature map with feature outlines.

Area C (Figures 5.2c, 5.8, and 5.9) is located on a large roof-fall boulder and just has one BRF on the northern end of the rock, close to the ground surface. The feature is located on an incline and is gently sloped, grading into the surrounding rock surface.

Figure 5.8. Kelley Cave, Area C feature map with ID points.

Figure 5.9. Kelley Cave, Area C feature map with feature outlines.

Area D (Figures 5.2d, 5.10, and 5.11) is located just within the dripline and was originally covered with sediment. One of the seven BRFs was showing on the small piece of the boulder that was not covered so I pulled some of the sediment back. I did not reach the end of the boulder but I uncovered an area approximately 20 cm past the nearest feature and stopped when I did not encounter any more. It is plausible more BRFs are present on this rock but are still covered by sediment. All of the exposed features in this area are shallow and are on a steep slope. Further, most of the BRF's have gradual rims and are rugged with some minimal rounding of the macroscopic high points.

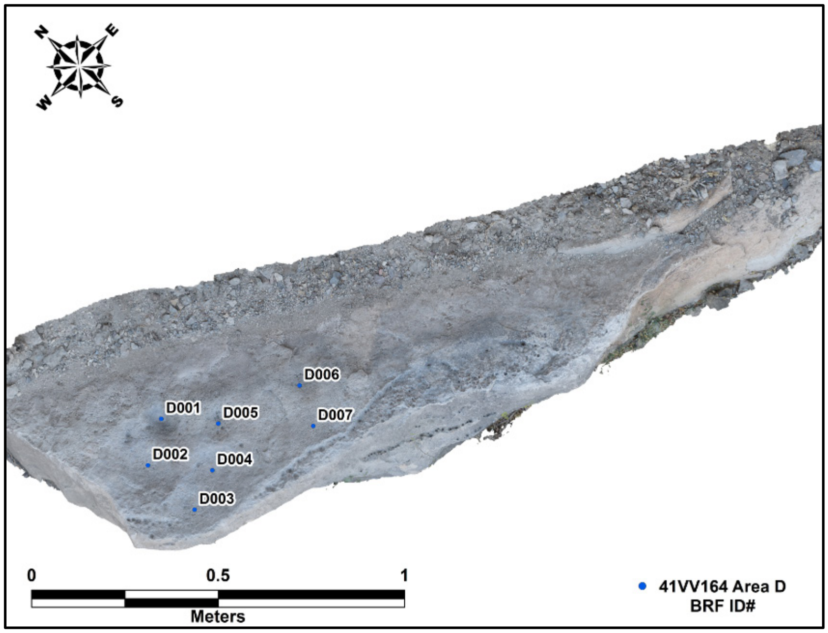


Figure 5.10. Kelley Cave, Area D feature map with ID points.

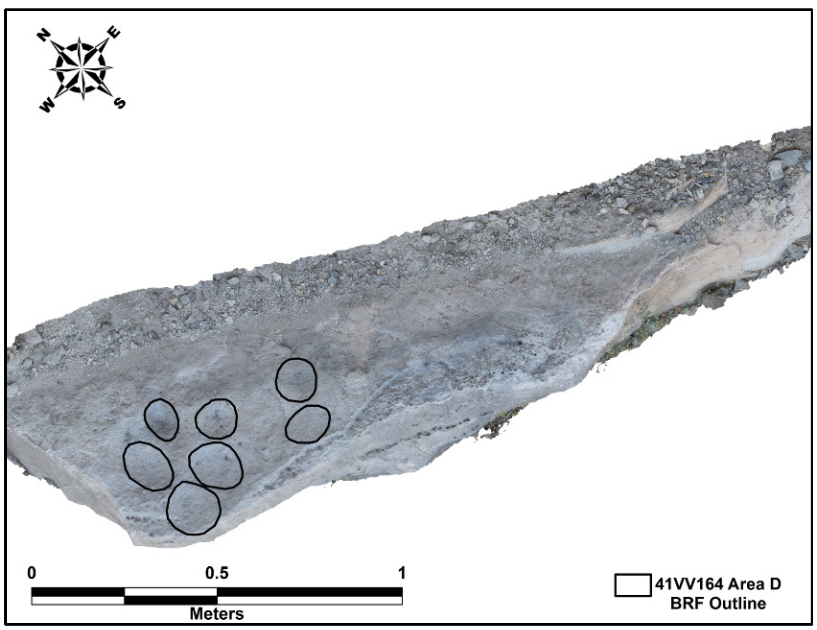


Figure 5.11. Kelley Cave, Area D feature map with feature outlines.

Area E (Figures 5.2e, 5.12, and 5.13) was found fortuitously after we cleared the site's vegetation in preparation for excavations. It is located on the furthest downstream area of the site and downslope from the shelter on top of a very large boulder that fell from the canyon wall. The seven BRFs are located in Area E are were relatively well preserved despite their uncovered location. It is possible the overlying vegetation protected the features from extensive rainwater etching and weathering. The features in this area are relatively shallow with gently sloping walls. Use-wear characteristics include intentional pecking with some leveled and rounded high points.

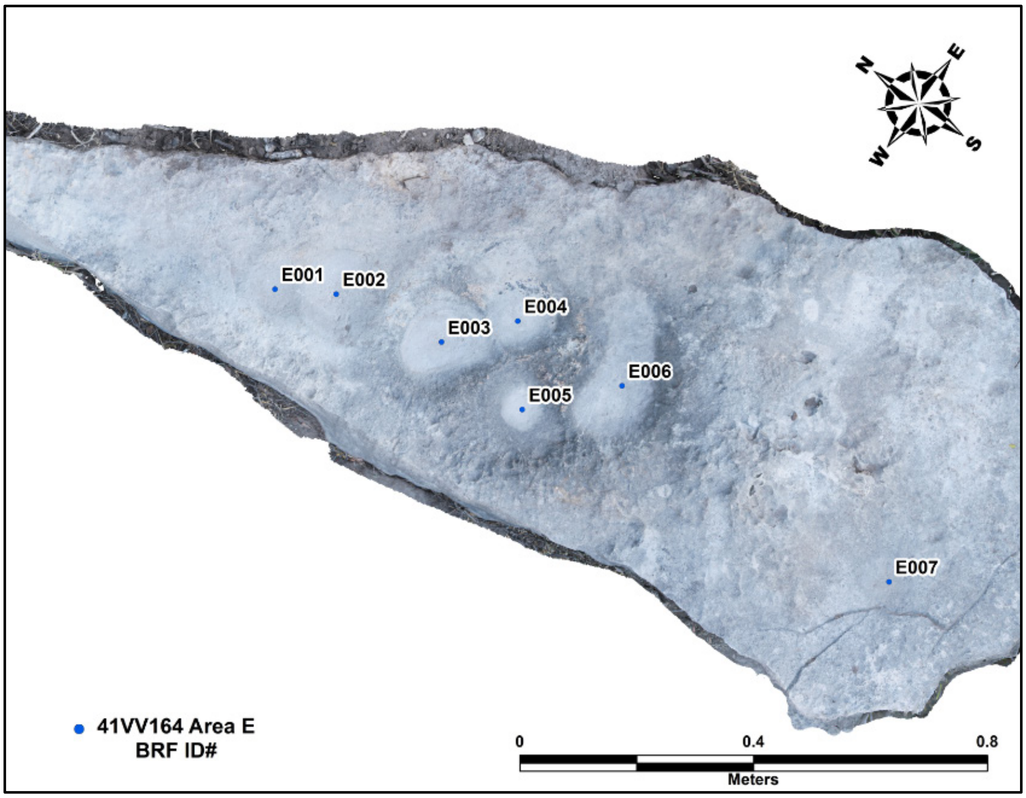


Figure 5.12. Kelley Cave, Area E feature map with ID points.

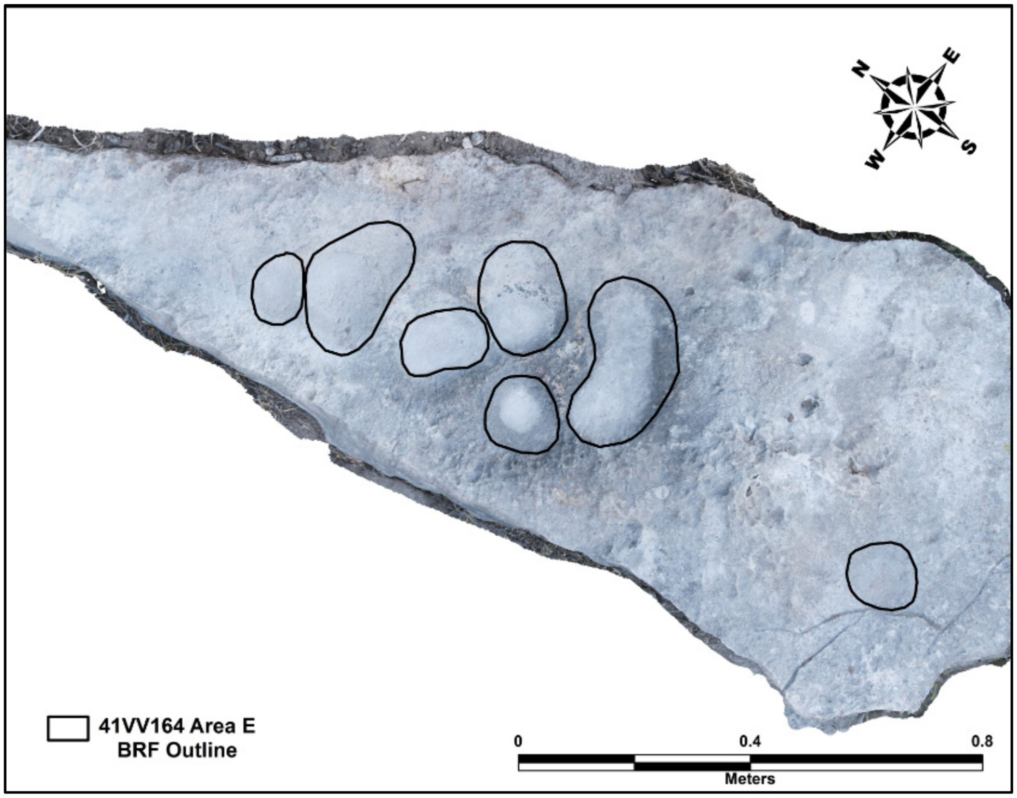


Figure 5.13. Kelley Cave, Area E feature map with feature outlines.

M1 (Figures 5.14 and 5.15) is a moveable slab with two BRFs located on one side. The slab itself is not extremely heavy, but it is large enough that it would not have likely been moved to differing site locations with the owner. In other words, this slab was likely made and used at Kelley Cave. One of the features is deep with multiple striations oriented vertically on the walls. The other feature is more oblong and shallow with rounded peck marks still visible on the walls and base.

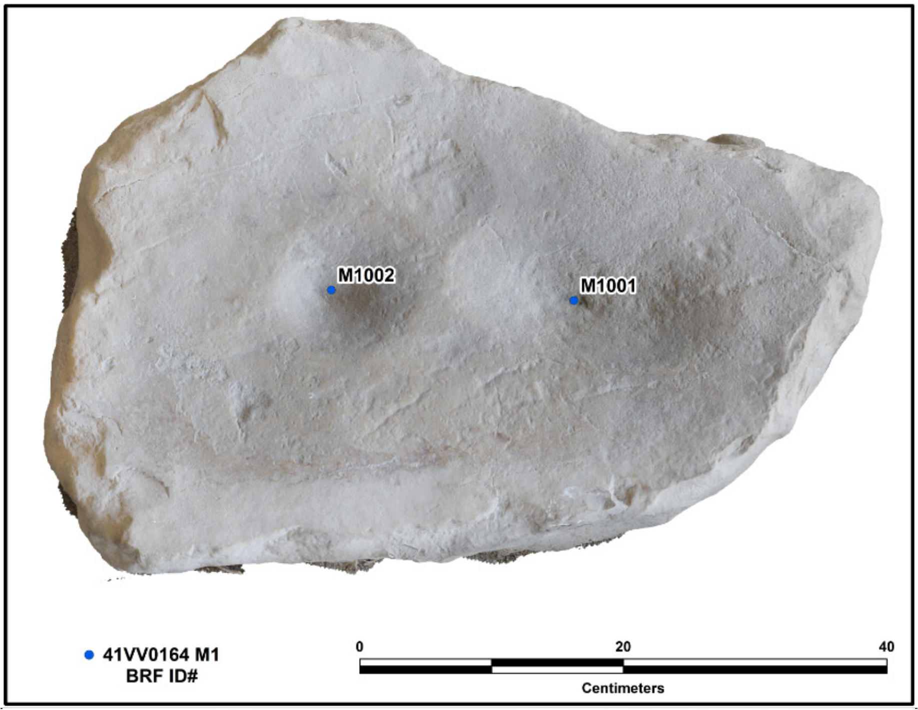


Figure 5.14. Kelley Cave, Moveable Slab 1 feature map with ID points.

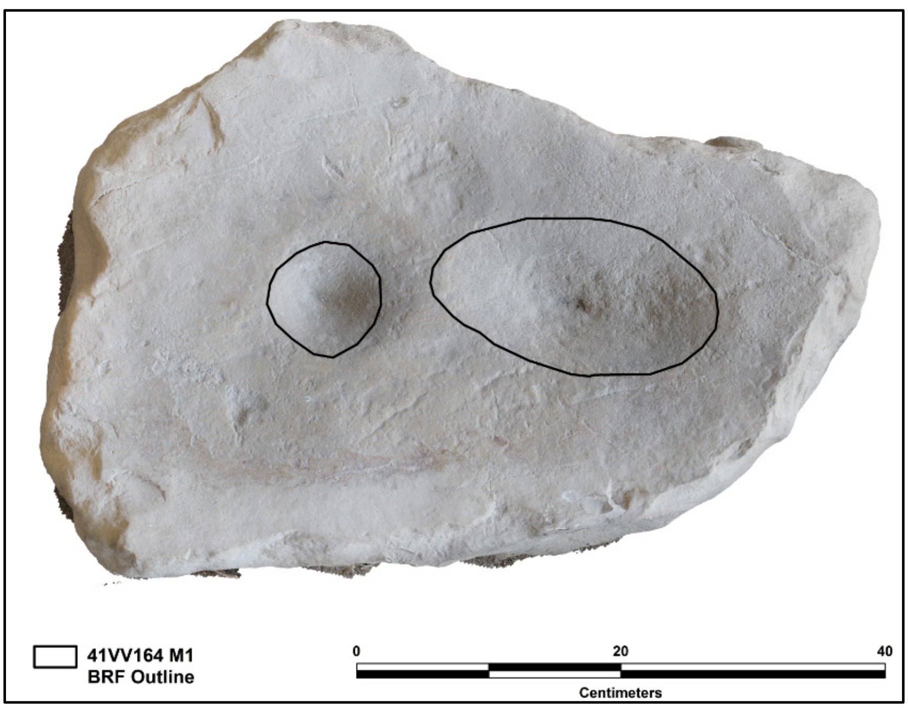


Figure 5.15. Kelley Cave, Moveable Slab 1 feature map with feature outlines.

After the initial recording of the bedrock features at Kelley Cave, another rock surface was uncovered by heavy rainfall outside of the dripline. There appears to be at least one bedrock feature on this surface, possibly more, but the entire rock is fractured and not well preserved (Figure 5.16). This feature was not included in the present analysis and is likely one of many unseen BRFs covered by deposits at Kelley Cave.

Figure 5.16. Recently uncovered, highly fractured, bedrock features at Kelley Cave.

41VV165 – Skiles Shelter

Skiles Shelter (Figure 5.17) is a bi-lobed rockshelter directly downstream of and adjacent to Kelley Cave (Figure 5.1). This site is not considered a true dry rockshelter as rain and flood waters often encroach upon the deposits. The majority of the cultural deposits and archaeological features are located in the upstream lobe of the shelter. This includes a large, yet faded, Pecos River style panel and an extensive burned rock talus. Excavations at this shelter in 2013 by Rodriguez (2015) and in 2014 by the Ancient Southwest Texas Project (ASWT) have uncovered deposits ranging from Late Prehistoric to the Early Archaic periods. There are six permanent bedrock feature areas (Figures 5.18 and 5.19) and one moveable limestone slab that have a total of 126 BRFs on them. Qualitative attribute data and use-wear observations collected for BRFs at Skiles Shelter and metric data are provided in Tables App B.3 and App B.4, respectively.

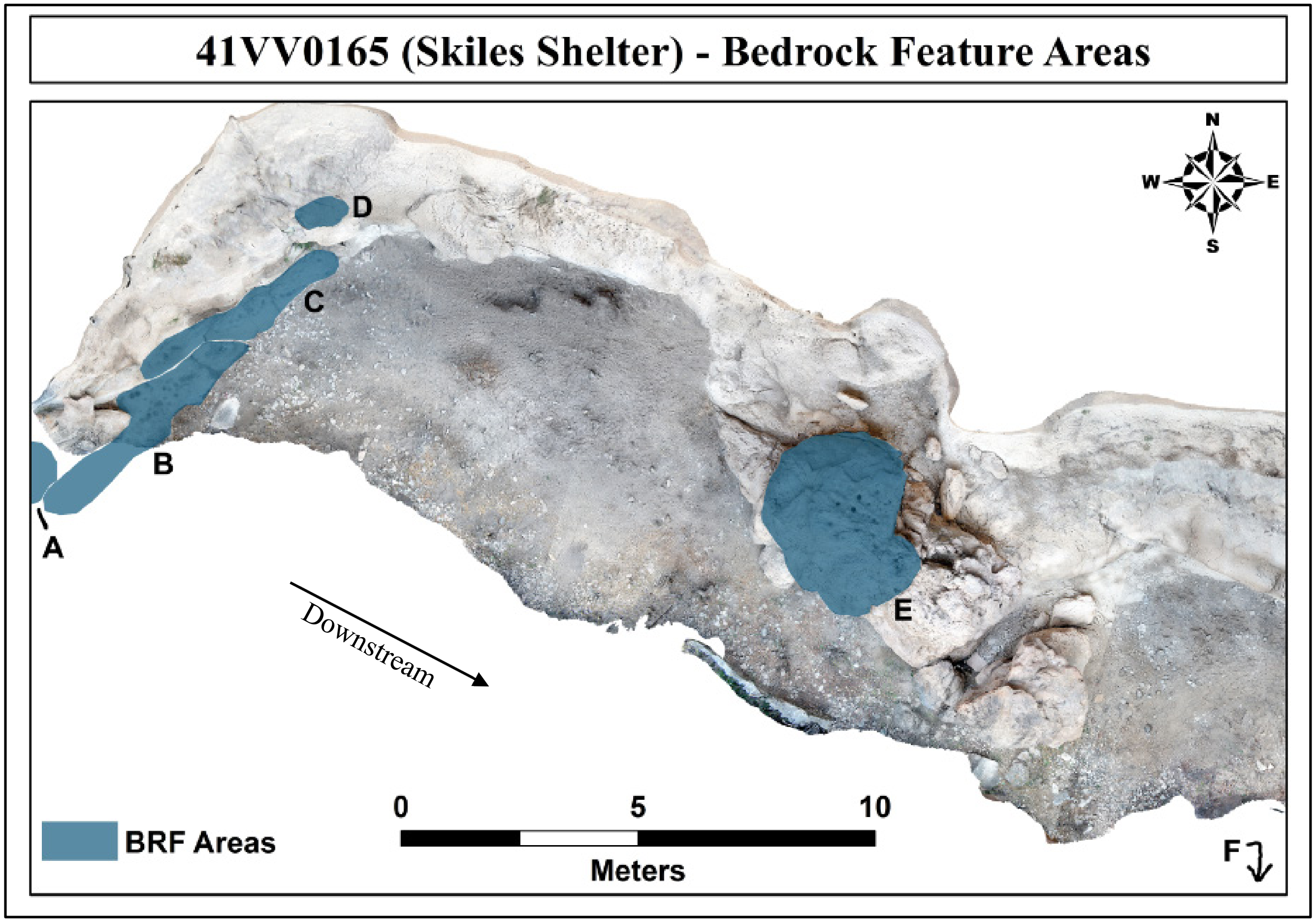


Figure 5.17. Plan view site map of Skiles Shelter showing five of the six permanent bedrock feature areas. The moveable slab was found below Area B on the talus slope beyond dripline and Area F is located on the trail leading up to the site (not shown on map).

Figure 5.18. Permanent bedrock feature areas at Skiles Shelter. (a) Area A; (b) Area B, outer; (c) Area B, inner.

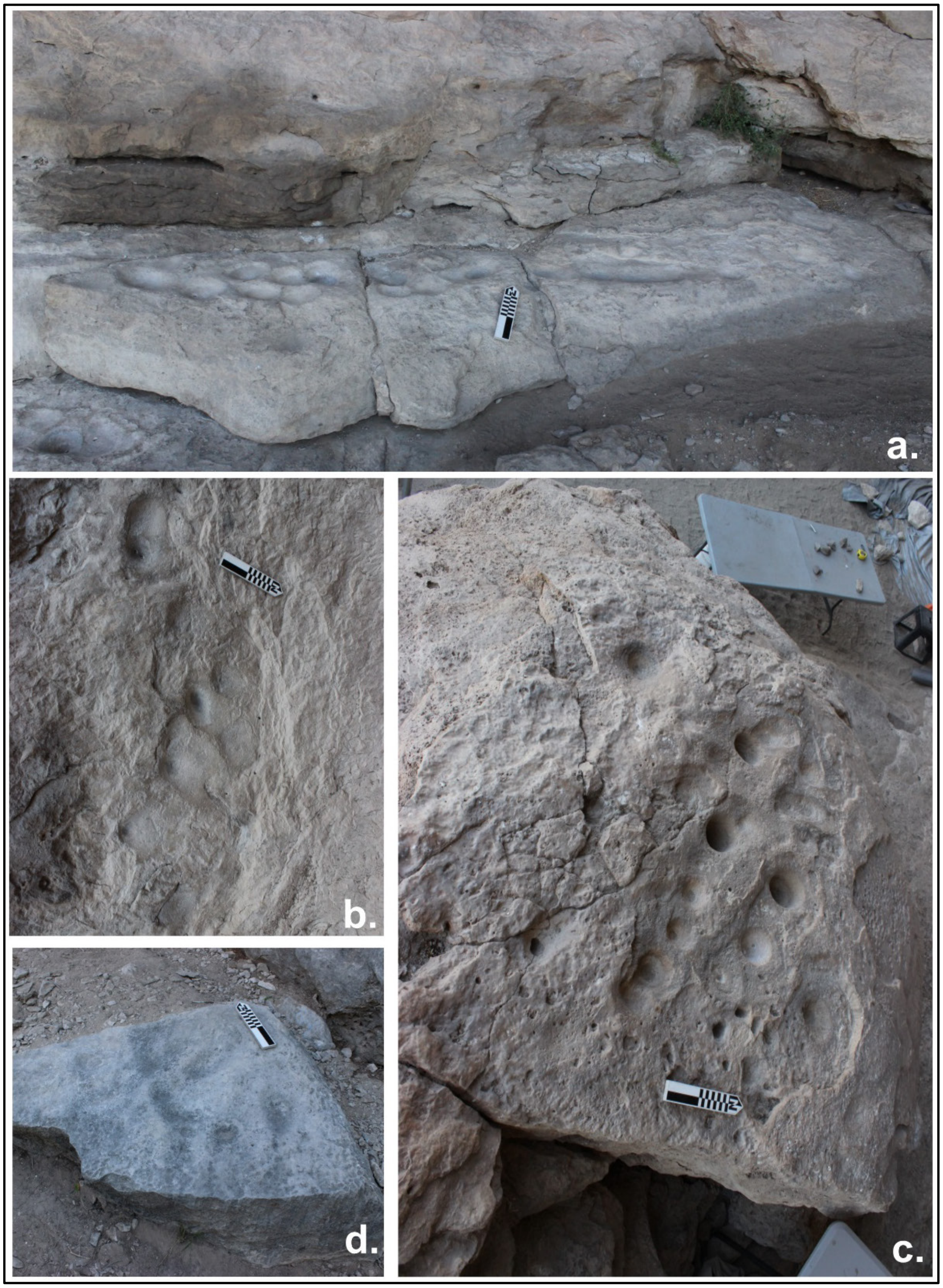


Figure 5.19. Permanent bedrock feature areas at Skiles Shelter. (a) Area C; (b) Area D; (c) Area E; (d) Area F.

Area A (Figures 5.18a, 5.20, and 5.21) has one bedrock feature located on a rock ledge on the far upstream end of the site. This area is outside of the dripline and is heavily weathered by rainwater etching. As such, use-wear data was not collected on the dished, ovoid feature present here.

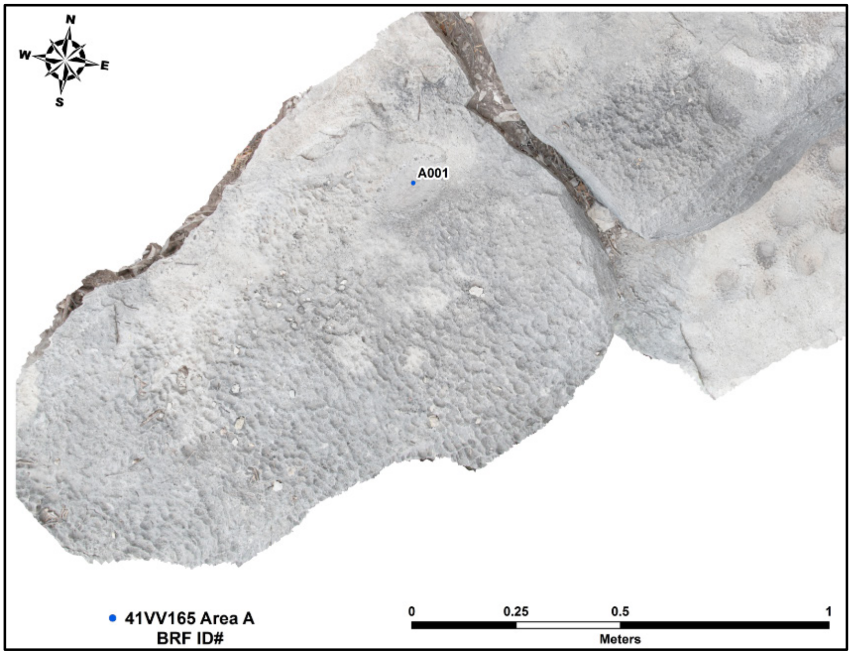


Figure 5.20. Skiles Shelter, Area A feature map with ID points.

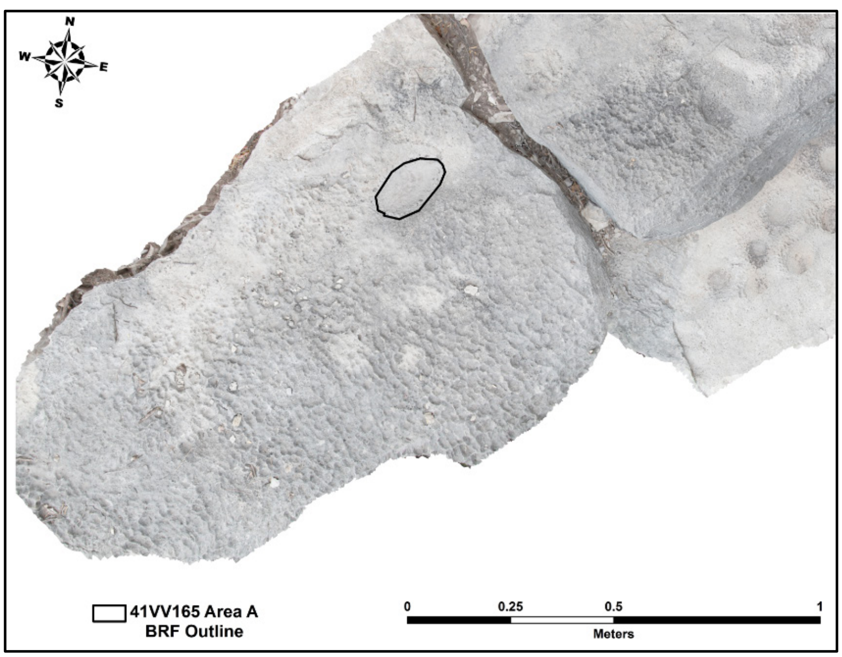


Figure 5.21. Skiles Shelter, Area A feature map with feature outlines.

Area B (Figures 5.18b, 5.18c, 5.22, and 5.23) is directly below and adjacent to Area A. This limestone bench contains 50 BRFs over an area of 4.5 meters. The features closest to the dripline are relatively weathered and some concretions are present, likely from water sitting in the features after rainfall. The majority of the BRFs in Area B are shallow and many of them are directly next to another feature. Further, most of the features show leveling of macroscopic high points, indicating some degree of use after the depression was originally pecked.

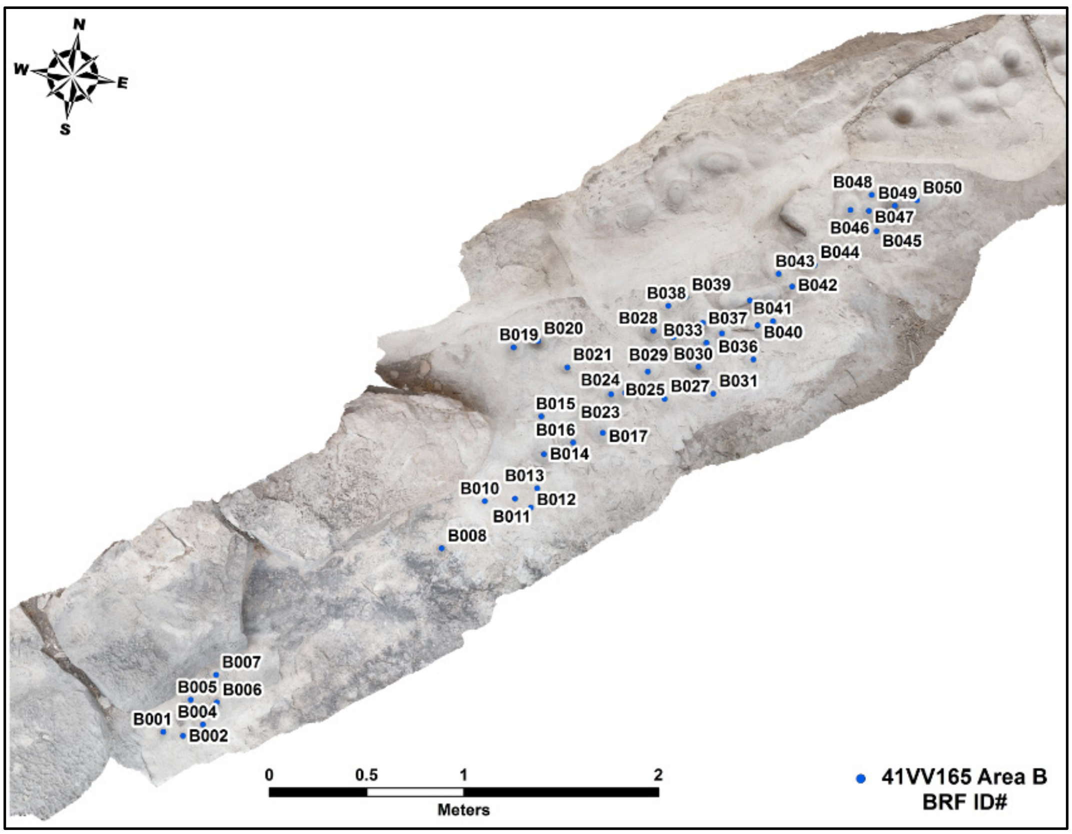


Figure 5.22. Skiles Shelter, Area B feature map with ID points. Both inner and outer parts from Figure 5.18 are shown.

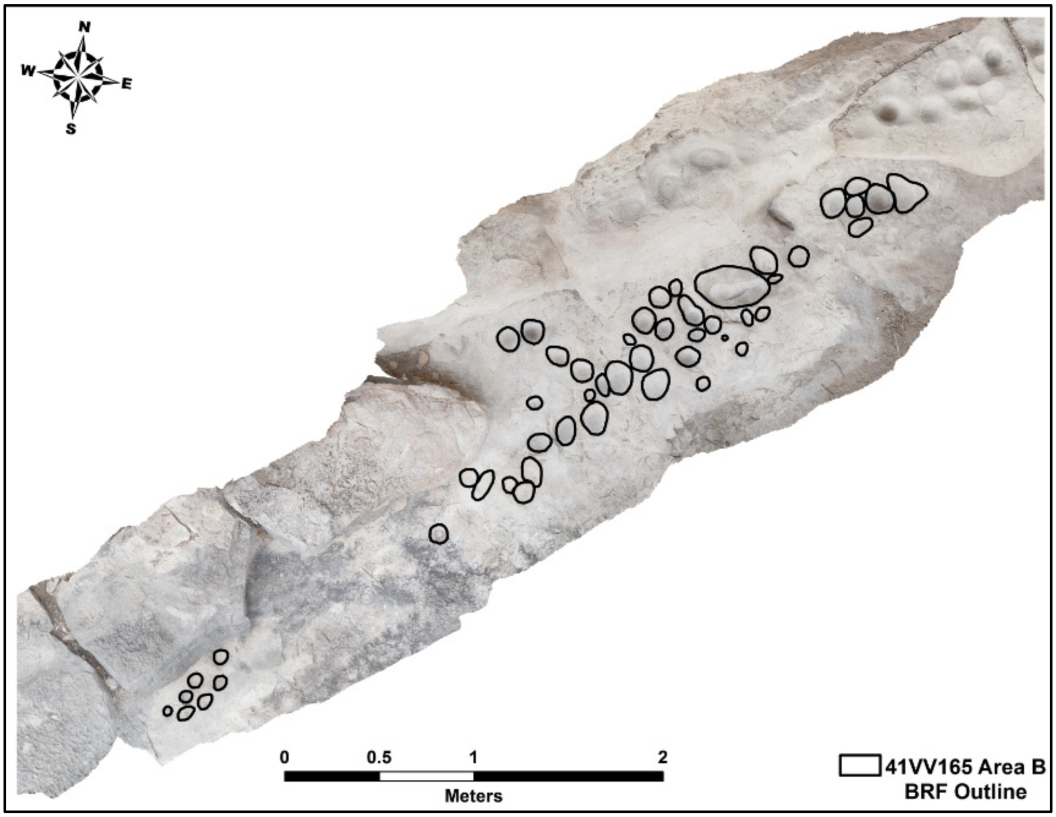


Figure 5.23. Skiles Shelter, Area B feature map with feature outlines. Both inner and outer parts from Figure 5.18 are shown.

On the limestone bench directly above Area B are 26 BRFs that are designated as Area C (Figures 5.19a, 5.24, and 5.25). This area is situated further back towards the shelter wall and is better preserved than Areas A and B with less weathering and accretions present in the features. In addition to the shallow, dished features, there are a series of deeper features with conical profiles that also have adjacent shallow features sharing their rims. The use-wear characteristics are similar to that of Area B, except some BRFs have more rounding of the leveled high points. One feature (C017) also has preserved striations oriented horizontally along the walls and has a surface that is completely smooth to the touch.

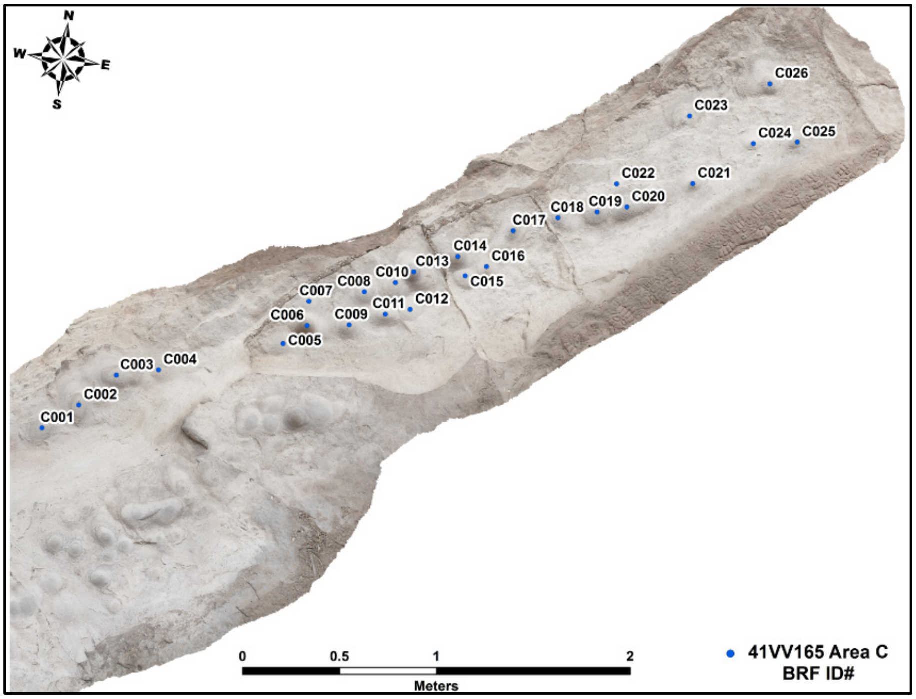


Figure 5.24. Skiles Shelter, Area C feature map with ID points.

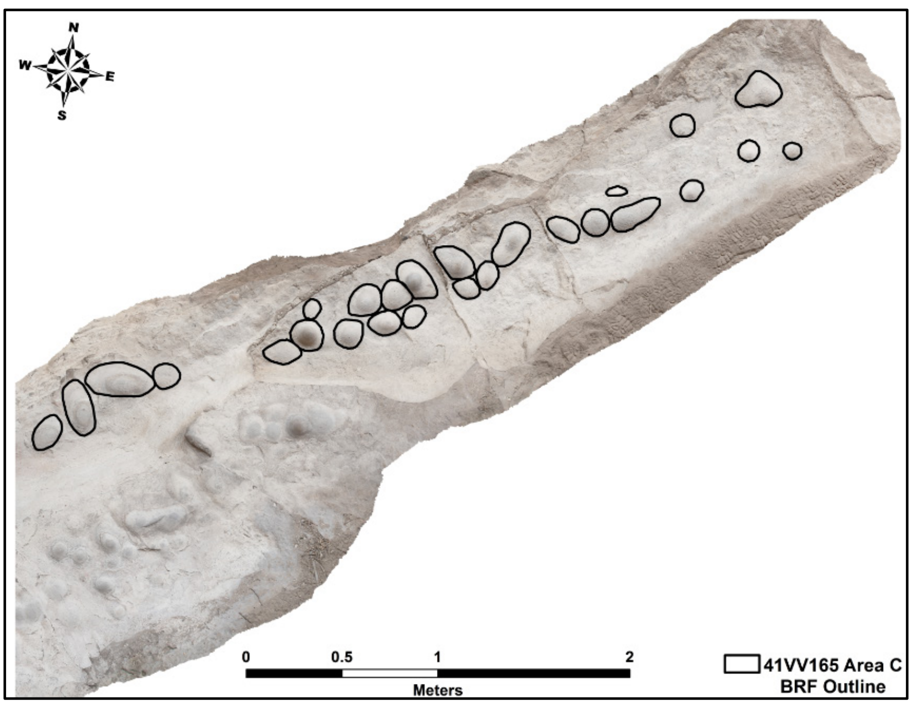


Figure 5.25. Skiles Shelter, Area C feature map with feature outlines.

Area D (Figures 5.19b, 5.26, and 5.27) is located on an upper limestone bench directly below a portion of the pictograph panel on the upstream end of the site. This area consists of 10 BRFs that are set on a moderate incline. Due to the morphology of the limestone bench, the longest wall of most features extends "upslope", which could provide clues as to motions used in features it with this morphology. The most common use-wear pattern in this area is rugged surfaces with some leveling of high points.

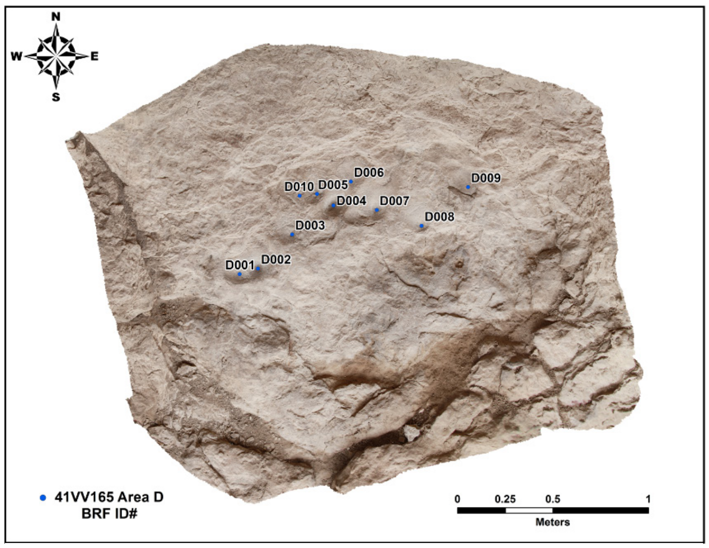


Figure 5.26. Skiles Shelter, Area D feature map with ID points.

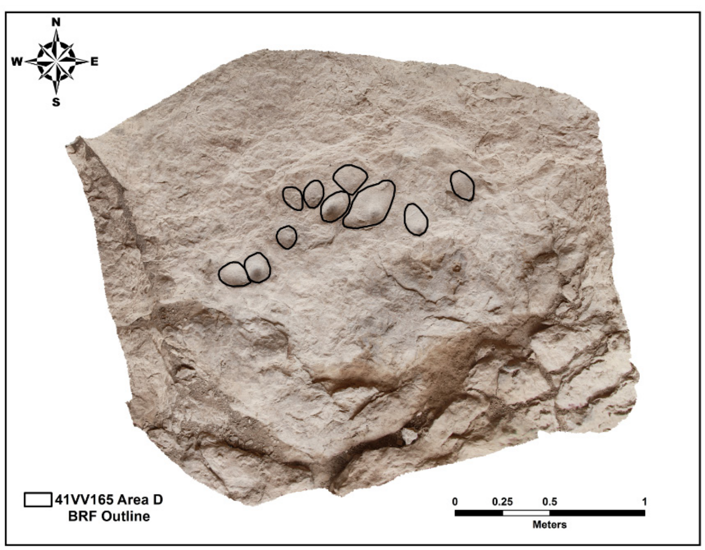


Figure 5.27. Skiles Shelter, Area D feature map with feature outlines.

Area E (Figures 5.19c, 5.28, and 5.29) consists of 25 BRFs and is located on the tufa mount that separates the two lobes of the rockshelter. On the north face of this boulder there is a slick area with many groove marks carved into the surface, although none are in direct association with the bedrock features (Figure 5.30). This unique surface is the only "slicked" area that I recorded in my study. Although previous hypotheses have been put forth about these features (e.g., Connolly 2012), I did not include slicks in my bedrock feature analysis. Area E has the greatest variety of feature depths at Skiles Shelter, ranging from shallow depressions to deep mortars. The shallow features are gently dished in profile, while the deepest feature (E007) has straight walls all the way down to the base. This profile morphology suggests the walls were intentionally shaped and maintained throughout its use life. Since the rock substrate was made of tufa (calcium carbonate deposited through a spring vent), it should have been easier to peck features than in other limestone present at the site. Most of the use-wear shows rugged surfaces with rounded bumps and some leveling.

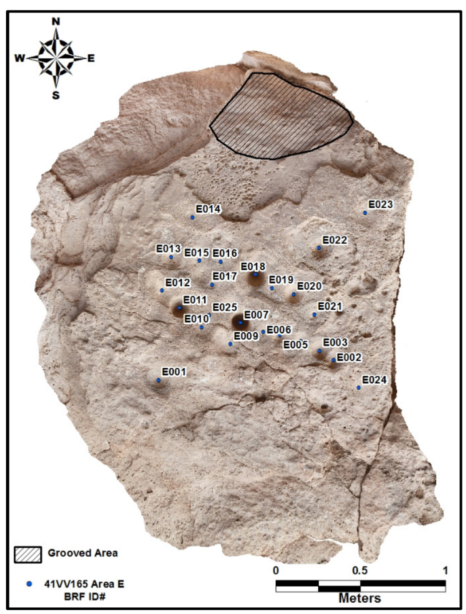


Figure 5.28. Skiles Shelter, Area E feature map with ID points.

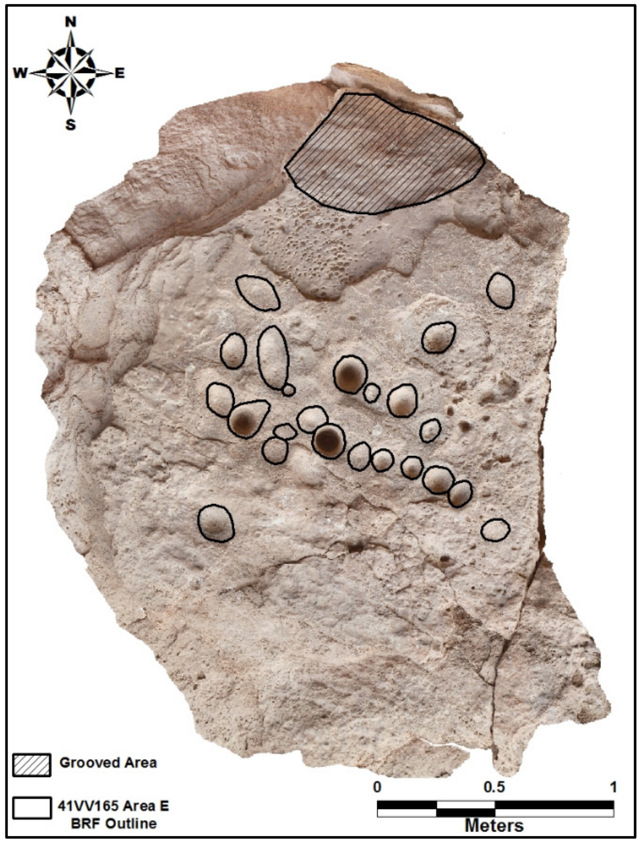


Figure 5.29. Skiles Shelter, Area E feature map with feature outlines.


Figure 5.30. Grooved, slicked surface on north face of Area E tufa mound.

Area F (Figures 5.19d, 5.31, and 5.32) is located in the current trail up to the shelter on the downstream end of the talus slope. All nine BRFs present in this area are shallow with dished profiles on a moderate incline. This area is completely out in the open and has no protection from general weathering. However, the rock is lacking any water pitting or ridges from weathering so the use-wear appears to relatively well preserved. The features' surfaces are mostly rugged with some gentle rounding of macroscopic high points, although some features have completely rugged bases.

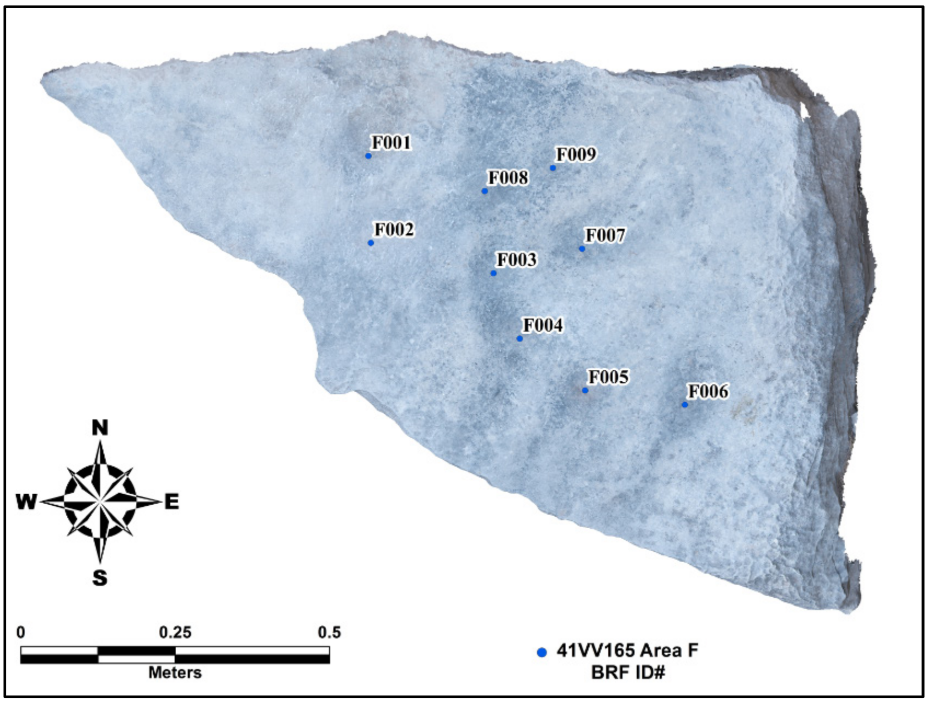


Figure 5.31. Skiles Shelter, Area F feature map with ID points.

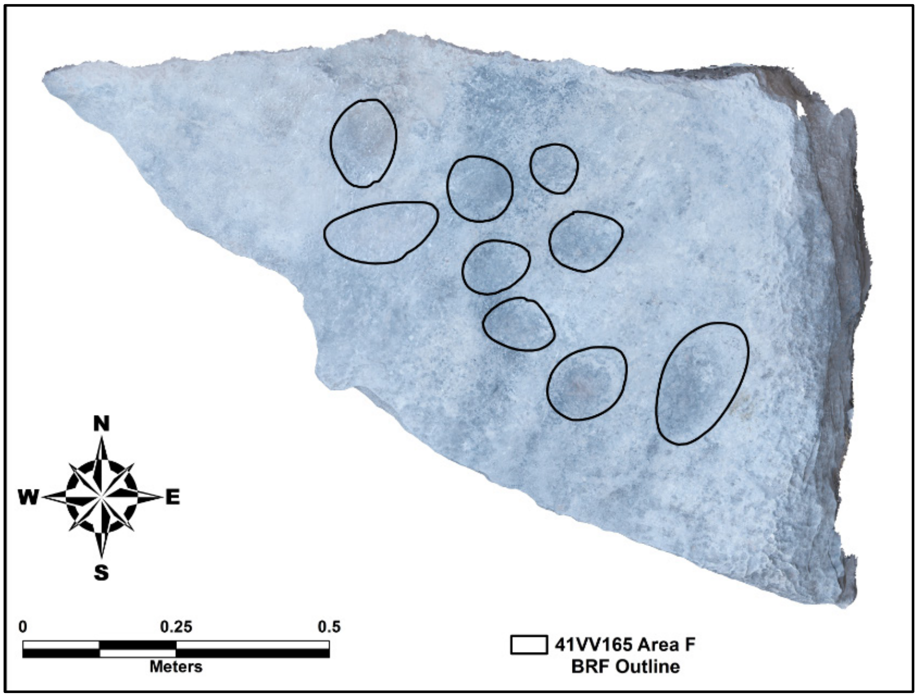


Figure 5.32. Skiles Shelter, Area F feature map with feature outlines.

The final bedrock features described at Skiles Shelter are on a moveable boulder, M1 (Figures 5.33 and 5.34), that was recovered on the talus slope while clearing vegetation. This boulder likely fell from the roof at some point in the past and then was utilized as a workspace for bedrock features. This rock is extremely heavy and has almost certainly not been removed from the shelter except for whatever force moved it to the talus slope (humans or gravity). Most of the features are slightly deeper than the typical shallow features found in the rest of the shelter and the use-wear is rugged with some leveling of high points. The high degree of ruggedness could be due to its location on the talus slope where it is exposed to more weathering agents; however, one BRF (D005) is completely leveled in the base which suggests the use-wear is relatively intact.

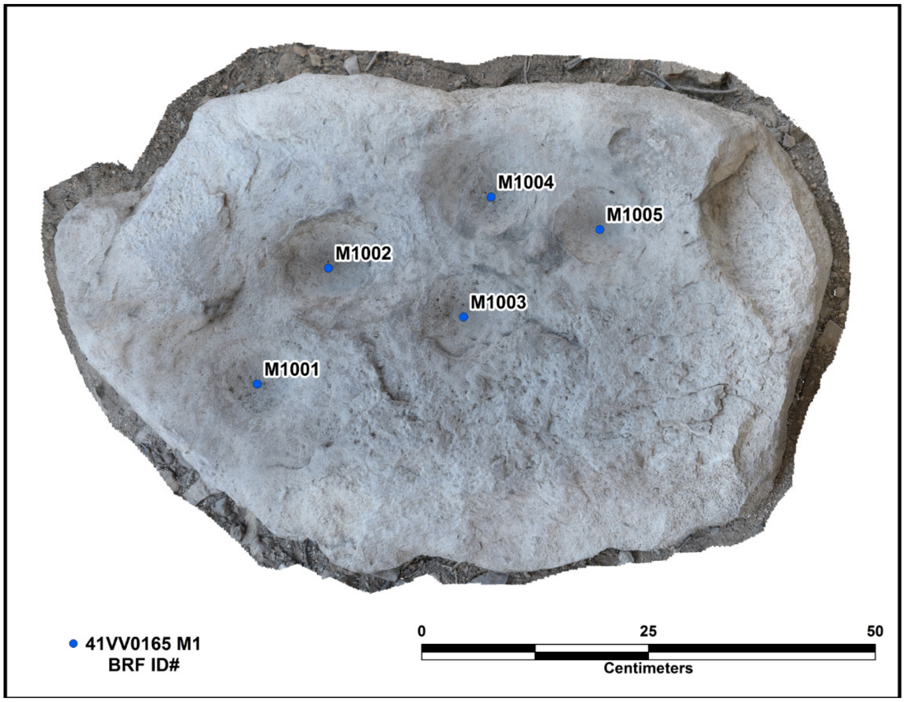


Figure 5.33. Skiles Shelter, Moveable Boulder 1 feature map with ID points.

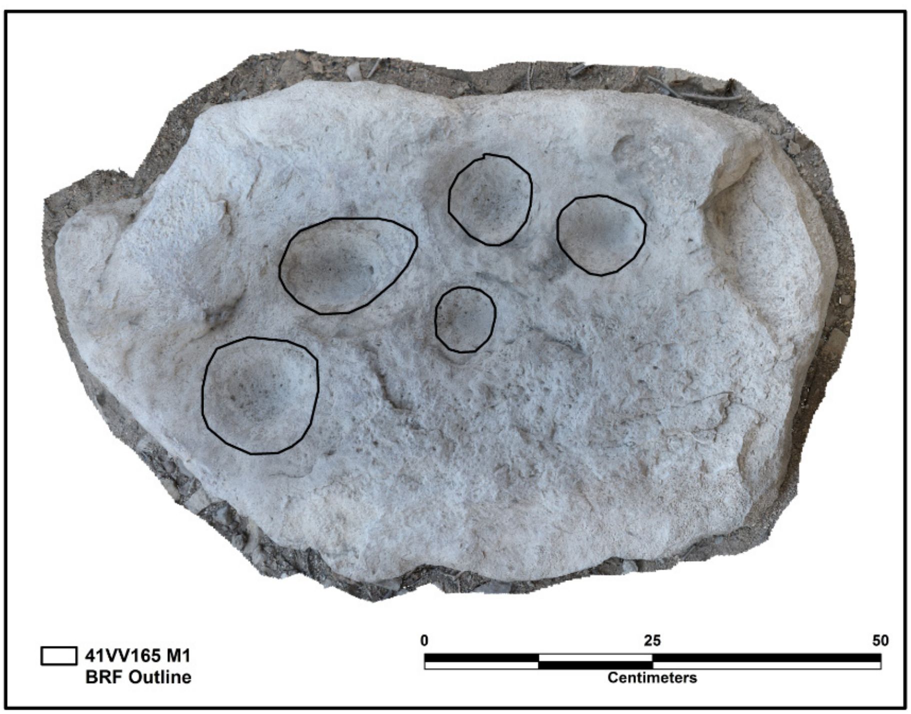


Figure 5.34. Skiles Shelter, Moveable Boulder 1 feature map with feature outlines.

Although not included in the present study, another moveable limestone slab with bedrock features was discovered during excavations in 2013 (Rodriguez 2015:Figure 4.21). The slab was found in a human-made pit that was dug into an alluvial flood layer that dates to the mid fourteenth century (Rodriguez 2015:77). On the side of the slab that was facing up, there was a small area with red discoloration on it, possibly pigment. Rodriguez (2015:78) collected charcoal adhering to the surface of a grinding feature on the lower side of the slab which returned a radiocarbon date of 518 ± 9 cal B.P., which is consistent with use of the BRF slab after the flood.

Pilot Residue Study at Skiles Shelter. In April, 2014, a group of archaeologists came together at Skiles Shelter to further investigate the grooved surface and attempt to recover residues from some of the bedrock features. Participants of this project included Dr. Tammy Buonasera, Dr. Dani Nadel, Dr. Stephen Black, Mark Willis, Julie Shipp, Charles Koenig, Eli Gershtein, and myself. The goal was to examine samples of rock from bedrock features for evidence of lipids and/or phytoliths. We collected a total of seven control samples of limestone near the BRF areas, five sediment samples, and 12 rock samples from features. The core samples were taken with a portable drill using bonded diamond core drill bits (Figure 5.35).

Figure 5.35. Sample collection at Skiles Shelter for residue analysis.

Unfortunately, phytolith analysis did not yield any substantive results and lipid analysis resulted in only a few elevated measurements. While some fatty acids were present in the feature samples, the lipid profiles were all within the range or slightly higher than the range of the control samples (Buonasera et al. 2015). One feature, B050 (Figure 5.36), contained an elevated measurement of neotigonen, a saponin found in agaves. This was substance was not found in any of the control samples and is more likely the result of use than some other contamination. B050 is a shallow feature that is immediately adjacent to and shares a rim with a deeper BRF (B049). It is possible baked agave leaves were placed in the shallower feature as an anchor point to hold the leaf while a scraper was used to push the pulp out of the leaf and into the deeper feature.

Figure 5.36. B049 (left) and B050 (right) were both sampled for residue. B050 returned an elevated measurement of neotigonen, an agave saponin.

Over all, our pilot residue study was only mildly successful, but yielded results to think about and expand upon. There are two possible reasons our analysis did not yield more lipid residue: 1) the wet nature of Skiles Shelter and frequent floods that encroach upon the shelter has degraded any lipid residue that may have been there; or 2) more carbohydrate rich, lipid poor, resources (e.g., mesquite, prickly pear cactus, yucca, agave) were processed in these features.

41VV166 – Horse Trail Shelter

Horse Trail shelter (Figure 5.37) is a narrow site located on the western wall of Eagle Nest Canyon underneath a shallow overhang. The site is most notable for large boulders containing deep bedrock features and a small vertical burned rock midden spilling down the talus slope. Based on the projectile points from limited excavations at this site, the deposits date to the Late Prehistoric period (Castañeda and Koenig 2015), although we know it was also utilized in historic times as a trail down to the bottom of the canyon. There are five permanent bedrock feature areas (Figure 5.38) spread out on boulders across the upstream end of the site, all of which are unprotected by the small overhang. These areas are described below, while Table App B.5 provides the qualitative attribute data and use-wear observations collected for each BRF at Horse Trail Shelter and Table App B.6 presents metric data.

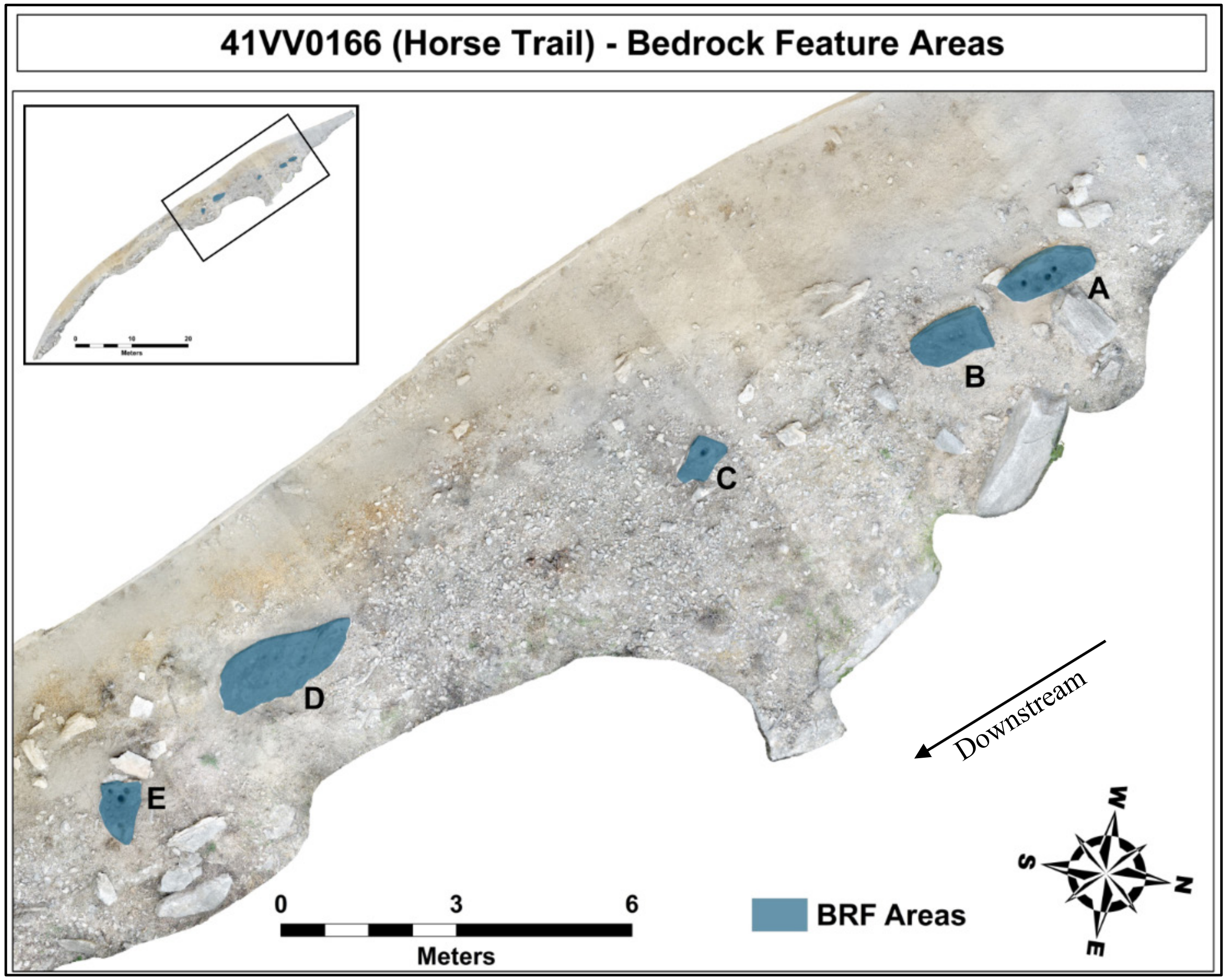


Figure 5.37. Plan view site map of Horse Trail Shelter showing the five permanent bedrock feature areas. As seen in the inset, the bedrock feature areas are restricted to the upstream end of the site. Striped appearance on the map is from overlapping orthophoto images.

Figure 5.38. Permanent bedrock feature areas at Horse Trail Shelter. (a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

Area A (Figures 5.38a, 5.39, and 5.40) is the furthest upstream area and is on a large boulder that likely fell from the side of the canyon above. There are 18 BRFs on this rock, including the deepest features recorded at any of the sites within Eagle Nest Canyon. The majority of features on this rock are an intermediate depth, between shallow and deep mortars. As such, there are more conical profile shapes on this boulder than in other areas with mostly shallow features. Two of the deep features (A007 and A009) become extremely narrow towards the base, approximately 2-3cm wide. These features have some of the most pointed base shapes in the entire dataset across all 10 sites. Another unique morphology present in this area are three very small pecked depressions (A016, A017, and A018) which are reminiscent of cupules—a phenomenon typically associated with non-utilitarian rock art. The use-wear is mixed but there are more overall leveled/smooth areas with gentle rounded bumps. Despite the location in the open air, there are not great amounts of weathering and water etching.

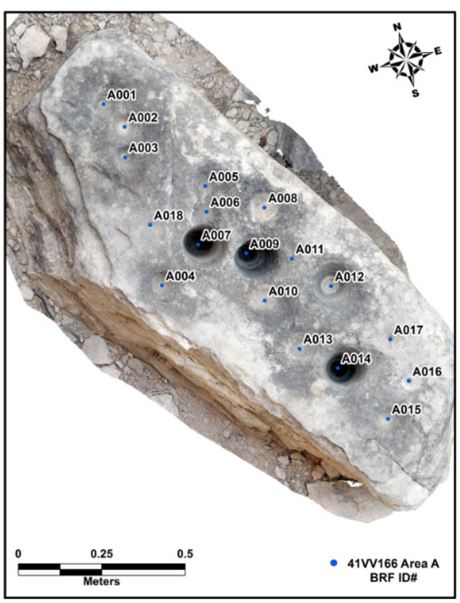


Figure 5.39. Horse Trail, Area A feature map with ID points.

Figure 5.40. Horse Trail, Area A feature map with feature outlines.

Area B (Figures 5.38b, 5.41, and 5.42), another probable “cliff fall” boulder, is directly downstream and adjacent to Area A. There are seven features present, ranging from a similar cupule form seen on Area A to an intermediate depth. The use-wear characteristics are mixed with some features that are rugged with leveled high points and others that are mostly leveled with smooth rounded bumps.

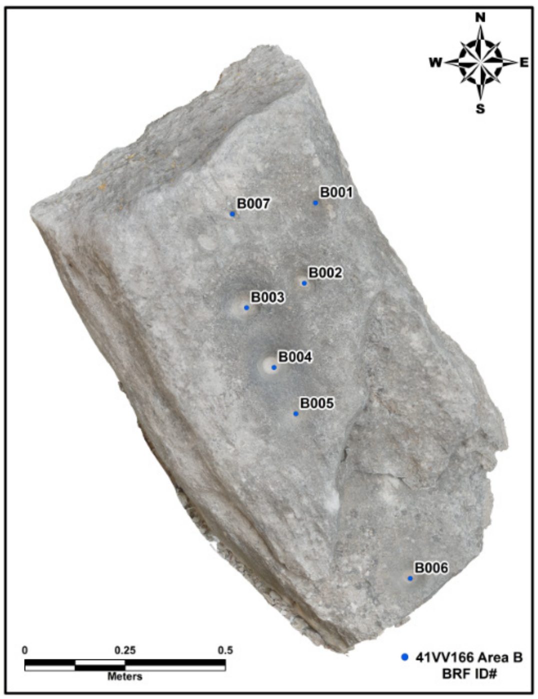


Figure 5.41. Horse Trail, Area B feature map with ID points.

Figure 5.42. Horse Trail, Area B feature map with feature outlines.

Area C (Figures 5.38c, 5.43, and 5.44) has five BRFs on a small boulder that is mostly buried with the top surface sticking up just above ground level. Before we cleared the site, this area was mostly covered by a cenizo bush that was growing out of C001, a deep feature with a hole in the bottom. This broken-through feature is unique in the data set because of the depth combined with the oblong opening. Unfortunately, due to the sediment, water, and the plants growing in it, the surface was covered by a thick accretion and use-wear could not be recorded. The shallower, better preserved features have large amounts of leveling and rounded bumps.

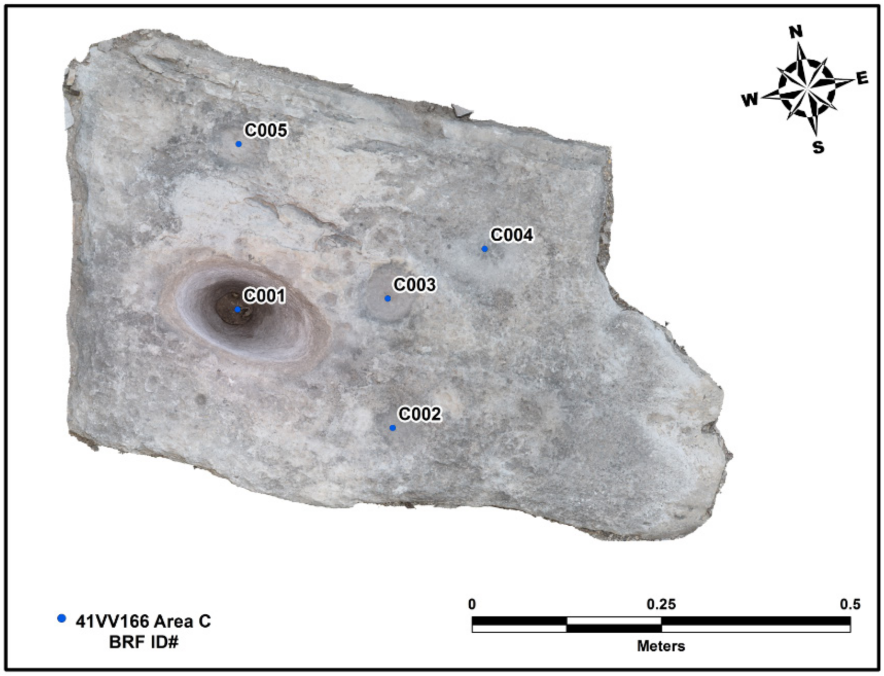


Figure 5.43. Horse Trail, Area C feature map with ID points.

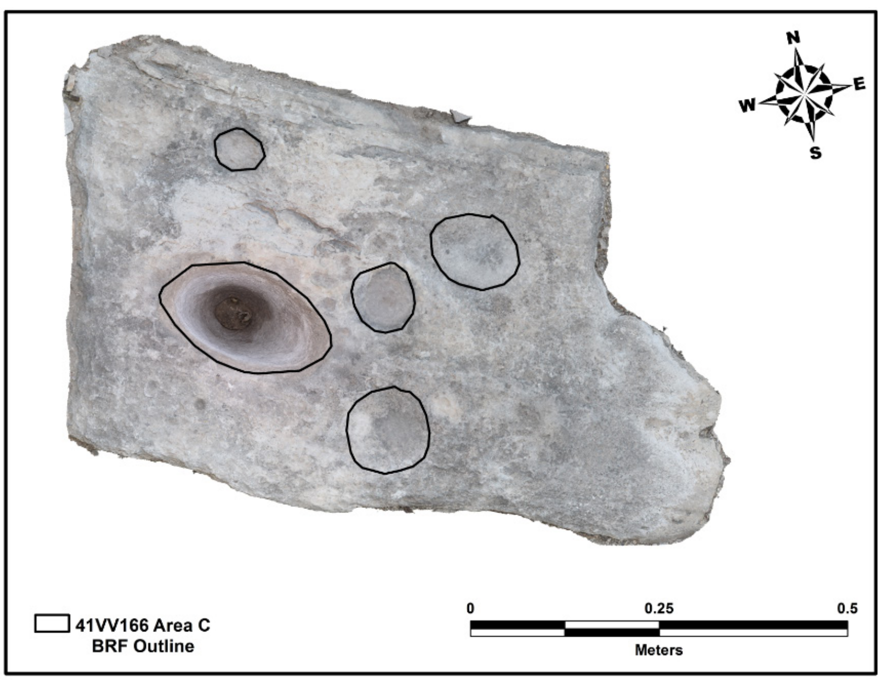


Figure 5.44. Horse Trail, Area C feature map with feature outlines.

Area D (Figures 5.38d, 5.45, and 5.46) was also discovered while the site was being cleared of vegetation along the dripline. The boulder was mostly covered by colluvial, disturbed sediment with one bedrock feature exposed on the northern end of the boulder. When the remainder of the boulder was uncovered, 24 bedrock features were found across the entirety of the surface. A majority of these features are shallow. Similar to at Skiles Shelter, there are some intermediate depth features that share a rim with one or more shallow features. The predominant use-wear pattern is a rugged surface with some light rounding of high points creating smoothed bumps.

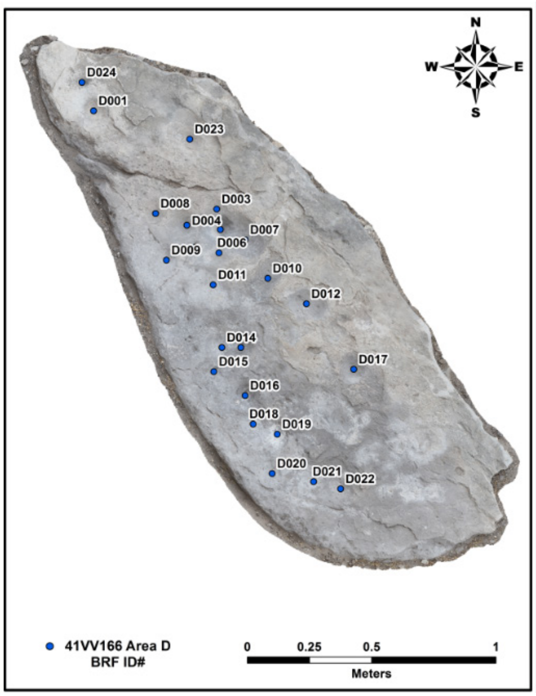


Figure 5.45. Horse Trail, Area D feature map with ID points.

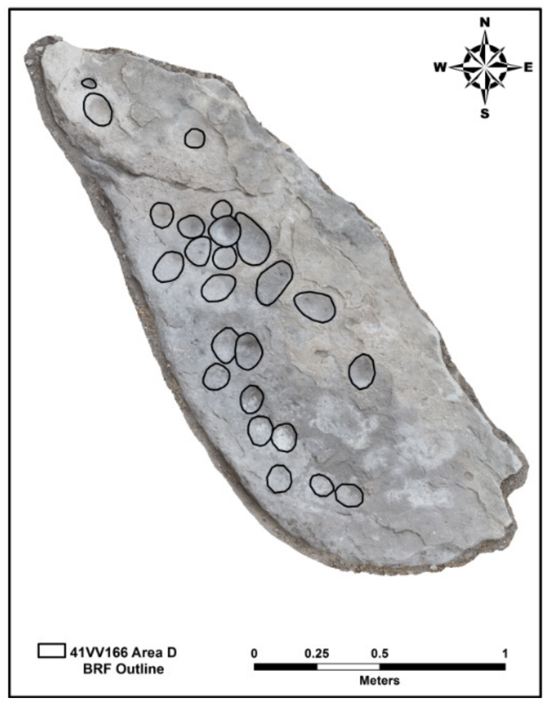


Figure 5.46. Horse Trail, Area D feature map with feature outlines.

Area E (Figures 5.38e, 5.47, and 5.48) is the furthest downstream bedrock feature area and consists of 11 BRFs on a small boulder. This rock is broken in multiple places including a fracture that cuts three features in half around the mid-point of the shaft. This piece was refit for the photography. The other broken area is near E011, where a plant was growing that seemingly broke apart the rock. Most of the features on this rock are intermediate or deep in depth and the use-wear data consists of rugged surfaces that have been smoothed and rounded.

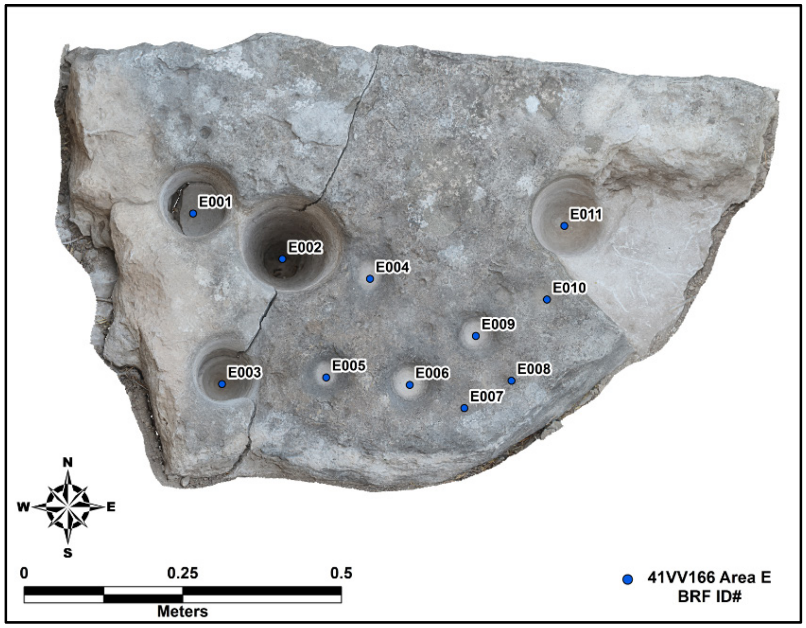


Figure 5.47. Horse Trail, Area E feature map with ID points.

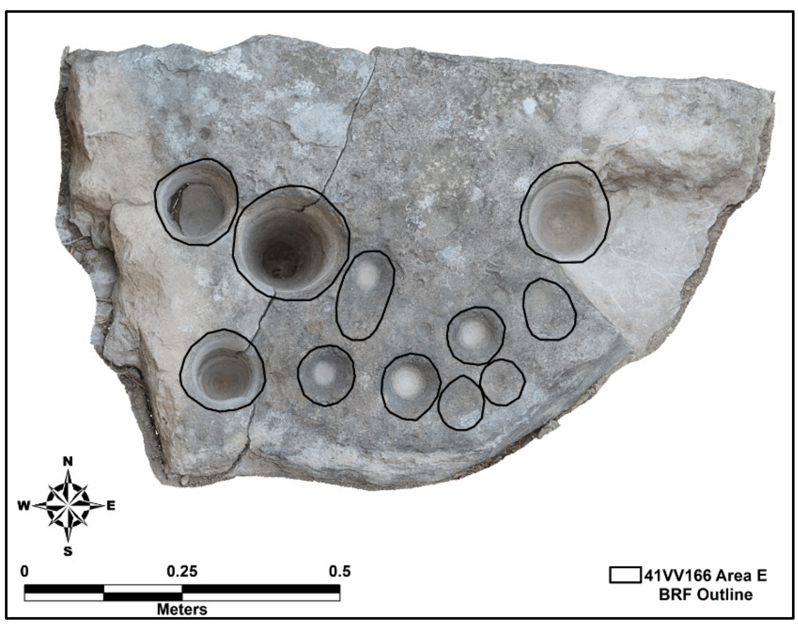


Figure 5.48. Horse Trail, Area E feature map with feature outlines.

During 2015 excavations, another large slab with ground stone bedrock features was recovered at Horse Trail. This slab was located on the far downstream end of the site at the bottom of a 1 meter-deep pit (Figure 5.49). On one side of the boulder are four features and a black coloration which could be pigment or charcoal smudging (Figure 5.50). On the underside are three more features. None of these features were included in the present analysis but it once again highlights the potential for buried bedrock features.

Figure 5.49. Limestone slab at bottom of pit.

Figure 5.50. Limestone slab with bedrock features on both sides.

41VV167 – Eagle Cave

Eagle Cave (Figure 5.51) is a large rockshelter located approximately 650 meters northwest of the Rio Grande River. This shelter is best-known for early excavations that took advantage of the excellent organic preservation (e.g., Davenport 1938; Ross 1965) and the Pecos River style pictographs located on the downstream wall (Kirkland and Newcomb 1967). Excavations show Eagle Cave was occupied throughout a wide time span, ranging from the Early Archaic to Late Prehistoric (Ross 1965). Despite its size and long-period use, this site has relatively few bedrock features. There are four permanent bedrock feature areas, one moveable slab, and one roof fall boulder that contain a total of 38 BRFs (Figure 5.52). Table App B.7 provides the qualitative attribute data and use-wear observations collected for BRFs at Eagle Cave and metric data are provided in Table App B.8.

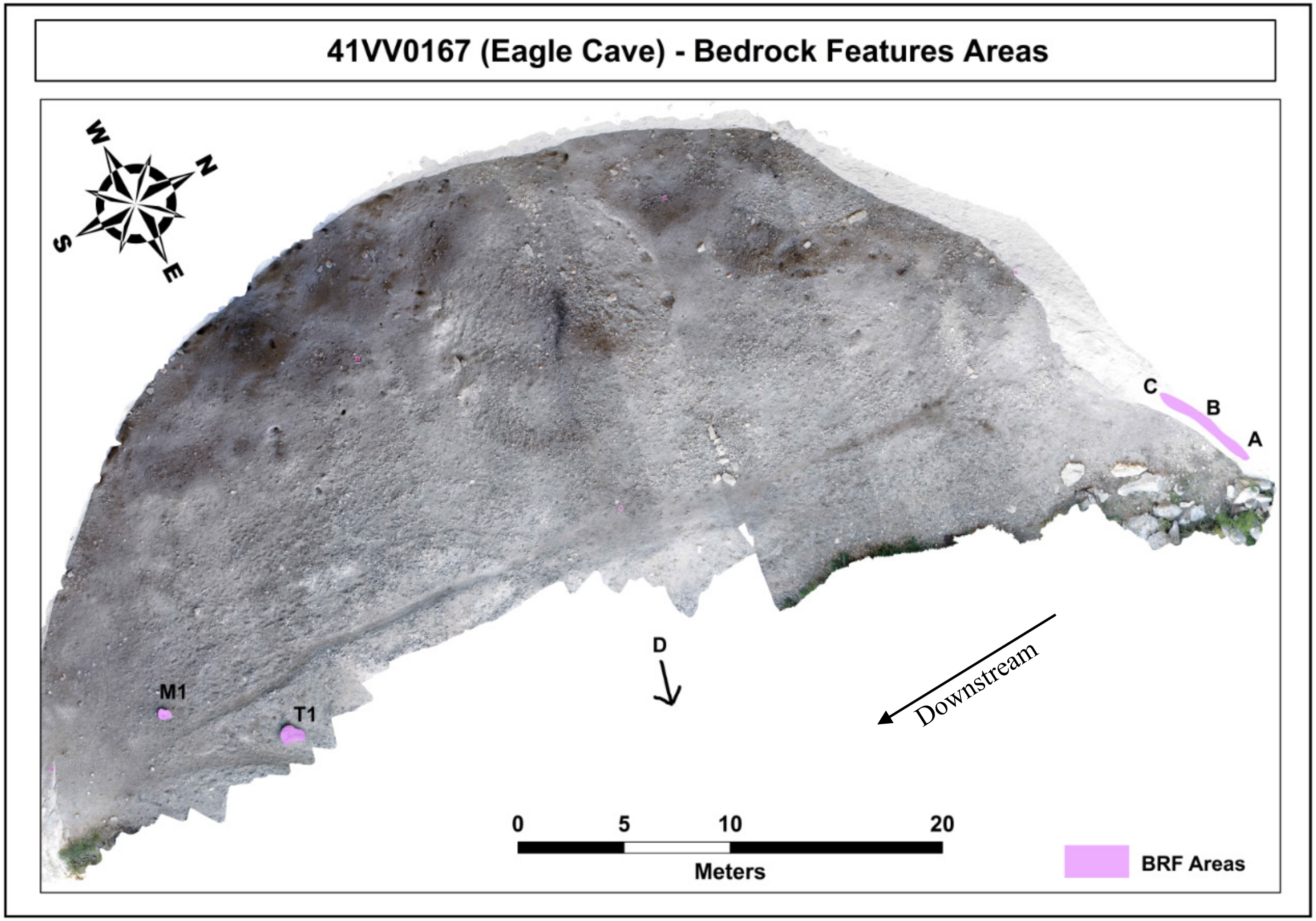


Figure 5.51. Plan view site map of Eagle Cave showing three of the permanent bedrock feature areas, the moveable slab, and the talus boulder. Not shown on the map is Area D, which is located in the canyon bottom directly in front of the site. Striped appearance on the map is from overlapping orthophoto images.

Figure 5.52. Permanent bedrock feature areas at Eagle Cave. (a) Area A; (b) Area B; (c) Area C; (d) Area D.

Area A (Figures 5.52a, 5.53, and 5.54) is located at the end of on an elevated limestone bench on the upstream end of the site. This area is outside of the dripline and is exposed to rainfall and other weathering agents. There are two features in this area, directly adjacent to one another. One feature is of intermediate depth and is highly leveled with some remnant peck maps still visible. The other is much shallower and also more rugged with some high points leveled.

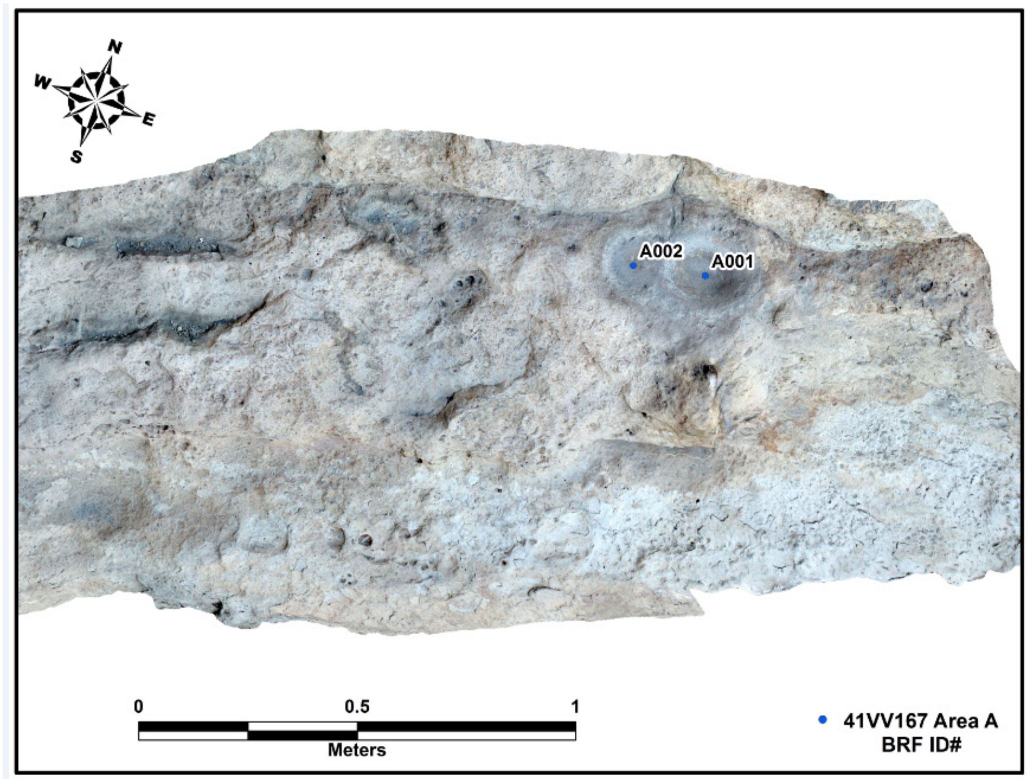


Figure 5.53. Eagle Cave, Area A feature map with ID points.

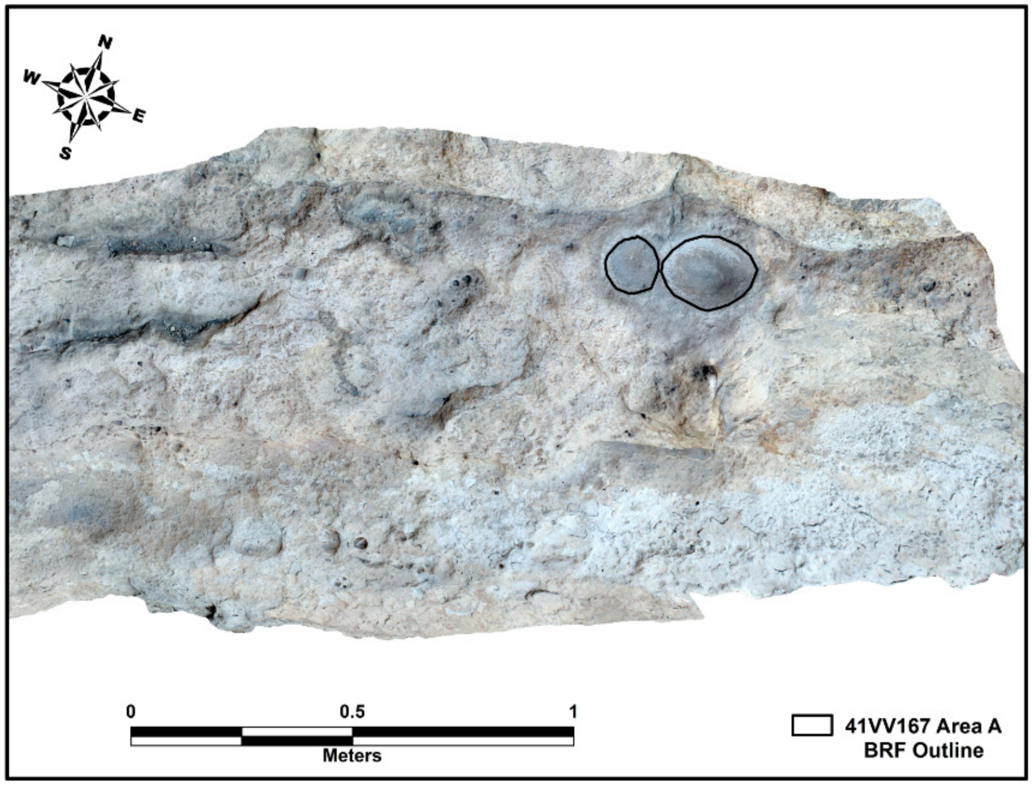


Figure 5.54. Eagle Cave, Area A feature map with feature outlines.

Area B (Figures 5.52b, 5.55, and 5.56) is adjacent to Area A on the elevated limestone bench but further back towards the back of the shelter. This area is still close enough to the dripline that water does get into the features, causing some extreme weathering on a few features. There are 14 BRFs in this section ranging from shallow to deep and most of the use-wear is rugged with some leveling of high points. A couple BRFs (B009 and B011) have possible striations oriented vertically on the wall, which makes sense as they are deeper features that would have likely been used with a pounding motion.

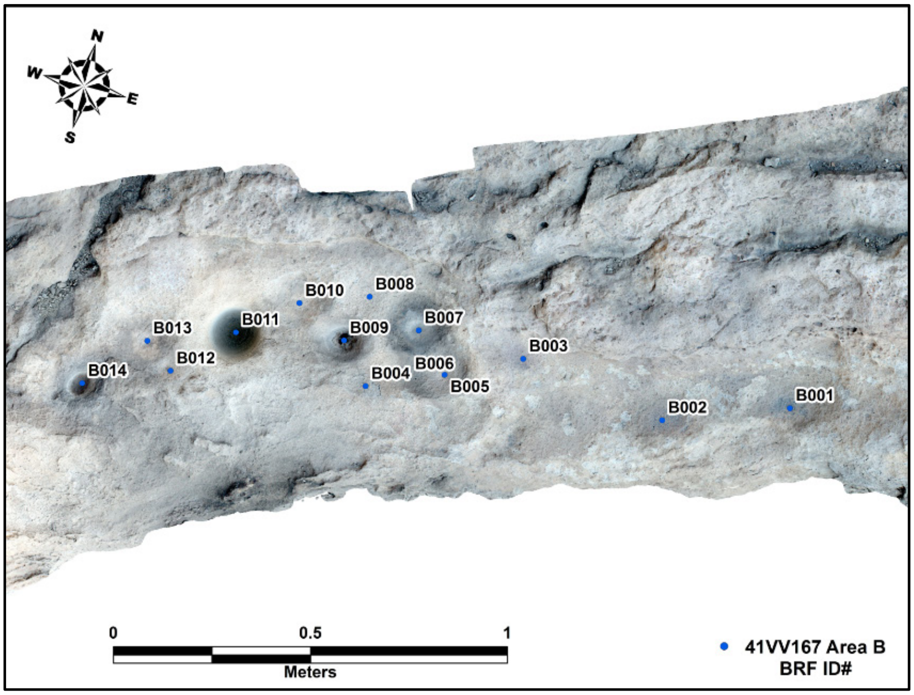


Figure 5.55. Eagle Cave, Area B feature map with ID points.

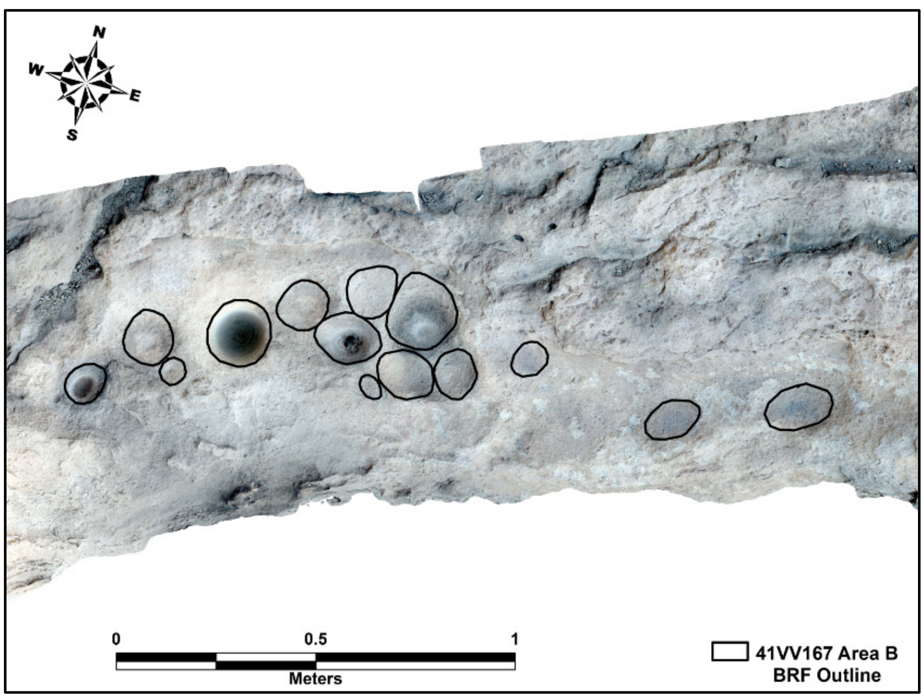


Figure 5.56. Eagle Cave, Area B feature map with feature outlines.

Area C (Figures 5.52c, 5.57, and 5.58), the last section on the elevated limestone bench contains eight shallow bedrock features, one of which has almost no concavity. All features have gently sloping walls and the better preserved features have rugged surfaces with high points leveled.

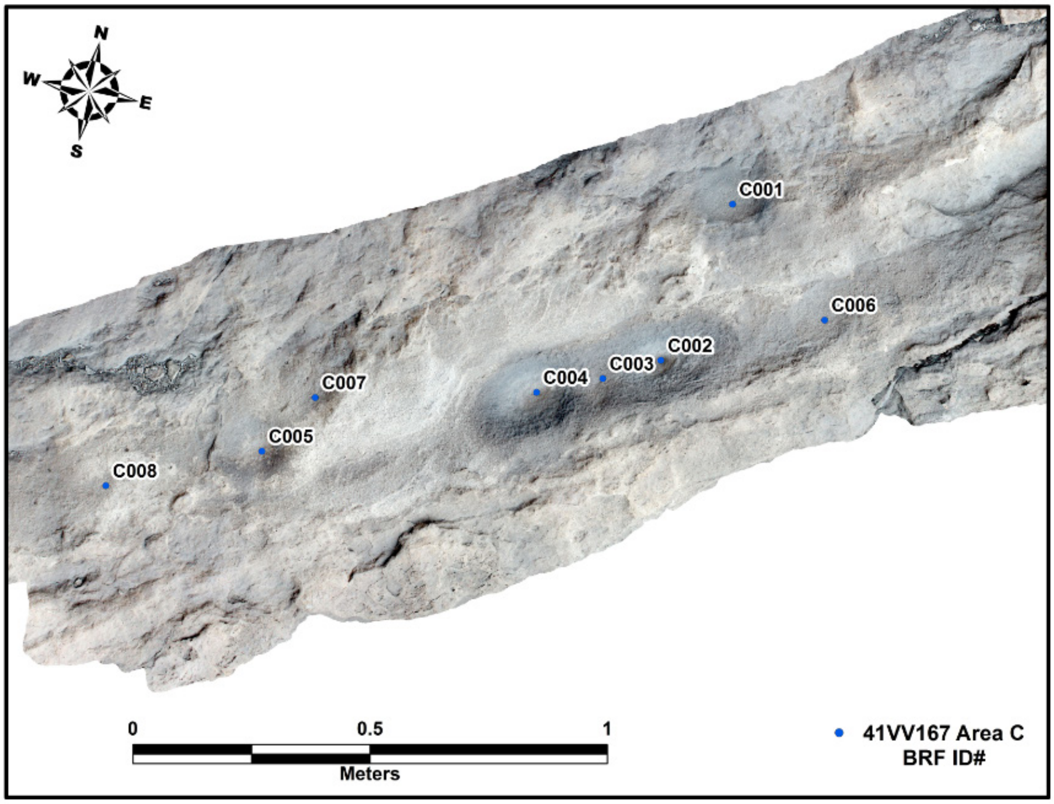


Figure 5.57. Eagle Cave, Area C feature map with ID points.

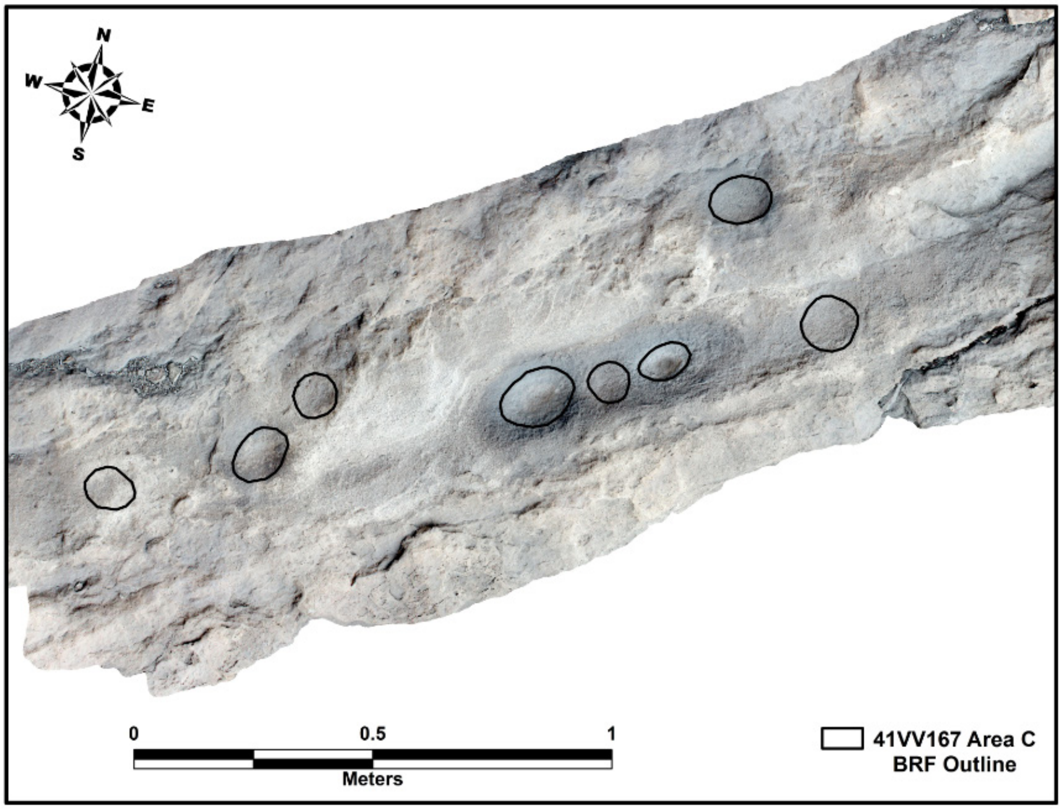


Figure 5.58. Eagle Cave, Area C feature map with feature outlines.

Area D (Figures 5.52d, 5.59, and 5.60) is located on the canyon floor, immediately in front of the rockshelter. There is only one convincing feature in the area, although another deep hole is a few meters away and may have been culturally modified. Unfortunately, Area D is not always available due to relatively frequent flooding and changes in the gravel deposits. I was able to photograph Area D and record basic attributes, but a couple weeks later a flood occurred and the feature is now buried underneath gravel deposits. The feature is deep with a conical profile and a round opening.

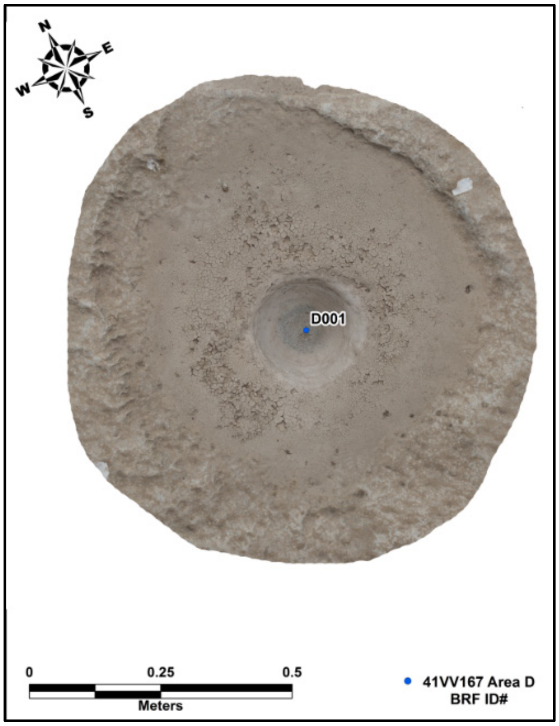


Figure 5.59. Eagle Cave, Area D feature map with ID points.

Figure 5.60. Eagle Cave, Area D feature map with feature outlines.

M1 (Figures 5.61, 5.62, 5.63, and 5.64) is a moveable limestone slab that was likely found during the Sayles and Kelley excavations (Kelley 1932). This slab has eight bedrock features on one side and one feature on the opposite side. Of interest, the deepest feature on side one is worn all the way through the slab. The entirety of the side one surface is covered by features that are all touching one another. Perhaps that is why the slab was turned over and used on the opposite side to create another BRF. The features are all shallow to intermediate in depth and have dished to conical profile ranges. The limestone's surface and texture of the M1 slab is slightly different than the bedrock creating the shelter. Instead of a fine grain texture, M1 has a coarser granularity which also ties into the use-wear patterns. Most of the surfaces are rugged with some possible rounding. It is possible these observations are simply a product of the underlying rock texture, and not the product of specific actions.

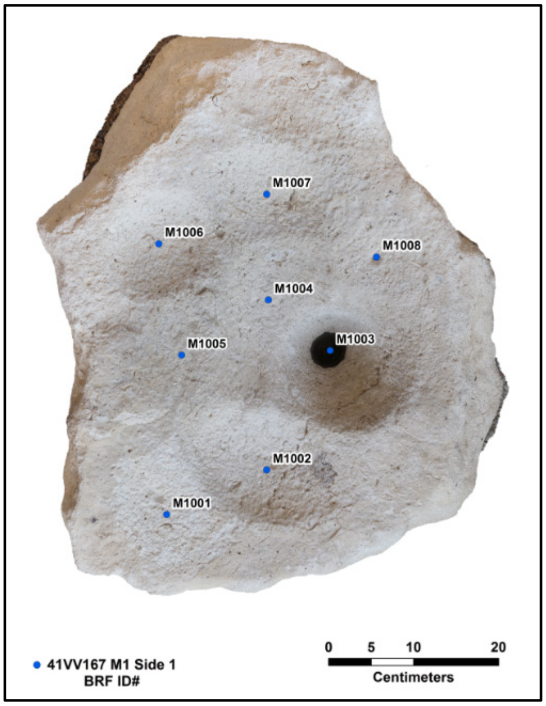


Figure 5.61. Eagle Cave, M1 (side 1) feature map with ID points.

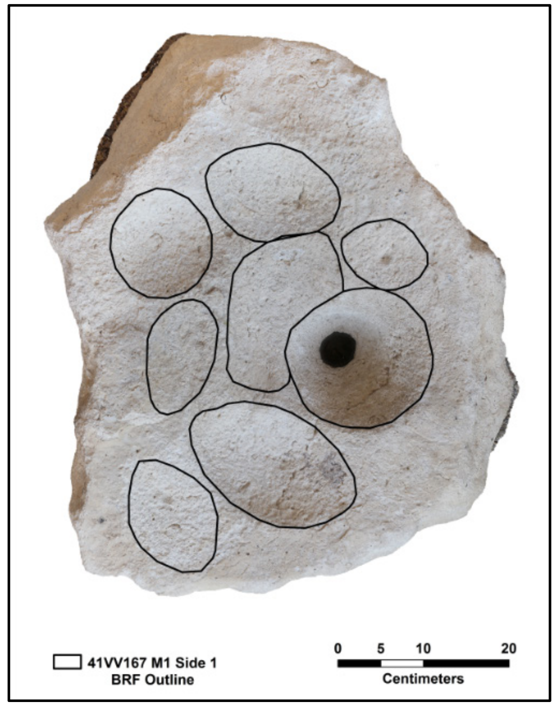


Figure 5.62. Eagle Cave, M1 (side 1) feature map with feature outlines.

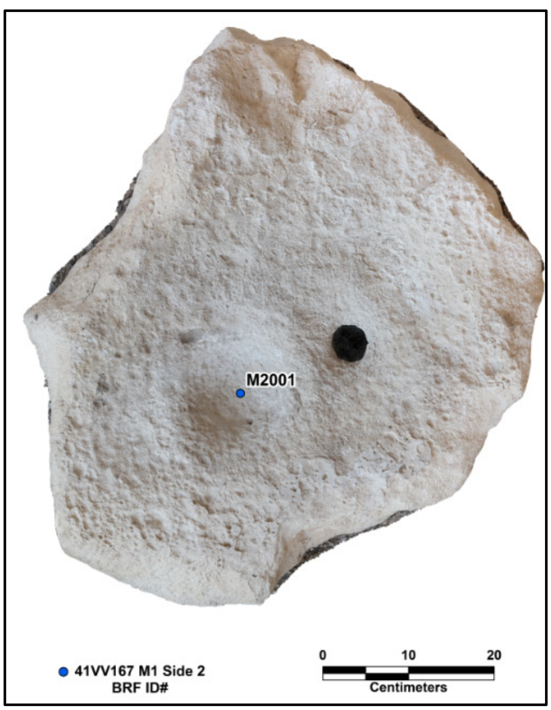


Figure 5.63. Eagle Cave, M1 (side 2) feature map with ID points.

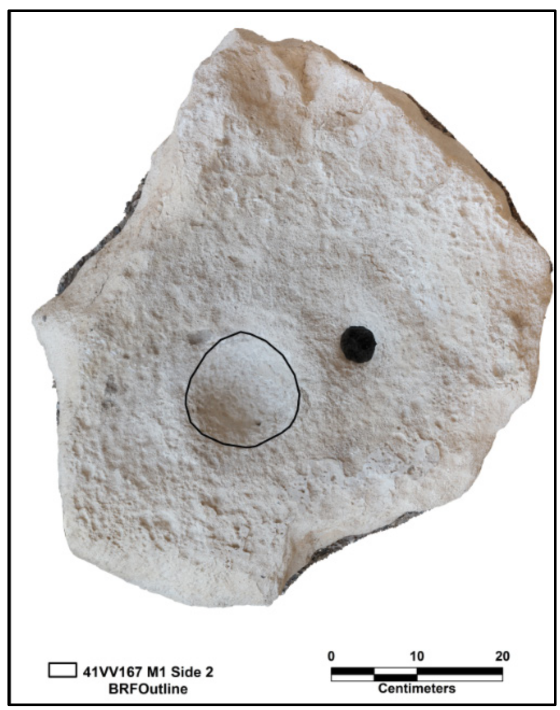


Figure 5.64. Eagle Cave, M1 (side 2) feature map with feature outlines.

Area T (Figures 5.65 and 5.66), the final area at Eagle Cave, is a roof fall boulder located on the talus slope. Although it is a large boulder, it is possible its location has changed at some point between now and when it was used due to the steep talus slope. There are four bedrock features on this boulder that are all of intermediate depth and have gently sloping walls. This rock is fairly weathered and some of the features are in bad shape or have only partial areas preserved. The use-wear patterns on the intact areas show mostly leveling of large areas and sheen or polish.

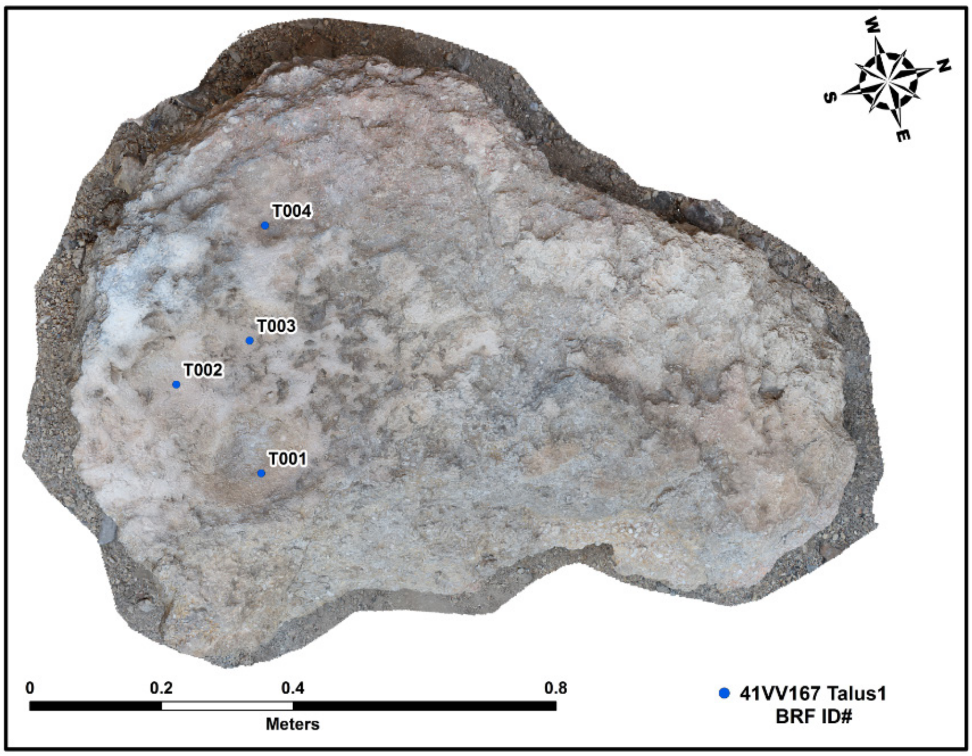


Figure 5.65. Eagle Cave, Area T feature map with ID points.

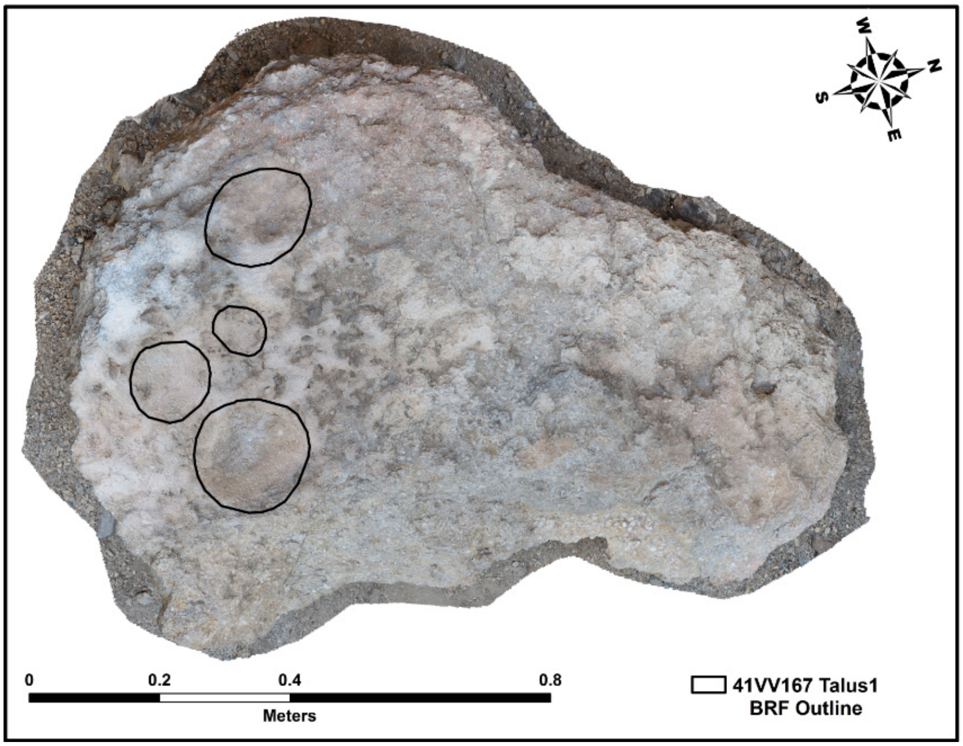


Figure 5.66. Eagle Cave, Area T feature map with feature outlines.

41VV890

41VV890 is a large, multi-component upland site located along the western edge of Eagle Nest Canyon. The site contains historic structures, numerous fire-cracked rock features, and a handful of bedrock features. The BRFs occur on the far southeastern end of the site near the circular stone alignments and some burned rock clusters (Figure 6.67). This site exemplifies how difficult it can be to tell the difference between ground stone bedrock features and natural depressions in an upland setting. Unless the features are very deep and obvious, weathered concavities in the limestone can easily mimic a cultural bedrock feature. Although there were many semi-round holes in the area, I only felt comfortable identifying four bedrock features in one small area as culturally modified.

General attribute data, use-wear observations, and metric data are presented in Table App B.9 and Table App B.10 respectively.

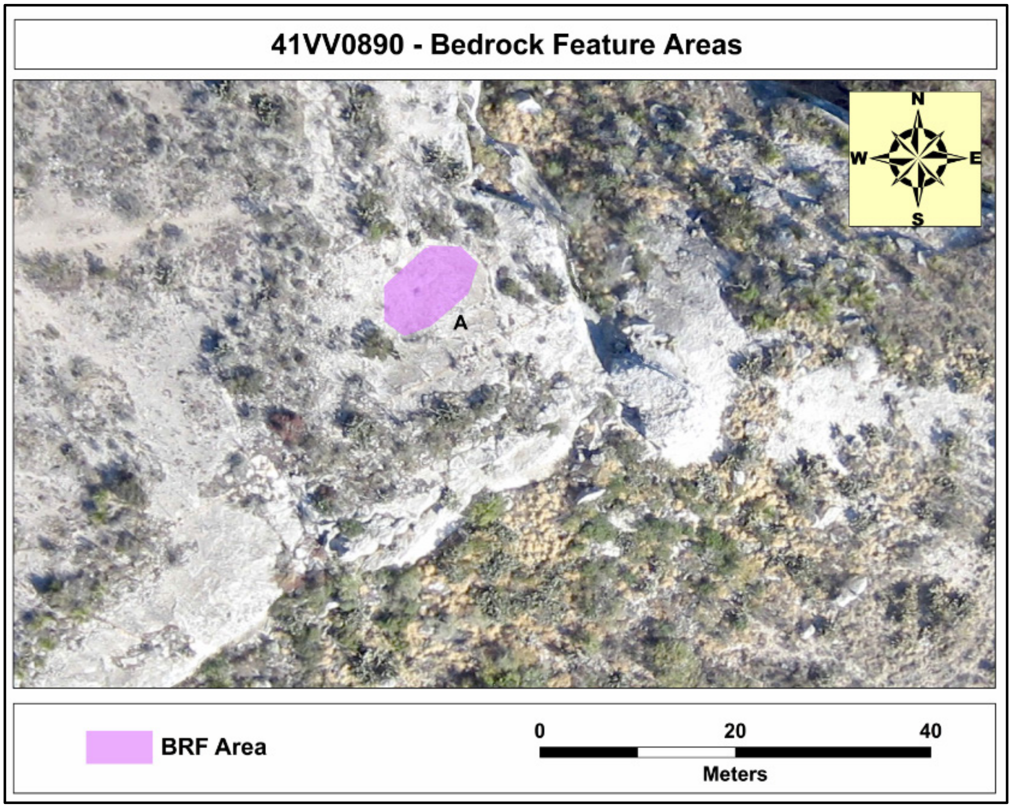


Figure 5.67. Plan view site map of the southeastern portion of 41VV890 showing the probable permanent bedrock feature area. The site continues along the canyon edge to the northwest.

Area A (Figures 5.68 and 5.69) has four likely cultural bedrock features. Two of them (A001 and A002) are much wider and shallower than other holes on the surface and had a more gently grading rim. The other two features (A003 and A004) were deeper but had more rounded rims. Other holes in the area had very abrupt rims, which likely were created through rainwater etching and other natural processes, and this trait was used to rule out naturally-created holes. The use-wear characteristics were mostly rugged with some light leveling and rounding.

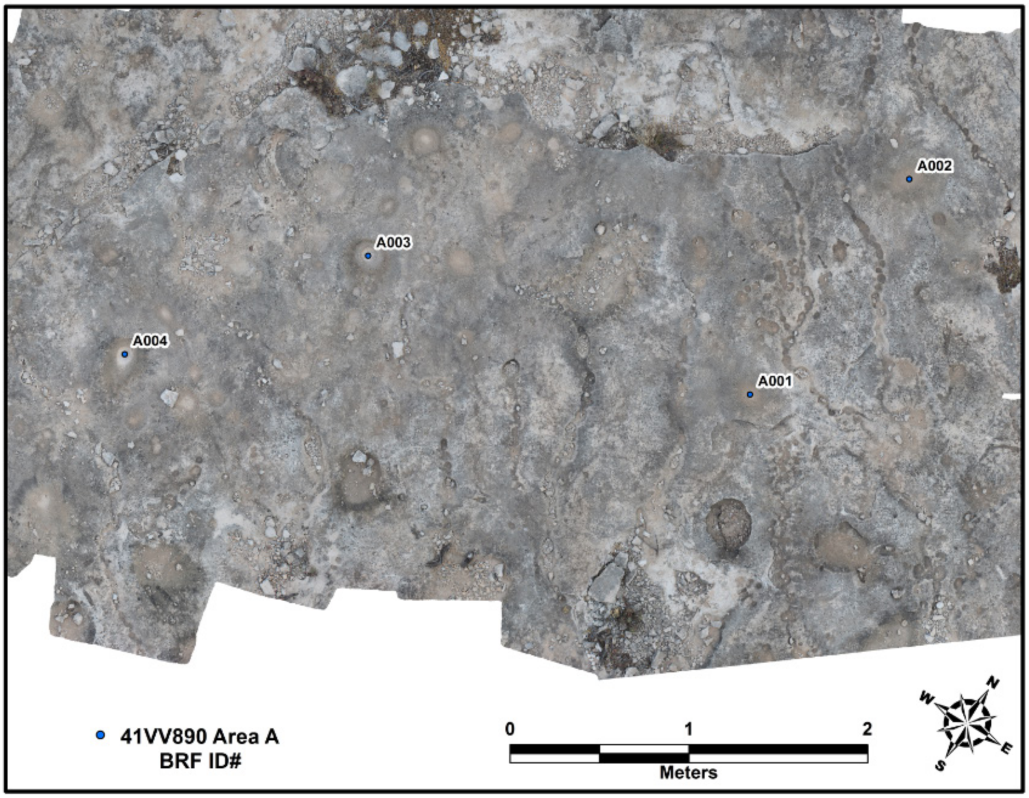


Figure 5.68. 41VV890, Area A feature map with ID points.

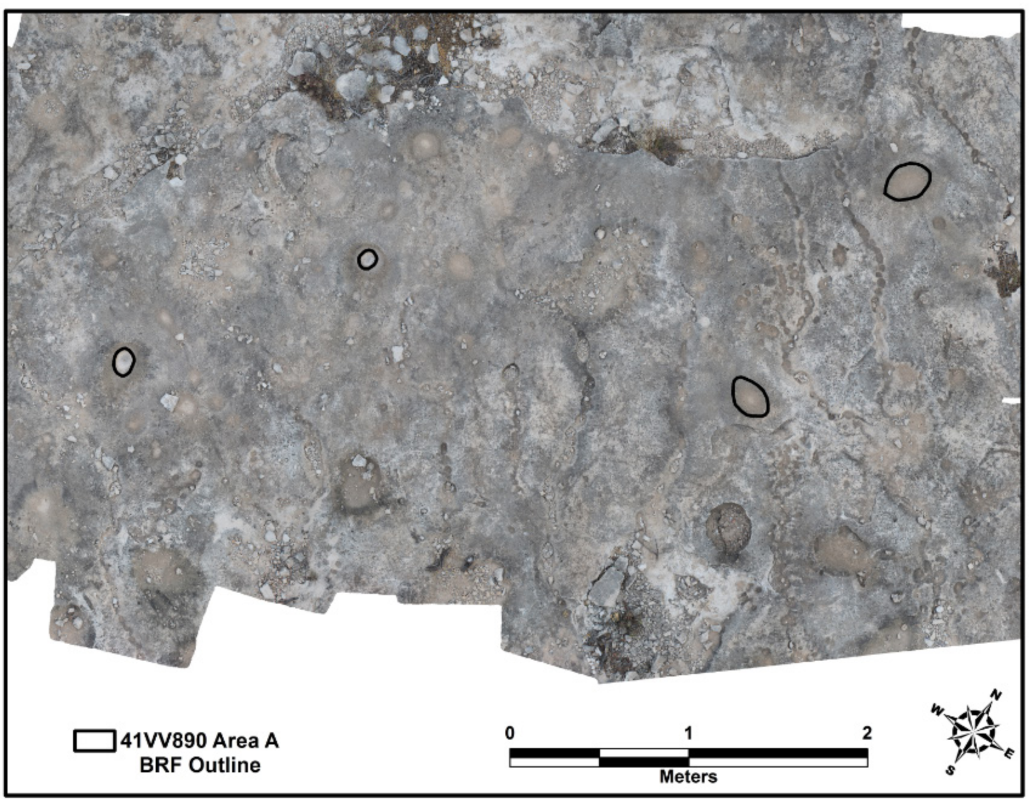


Figure 5.69. 41VV890, Area A feature map with feature outlines.

41VV75

41VV75 (Figure 5.70) is located further downstream within the Rio Grande drainage system in Seminole Canyon State Park and Historic Site (Figure 5.1). It is a large rockshelter with excellent preservation of both the deposits and the pictographic panels covering the entire back wall. Unfortunately, the site was heavily looted and disturbed during historic times by individuals looking for perishable artifacts so today the surface of the shelter has dozens of large mounds and pits from uncontrolled digging. Despite 41VV75's potential for yielding valuable archaeological information, no professional excavations have been undertaken at the site although the site's pictographs have been sampled multiple times for radiocarbon dating (Boyd et al. 2014; Hyman and Rowe 1997; Rowe 2003, 2009). In regards to the bedrock features present, 41VV75 has the most BRFs (n=353) of any site recorded in this study. These BRFs are spread out across 11 (Figures 5.71 and 5.72) permanent areas and nine portable rock slabs. These areas will be described below while Table App B.11 provides the qualitative attribute data and use-wear observations collected for BRFs and Table App B.12 presents the metric data. It should also be noted that use-wear analysis was conducted on only 25% of the features due to time constraints. Efforts were focused on the deeper features since this site contained so many in comparison to other sites in the study.

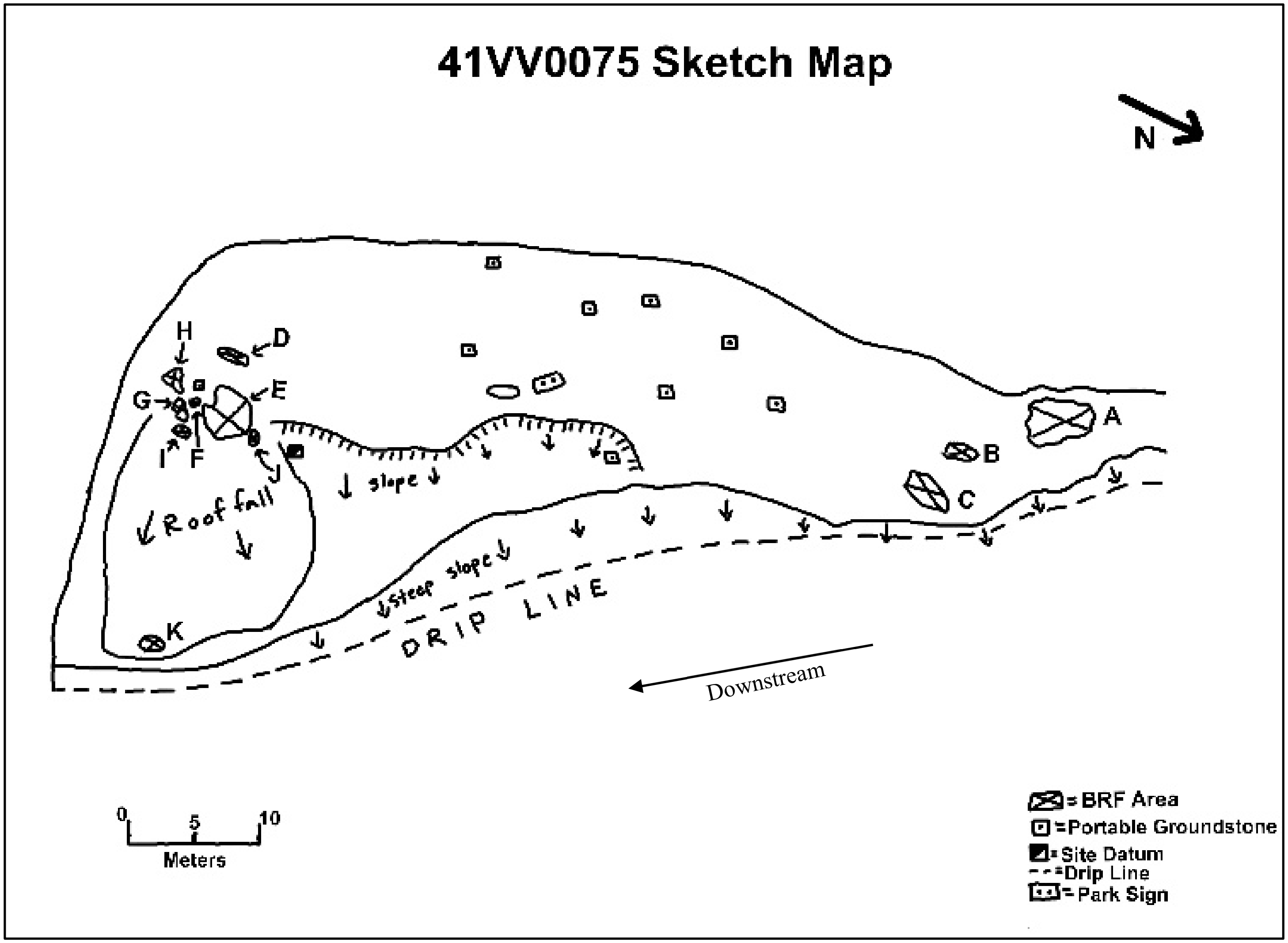


Figure 5.70. Plan view sketch map of 41VV75. Map by Spencer Lodge.

Figure 5.71. Permanent bedrock feature areas at 41VV75. (a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

Figure 5.72. Permanent bedrock feature areas at 41VV75. (a) Area F; (b) Area G; (c) Area H; (d) Area I; (e) Area J; (f) Area K.

Area A (Figures 5.71a, 5.73, and 5.74) is a large roof fall boulder located at the furthest upstream end of the site outside of the dripline. This area was cleared of vegetation and loose leaves before photography, which uncovered about one third of the 105 recorded bedrock features. This rock contains BRFs of all depths ranging from shallow to deep and many are set on a gentle incline. Use-wear characteristics of deeper features in this area included mostly leveled surfaces while the shallower features were more rugged with only leveling and rounding of high points.

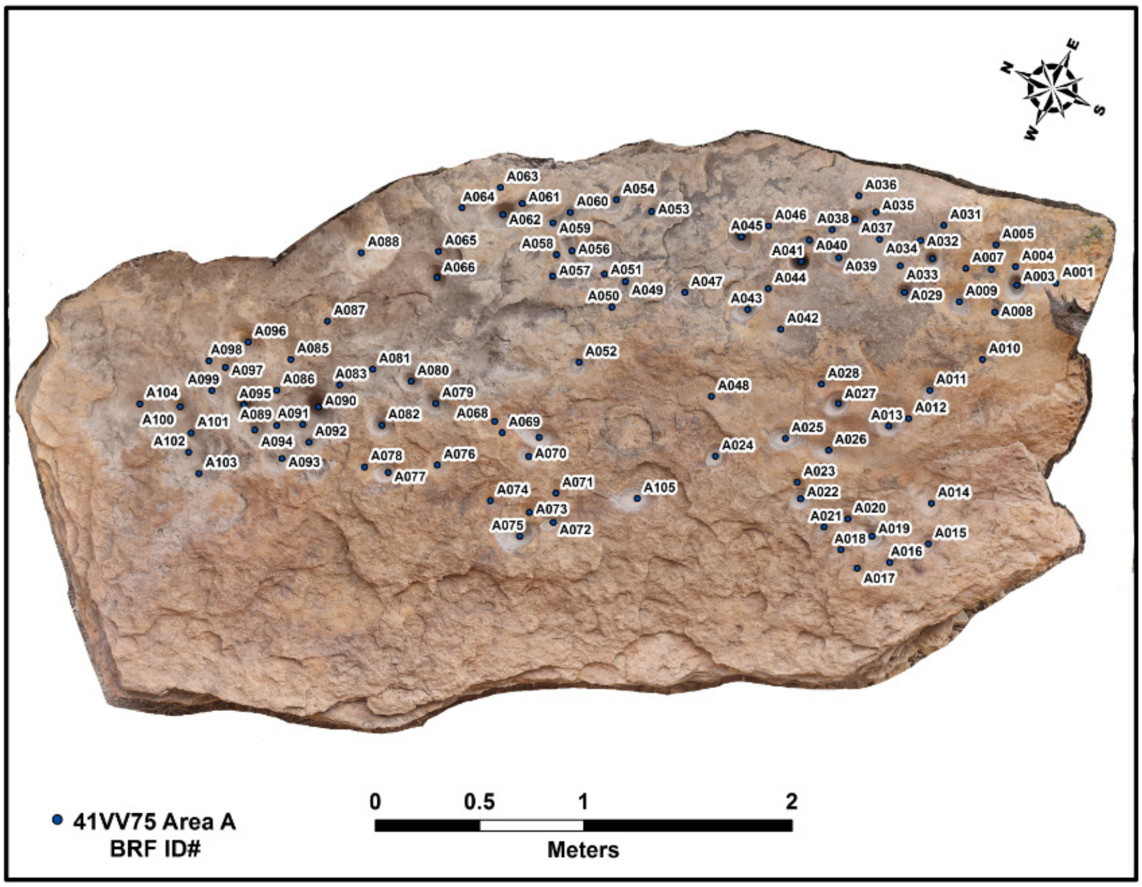


Figure 5.73. 41VV75, Area A feature map with ID points.

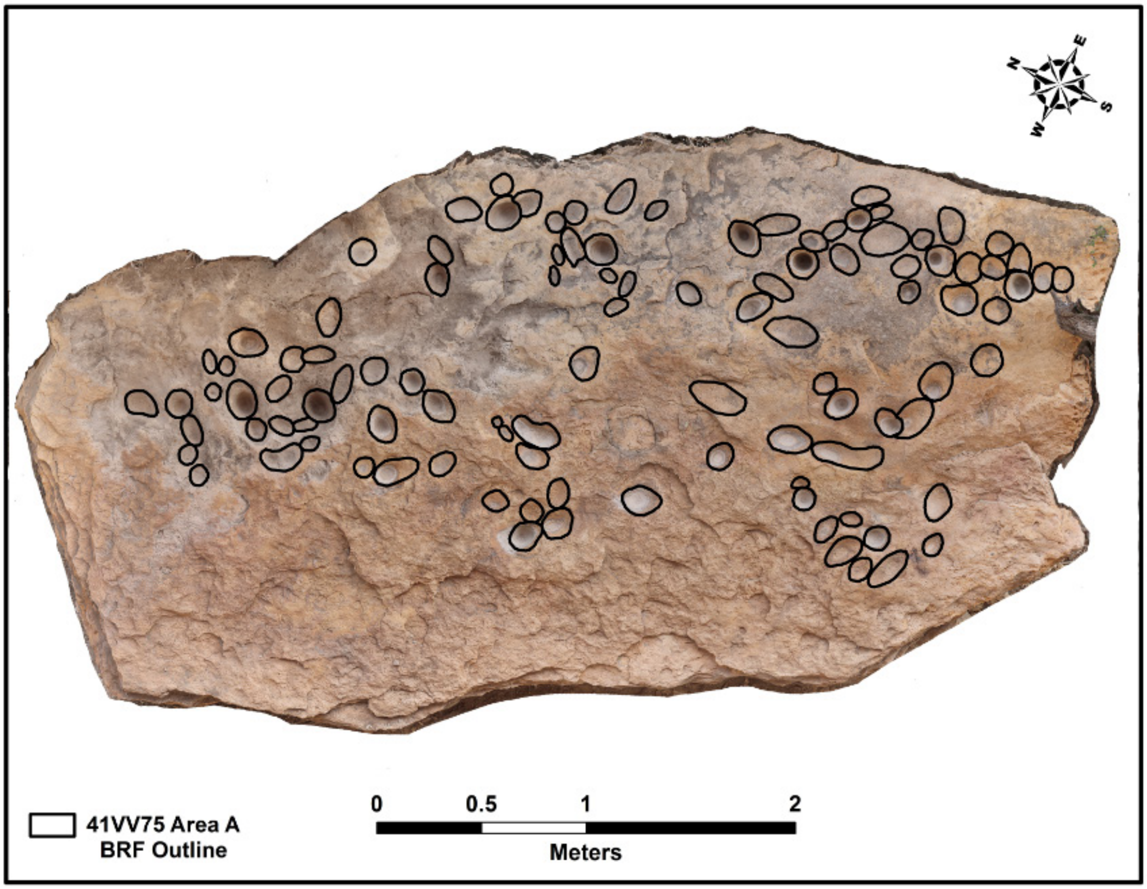


Figure 5.74. 41VV75, Area A feature map with feature outlines.

Area B (Figures 5.71b, 5.75, and 5.76) is another roof fall boulder located outside of the dripline on the upstream end of the site. There are 20 BRFs on this surface that include shallow to intermediate depth features as well as small cupule-like divots (similar to the ones in Area A at Horse Trail). Interestingly, the divots all have a conical profile as if they were pecked in a few centimeters and then never really utilized. Across the boulder, the use-wear data ranges from leveled high points to leveling and rounding of larger areas.

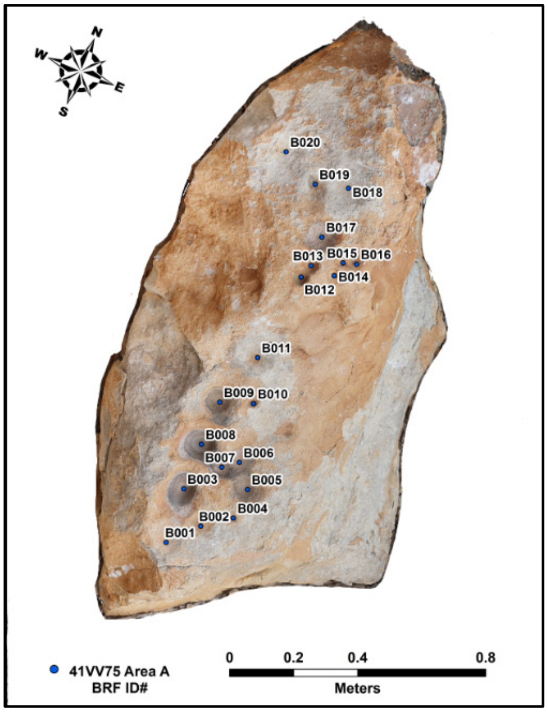


Figure 5.75. 41VV75, Area B feature map with ID points.

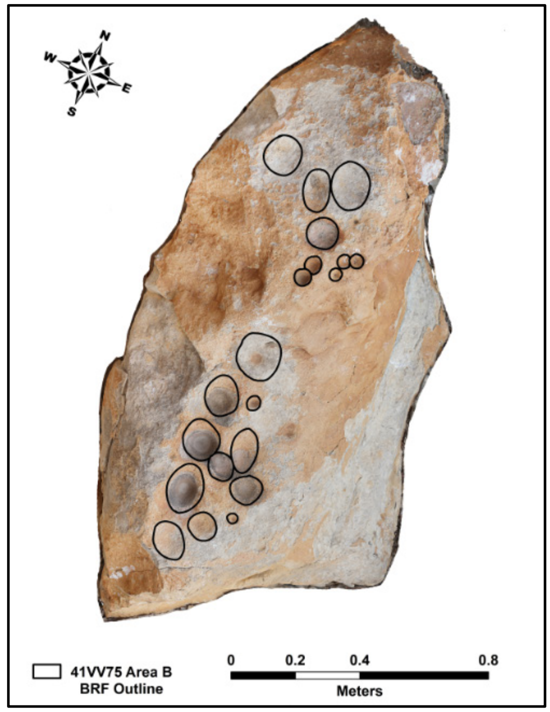


Figure 5.76. 41VV75, Area B feature map with feature outlines.

Area C (Figures 5.71c, 5.77, and 5.78) is a large boulder sitting at the edge of the shelter floor and a steep drop off to the bottom floor. This boulder is unprotected by the shelter roof and the top surface is highly weathered by rainwater etching. Due to this circumstance, use-wear analysis was not conducted on the BRFs in Area C. There are multiple natural concavities on this surface, but all have a smoothed level surface. Other natural concavities have ground stone BRFs pecked into the middle of them. Thirteen BRFs are located on this rock that range from shallow to very deep. Two of the deepest features (C005 and C008) were dug out as far as possible since there was little chance for in situ cultural deposits. We encountered a tightly wedged rock in the bottom of C008 and could not remove it. The wedged rock did not appear to be a ground stone item but it is not likely the rock fell in the hole naturally, given the tight fit.

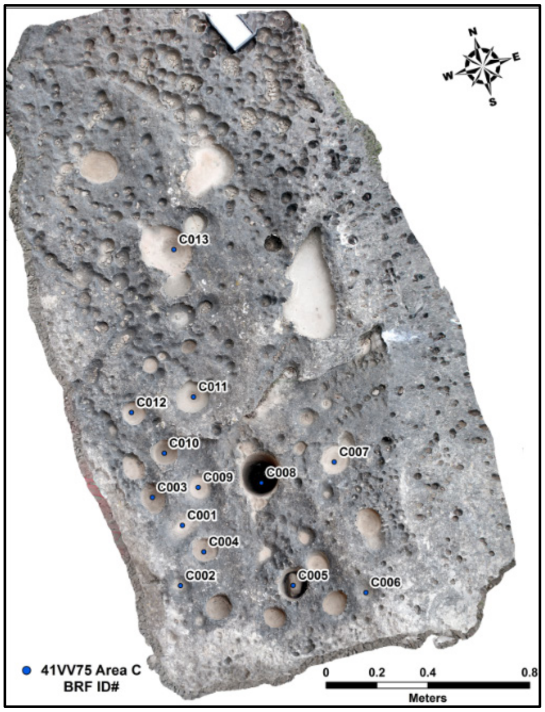


Figure 5.77. 41VV75, Area C feature map with ID points.

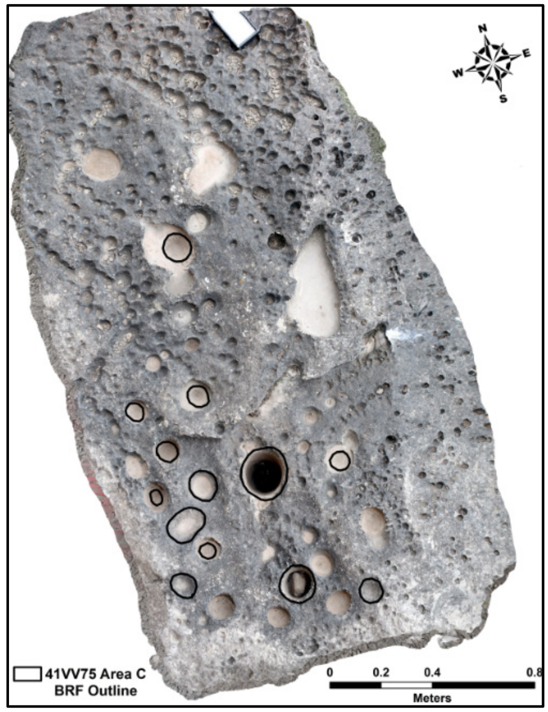


Figure 5.78. 41VV75, Area C feature map with feature outlines.

Area D (Figures 5.71d, 5.79, and 5.80) is located on the downstream end of the site and contains seven bedrock features that are grouped into two clusters. These BRFs are all shallow with gently sloping walls and occur on a moderately sloped surface. Above the bedrock features are a series of incised groove marks carved into the limestone boulder. The recorded use-wear characteristics included rugged walls with some high points leveled and completely leveled bases.

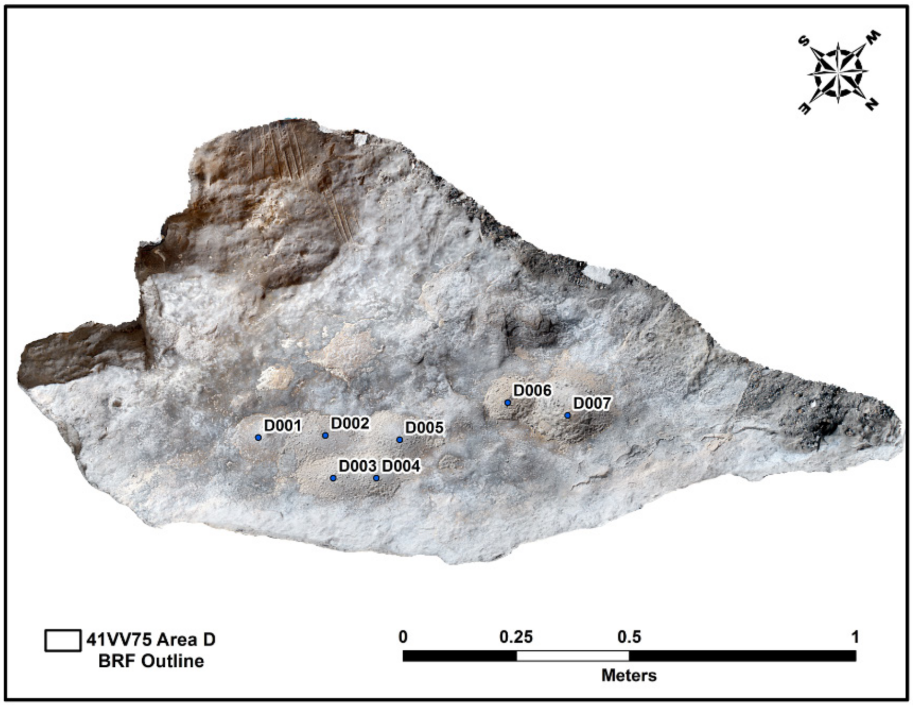


Figure 5.79. 41VV75, Area D feature map with ID points.

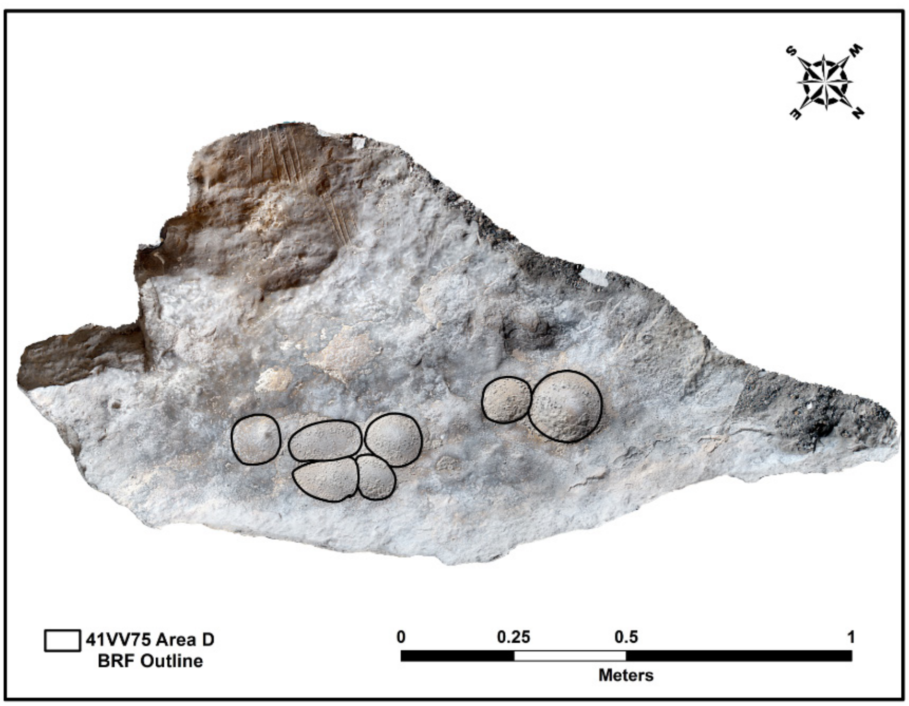


Figure 5.80. 41VV75, Area D feature map with feature outlines.

Area E (Figures 5.71e, 5.81, and 5.82) is a large slab of bedrock on the downstream end of the site that contains 128 BRFs. The limestone in this area is protected by the shelter roof but is relatively fragile and there is evidence of many recent breaks on the surface. The bedrock features extend across this surface in close proximity to one another, with many features sharing rims. The depths of the features range from shallow to very deep and the profiles are dished, conical, and straight-walled. There are three large, deep features (E025, E040, and E051) in the middle of the area that have deposits in the bottom but were not dug out. Although there is undoubtedly material in these features not associated with its use, these BRFs have the best potential of finding in situ deposits or botanical remains at the bottom. It should be noted that the depths recorded for these features are a minimum depth since they were not cleaned out. It is also very likely that bedrock features continues further to the southwest of this area but are covered by sediment. Due to time constraints, this possibility was not explored. In regards to use-wear, most of the features on the southern end of the area had more rugged surfaces with leveled high points and some rounding. The exception to this were the three deep mortars discussed previously. The upper walls of the mortars were fairly rugged, but the lower 2/3 of the walls were extremely leveled and smooth to the touch. Use-wear on the northern end of the boulder had more completely leveled surfaces with low rounded bumps.

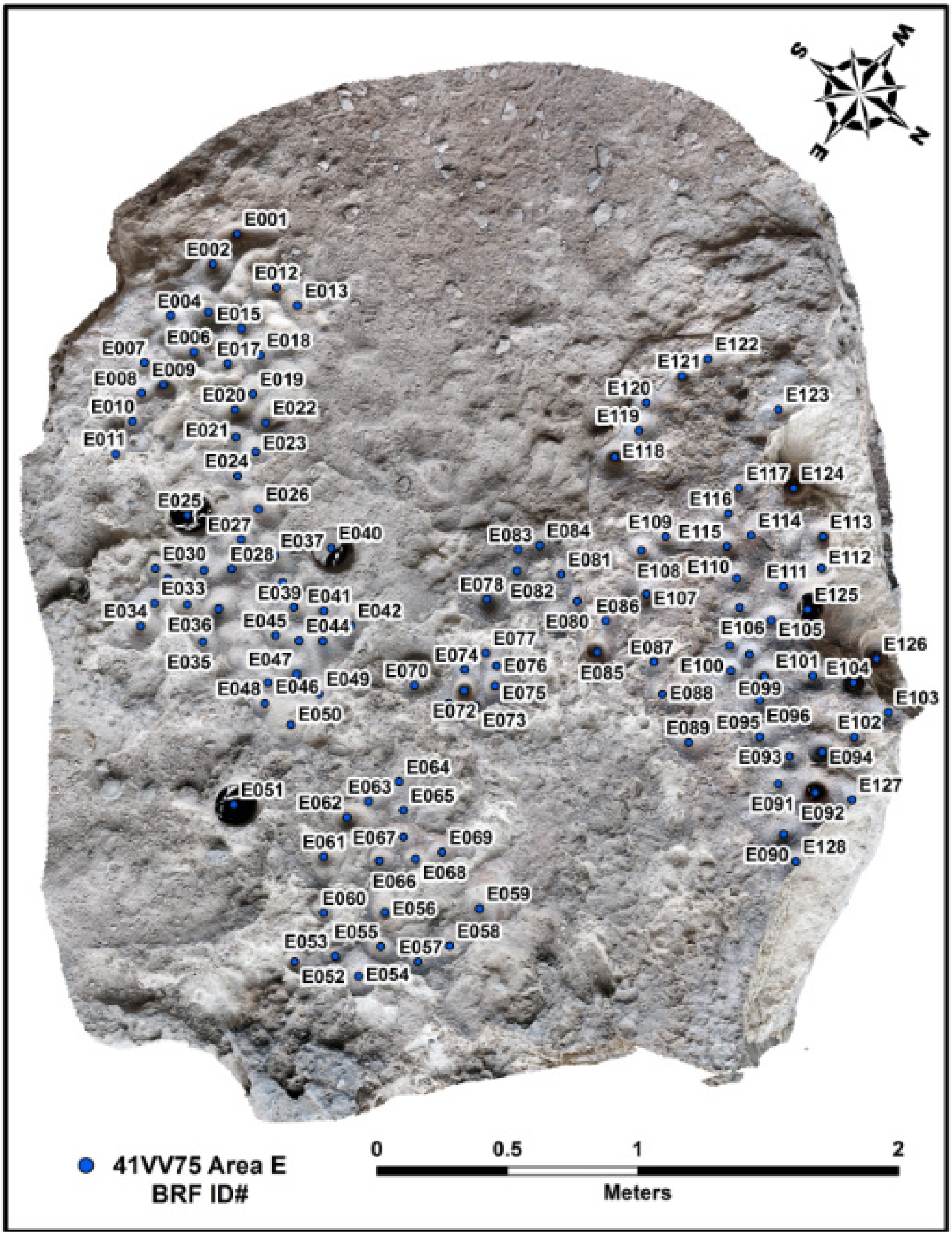


Figure 5.81. 41VV75, Area E feature map with ID points.

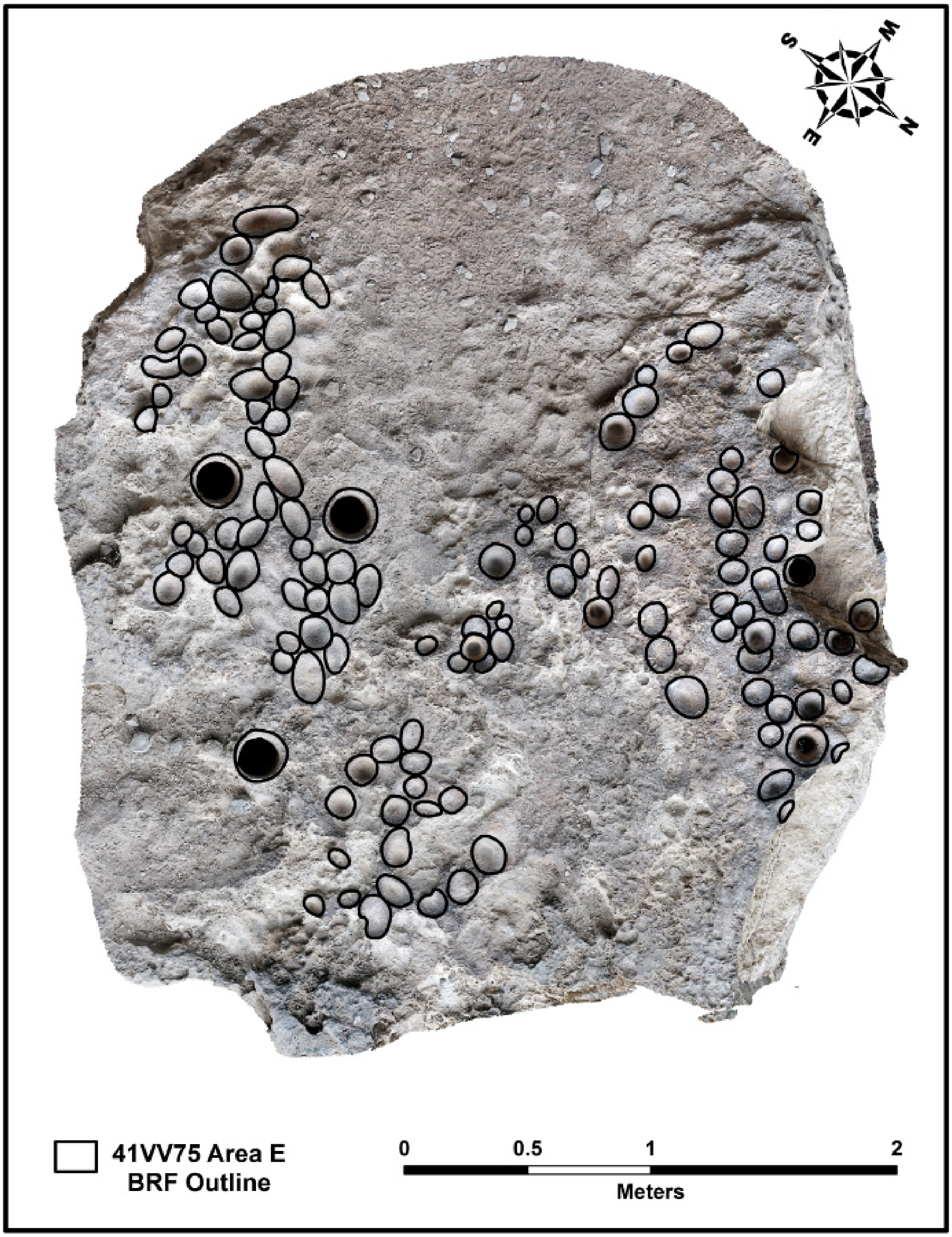


Figure 5.82. 41VV75, Area E feature map with feature outlines.

Area F (Figures 5.72a, 5.83, and 5.84) is a small limestone boulder directly adjacent to Area E that contains five bedrock features. All five are of intermediate depth and have conical profile shapes. Two features were analyzed for use-wear, one had rugged surfaces with somewhat rounded bumps and the other was mostly leveled with rounded bumps.

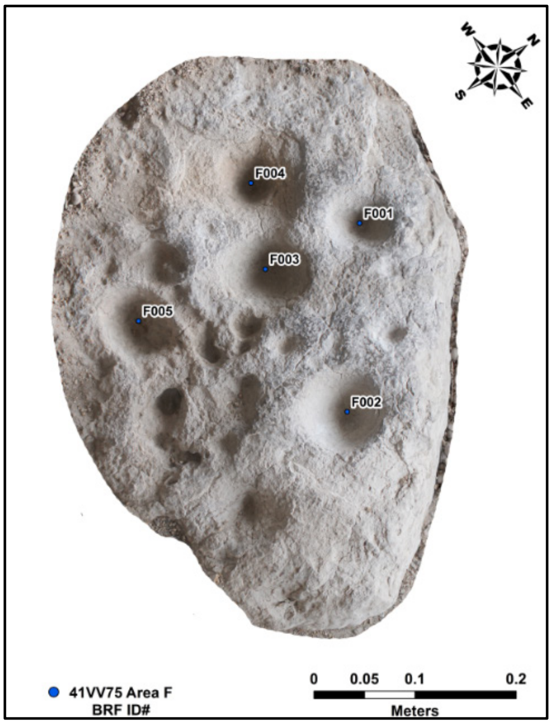


Figure 5.83. 41VV75, Area F feature map with ID points.

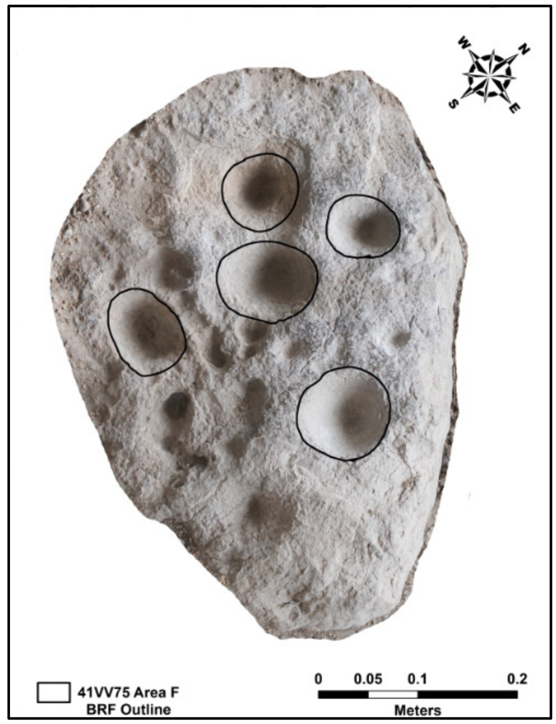


Figure 5.84. 41VV75, Area F feature map with feature outlines.

Area G (Figures 5.72b, 5.85, and 5.86) is a roof fall boulder on the downstream end of the site, next to Area F. There are 14 bedrock features on this boulder with types ranging from shallow to deep and profile shapes occurring in dished, conical, and straight-walled morphologies. The use-wear varies from rugged with high points leveled to completely leveled surfaces. Besides the general characteristics, there are a few notable attributes about Area G. First, two petroglyphs are carved into some of the shallow BRFs

(Figure 5.87). Second, the deepest feature (G008) is broken through at the base at a depth of 58cm and part of the top wall and rim has broken away but is still visible on the adjacent rock.

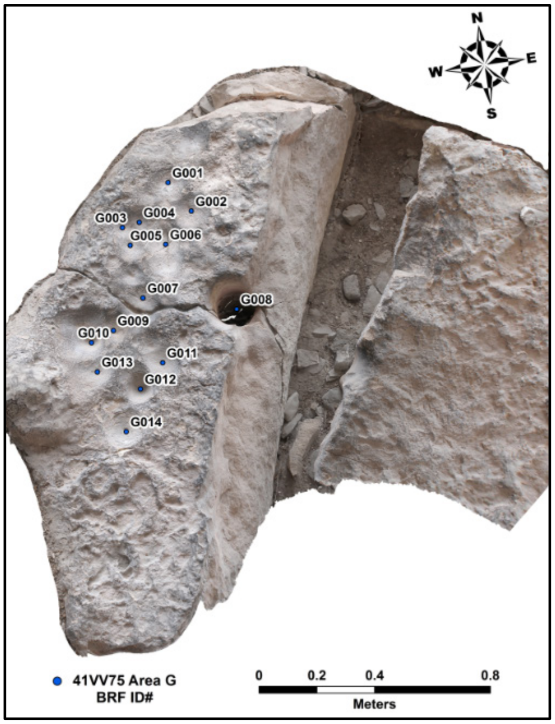


Figure 5.85. 41VV75, Area G feature map with ID points.

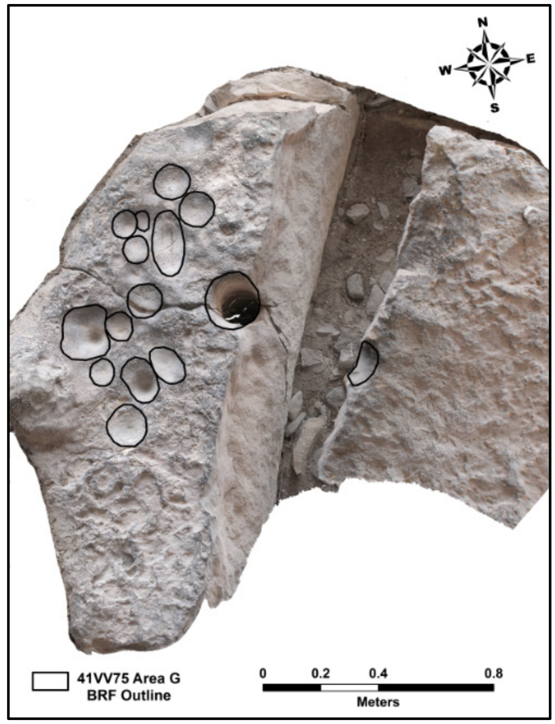


Figure 5.86. 41VV75, Area G feature map with feature outlines.

Figure 5.87. 41VV75, one of the petroglyphs in Area G.

Area H (Figures 5.72c, 5.88, and 5.89) is made up of two large boulder directly southwest of Area G and contains 17 bedrock features. All of the BRFs except for one (H008) are shallow in depth and have gently sloping walls. H008 is another deep mortar that has deposits in the bottom, but was not dug out. The use-wear on H008's walls is mostly leveled with some rounded bumps and vertically oriented striations on the lower parts of the wall. Elsewhere, use-wear attributes include overall leveling and rounding or rugged surfaces with high points leveled.

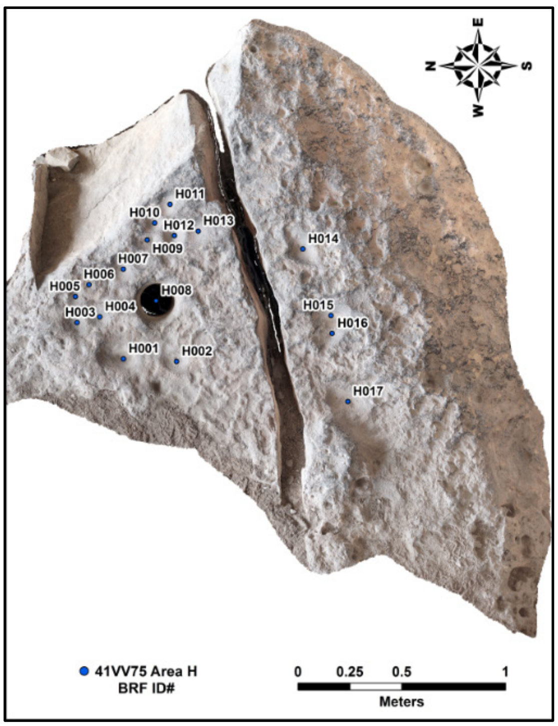


Figure 5.88. 41VV75, Area H feature map with ID points.

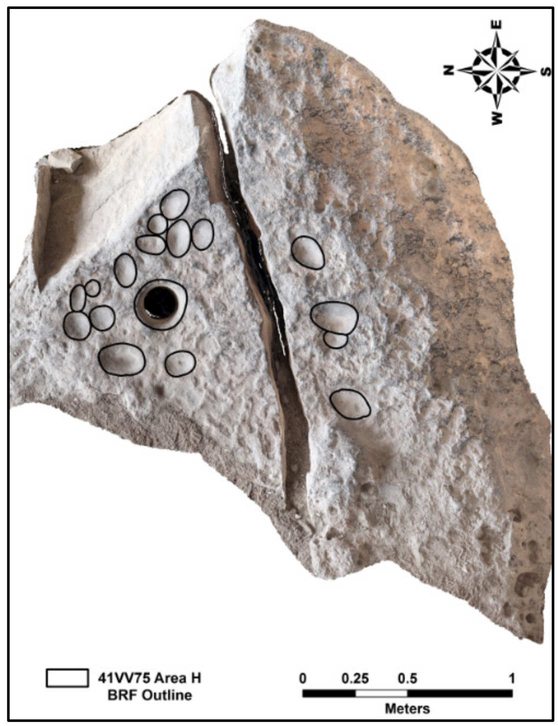


Figure 5.89. 41VV75, Area H feature map with feature outlines.

Nearby, Area I (Figures 5.72d, 5.90, and 5.91) is another large boulder with four bedrock features on a gently sloping surface. One of the features is of intermediate depth and has a conical profile while the other three are shallow with a dished profile. The recorded use-wear attributes include rugged walls with some leveled high points.

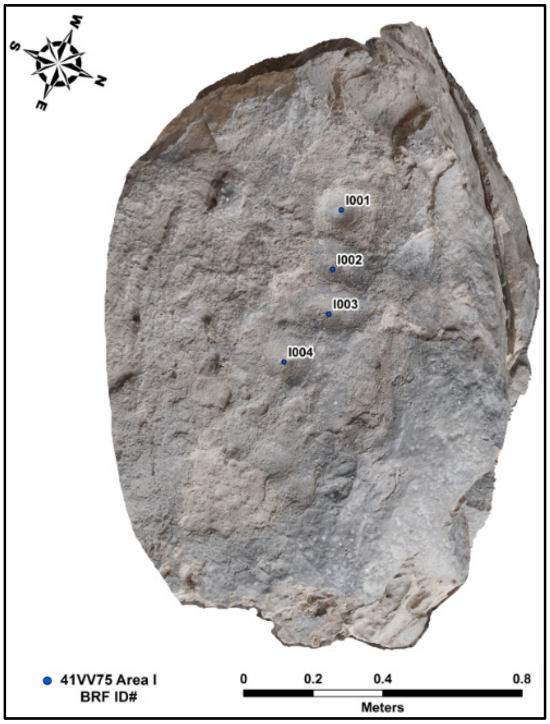


Figure 5.90. 41VV75, Area I feature map with ID points.

Figure 5.91. 41VV75, Area I feature map with feature outlines.

Area J (Figures 5.72e, 5.92, and 5.93) is a broken piece of bedrock located on the talus slope below Area E. It is likely this rock came off of the large Area E rock but I could not identify any similar areas that might connect back together. There are 15 features on this rock and the majority of the BRFs are deeper than the typical shallow features and have conical profile shapes. Further, the most prominent use-wear pattern is a leveled surface with some rounded bumps. This is similar to the use-wear observed on the northern features in Area E, which also supports the assumption that Area J broke off of that side of Area E.

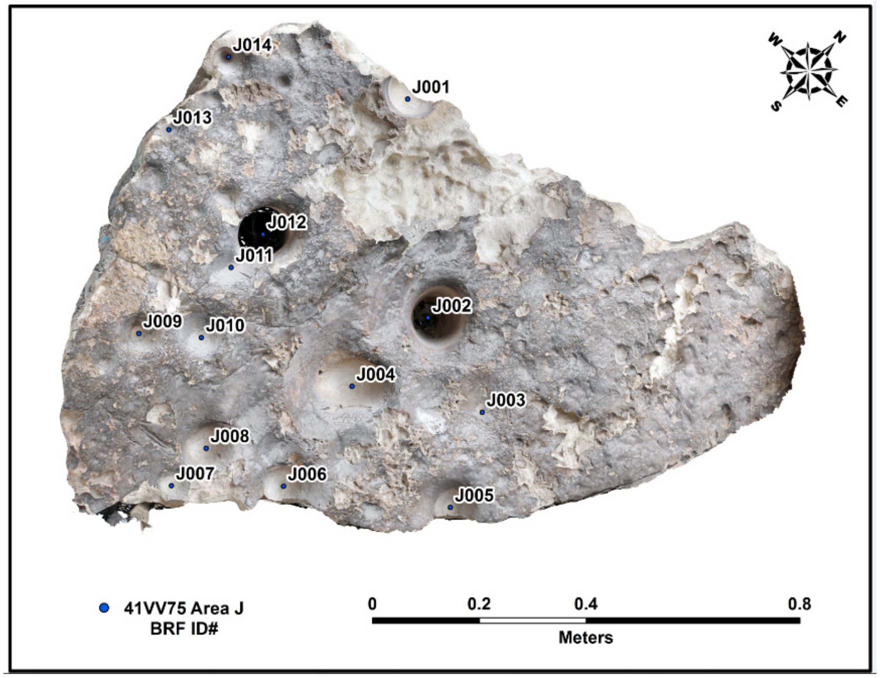


Figure 5.92. 41VV75, Area J feature map with ID points.

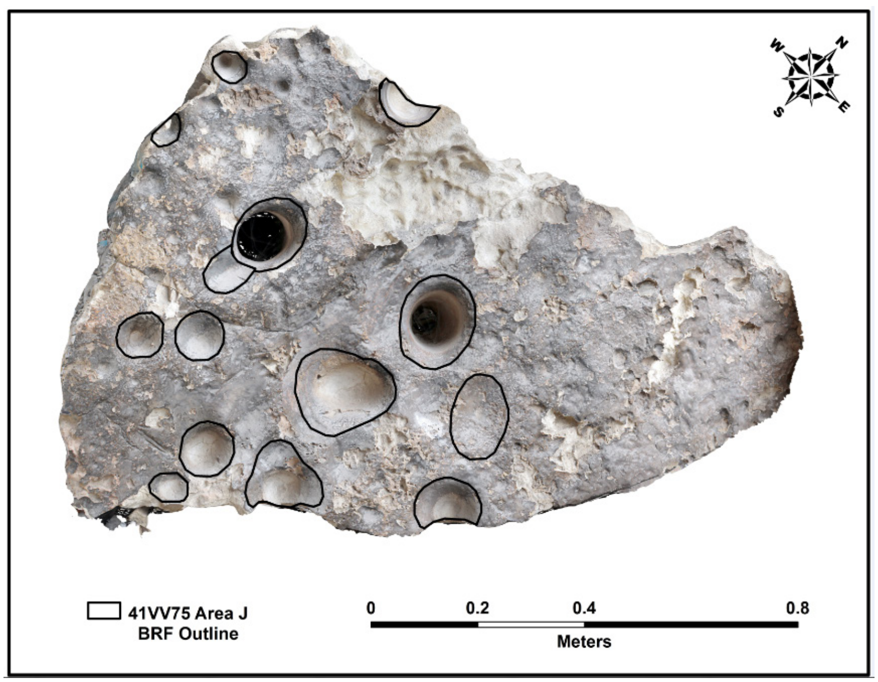


Figure 5.93. 41VV75, Area J feature map with feature outlines.

Area K (Figures 5.72f, 5.94, and 5.95) is a boulder on the far downstream end of the site, located along the dripline. There are 15 BRFs on this roof fall boulder, the majority of which are shallow in depth and have dished profiles. This rock and associated features are fairly weathered but some of the better preserved features had use-wear characteristics of leveling and rounded bumps.

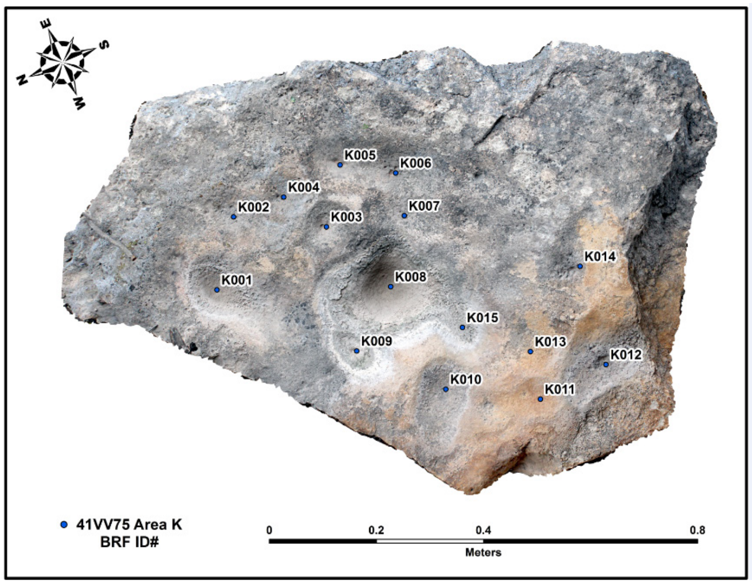


Figure 5.94. 41VV75, Area K feature map with ID points.

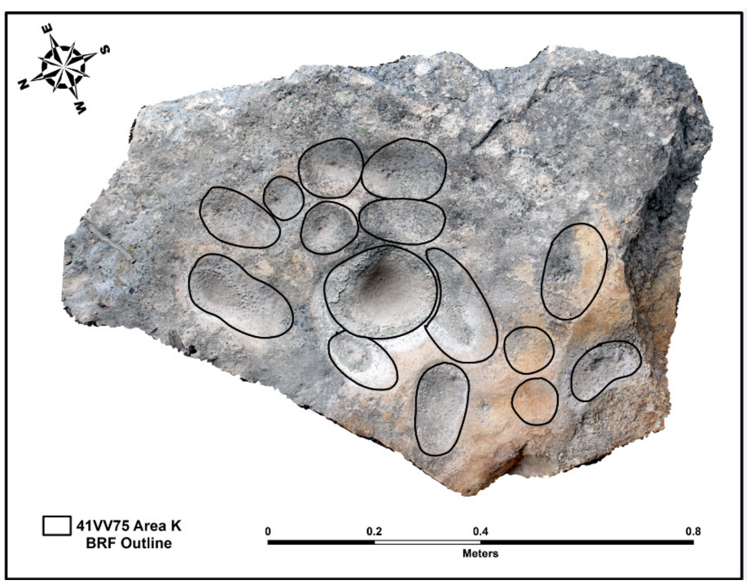


Figure 5.95. 41VV75, Area K feature map with feature outlines.

M1 (Figures 5.96 and 5.97) is a small, portable limestone slab with one bedrock features on it. This feature is mostly flat and roughly diamond shaped at the opening. The use-wear is particularly interesting with very visible peck marks creating the worked surface, but all of these marks have been smoothed over by leveling. Even though the surface appears rough, it is smooth to the touch.

Figure 5.96. 41VV75, M1 feature map with ID points.

Figure 5.97. 41VV75, M1 feature map with features outlines.

M2 (Figures 5.98 and 5.99) is also small and portable but the material is not of the local limestone. Instead, it appears to be another type of sedimentary rock, likely sandstone, which may have been obtained from the Rio Grande gravels. There is one shallow bedrock feature with an ovoid opening and a dished profile. The use-wear patterns are slightly different due to the material. The surface is leveled but the fracture marks are linear and curved as opposed to pecked.

Figure 5.98. 41VV75, M2 feature map with ID points.

Figure 5.99. 41VV75, M2 feature map with features outlines.

M3 (Figures 5.100 and 5.101) is a slightly larger limestone slab than the previous two rocks with one bedrock feature. The feature is intermediate in depth and ovoid at the mouth, although the rock is fractured so a portion of the rim and upper wall are missing. The surface is rugged with some leveling of high points and the rim is fairly abrupt. There are some linear striations oriented horizontally along the wall but I suspect they may be modern, as public tours come to this site and people often like to pretend they are using a grinding slab.

Figure 5.100. 41VV75, M3 feature map with ID points.

Figure 5.101. 41VV75, M3 feature map with features outlines.

M4 (Figures 5.102 and 5.103) is a portable limestone slab with one ephemeral bedrock feature. This feature is a flat area that is completely leveled and slicked with a few scattered peck marks. Similar to M3, there are light horizontal striations present which may be of modern origin.

Figure 5.102. 41VV75, M4 feature map with ID points.

Figure 5.103. 41VV75, M4 feature map with features outlines.

M5 (Figures 5.104 and 5.105) is a thick limestone slab with one bedrock feature. The BRF is deep with a conical profile but it is also fractured so half of the feature is missing. The use-wear patterns on the walls are mostly leveled surfaces with a few rounded bumps and the rim is abrupt.

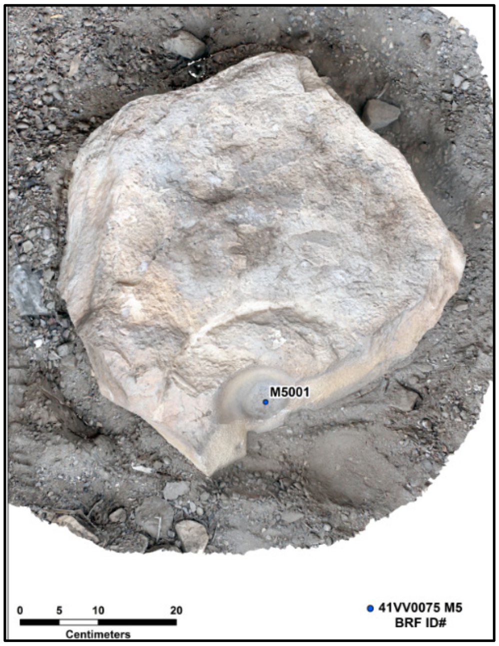


Figure 5.104. 41VV75, M5 feature map with ID points.

Figure 5.105. 41VV75, M5 feature map with features outlines.

M6 (Figures 5.106 and 5.107) is another fractured limestone slab with one BRF. The feature is of intermediate depth and is missing one part of its oblong rim.

Figure 5.106. 41VV75, M6 feature map with ID points.

Figure 5.107. 41VV75, M6 feature map with features outlines.

M7 (Figures 5.108 and 5.109) is a portable limestone slab with one circular pecked area. This feature does not appear to have had much use.

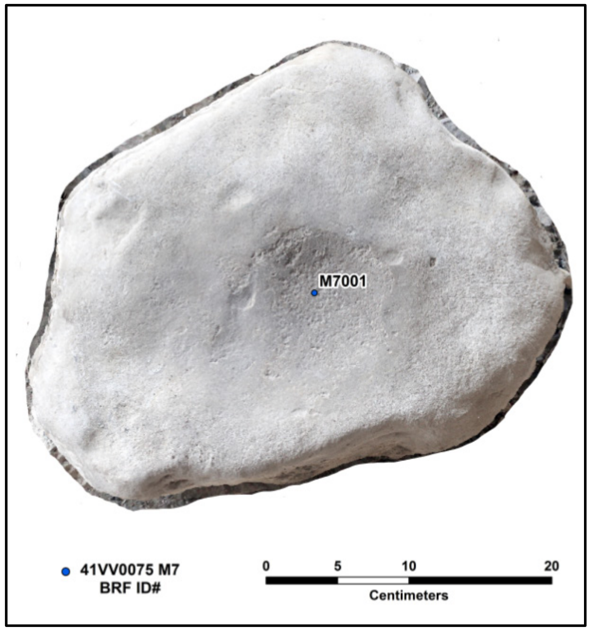


Figure 5.108. 41VV75, M7 feature map with ID points.

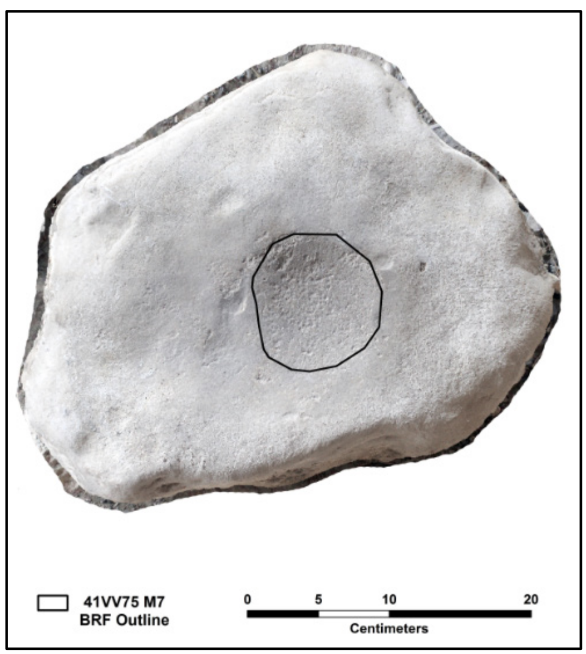


Figure 5.109. 41VV75, M7 feature map with features outlines.

M8 (Figures 5.110 and 5.111) is a small, portable limestone slab with two bedrock features immediately adjacent to one another. M8001 is a circular shallow feature and M8002is a semi-crescent shaped pecked area.

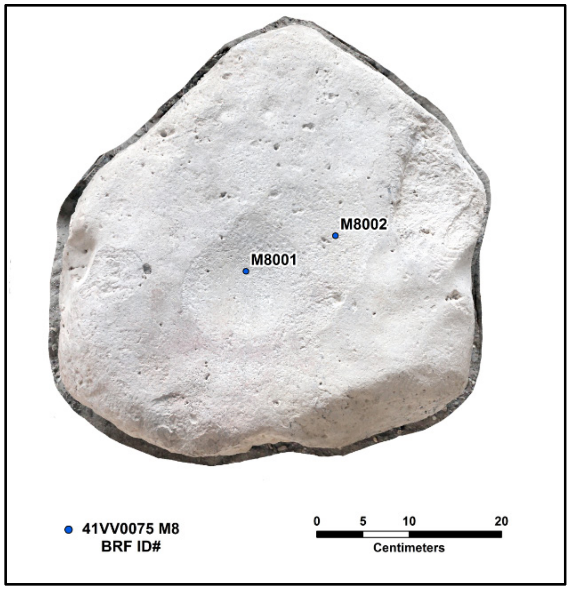


Figure 5.110. 41VV75, M8 feature map with ID points.

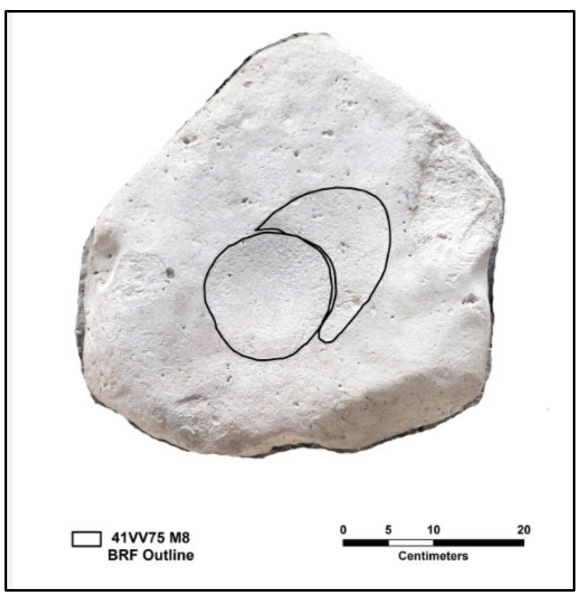


Figure 5.111. 41VV75, M8 feature map with features outlines.

M9 (Figures 5.112 and 5.113) is a small limestone slab found in the talus slope with one round pecked area.

Figure 5.112. 41VV75, M9 feature map with ID points.

Figure 5.113. 41VV75, M9 feature map with features outlines.

Sites within the Pecos River Drainage

Two sites analyzed in this study are located within drainages that empty into the Pecos River, both in the lower sections of the river above the confluence with the Rio Grande (Figure 5.114).

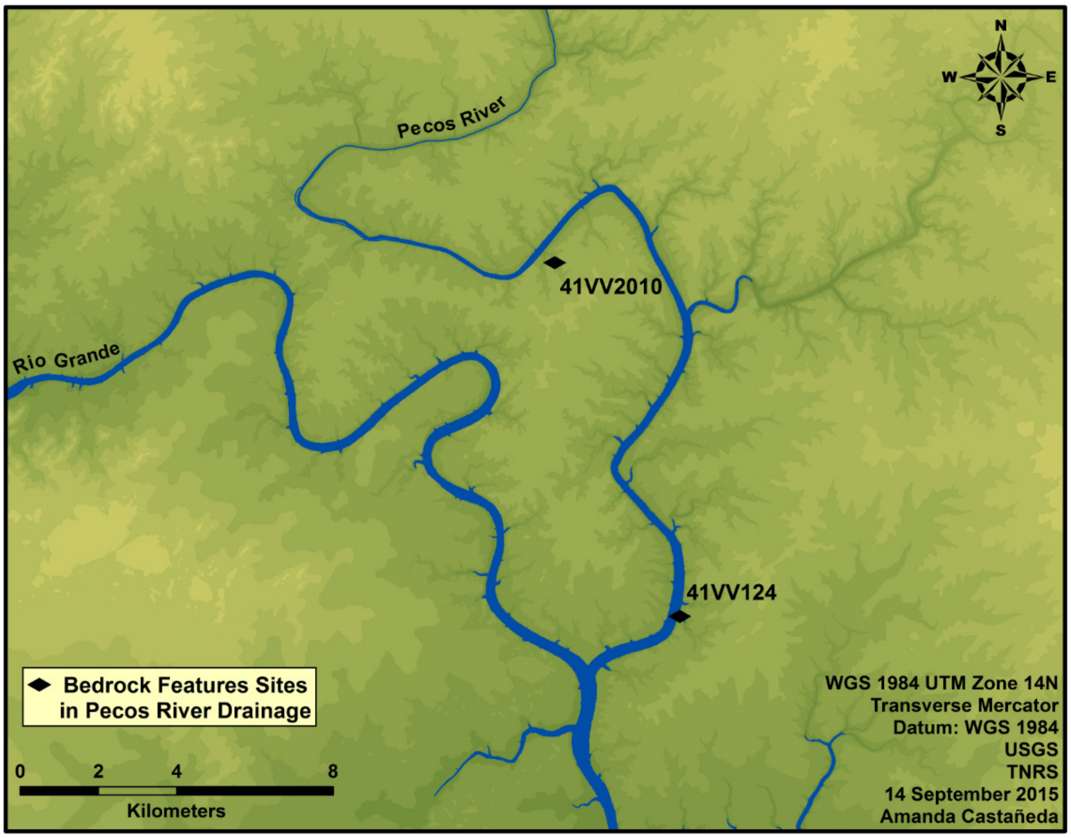


Figure 5.114. Sites recorded within the Pecos River drainage system.

41VV2010 – Mountain Laurel

Mountain Laurel (Figure 5.115) is a decent sized rockshelter in a small tributary to the Pecos River. The shelter is situated high enough off the canyon floor that it does not appear to receive much damage from flooding and the roof is large enough to provide good protection from rainfall. Although no professional excavations have taken place here, perishable items laying on the surface (e.g., quids and cordage fragments) are a testament to the good preservation and potential for archaeological information. There are a total of 89 bedrock features spread across 13 permanent areas and one portable grinding slab in the shelter (Figures 5.116, 5.117, and 5.118). These areas will be summarized below while the attribute data, use-wear characteristics, and metric data are presented in Table App B.13 and Table App B.14, respectively.

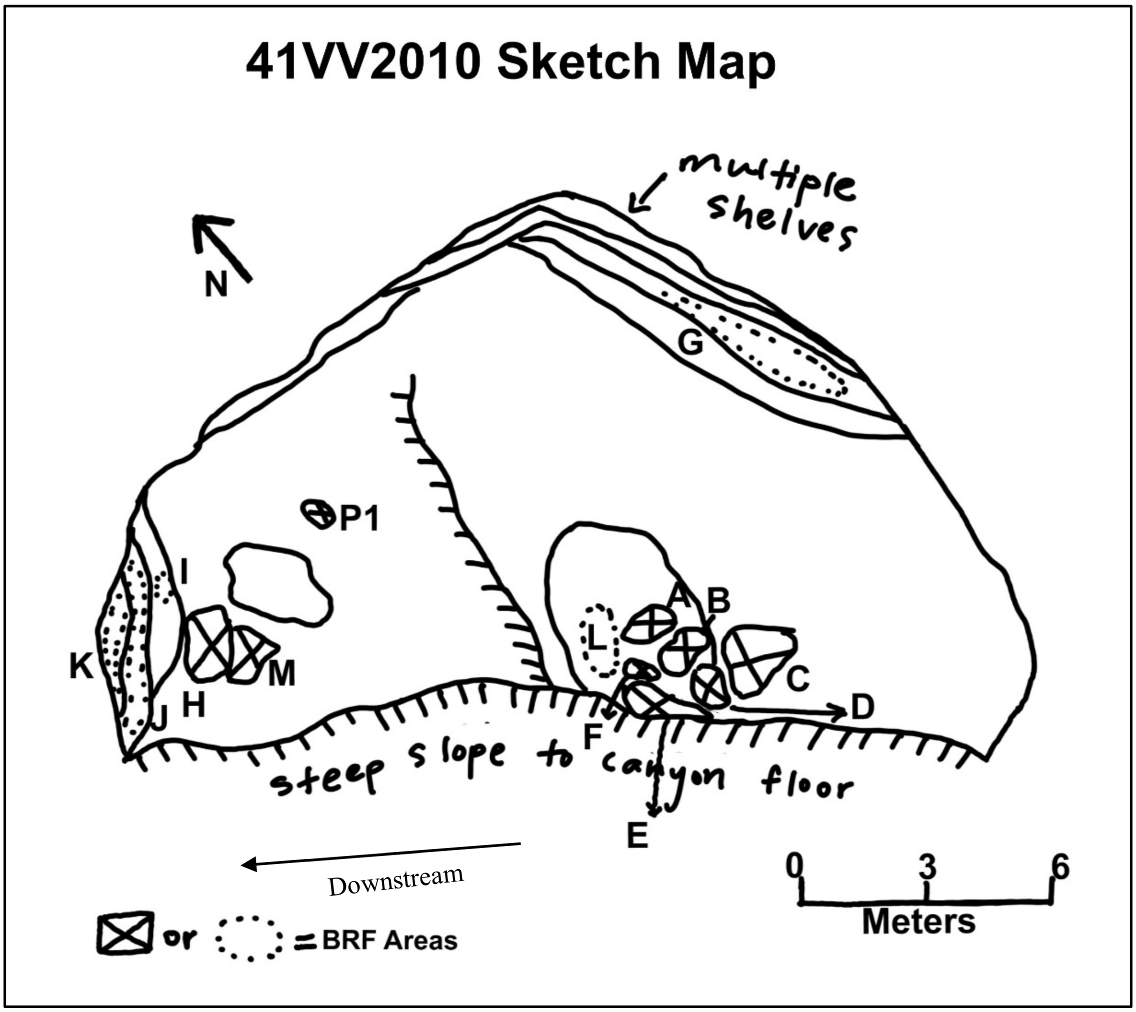


Figure 5.115. Plan view sketch map of Mountain Laurel.

Figure 5.116. Permanent ground stone bedrock feature areas at Mountain Laurel. (a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

Figure 5.117. Permanent ground stone bedrock feature areas at Mountain Laurel. (a) Area F; (b) Area H; (c) Area G; (d) Area I; (e) Area L.

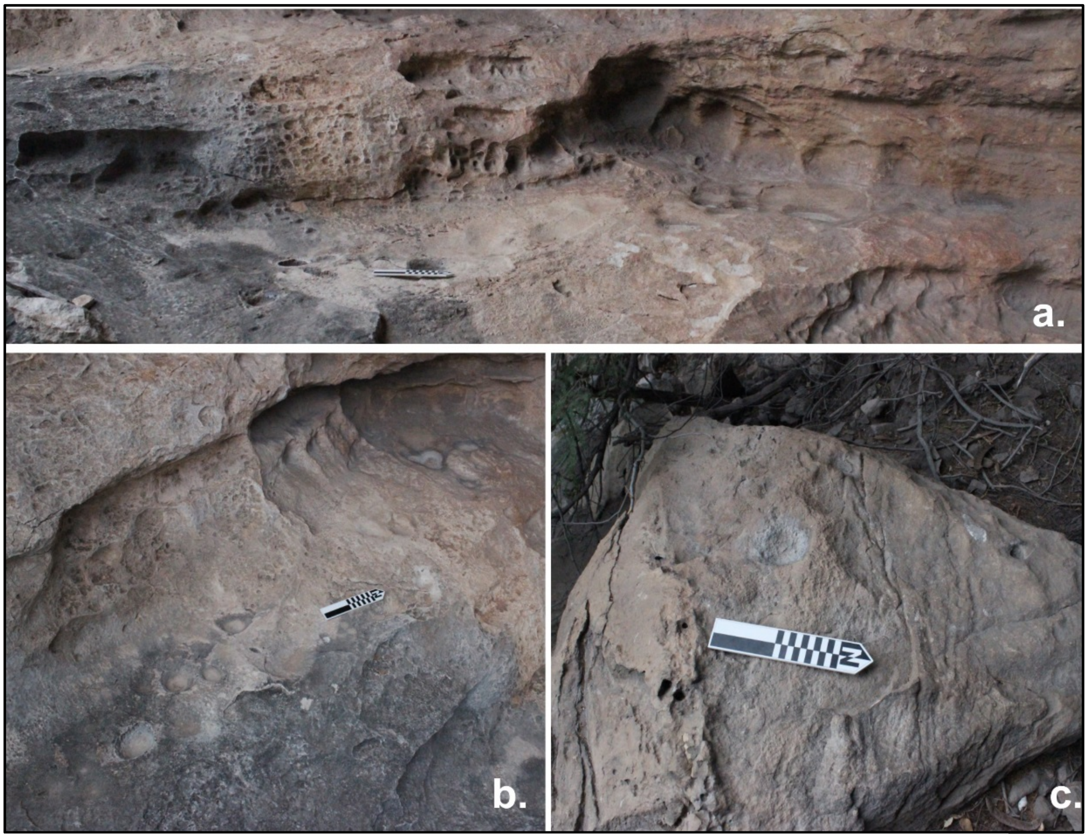


Figure 5.118. Permanent ground stone bedrock feature areas at Mountain Laurel.
(a) Area J; (b) Area K; (c) Area M.

Area A (Figures 5.116a, 5.119, and 5.120) contains two bedrock features on a roof fall boulder located towards the front of the shelter along the dripline. One feature is of intermediate depth (A001) and the other (A002) is shallow. Both features have rounded rims with leveled high points.

Figure 5.119. Mountain Laurel, Area A feature map with ID points.

Figure 5.120. Mountain Laurel, Area A feature map with feature outlines.

Area B (Figures 5.116b, 5.121, and 5.122), another roof fall boulder along the dripline contains just one shallow feature with an ovoid opening This feature has some rounding on the walls and high points leveled on the base.

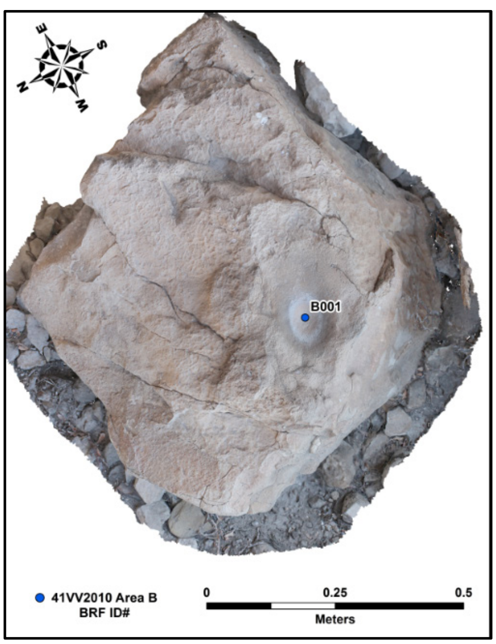


Figure 5.121. Mountain Laurel, Area B feature map with ID points.

Figure 5.121. Mountain Laurel, Area B feature map with feature outlines.

Area C (Figures 5.116c, 5.123, and 5.124) is a large roof fall boulder immediately upstream of Area B. There is only one shallow feature present with a circular opening and a dished profile. The surface was too weathered for any use-wear analysis.

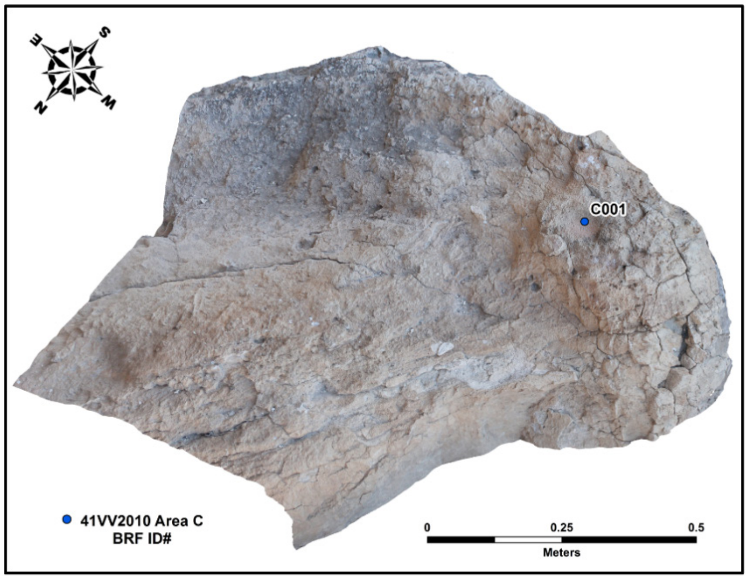


Figure 5.123. Mountain Laurel, Area C feature map with ID points.

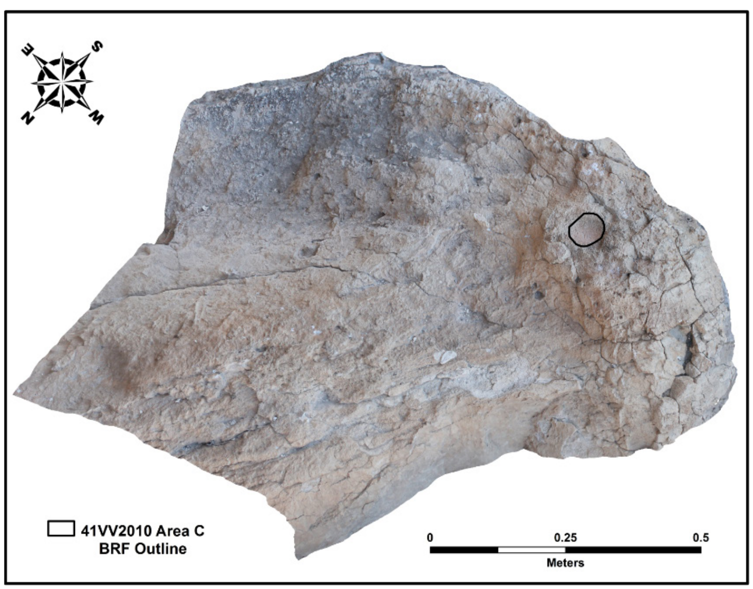


Figure 5.124. Mountain Laurel, Area C feature map with feature outlines.

Area D (Figures 5.116d, 5.125, and 5.126) contains three bedrock features on a large boulder just outside the dripline in the middle of the shelter. All three features have gently sloping walls with a circular opening but one is deeper than the other two. Use-wear observations were not collected on this area due to poor preservation from weathering.

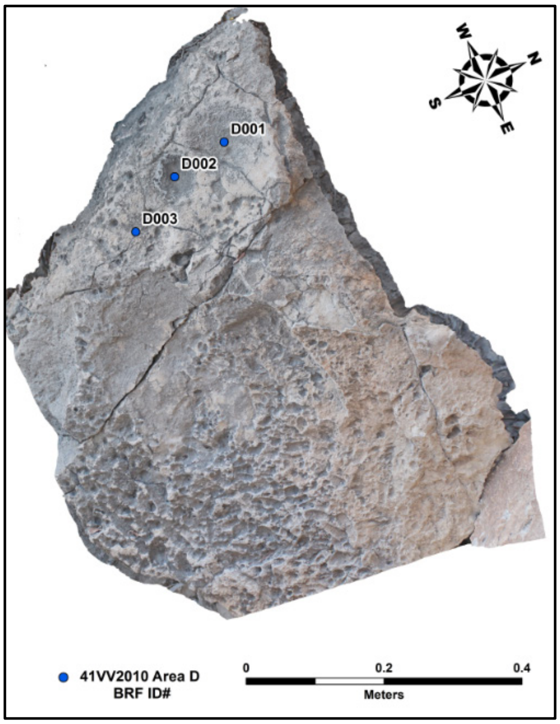


Figure 5.125. Mountain Laurel, Area D feature map with ID points.

Figure 5.126. Mountain Laurel, Area D feature map with feature outlines.

Area E (Figures 5.116e, 5.127, and 5.128) in a large boulder located outside the dripline and on the edge of the drop off to the canyon floor. There are two features on this rock. E001 is of intermediate depth and has an ovoid opening while E002 is a shallow circular feature. This surface was also too weathered to determine any use-wear attributes.

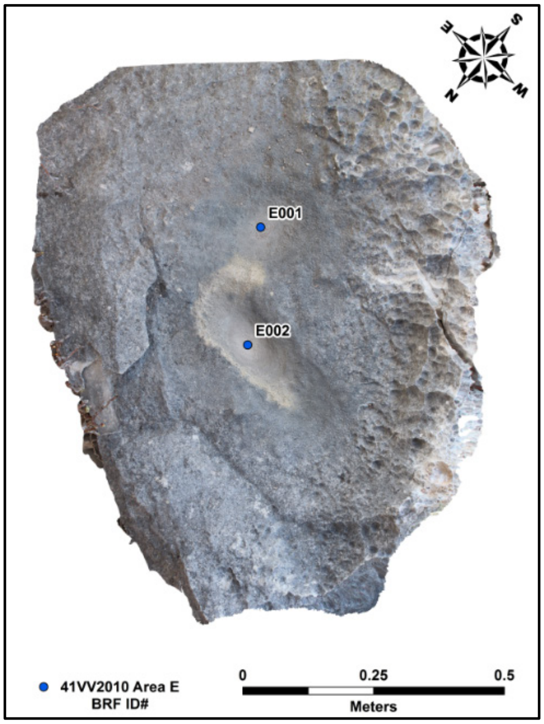


Figure 5.127. Mountain Laurel, Area E feature map with ID points.

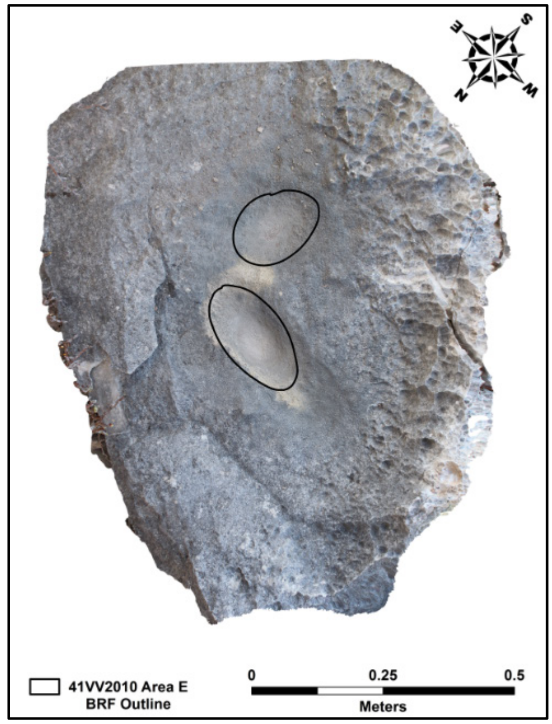


Figure 5.128. Mountain Laurel, Area E feature map with feature outlines.

Area F (Figures 5.117a, 5.129, and 5.130) is the last roof fall boulder in the front of the shelter with bedrock features on it. There are two small BRFs, a shallow circular feature (F001) and a circular pecked area (F002). This boulder is also outside of the dripline and was too weathered to determine any use-wear patterns.

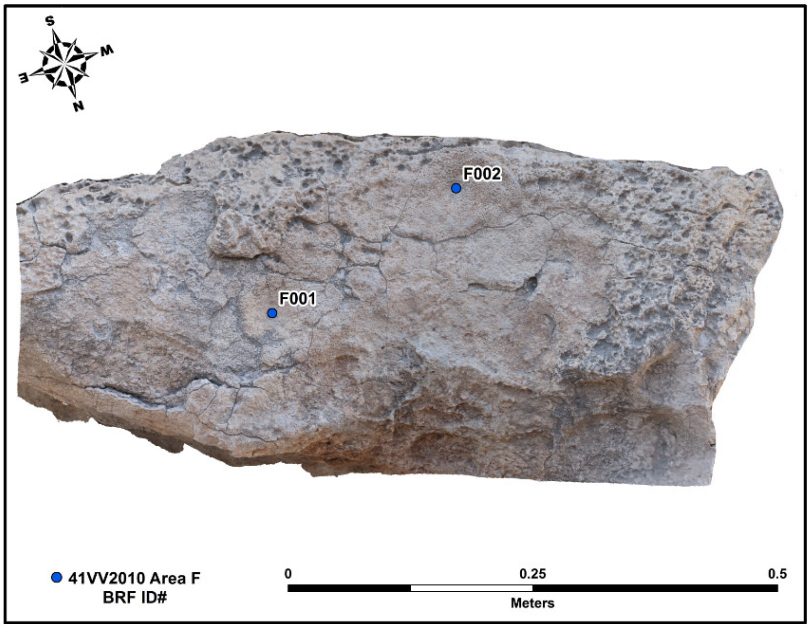


Figure 5.129. Mountain Laurel, Area F feature map with ID points.

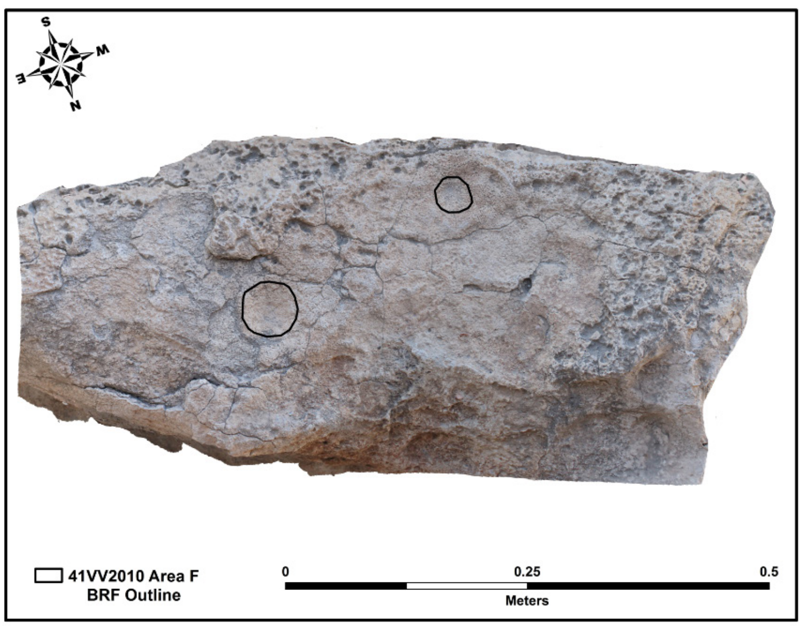


Figure 5.130. Mountain Laurel, Area F feature map with feature outlines.

Area G (Figures 5.117c, 5.131, and 5.132) is located on a narrow, elevated limestone bench at the back of the shelter. There are 26 bedrock features located on this shelf that are mostly shallow but there are few intermediate depth types as well. The majority of the features have rugged surfaces with some high points leveled, although one deeper feature (G018) has mostly leveled surfaces.

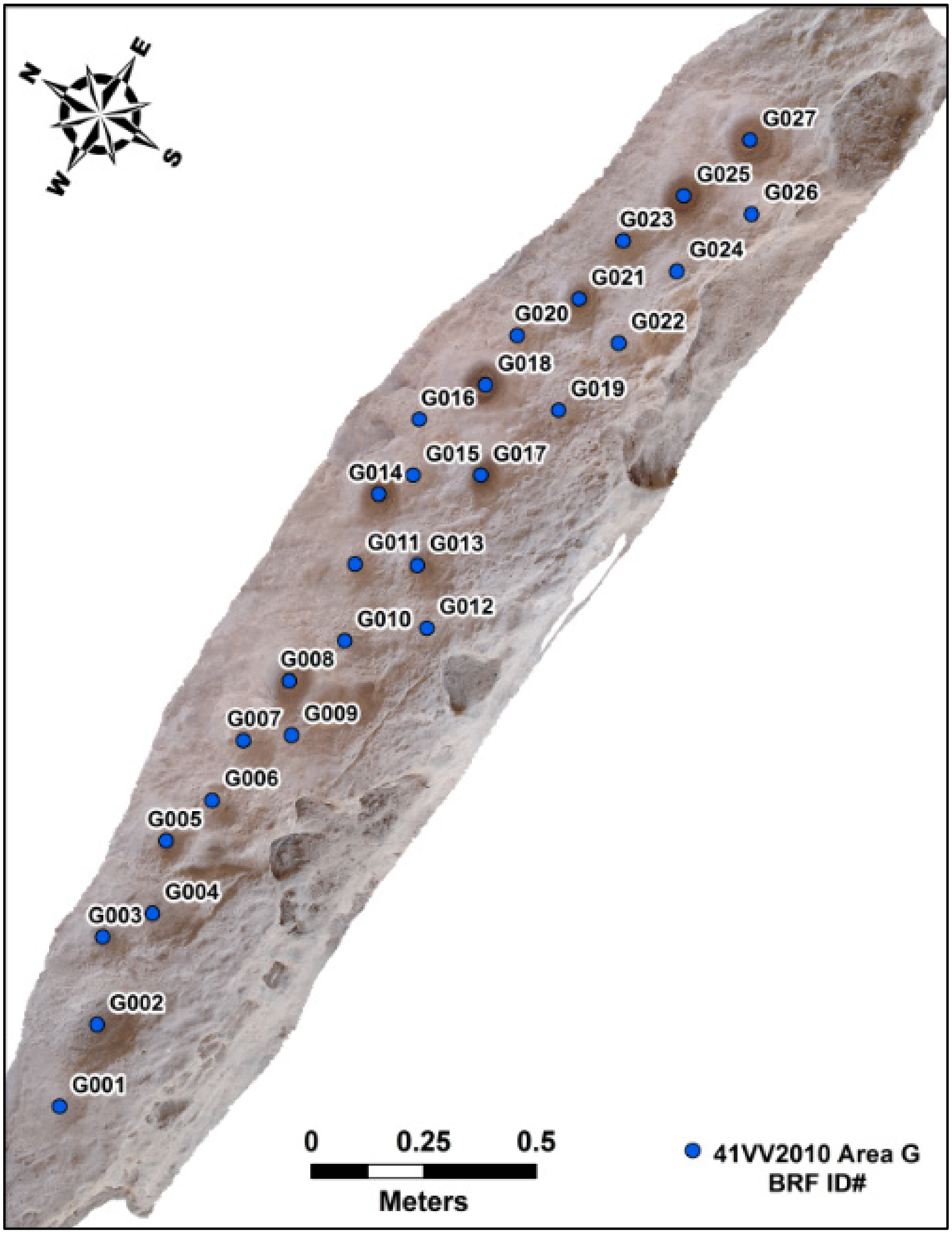


Figure 5.131. Mountain Laurel, Area G feature map with ID points.

Figure 5.132. Mountain Laurel, Area G feature map with feature outlines.

Area H (Figures 5.117b, 5.133, and 5.134) is on a large roof fall boulder resting at the base of a series of limestone benches on the downstream end of the site. There are 13 bedrock features on this rock, the majority of which are an intermediate depth and have circular openings. Use-wear analysis was not conducted on this surface due to heavy weathering and accretions obstructing the limestone.

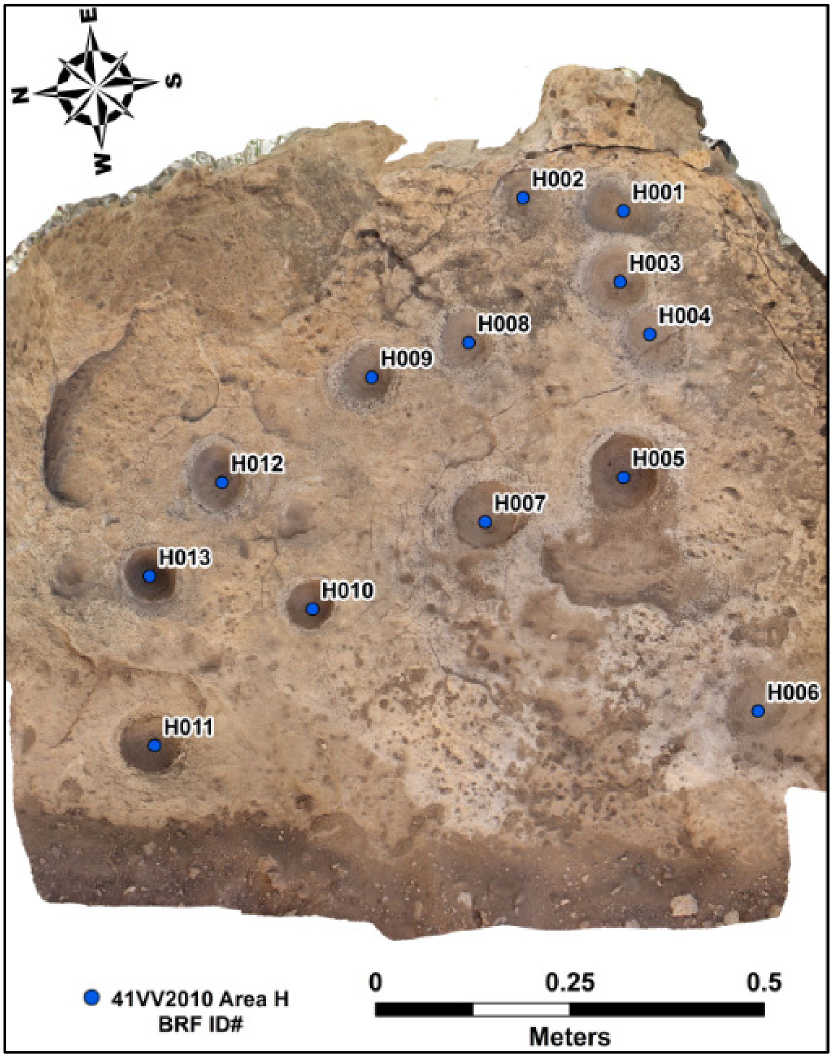


Figure 5.133. Mountain Laurel, Area H feature map with ID points.

Figure 5.134. Mountain Laurel, Area H feature map with feature outlines.

Area I (Figures 5.117d, 5.135, and 5.136) is a small area on the lowest downstream limestone bench. There is only one feature here that is shallow with an ovoid opening and is mostly leveled with some remnant peck marks.

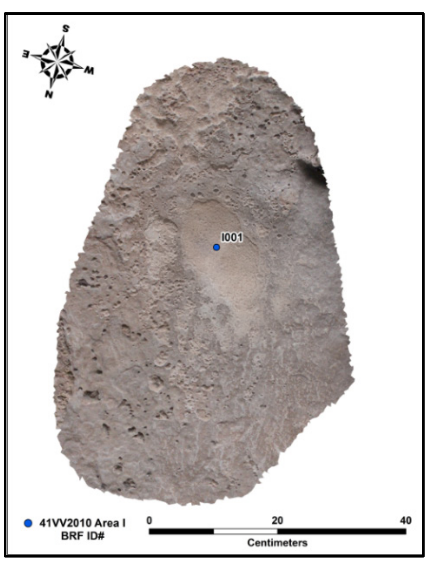


Figure 5.135. Mountain Laurel, Area I feature map with ID points.

Figure 5.136. Mountain Laurel, Area I feature map with feature outlines.

Area J (Figures 5.118a, 5.137, and 5.138) is located above Area I on an elevated limestone bench. There are 17 bedrock features present on this bench that range in depth from shallow to deep mortars. The profiles include dished, conical, and flat morphologies. Many of the features are too weathered for use-wear observations. In the features where the surface is intact, it ranges from rugged with leveled and rounded high points to completely leveled areas.

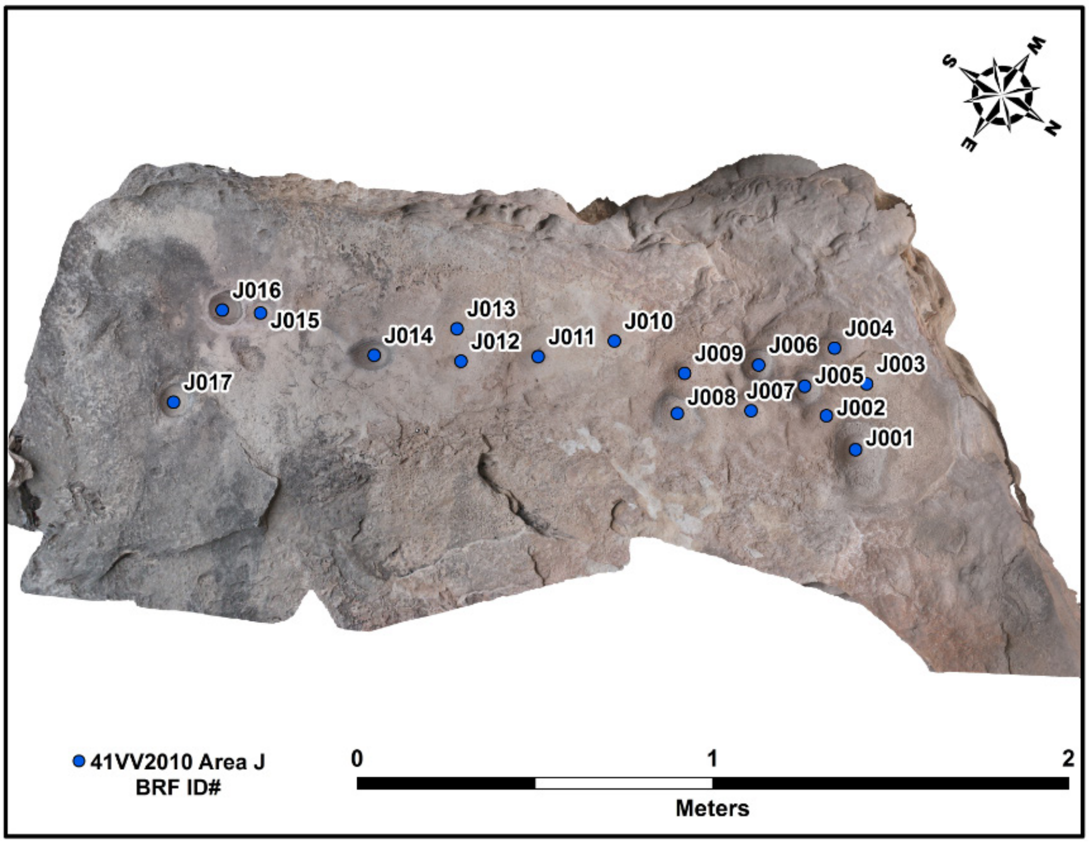


Figure 5.137. Mountain Laurel, Area J feature map with ID points.

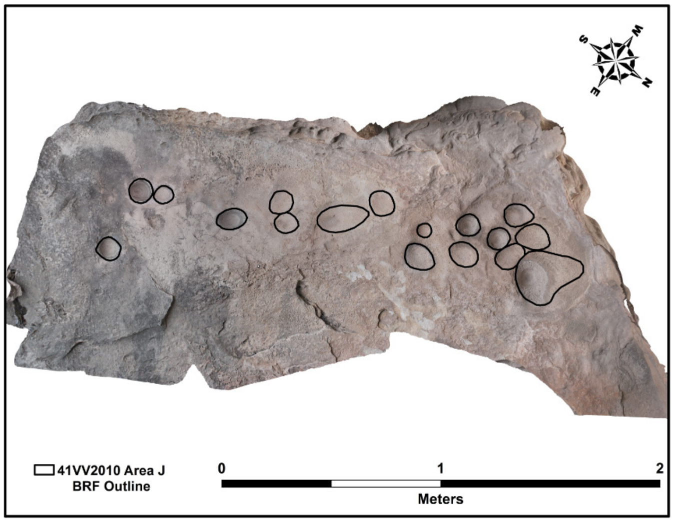


Figure 5.138. Mountain Laurel, Area J feature map with feature outlines.

Area K (Figures 5.118b, 5.139, and 5.140) is located on the limestone bench directly above Area J and also contains 17 bedrock features. The majority of the features are shallow but a few intermediate depths are present. Most of the features' surfaces are obscured by weathering but the use-wear that is visible ranges from rugged surfaces with some leveled areas to completely leveled surfaces across the feature.

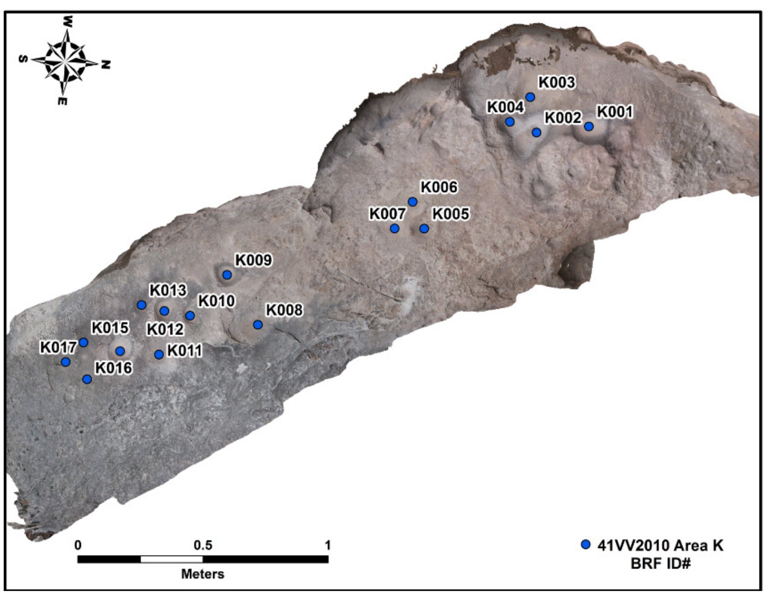


Figure 5.139. Mountain Laurel, Area K feature map with ID points.

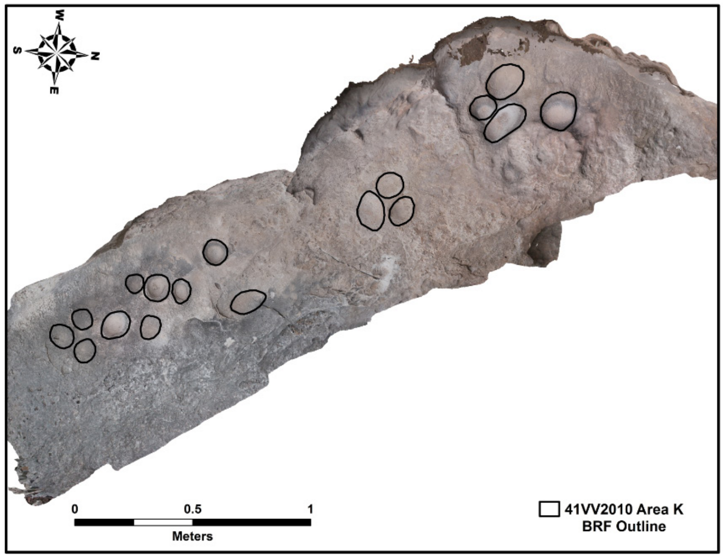


Figure 5.140. Mountain Laurel, Area K feature map with feature outlines.

Area L (Figures 5.117e, 5.141, and 5.142) is a small section on the bedrock in the middle of the rockshelter. There is only one feature in this area that is shallow with an ovoid opening. The use-wear attributes for this feature include leveling and rounding of high points.

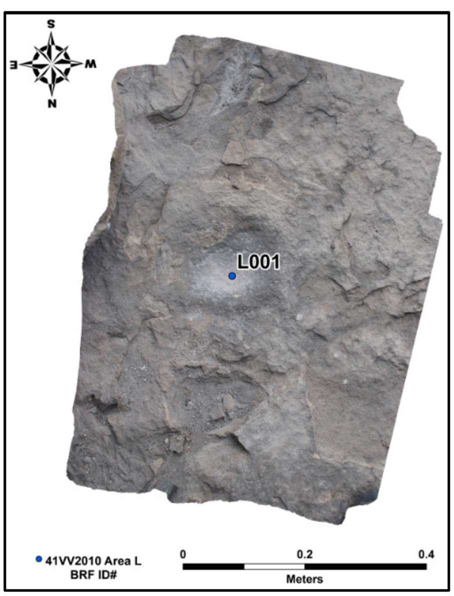


Figure 5.141. Mountain Laurel, Area L feature map with ID points.

Figure 5.142. Mountain Laurel, Area L feature map with feature outlines.

Area M (Figures 5.118c, 5.143, and 5.144) is located on a boulder near the edge of the talus slope on the downstream end of the site. There is one feature of intermediate depth in this area with a circular opening and a conical profile. Use-wear attributes were not collected due to significant weathering of the rock surface.

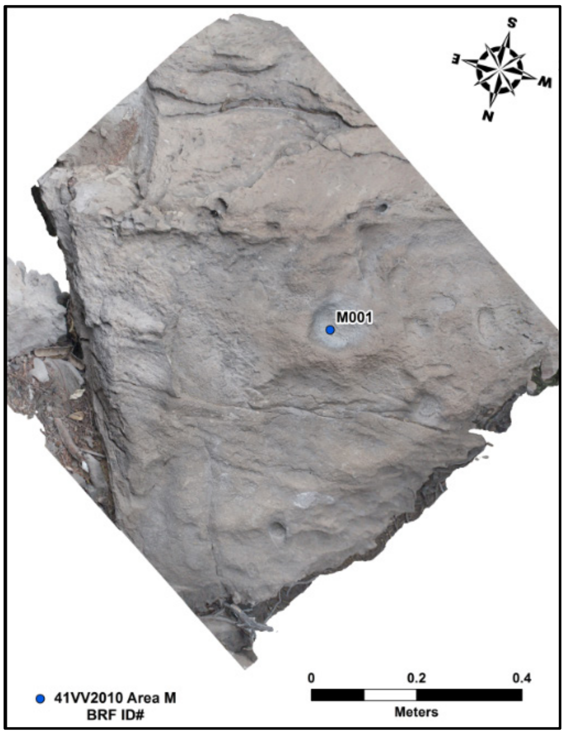


Figure 5.143. Mountain Laurel, Area M feature map with ID points.

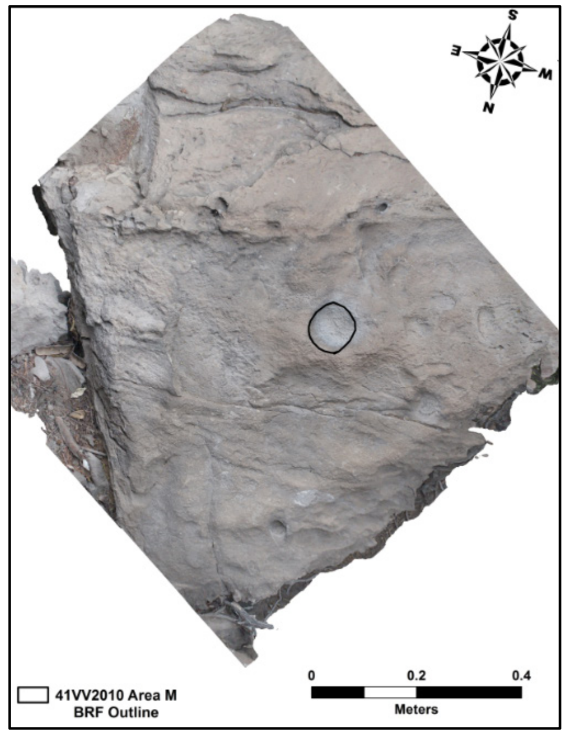


Figure 5.144. Mountain Laurel, Area M feature map with feature outlines.

P1 (Figures 5.145 and 5.146) is a small portable limestone slab with one shallow bedrock feature on the surface. The opening is ovoid and the profile has gently sloping walls. The use-wear attributes include an almost completely leveled surface with some remnant peck marks and light striations along the long axis.

Figure 5.145. Mountain Laurel, P1 feature map with ID points.

Figure 5.146. Mountain Laurel, P1 feature map with feature outlines.

41VV124 – White Shaman

White Shaman (Figure 5.147) is a rockshelter in a small tributary to the Pecos River near its confluence with the Rio Grande. The site is well-known for the extremely vibrant and well-preserved Pecos River Style mural present and tours visit every Saturday for the majority of the year. Often overlooked are a burned rock talus below the site and numerous ground stone bedrock features. There are a total of 54 bedrock features spread across five permanent areas within the shelter (Figure 5.148). These areas will be summarized below while the attribute data, use-wear characteristics, and metric data are presented in Table App B.15 and Table App B.16, respectively.

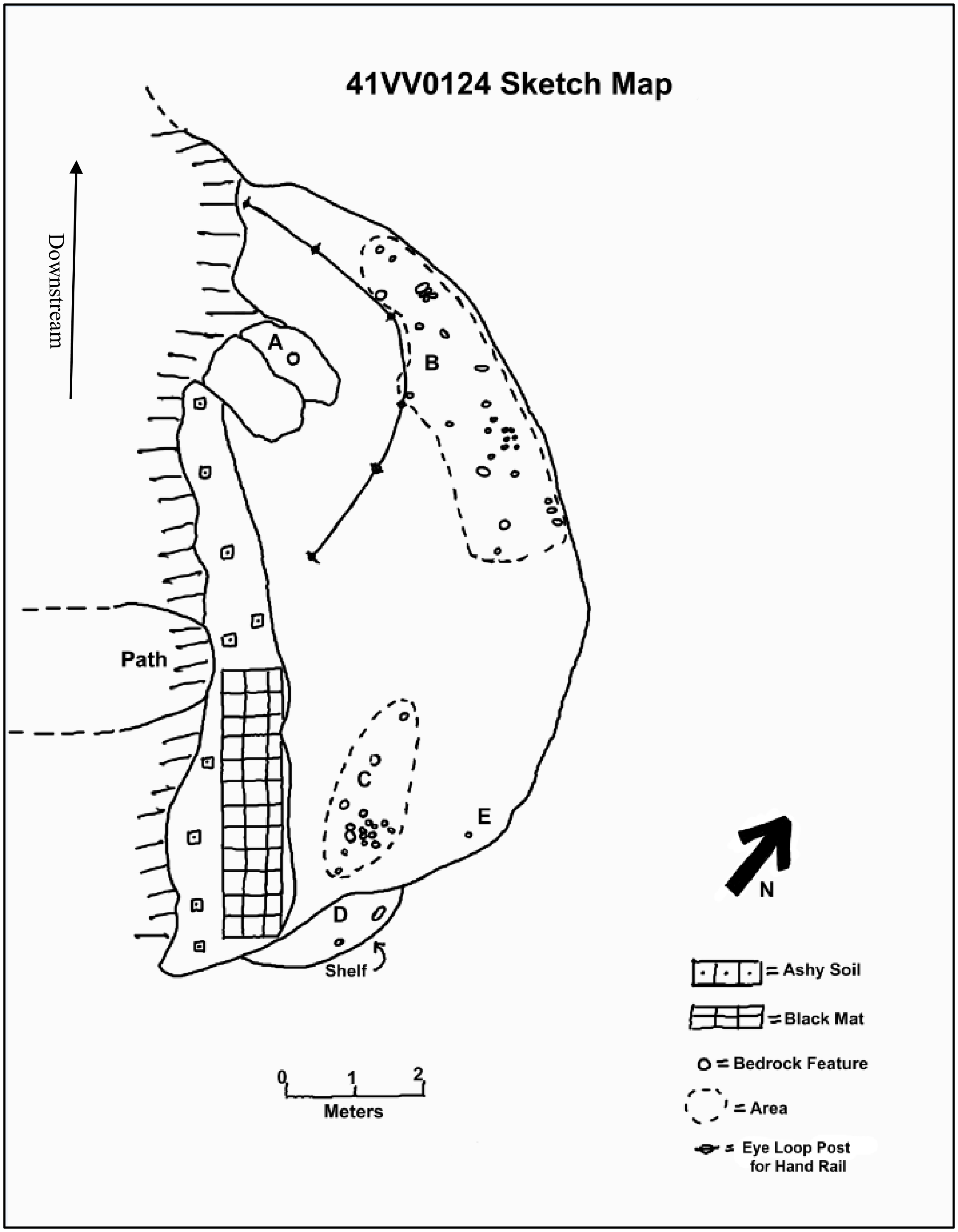


Figure 5.147. Plan view sketch map of White Shaman. Map by Spencer Lodge.

Figure 5.148. Permanent ground stone bedrock feature areas at White Shaman.
(a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

Area A (Figures 5.148a, 5.149, and 5.150) is a large boulder located outside of the dripline on the northwest end of the site. This boulder has at least four bedrock features, three of which are currently on the underside of the rock. The most notable feature is the large BRF (A001) that extends all the way through the boulder. However, the now-visible surface is actually the underside of the original feature. At some point, the boulder was flipped and the other small features were hidden. The three shallow features are adjacent to A001 and some even share a rim with it. Although difficult to get a good look, the use-wear on the shallow features is rugged with some leveling and rounding. The deep feature has walls that are extremely smooth to the touch with only remnant pecks and some small rounded bumps. Also of note, there appears to be a design of black pigment on the wall of A001, although it is difficult to tell what the image might be (Figure 5.151).

Figure 5.149. White Shaman, Area A feature map with ID points.

Figure 5.150. White Shaman, Area A feature map with feature outlines.

Figure 5.151. Black pigment within the shaft of the deep feature in Area A.

Area B is (Figures 5.148b, 5.152, and 5.153) located on the upper bedrock floor of the shelter towards the back wall. There are 30 bedrock features here that range from very shallow to very deep. The features appear to be fairly spread out across the area but there are a few clusters of multiple together or situated in a linear pattern. In regards to the use-wear patterns, most features are relatively rugged with some leveling of high points or rounding of bumps. There are a few features (B013 and B025) that have leveled surfaces smooth to the touch.

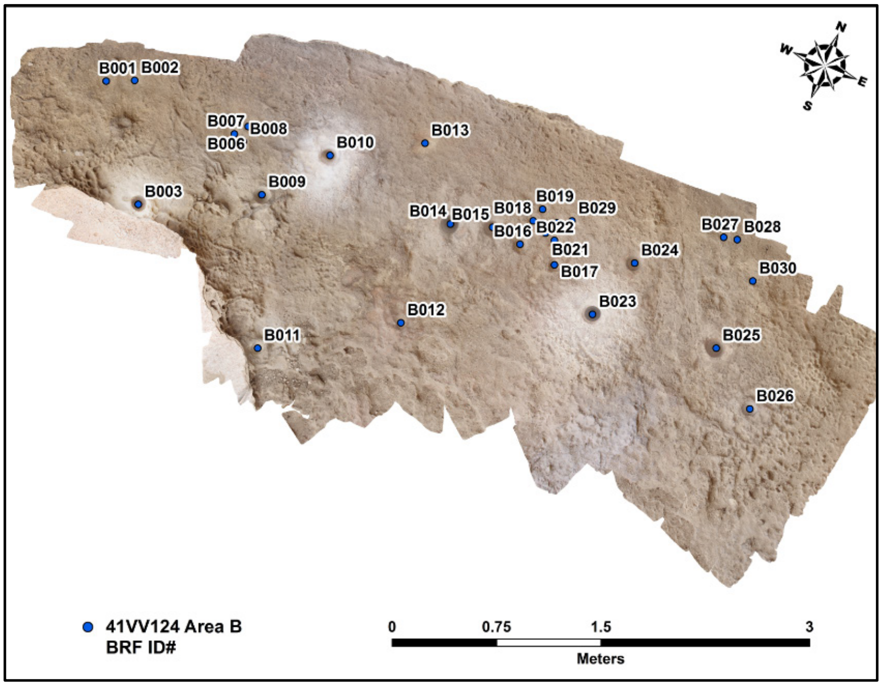


Figure 5.152. White Shaman, Area B feature map with ID points. White areas on map from using lighting to illuminate deep features.

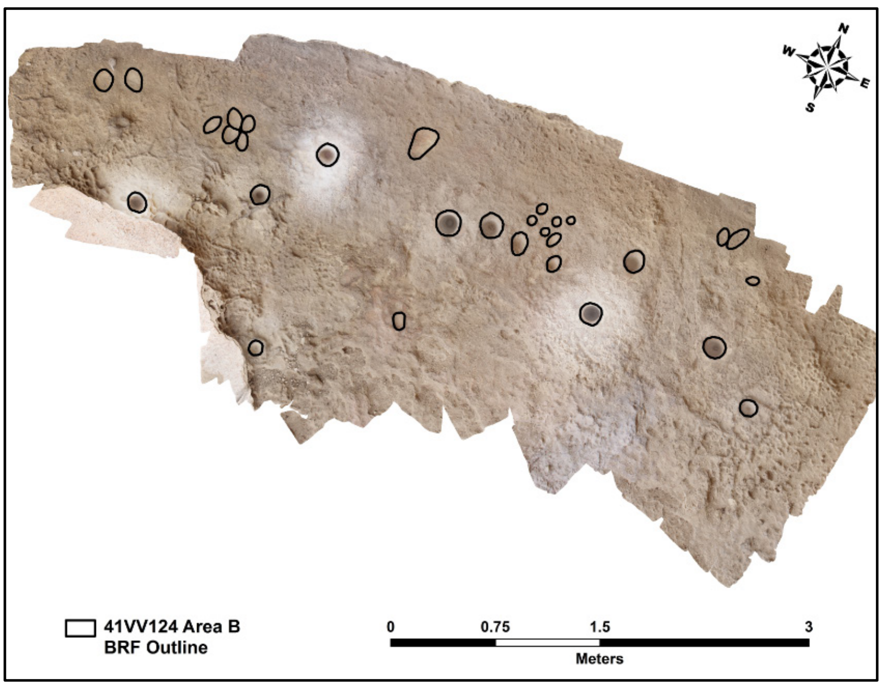


Figure 5.153. White Shaman, Area B feature map with feature outlines. White areas on map from using lighting to illuminate deep features.

Area C (Figures 5.148c, 5.154, and 5.155) is located on the limestone floor northwest of the rock art panel. There are 17 bedrock features in this area with a variety of depths, including shallow, intermediate, and deep features. Some of the features have rugged surfaces with high points leveled and rounded but many others have completely leveled and smooth surfaces.

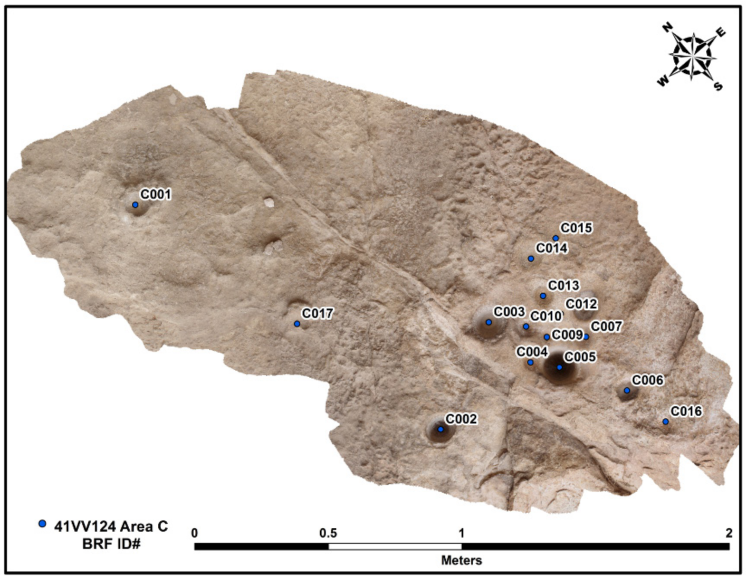


Figure 5.154. White Shaman, Area C feature map with ID points.

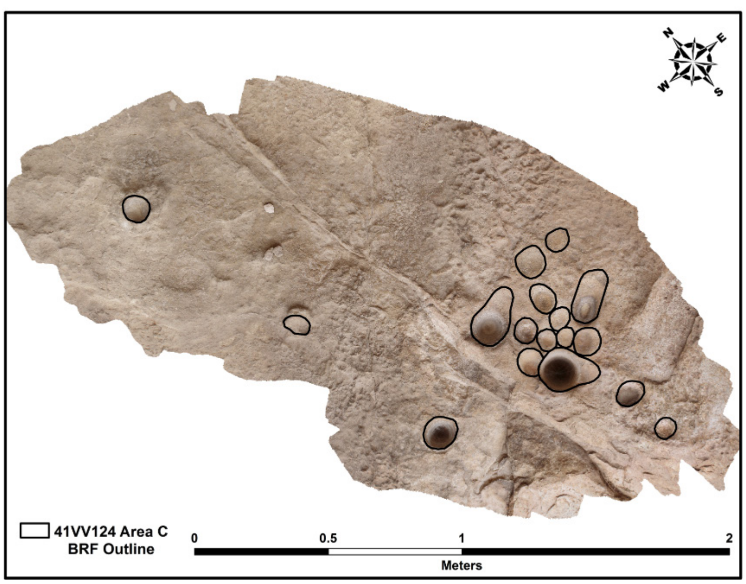


Figure 5.155. White Shaman, Area C feature map with feature outlines.

Area D (Figures 5.148d, 5.156, and 5.157) contains two features that are located on a limestone shelf immediately in front of and below the main rock art panel. Both features are shallow and the sloped surface is extremely slick.

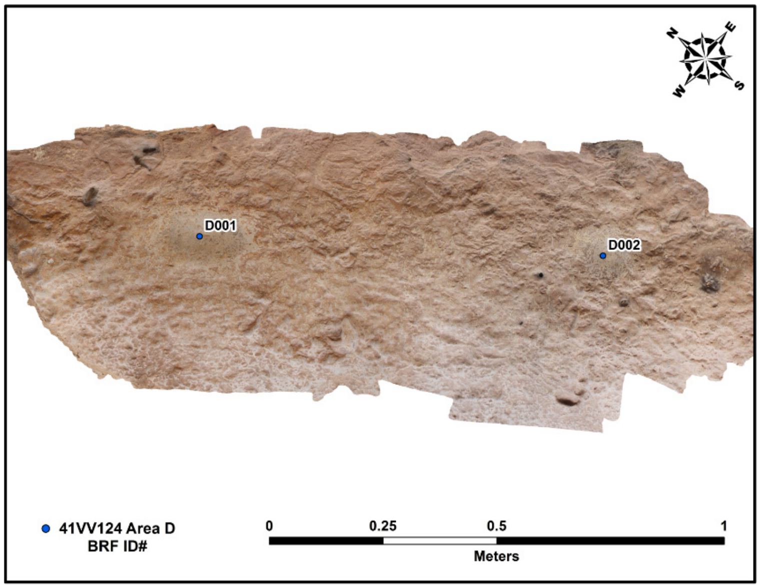


Figure 5.156. White Shaman, Area D feature map with ID points.

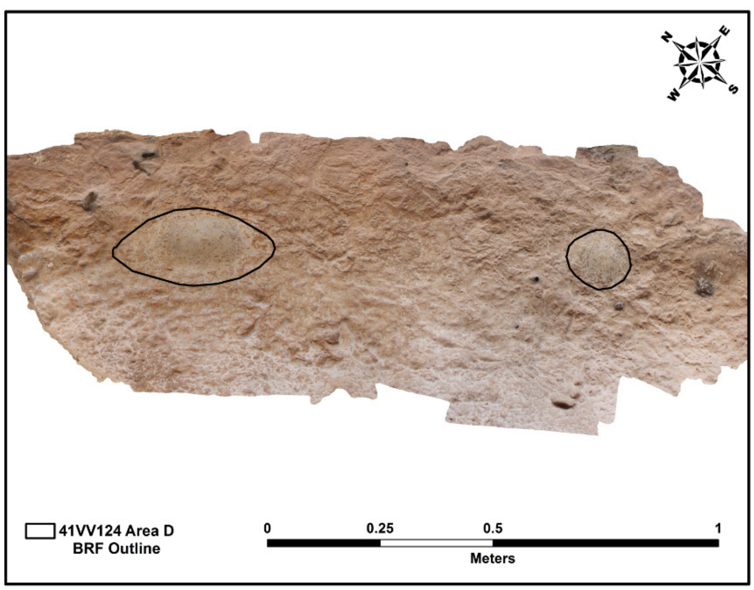


Figure 5.157. White Shaman, Area D feature map with feature outlines.

Area E (Figures 5.158) consists of one intermediate depth feature that is near the back wall on the southeast end of the site. The feature had originally gone unnoticed because it blended in with the natural weathering holes surrounding the area. This area was not mapped with Structure from Motion Photogrammetry.

Figure 5.158. White Shaman, Area E.

Sites within the Devils River Drainage

The final two sites recorded in the present study are located within Dead Man's Creek (DMC), a large tributary to the Devils River (Figure 5.159).

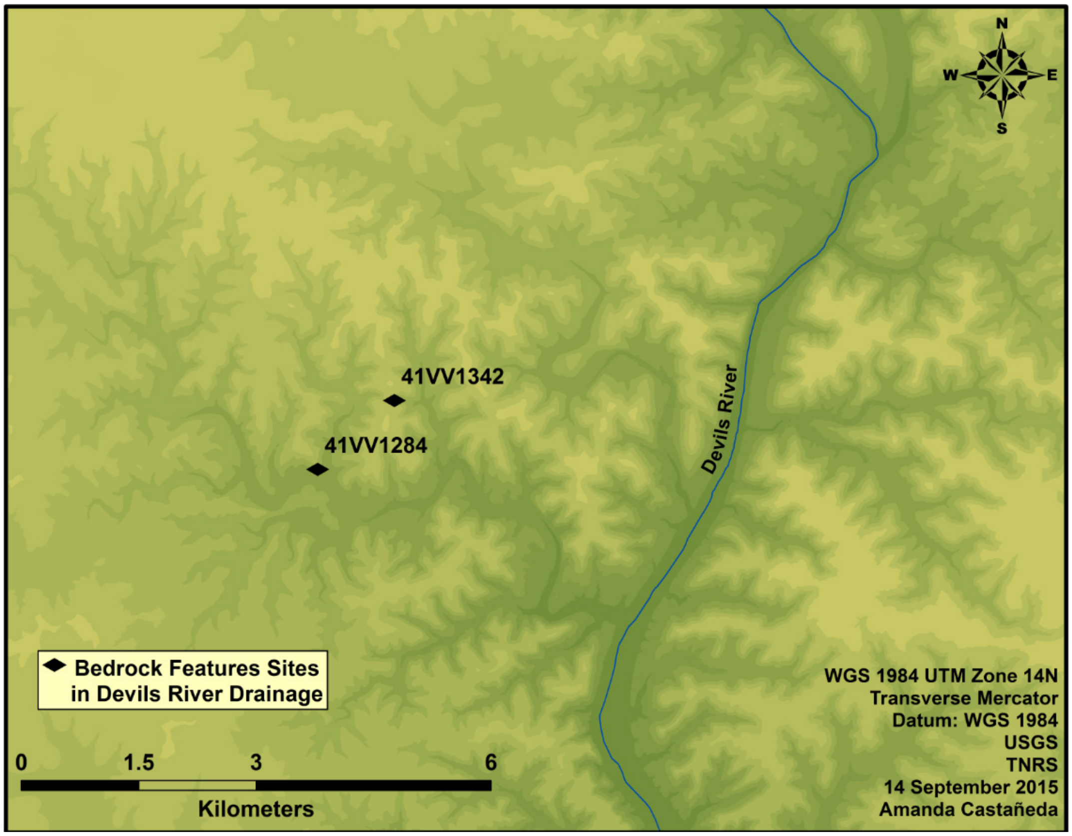


Figure 5.159. Sites recorded within the Devils River drainage system.

41VV1284 – Running Deer

Running Deer (Figure 5.160) is a rockshelter situated high at the top of a ridge of two intersecting drainages. The shelter appears to have decent preservation, as evidenced by the large and intricate Pecos River Style mural on the back wall, but perhaps the most impressive part of the site is the huge burned rock talus extending downslope from the shelter. No excavations have taken place at this site, although it was recorded on survey by Koenig (2012) and the pictographs have been documented by Shumla Archaeological Research and Education Center. There are 23 bedrock features spread across eight permanent areas (Figures 5.161 and 5.162). These areas will be summarized below while the attribute data, use-wear characteristics, and metric data are presented in Table App B.17 and Table App B.18, respectively.

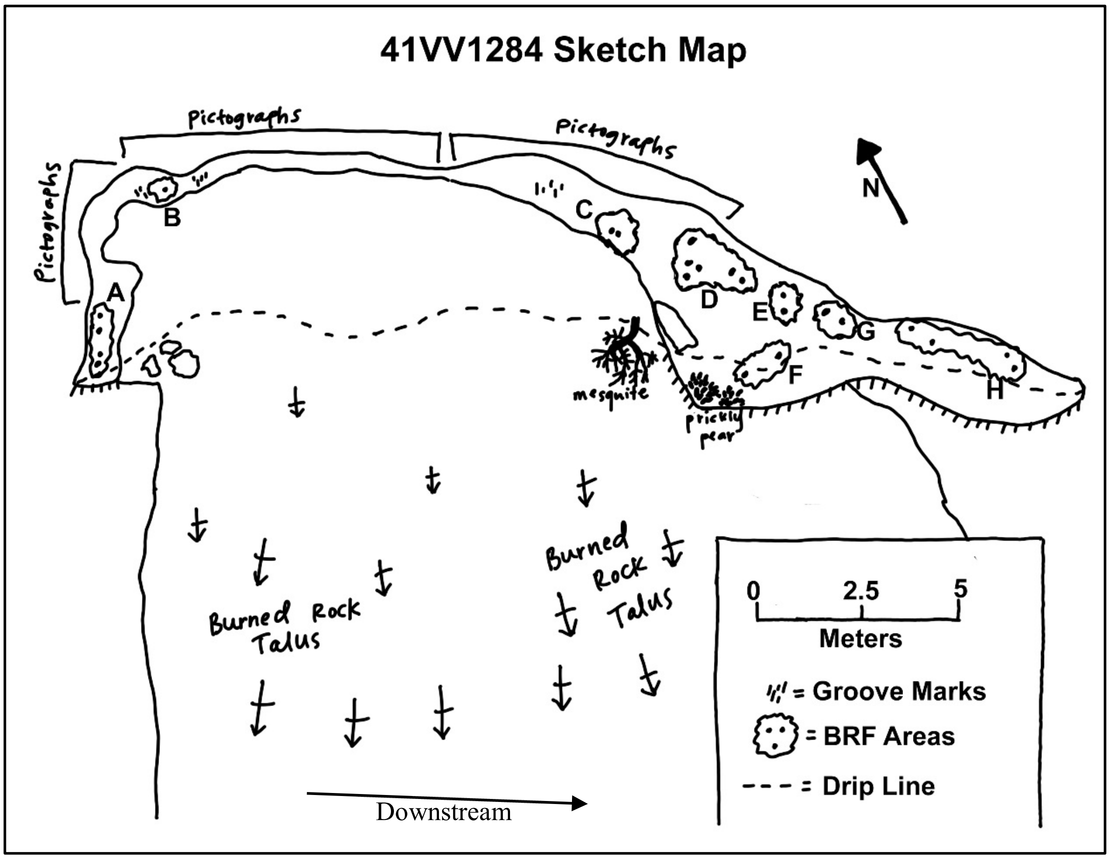


Figure 5.160. Plan view sketch map of Running Deer.

Figure 5.161. Permanent ground stone bedrock feature areas at Running Deer.
(a) Area A; (b) Area B; (c) Area C; (d) Area D.

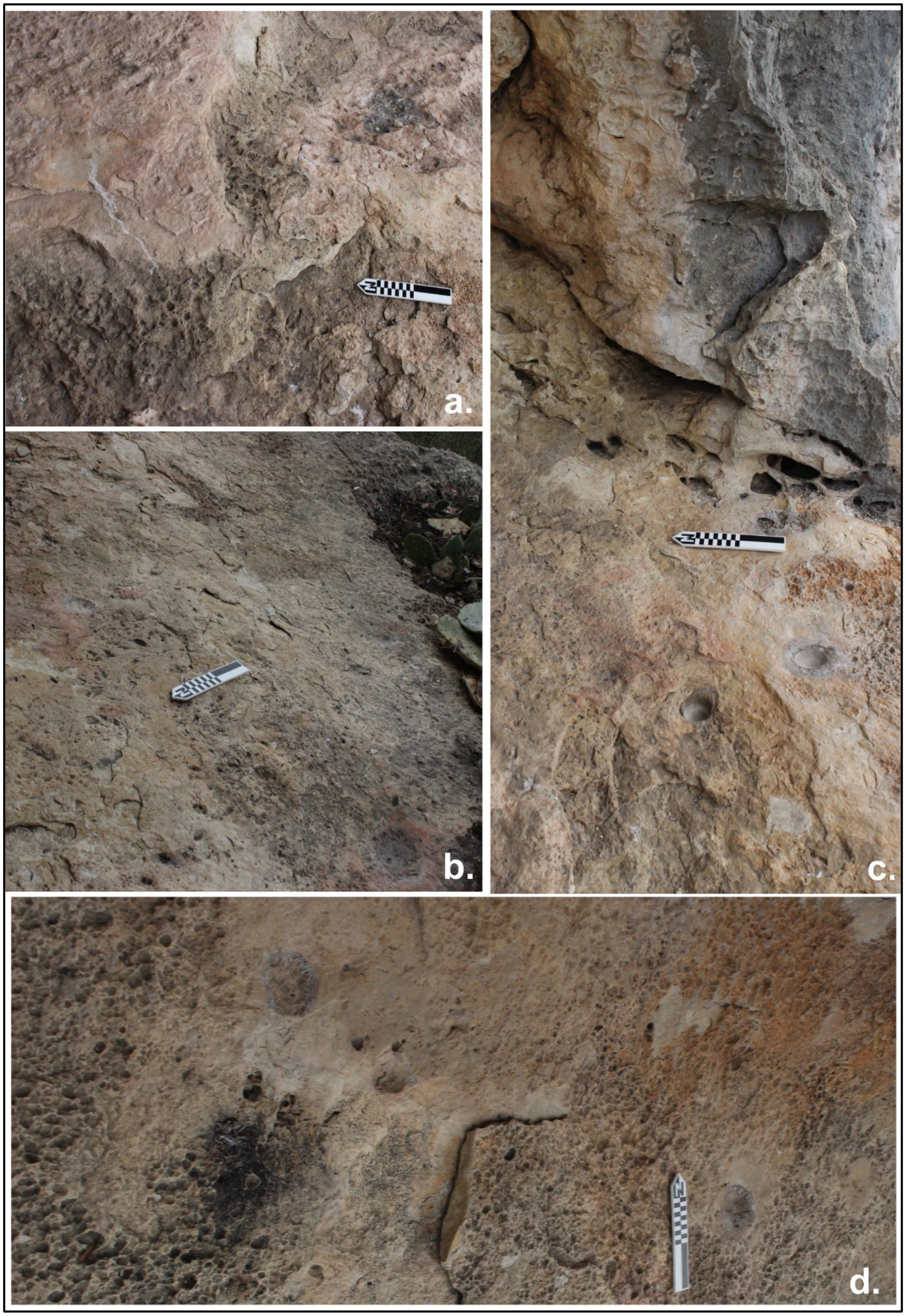


Figure 5.162. Permanent ground stone bedrock feature areas at Running Deer.
(a) Area E; (b) Area F; (c) Area G; (d) Area H.

Area A (Figures 5.161a, 5.163, and 5.164) is located on bedrock at the furthest western end of the site. There are only four features in this area but they are varied in depth with two shallow features, one of intermediate depth, and one deep mortar. This area is right along the dripline so it is fairly weathered and rainwater collects in the deeper features. Consequently, some of the use-wear is obscured by accretions or pitting but other areas show extensive leveling and rounding of bumps.

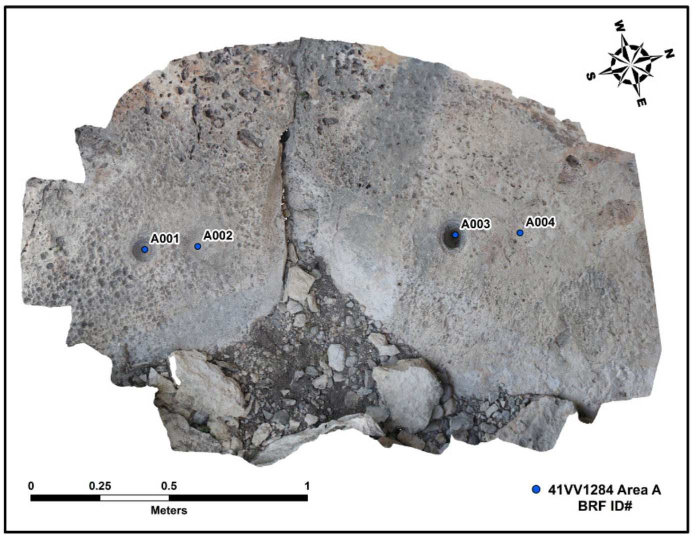


Figure 5.163. Running Deer, Area A feature map with ID points.

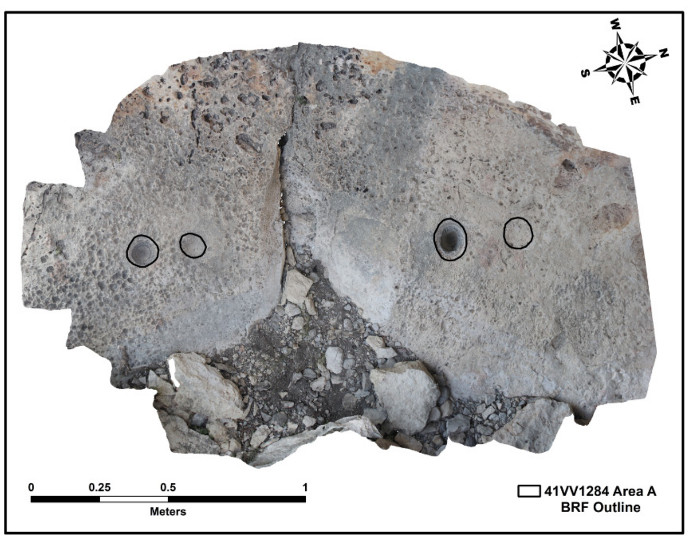


Figure 5.164. Running Deer, Area A feature map with feature outlines.

Area B (Figures 5.161b, 5.165, and 5.166) is located on the shelter wall in a natural indentation of the wall. There is only one shallow feature with an ovoid opening situated on a gentle incline. The use-wear patterns observed include rugged surfaces with rounding of the high points.

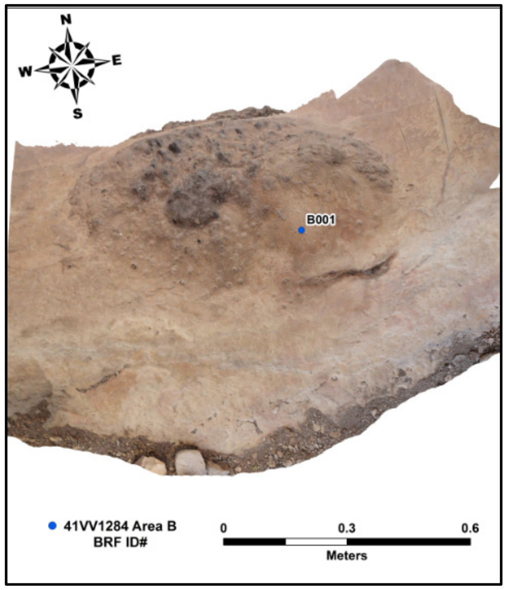


Figure 5.165. Running Deer, Area B feature map with ID points.

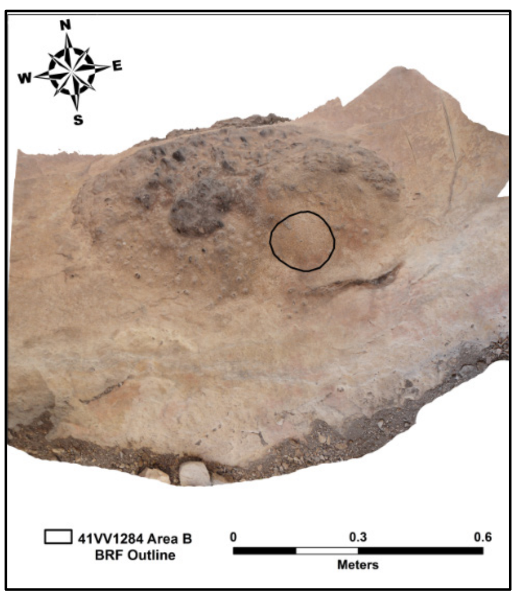


Figure 5.166. Running Deer, Area B feature map with feature outlines.

Area C (Figures 5.161c, 5.167, and 5.168) contains two intermediate type features on a horizontal bedrock surface in front of some pictographs. These features are both relatively rugged with only some leveling of high points.

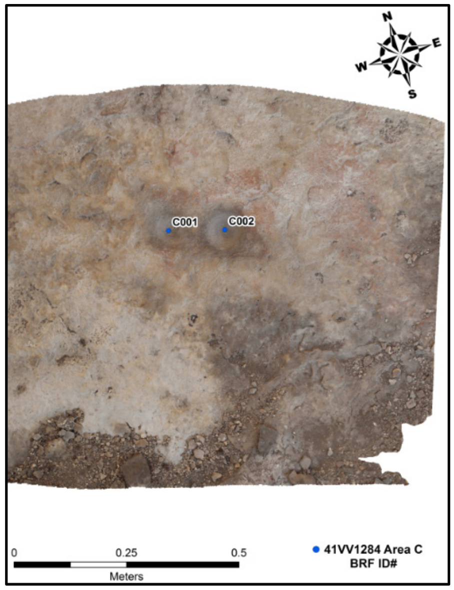


Figure 5.167. Running Deer, Area C feature map with ID points.

Figure 5.168. Running Deer, Area C feature map with feature outlines.

Area D (Figures 5.161d, 5.169, and 5.170) is located on horizontal bedrock in front of the easternmost pictographs in the shelter. There are six bedrock features in this area that are a mix of shallow and intermediate depths. The use-wear attributes range from rugged with some leveling to completely leveled areas and rounded bumps.

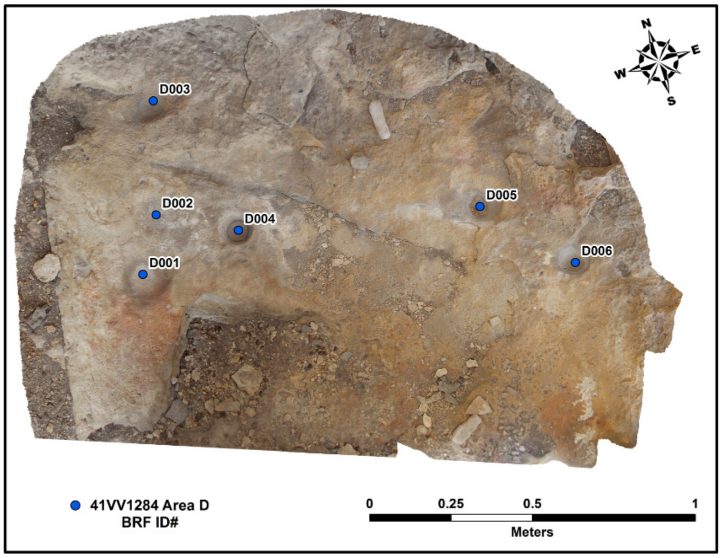


Figure 5.169. Running Deer, Area D feature map with ID points.

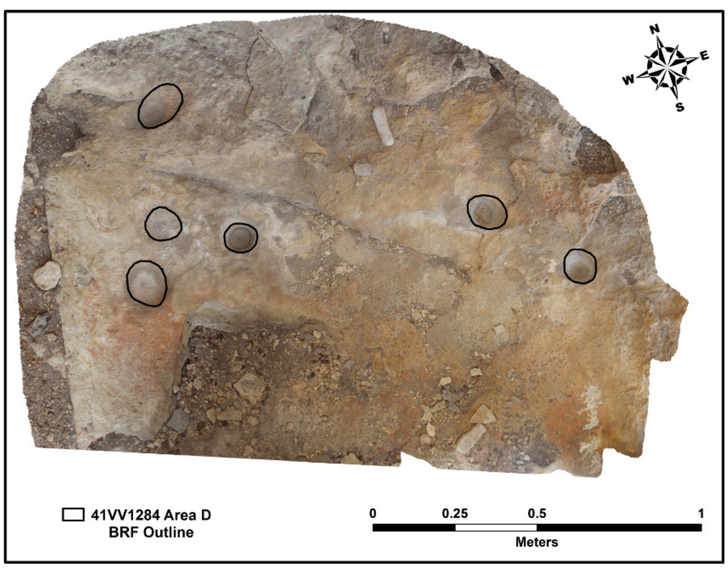


Figure 5.170. Running Deer, Area D feature map with feature outlines.

Area E (Figures 5.162a, 5.171, and 5.172) is located on a gently sloping limestone bedrock surface on the eastern edge of the site. There are two flat bedrock features in this area that are completely leveled and smooth to the touch. These features are very ephemeral but they stand out due to the rough nature of the surrounding rock.

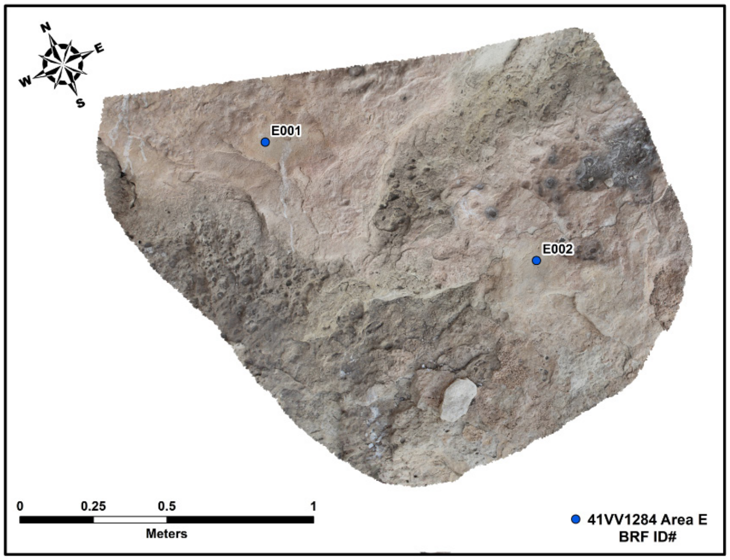


Figure 5.171. Running Deer, Area E feature map with ID points.

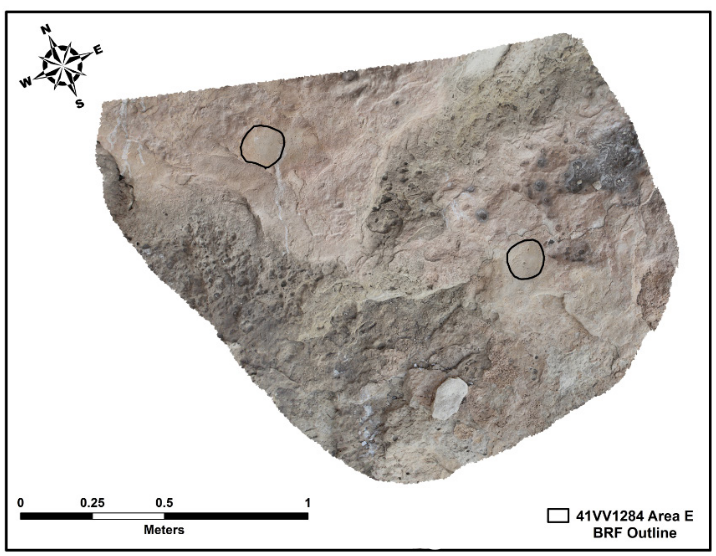


Figure 5.172. Running Deer, Area E feature map with feature outlines.

Area F (Figures 5.162b, 5.173, and 5.174) contains two shallow features with ovoid openings located on bedrock near the dripline. These features are very ephemeral and weathered due to rain water. However, the base of F001 does appear to be intact and has a fairly leveled and rounded surface.

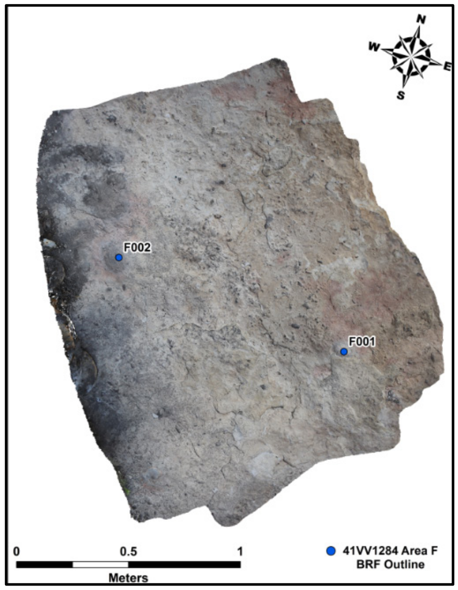


Figure 5.173. Running Deer, Area F feature map with ID points.

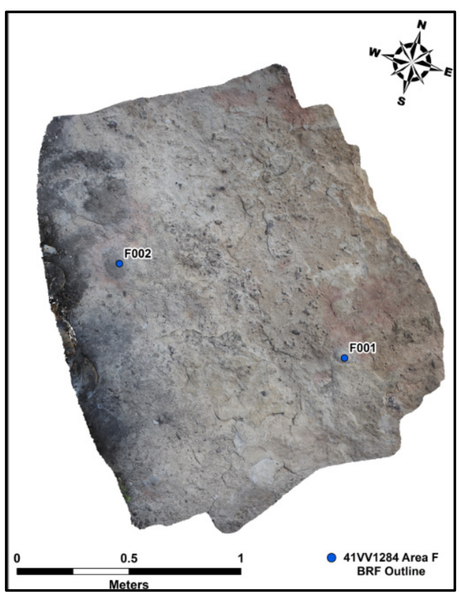


Figure 5.174. Running Deer, Area F feature map with feature outlines.

Area G (Figures 5.162c, 5.175, and 5.176) contains two features on bedrock just inside of the dripline on the eastern end of the site. G001 is of intermediate depth and has thick accretions covering the rims and upper walls. The lower walls are preserved and are completely leveled and smooth. G002 is shallow and the preserved areas are mostly leveled.

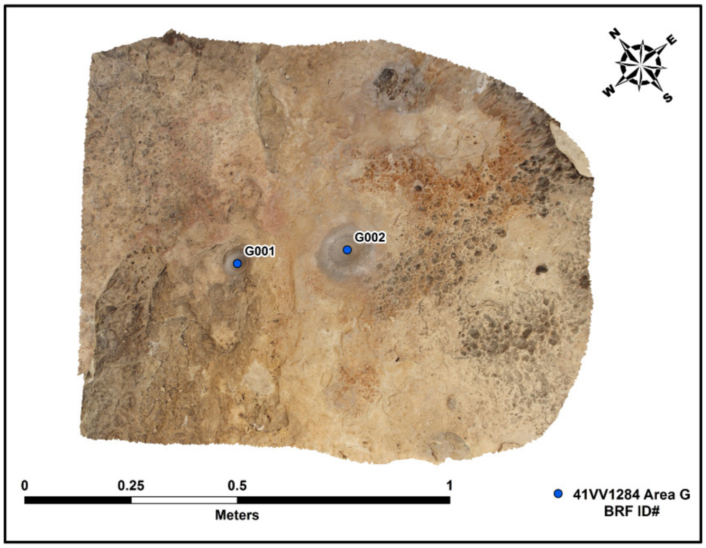


Figure 5.175. Running Deer, Area G feature map with ID points.

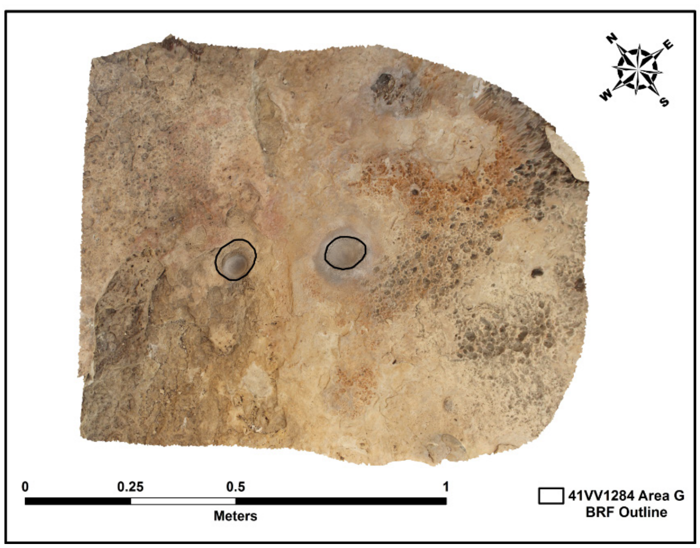


Figure 5.176. Running Deer, Area G feature map with feature outlines.

Area H (Figures 5.162d, 5.177, and 5.178) is the easternmost bedrock feature area at Running Deer and is situated near a steep drop off. This area is not protected by the shelter roof and is extremely weathered. There are four convincing bedrock features, all of which are shallow in nature. In the areas that are not weathered, the features have mostly leveled walls with somewhat rugged bases.

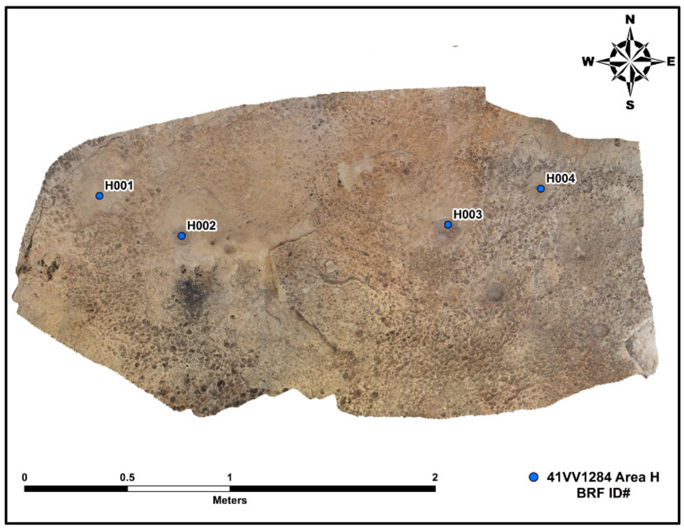


Figure 5.177. Running Deer, Area H feature map with ID points.

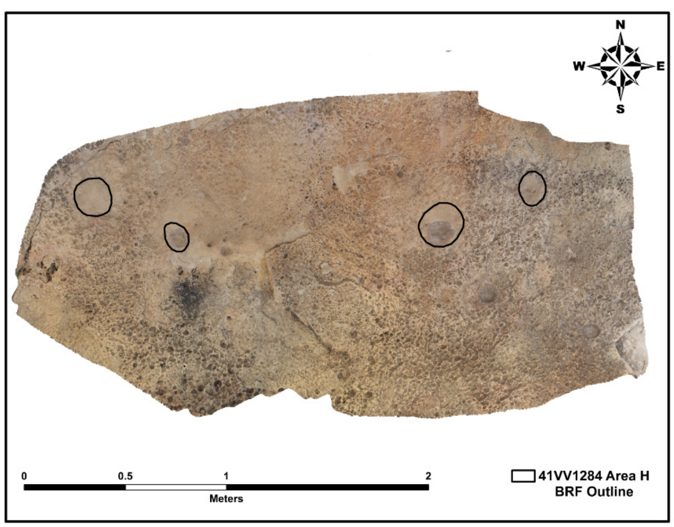


Figure 5.178. Running Deer, Area H feature map with feature outlines.

41VV1342 – Ryes 'N Sons Retreat

Ryes 'N Sons Retreat (Figure 5.179) is a large rockshelter located in the Dead Man's Creek tributary to the Devils River. The site contains large amounts of lithics scattered across the floor, a small amount of burned rock, and a small faded panel of pictographs on the rear wall above some cemented gravels. There are thick calcium carbonate stains over the rock art and above the cemented gravels so it is likely a spring vent once flowed from the back wall. In addition, there are 45 bedrock features spread across seven permanent areas (Figures 5.180 and 5.181) and two moveable slabs. These areas will be summarized below while the attribute data, use-wear characteristics, and metric data are presented in Table App B.19 and Table App B.20, respectively.

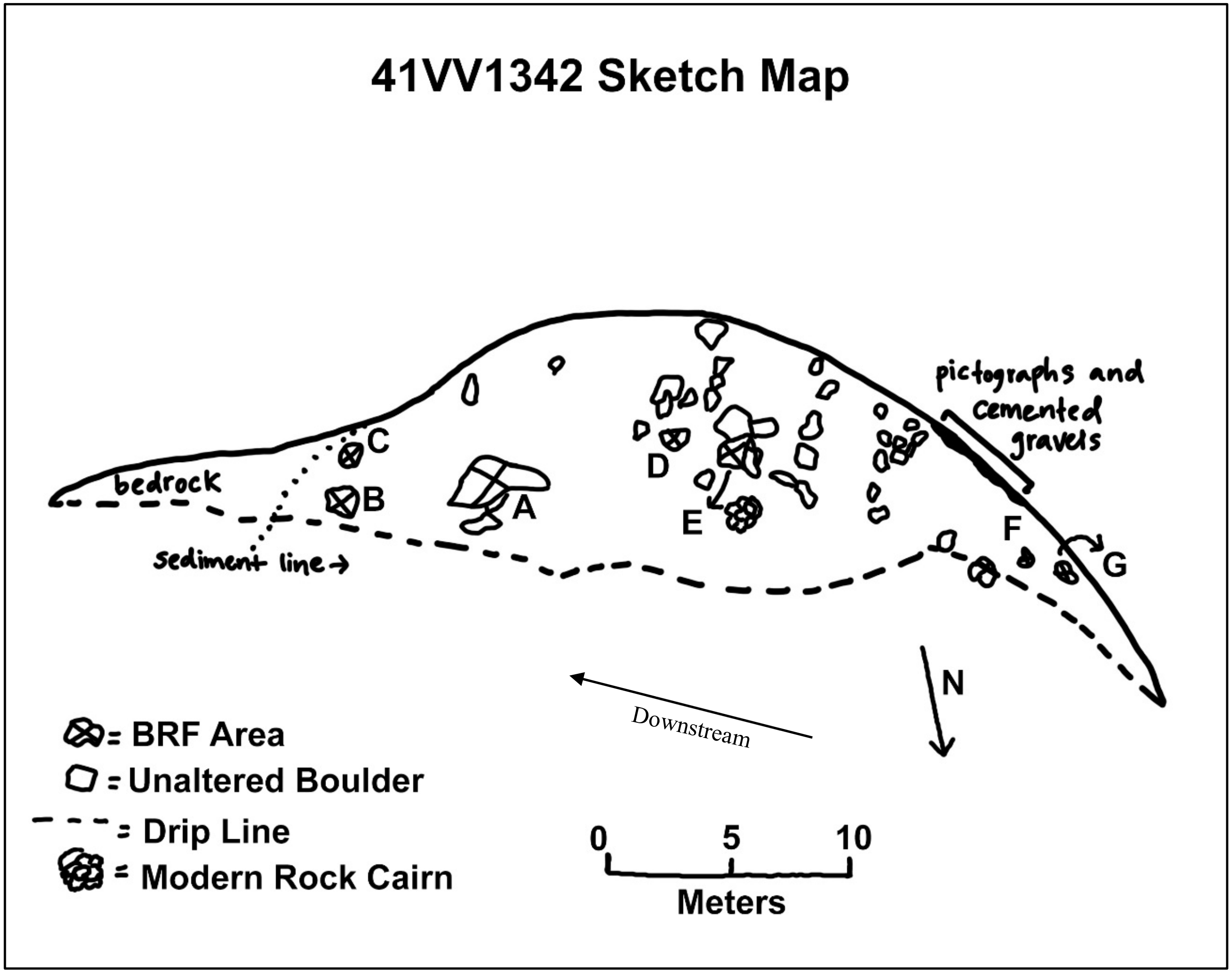


Figure 5.179. Plan view sketch map of Ryes ‘N Sons Retreat.

Figure 5.180. Permanent ground stone bedrock feature areas at Ryes ‘N Sons Retreat.
(a) Area A; (b) Area B; (c) Area C; (d) Area D; (e) Area E.

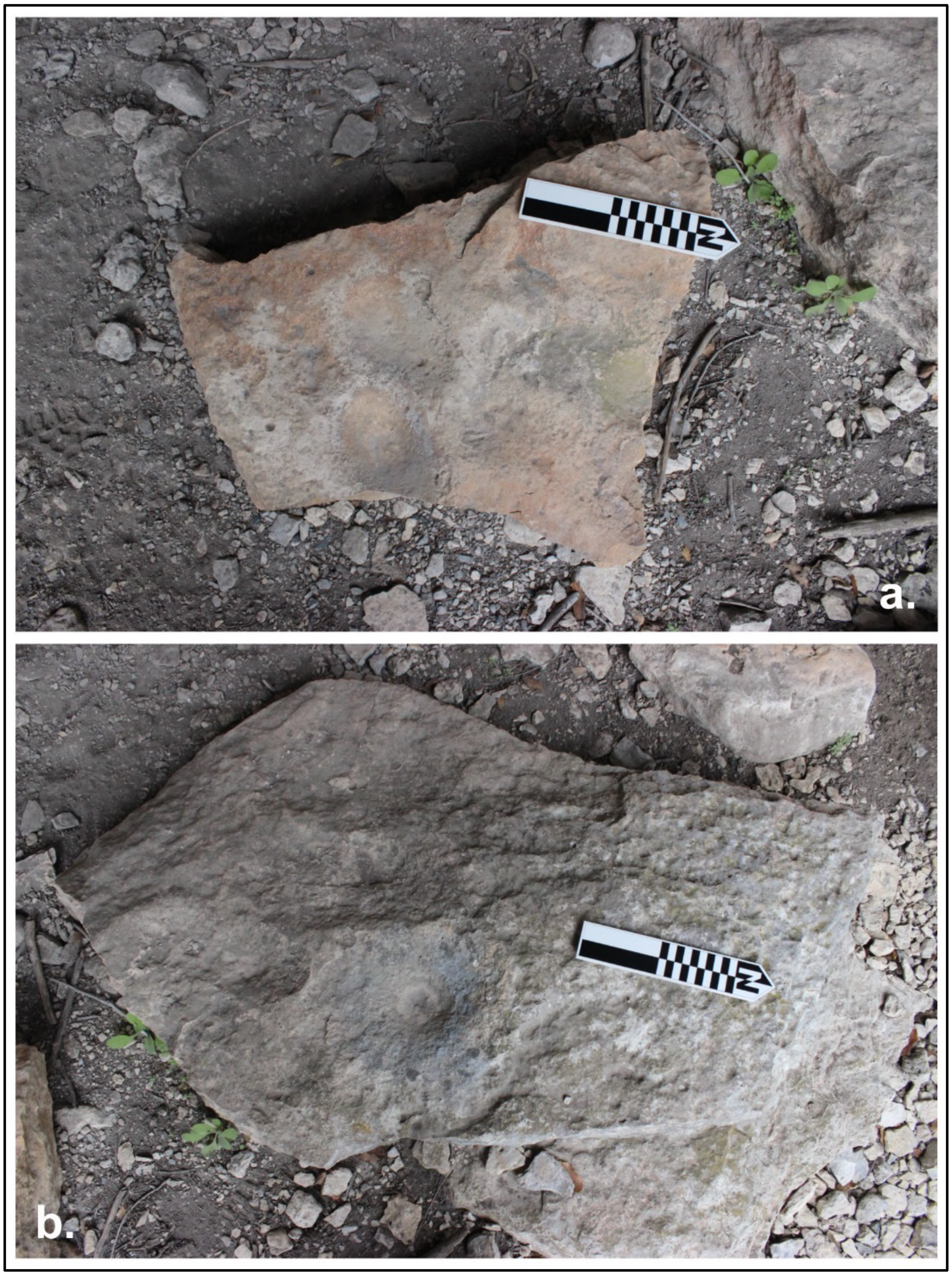


Figure 5.181. Permanent ground stone bedrock feature areas at Ryes 'N Sons Retreat. (a) Area F; (b) Area G.

Area A (Figures 5.180a, 5.182, and 5.183) is on a large boulder in the eastern part of the shelter. There are 16 bedrock features in this area that range from flat slicks to intermediate depth features. Many of these features are set on an incline on a side of the boulder. The use-wear attributes include some features that are pecked and have leveled or rounded points to some features that are mostly leveled.

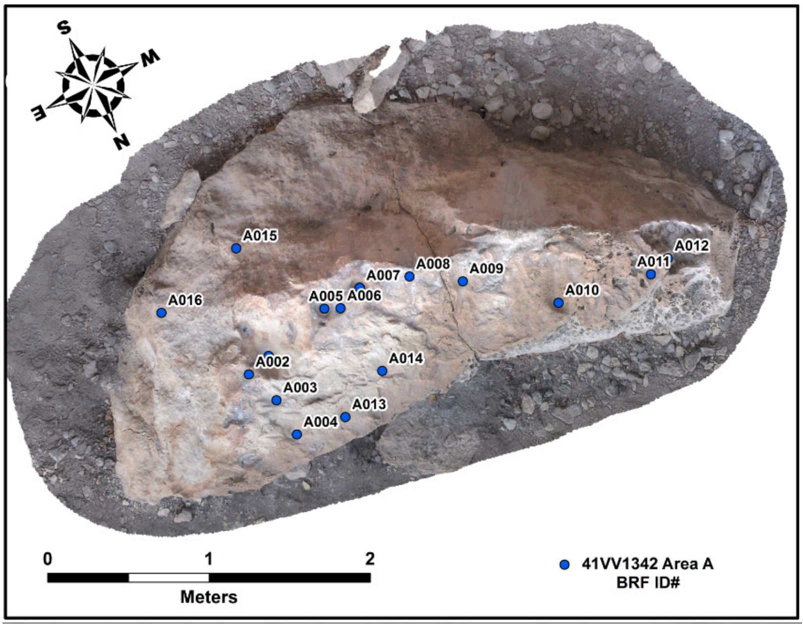


Figure 5.182. Ryes ‘N Sons Retreat, Area A feature map with ID points.

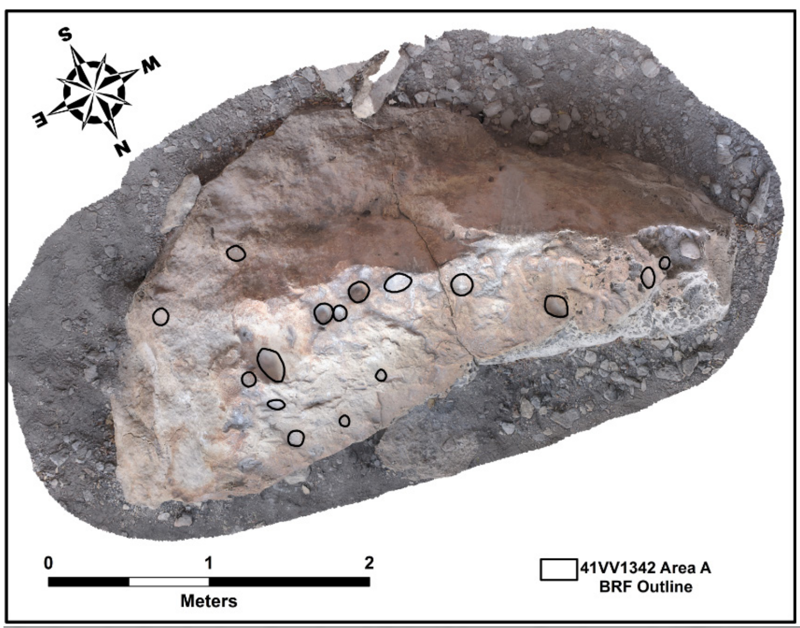


Figure 5.183. Ryes ‘N Sons Retreat, Area A feature map with feature outlines.

Area B (Figures 5.180b, 5.184, and 5.185) is located on a partially buried rock along the dripline on the eastern half of the shelter. During the first visit to the site, we cleared away some colluvial sediment that was covering approximately half of the boulder. In total, there are 14 BRF on this rock, the majority of which are shallow. No use-wear analyses were conducted on these surfaces due to weathering and obstruction from dirt staining.

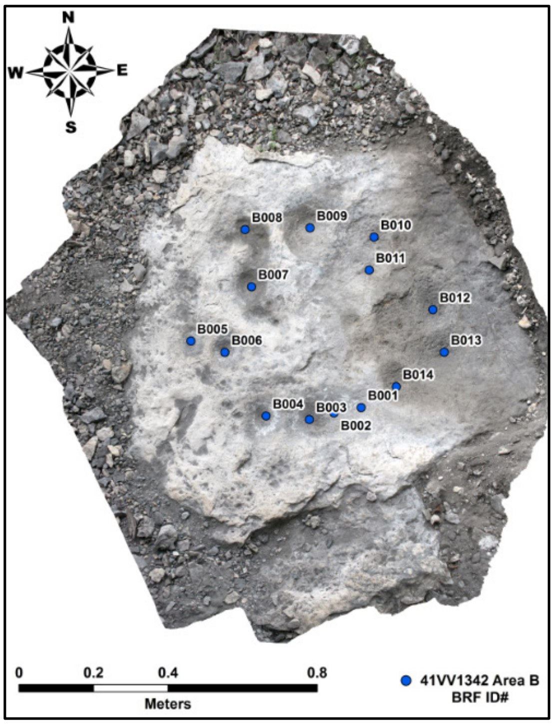


Figure 5.184. Ryes 'N Sons Retreat, Area B feature map with ID points.

Figure 5.185. Ryes 'N Sons Retreat, Area B feature map with feature outlines.

Area C (Figures 5.180c, 5.186, and 5.187) is located south of Area B and is a partially buried boulder near the back wall. There is one shallow feature with an ovoid opening and gently sloping walls in this area. Area C was also too heavily weathered for any use-wear observations.

Figure 5.186. Ryes 'N Sons Retreat, Area C feature map with ID points.

Figure 5.187. Ryes 'N Sons Retreat, Area C feature map with feature outlines.

Area D (Figures 5.180d, 5.188, and 5.189) contains three bedrock features and is located on a roof fall boulder near the center of the shelter. Two of the BRFs are shallow and one is of intermediate depth, all have a circular opening. Further, all of the features have rugged surfaces with rounded edges on the high points.

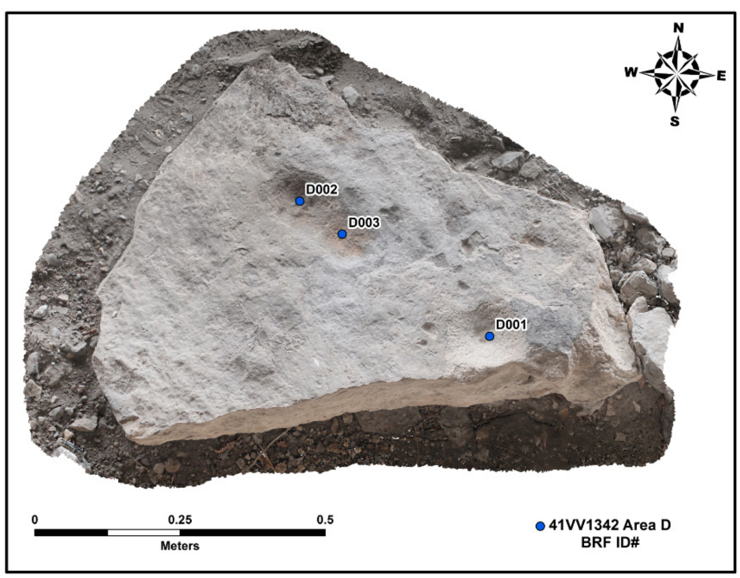


Figure 5.188. Ryes 'N Sons Retreat, Area D feature map with ID points.

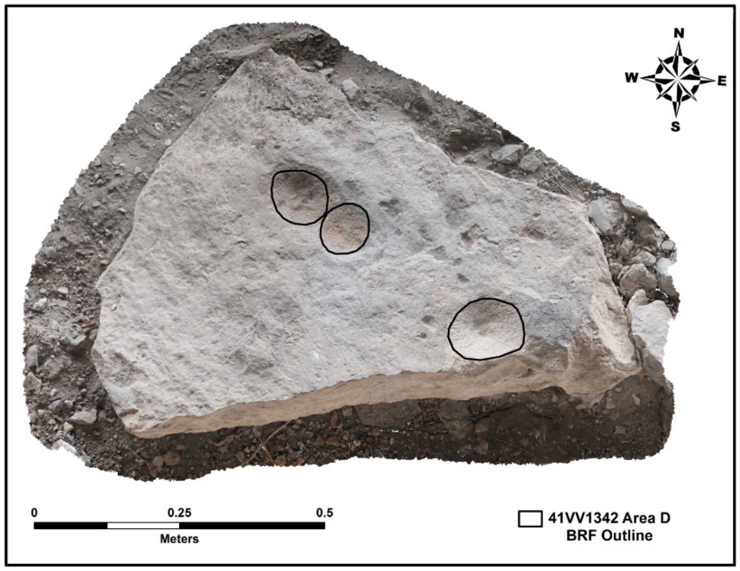


Figure 5.189. Ryes 'N Sons Retreat, Area D feature map with feature outlines.

Area E (Figures 5.180e, 5.190, and 5.191) is a roof fall boulder surrounded by other unmodified rocks in the middle of the shelter. There are two features present in Area E, one shallow and one flat slick. Both features have surfaces that are rugged with some leveling of high points.

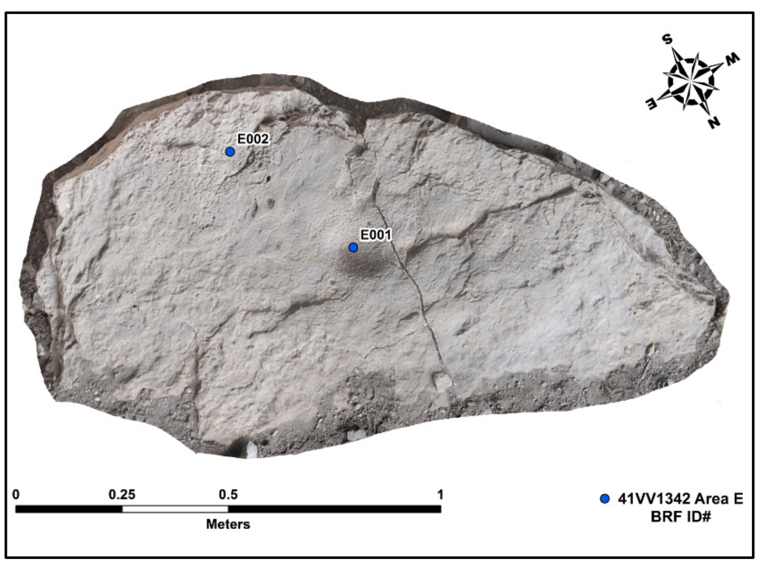


Figure 5.190. Ryes 'N Sons Retreat, Area E feature map with ID points.

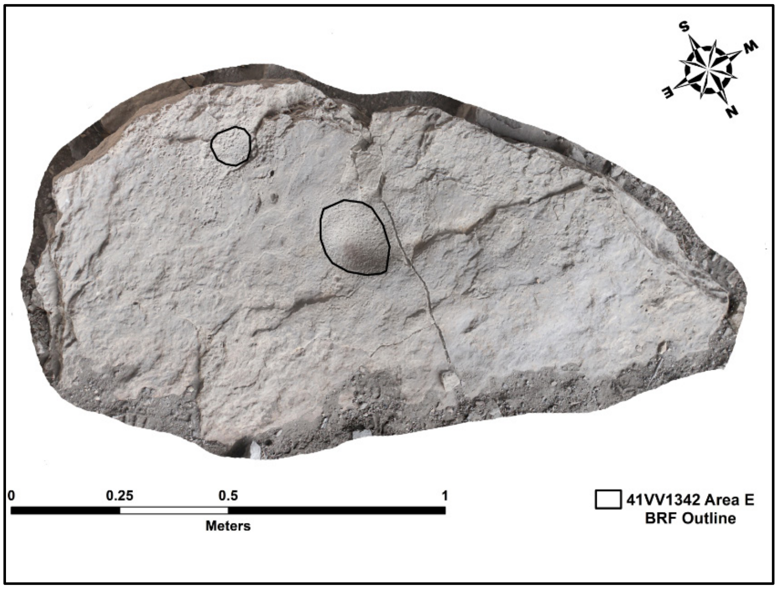


Figure 5.191. Ryes 'N Sons Retreat, Area E feature map with feature outlines.

Area F (Figures 5.181a, 5.192, and 5.193) is a rock slab on the western edge of the site with three bedrock features. There are two shallow and one intermediate depth features with leveled and rounded bumps on the surfaces.

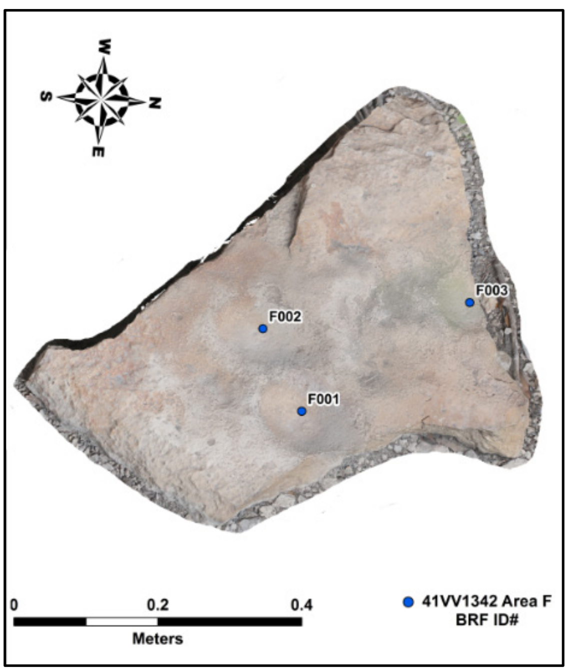


Figure 5.192. Ryes 'N Sons Retreat, Area F feature map with ID points.

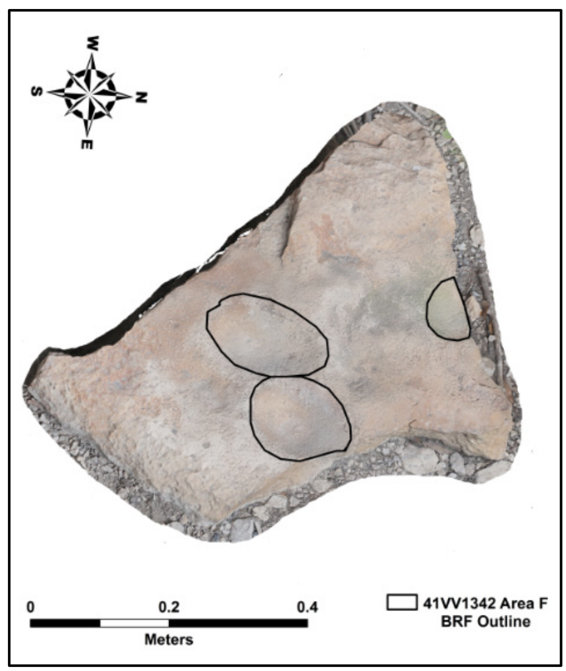


Figure 5.193. Ryes 'N Sons Retreat, Area F feature map with feature outlines.

Area G (Figures 5.181b, 5.194, and 5.195) is another rock slab located near Area F on the western end of the site. There are two bedrock features located on the boulder, from shallow to intermediate in depth. Both features have rugged surfaces with some rounded high points.

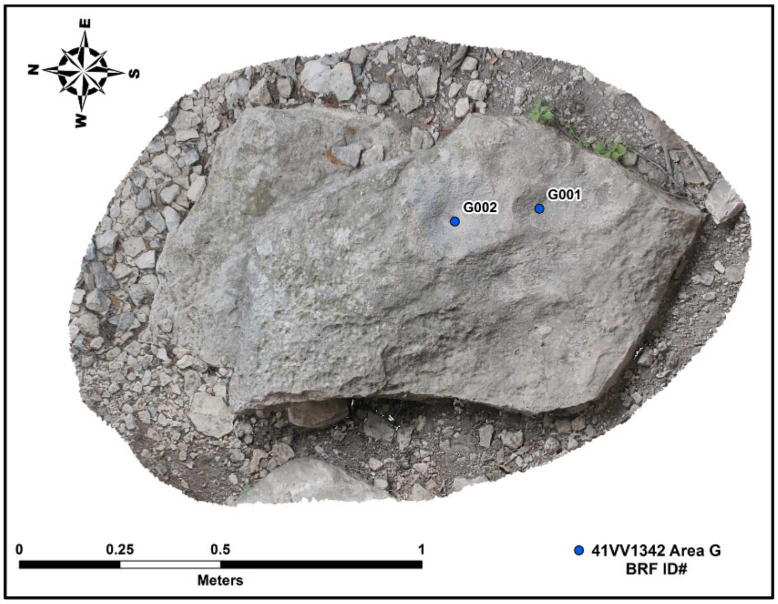


Figure 5.194. Ryes 'N Sons Retreat, Area G feature map with ID points.

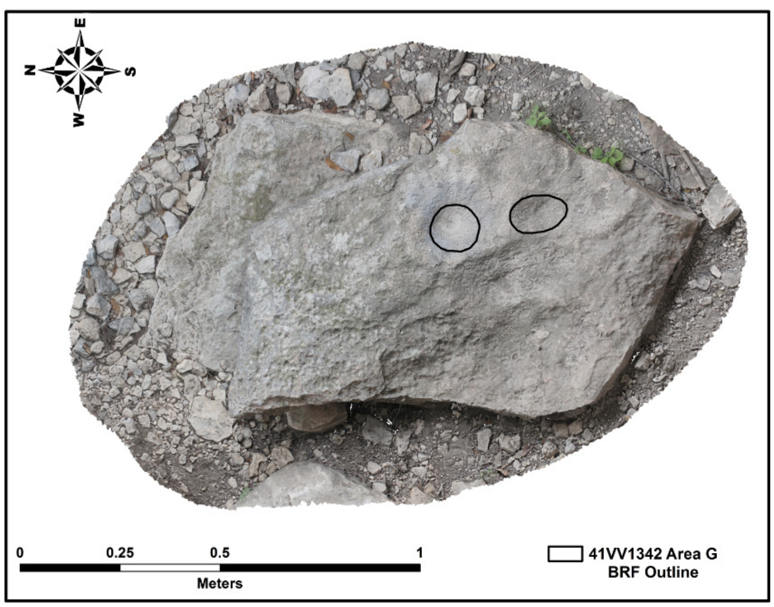


Figure 5.195. Ryes 'N Sons Retreat, Area G feature map with feature outlines.

M1 (Figures 5.196 and 5.197) is a limestone portable slab with three bedrock features on it, two of intermediate depth while the last one is shallow. The surfaces of the features are rugged with some rounding and some leveled areas in the base.

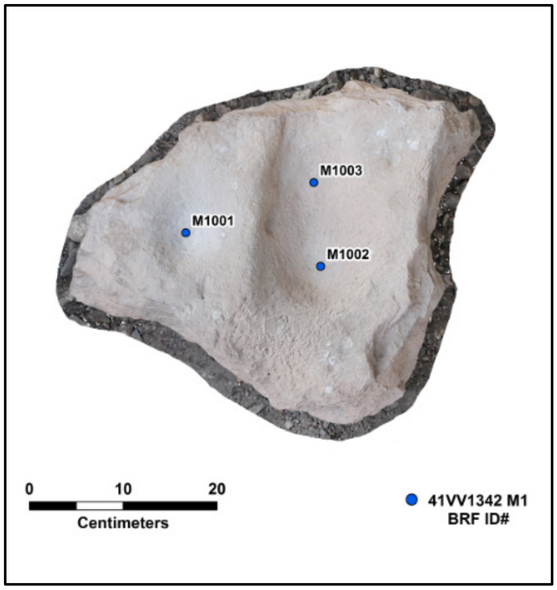


Figure 5.196. Ryes 'N Sons Retreat, M1 feature map with ID points.

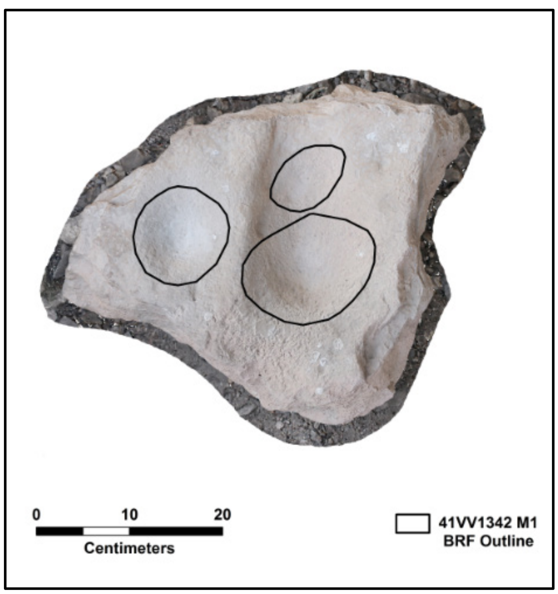


Figure 5.197. Ryes 'N Sons Retreat, M1 feature map with feature outlines.

M2 (Figures 5.198 and 5.199) is another moveable limestone slab with one intermediate depth feature that has a circular opening. The surface of the feature is pecked and rugged with some rounding of high points.

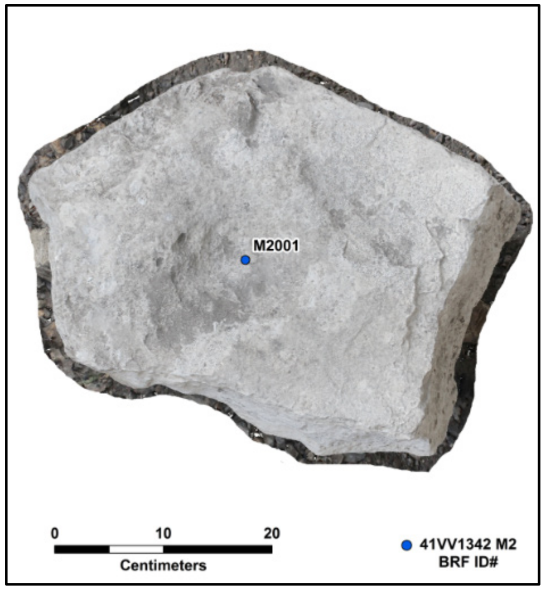


Figure 5.198. Ryes 'N Sons Retreat, M2 feature map with ID points.

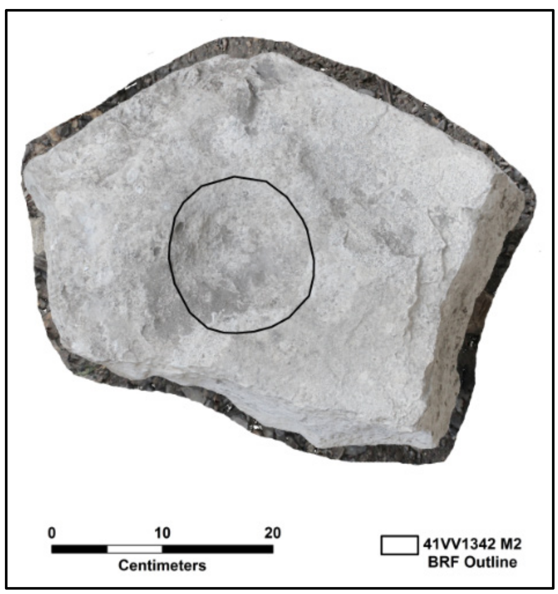


Figure 5.199. Ryes 'N Sons Retreat, M2 feature map with feature outlines.

VI. BEDROCK FEATURE MORPHOLOGICAL DISTRIBUTION

As seen in the previous chapter, bedrock feature attributes and measurements greatly vary within and between sites across the region. This chapter focuses on analyzing the quantitative bedrock feature data to better understand the morphological variation of these features within the Lower Pecos. While other useful data was collected in the form of qualitative attribute data, focusing on the quantitative measurements provides a more objective and standardized method for analyzing the distribution of bedrock feature types.

The distribution of depth, long axis (Axis-1), short axis (Axis-2), and the length-width ratio measurements are considered for each site as well as within the entire sample (n=824). All measurements were acquired digitally through GIS software using the 3D model created with Structure from Motion (SfM) Photogrammetry (see Chapter 4). Since the measurements obtained through this method are at a finer resolution than typical field-gathered measurements, I am able to break down the data into very small intervals if I so choose (e.g., a tenth of a centimeter). Data are presented below in the form of histograms showing the frequency of features present within a given measurement interval (e.g., 1.0 cm ranges, 0.25 cm ranges, etc.).

The following discussion provides data supporting what the most common type of feature is and also will identify what kind of features should be considered outliers or aberrant. First, I present metric data trends from within each site, starting with the site with the highest number of bedrock features and moving to the site with the lowest number. Then I expand the analysis to groups of sites in similar locations within the region in order to compare feature morphologies in slightly differing vegetation communities. Finally, I discuss the regional dataset altogether. Interpretations and discussions of these analyses are presented in Chapter 7.

Individual Site Quantitative Distribution

41VV75

41VV75 has the highest number of bedrock features (BRF) (n=353) out of all of the sites included in this study. The descriptive statistics for each measurement at 41VV75 are provided in Table 6.1 and each variable is discussed in more detail below.

Table 6.1. Descriptive Statistics for 41VV75 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	4.2	13.0	9.6	1.4
Standard Error	0.4	0.2	0.2	0.0
Median	2.2	12.5	9.6	1.3
Standard Deviation	7.71	4.42	2.88	0.35
Sample Variance	59.52	19.50	8.31	0.12
Kurtosis	32.67	1.76	2.72	2.63
Skewness	5.50	0.82	0.79	1.40
Range	57.75	30.52	20.81	2.29
Maximum	58.00	33.47	23.43	3.25
Minimum	0.25	2.95	2.62	1.00
Count	348	322	322	322

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. At 41VV75, 348 of the 353 bedrock features were measured for depth, the remainder were too fractured to obtain an accurate measurement.

Bedrock feature depths range from 0.25-58.0 cm, have a mean of 4.2 cm and a standard deviation of 7.7 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.3587; n=348; p=0.0), which is due to the heavily right-skewed data set (Figure 6.1). It is not a surprise the deep features are outliers since their unique presence is why 41VV75 was included in this project. The data set appears to be unimodal and increases very quickly from 0 cm (a flat surface) to 1-2 cm in depth (a shallow bedrock feature).

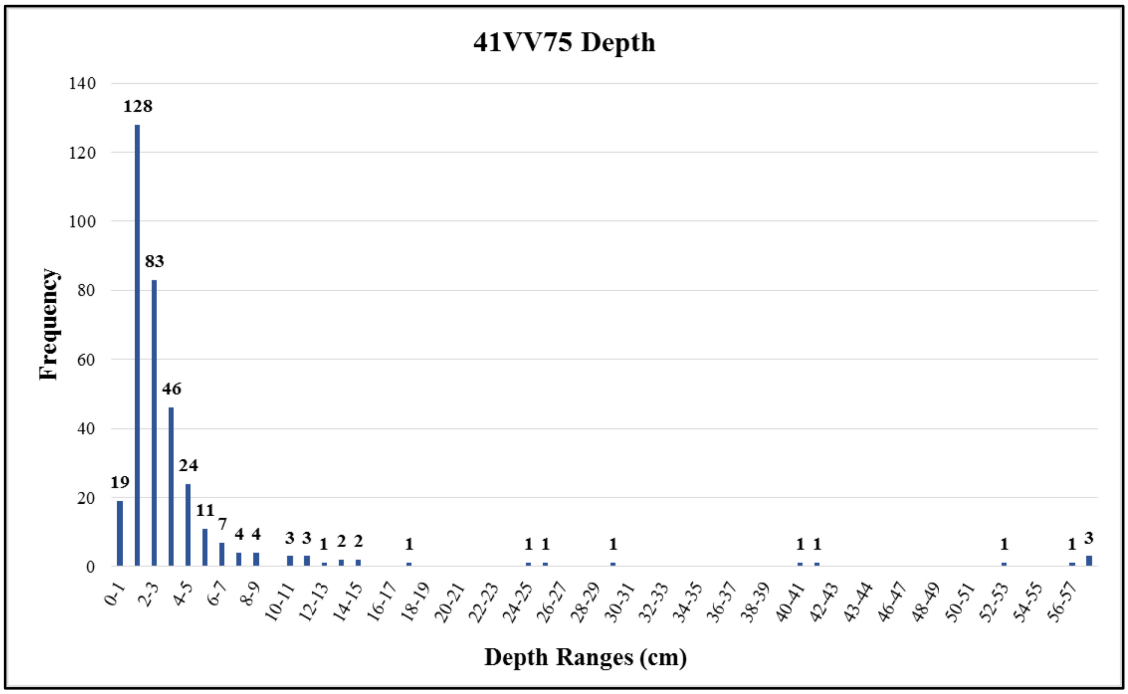


Figure 6.1. 41VV75 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). The Axis-1 measurement is the longer of the two axes across the mouth of the feature opening and is considered to be the length. Thirty-one features were too fractured to obtain accurate length measurements so 322 BRF were considered for this analysis. The maximum length of Axis-1 is 33.5 cm and the minimum length is 2.95 cm. The mean length for Axis-1 is 13.0 cm and the standard deviation is slightly less than for depth at 4.4 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.966; n=322; *p*=7.62E-07), which again is likely due to the slight tail extending out to the right with the outliers (Figure 6.2).

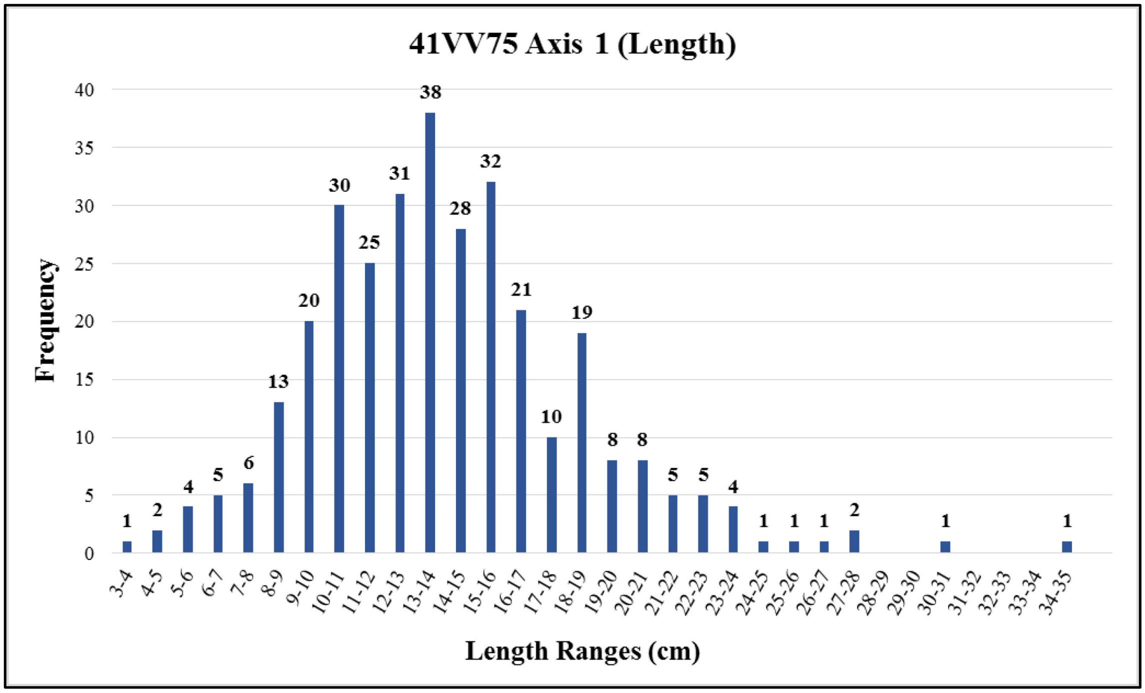


Figure 6.2. 41VV75 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). The Axis-2 measurement is the shorter of the two axes across the mouth of the feature opening and is considered to be the width. Thirty-one features were too fractured to obtain accurate length measurements so 322 BRF were considered for this analysis. The maximum width measures 23.4 cm and the shortest width measurement is 2.6 cm. The mean length for Axis-1 is 9.6 cm and the standard deviation is 2.9 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9601; n=322; *p*=1.08E-07). Once again, the abnormality of the data can likely be attributed to the outliers greater than 20 cm wide (Figure 6.3).

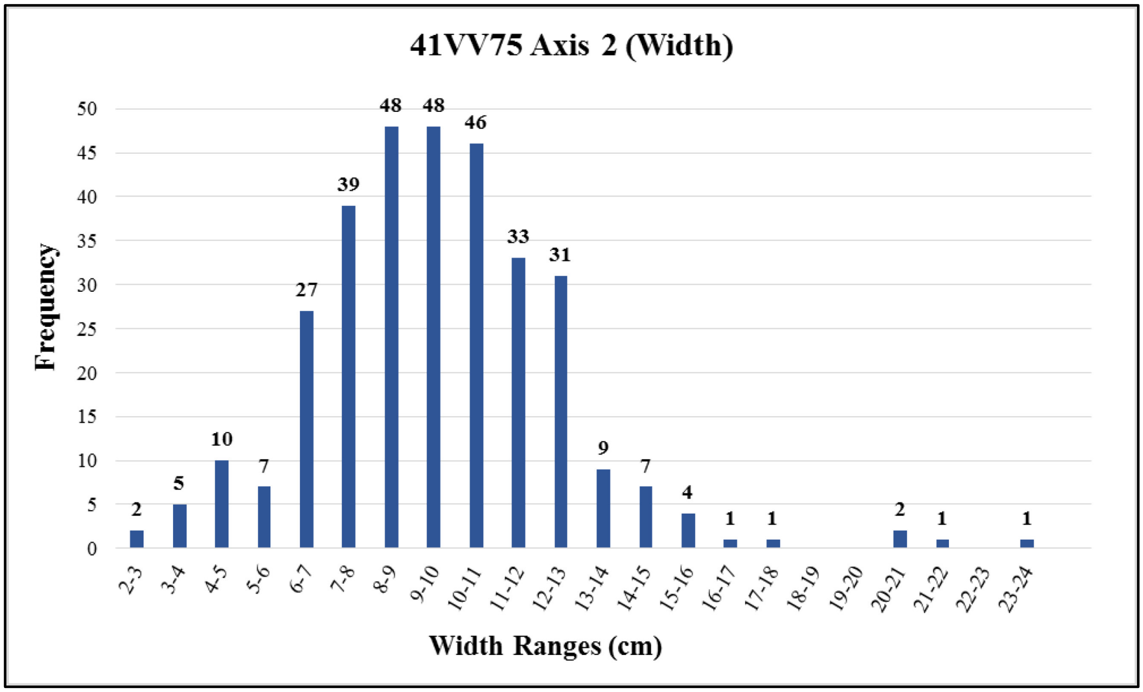


Figure 6.3. 41VV75 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. As mentioned in Chapter 4, the length-width ratio is a measurement that gives an approximation of how circular or elongated a feature is. Ratios close to 1.0 are more circular while ratios higher than 1.0 represent features that are more elliptical. The minimum value is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 3.2 cm. The mean ratio is 1.4 cm and the standard deviation is 0.4 cm. A Shapiro-Wilk test shows these data are is not normally distributed (W=0.8723; n=322; *p*=1.22E-15), which is likely due to the fact that the data is skewed right. The length-width ratio histogram (Figure 6.4) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

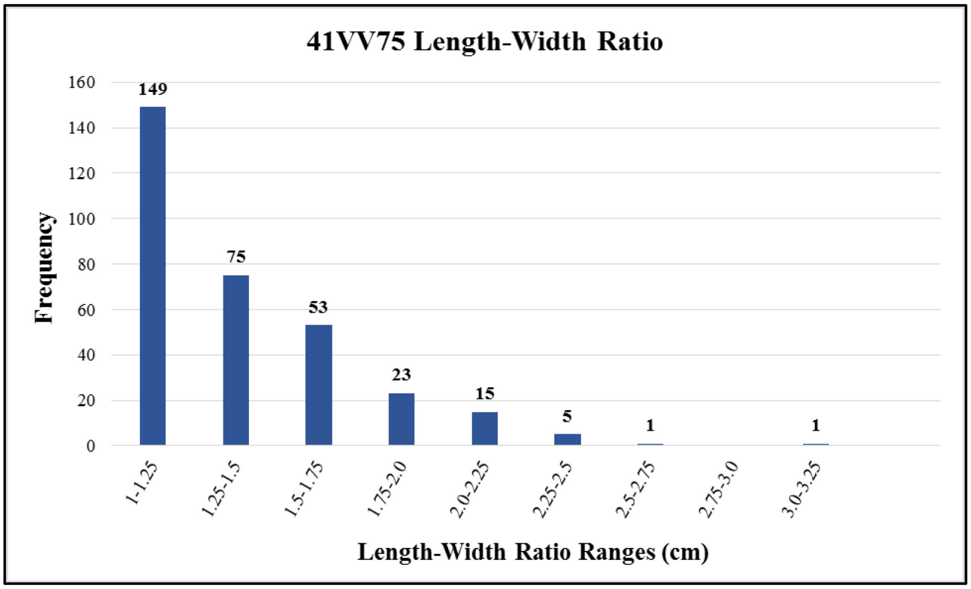


Figure 6.4. 41VV75 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV165 – Skiles Shelter

41VV165 has the second highest number of bedrock features (n=126) out of all of the sites included in this study. The descriptive statistics for each variable at 41VV165 are provided in Table 6.2 and each variable is discussed in more detail below.

Table 6.2. Descriptive Statistics for 41VV165 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	2.55	13.76	10.36	1.32
Standard Error	0.21	0.51	0.30	0.03
Median	1.78	12.61	10.17	1.22
Standard Deviation	2.37	5.78	3.32	0.31
Sample Variance	5.60	33.36	11.04	0.10
Kurtosis	18.82	2.74	0.02	1.74
Skewness	3.59	1.33	0.36	1.51
Range	18.38	33.65	16.98	1.41
Maximum	18.59	36.57	19.78	2.41
Minimum	0.20	2.92	2.80	1.01
Count	126	126	126	126

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 126 bedrock features at 41VV165 were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.2-18.6 cm, have a mean of 2.6 cm and a standard deviation of 2.4 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.6773; n=126; p=2.89E-15), which is due to the heavily right-skewed data set (Figure 6.5). While the deepest features might not have been outliers within the previous dataset (41VV75), the range of depths at 41VV165 is much less drastic and features deeper than 9.0 cm stand out in this distribution. The most common depth are features between 1.0-2.0 cm in depth but there another small peak between 3.0-4.0 cm as well.

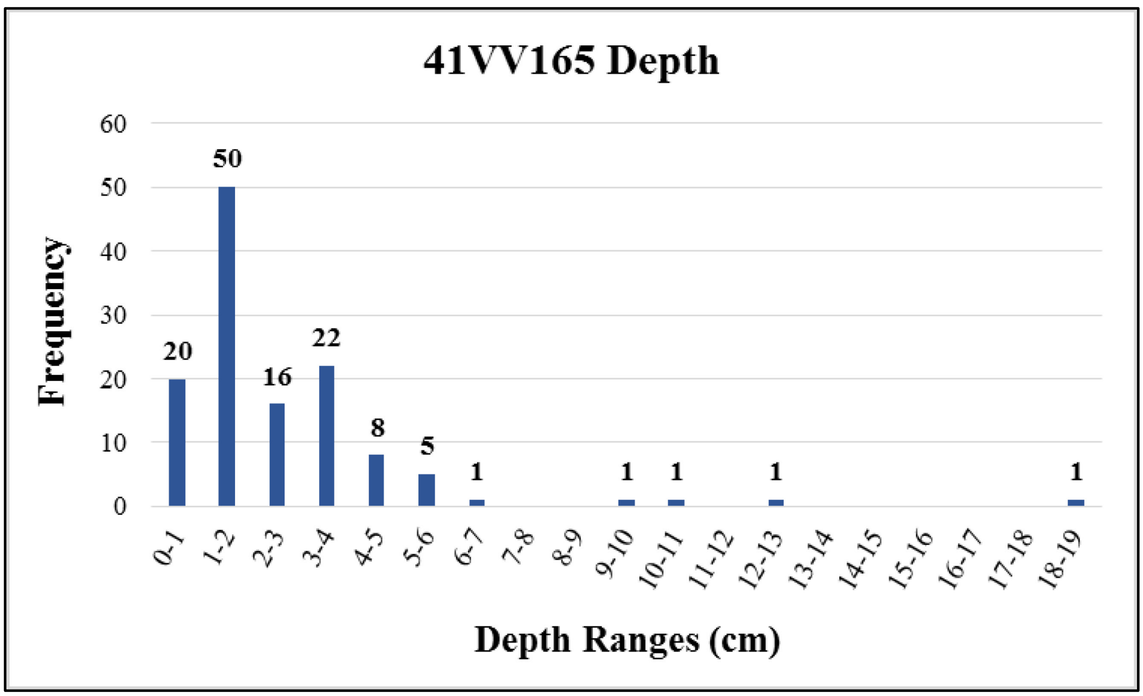


Figure 6.5. 41VV165 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). All 126 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 36.6 cm and the minimum length is 2.9 cm. The mean length for Axis-1 is 13.8 cm and the standard deviation is 5.8 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9147; n=126; *p*=7.17E-07), which again is likely due to the slight tail extending out to the right with the outliers and the relatively evenly spread frequency of features between 7.0-18.0 cm deep. (Figure 6.6).

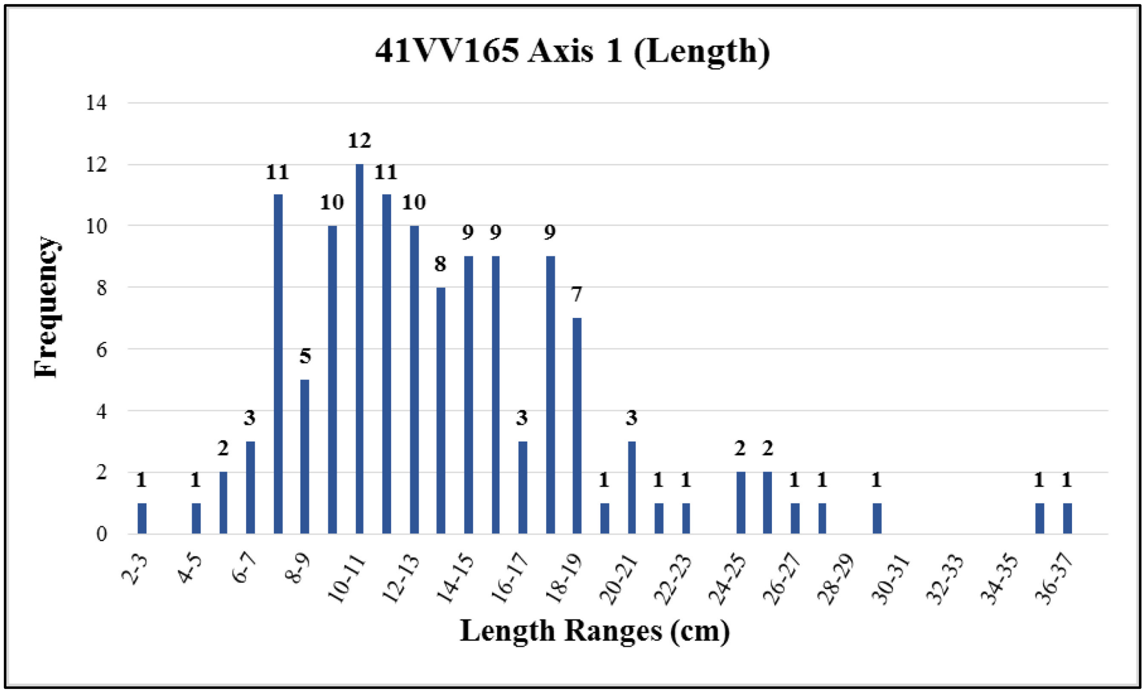


Figure 6.6. 41VV165 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 126 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 19.8 cm and the shortest width measurement is 2.8 cm. The mean length for Axis-2 is 10.4 cm and the standard deviation is 3.3 cm. The Shapiro-Wilk test for normality shows these data are normally distributed (W=0.9869; n=126; *p*=0.2722). The data set is relatively unimodal with a gentle slope down from the mean (Figure 6.7).

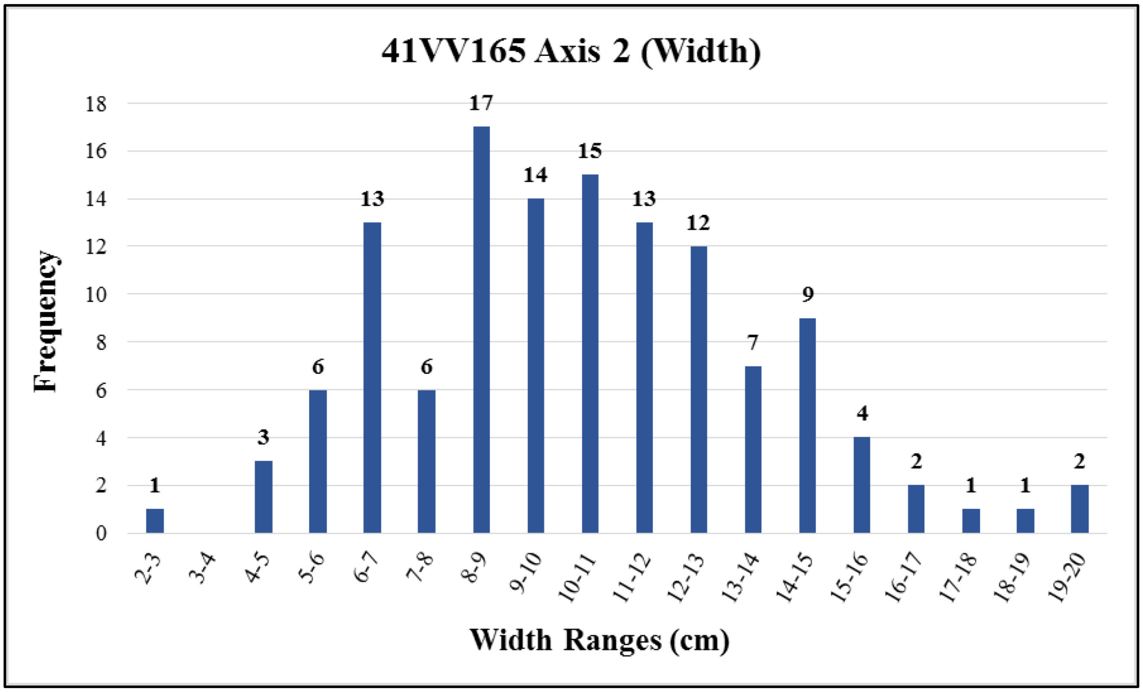


Figure 6.7. 41VV165 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV165 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.4 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.825388; n=126; *p*=6.35E-11). The length-width ratio histogram (Figure 6.8) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

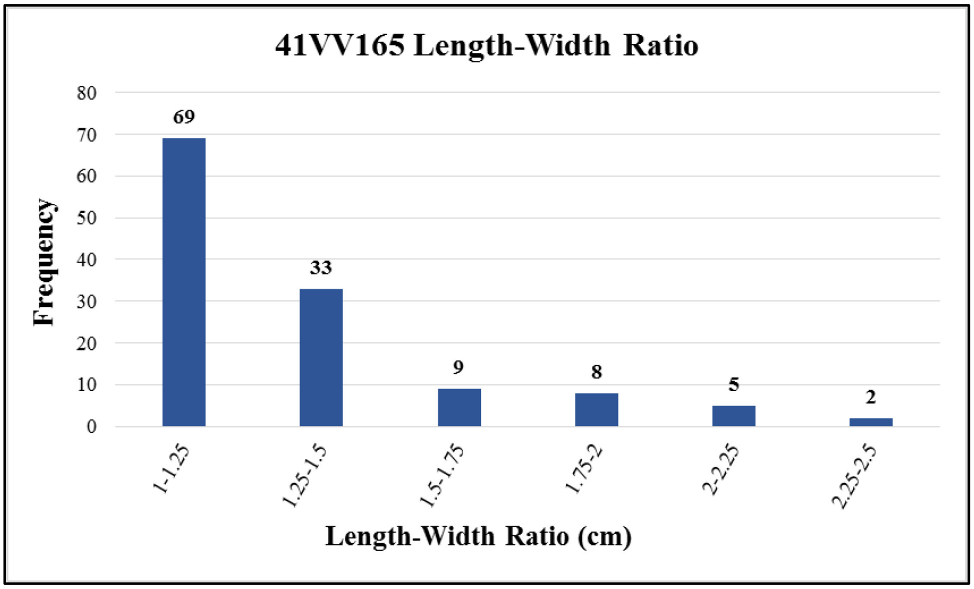


Figure 6.8. 41VV165 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV2010 – Mountain Laurel

41VV2010 has 89 of bedrock features located throughout much of the existing bedrock at the site. The descriptive statistics for each measurement at 41VV2010 are provided in Table 6.3 and each variable is discussed in more detail below.

Table 6.3. Descriptive Statistics for 41VV2010 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.23	12.37	9.75	1.26
Standard Error	0.20	0.49	0.31	0.03
Median	2.75	11.50	9.54	1.17
Standard Deviation	1.89	4.62	2.88	0.28
Sample Variance	3.57	21.31	8.32	0.08
Kurtosis	0.81	2.59	7.36	1.88
Skewness	1.00	1.31	1.83	1.58
Range	9.35	27.42	20.58	1.25
Maximum	9.86	31.31	24.33	2.26
Minimum	0.51	3.88	3.75	1.00
Count	89	89	89	89

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 89 bedrock features at 41VV2010 were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.5-9.9 cm, have a mean of 3.2 cm and a standard deviation of 1.9 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.9271; n=89; p=9.08E-05), which is likely due to the one outlier that is greater than 9.0 cm in depth and the low number of features less than 1.0 cm deep (Figure 6.9). The most common depth are features between 2.0-3.0 cm in depth but quite a few features are also between 1.0-2.0 cm and 3.0-4.0 cm in depth. This pattern is more consistent with a unimodal bell curve.

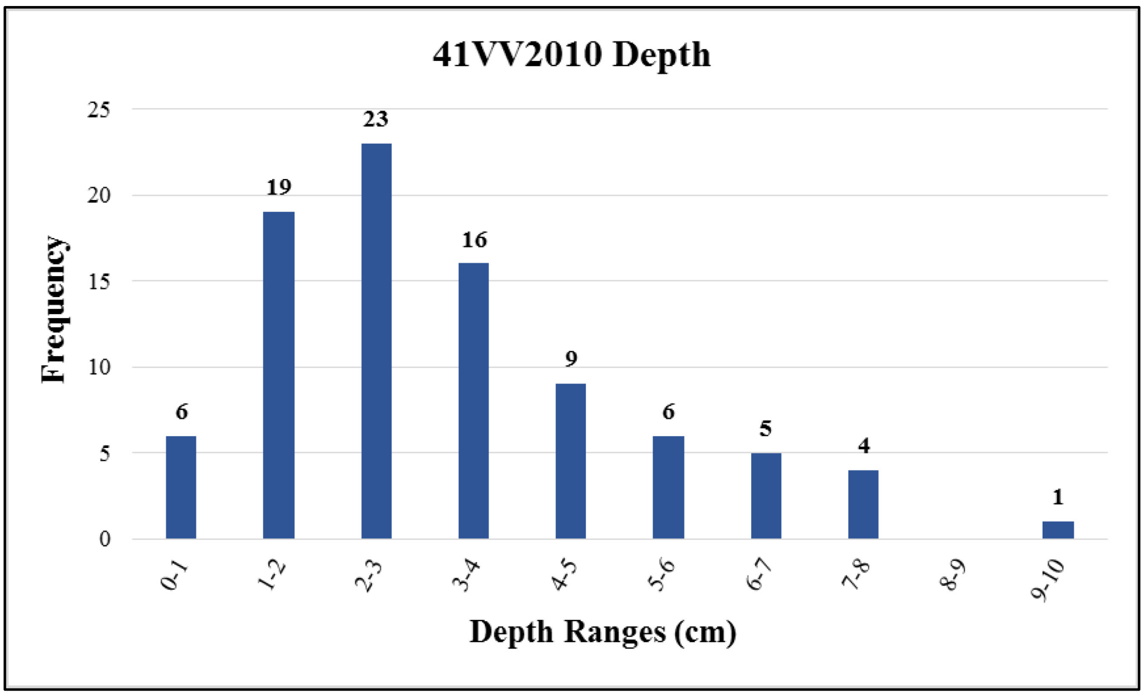


Figure 6.9. 41VV2010 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). All 89 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 31.3 cm and the minimum length is 3.9 cm. The mean length for Axis-1 is 12.4 cm and the standard deviation is 4.6 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9095; n=89; p=1.22E-05), which is likely due to the shortest and longest length range outliers (Figure 6.10). The data are bimodal with two even peaks of features that have a long Axis of 9.0-10.0 cm and 11.0-12.0 cm.

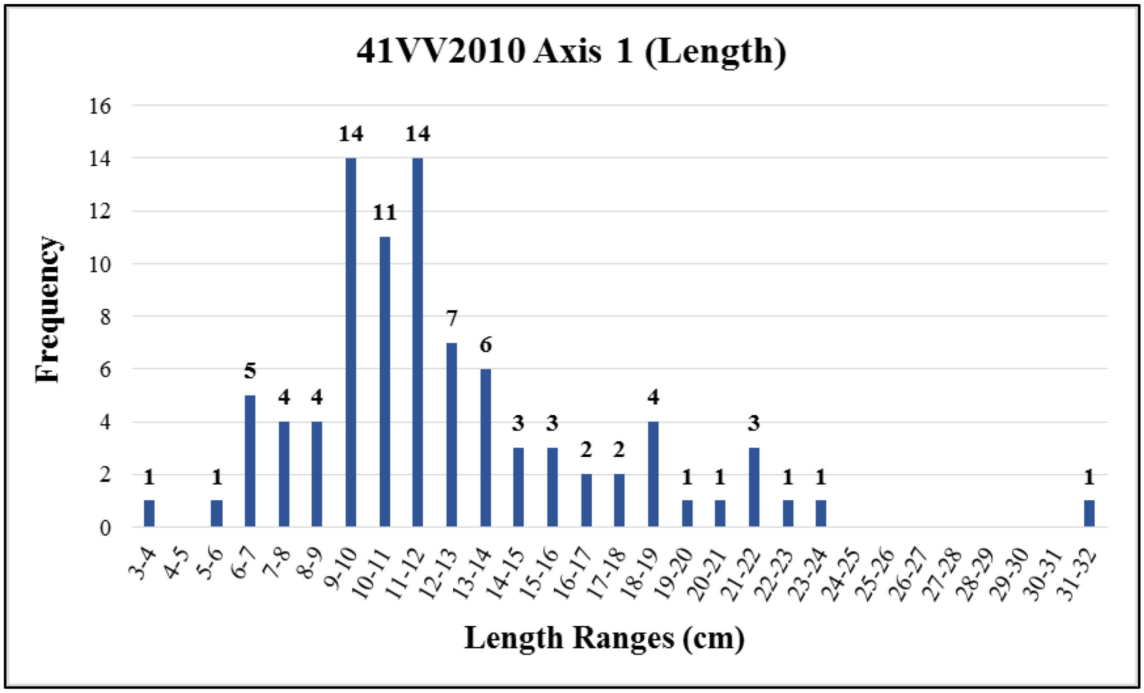


Figure 6.10. 41VV2010 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 89 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 24.3 cm and the shortest width measurement is 3.8 cm. The mean length for Axis-2 is 9.8 cm and the standard deviation is 2.9 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.8765; n=89; p=0.4.67E-07), which again is due to the outliers in the shortest and longest width ranges. Besides the outliers, the data set creates a rough unimodal bell curve (Figure 6.11).

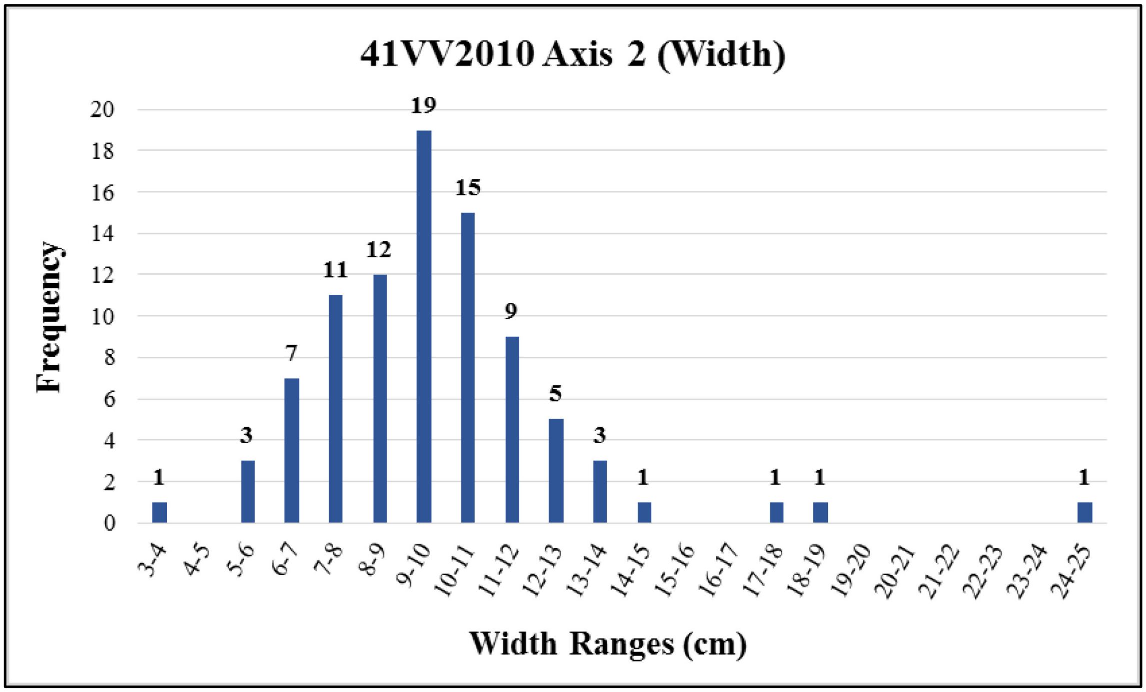


Figure 6.11. 41VV2010 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV2010 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.3 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8022; n=89; *p*=1.4E-09). The length-width ratio histogram (Figure 6.12) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

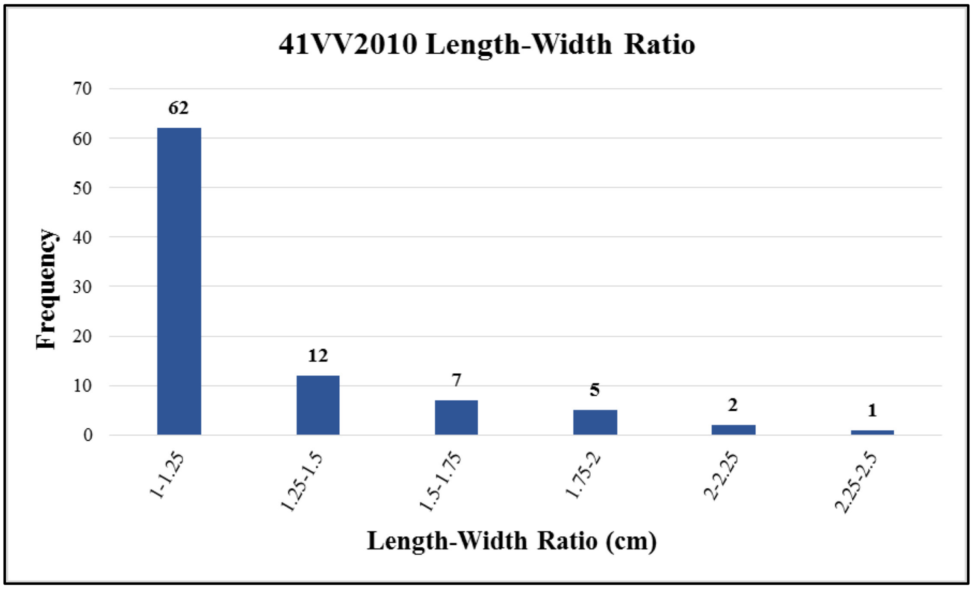


Figure 6.12. 41VV2010 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV166 – Horse Trail Shelter

41VV166 has a surprisingly high number of bedrock features (n=65), considering the complete lack of bedrock at the site (all features are located on roof fall boulders). The descriptive statistics for each measurement category at 41VV165 are provided in Table 6.4 and each variable is discussed in more detail below.

Table 6.4. Descriptive Statistics for 41VV166 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	4.74	11.30	9.13	1.24
Standard Error	0.82	0.54	0.39	0.03
Median	2.42	10.57	9.19	1.14
Standard Deviation	6.59	4.33	3.12	0.24
Sample Variance	43.40	18.78	9.76	0.06
Kurtosis	4.73	0.76	0.80	1.43
Skewness	2.40	0.38	-0.04	1.37
Range	29.42	21.66	15.88	1.06
Maximum	29.45	23.63	17.74	2.06
Minimum	0.03	1.97	1.86	1.00
Count	65	65	65	65

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 65 bedrock features at 41VV166 were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.03-29.5 cm, have a mean of 4.7 cm and a standard deviation of 6.6 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.5787; n=65; p=2.26E-12), which is likely due to the various outliers greater than 10.0 cm in depth (Figure 6.13). The most common depth are features between 2.0-3.0 cm in depth, although there are almost as many features 1.0-2.0 cm deep. Further, there is another small peak of feature depth around 21.0-23.0 cm.

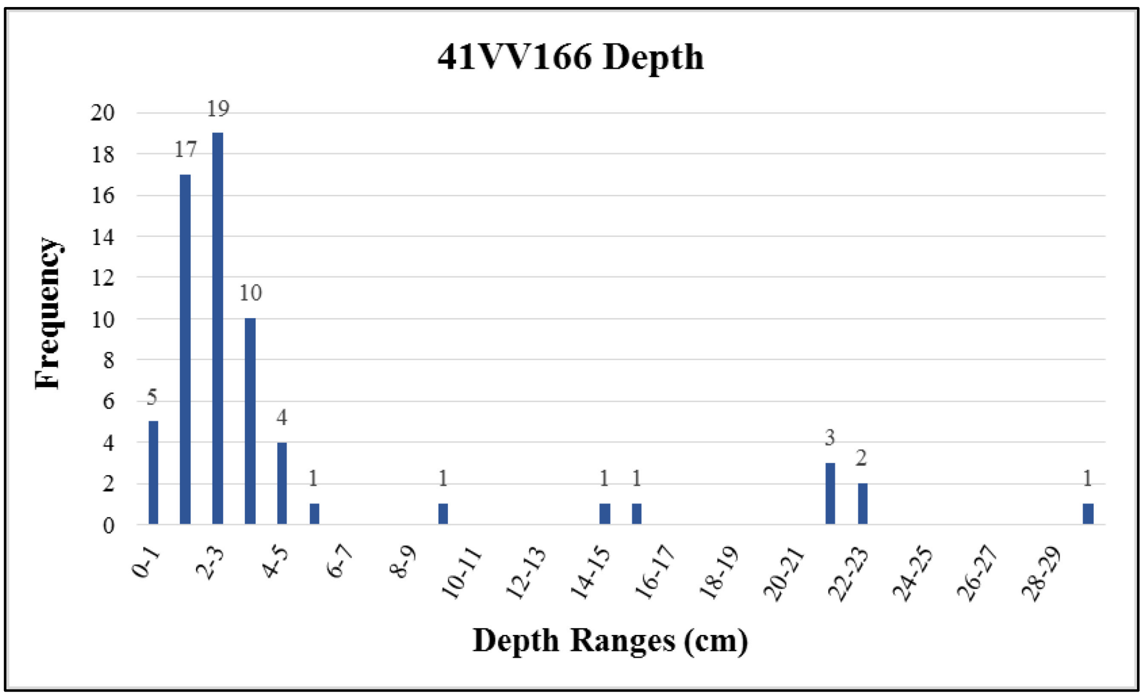


Figure 6.13. 41VV166 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). All 65 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 23.6 cm and the minimum length is 1.97 cm. The mean length for Axis-1 is 11.3 cm and the standard deviation is 4.3 cm. The Shapiro-Wilk test for normality shows these data are normally distributed (W=0.9647; n=65; p=0.061), despite the lack of features with a length between 3.0-5.0 cm (Figure 6.14). The data are relatively unimodal with a few minor peaks in the shortest lengths and between 13.0-15.0 cm.

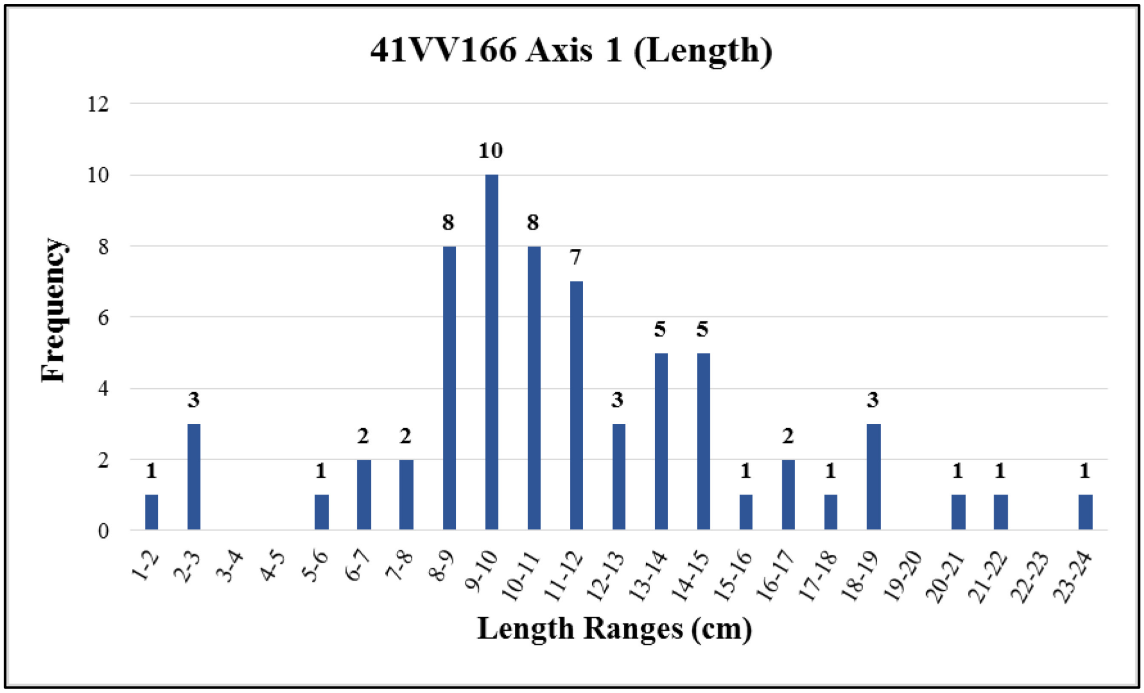


Figure 6.14. 41VV166 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 65 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 17.7 cm and the shortest width measurement is 1.9 cm. The mean length for Axis-2 is 9.1 cm and the standard deviation is 3.1 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9588, n=65; p=0.0298), which is likely due to the sharp drop off after the most common width measurement (9.0-10 cm) (Figure 6.15).

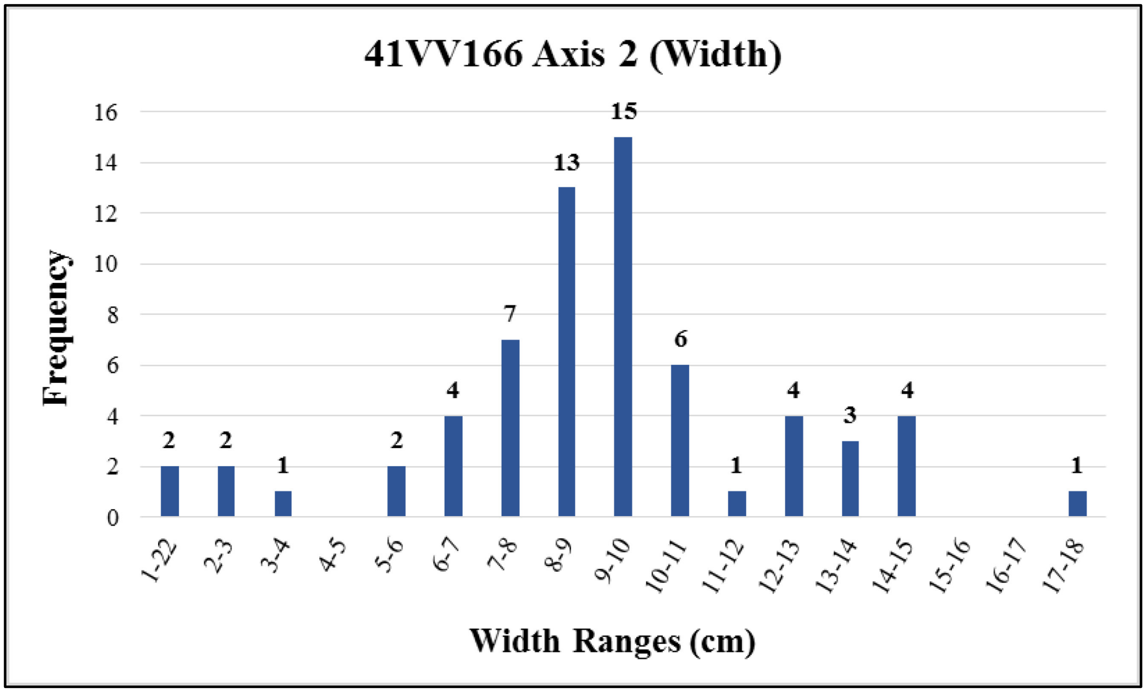


Figure 6.15. 41VV166 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV166 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.1 cm. The mean ratio is 1.2 cm and the standard deviation is 0.2 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8415; n=65; p=7.83E-07). The length-width ratio histogram (Figure 6.16) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

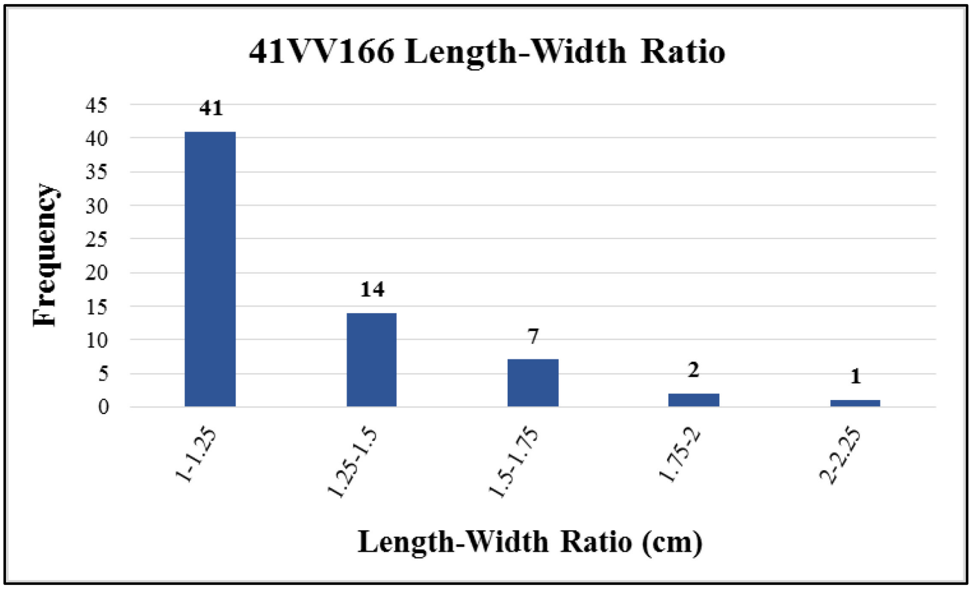


Figure 6.16. 41VV166 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV124 – White Shaman

41VV124 has a total of 54 bedrock features and the descriptive statistics for each measurement are provided in Table 6.5. Each variable is discussed in more detail below.

Table 6.5. Descriptive Statistics for 41VV124 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	6.64	11.94	9.90	1.24
Standard Error	1.69	0.63	0.44	0.04
Median	1.75	11.37	9.35	1.10
Standard Deviation	12.19	4.56	3.17	0.30
Sample Variance	148.65	20.83	10.06	0.09
Kurtosis	9.67	11.23	-0.93	6.62
Skewness	3.16	2.36	0.34	2.33
Range	55.51	28.68	11.23	1.55
Maximum	56.00	34.78	16.08	2.55
Minimum	0.49	6.10	4.85	1.00
Count	52	52	52	52

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. At 41VV124, 52 of the 54 bedrock features were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.5-56.0 cm, have a mean of 6.6 cm and a standard deviation of 12.9 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.5091; n=52; p=6.15E-12), which is likely due to the one peak at 1.0-2.0 cm in depth and the steep drop off to the right-skewed tail (Figure 6.17). The most common depth are features between 1.0-2.0 cm in depth and the rest are spread in low frequencies across a broad range of depths.

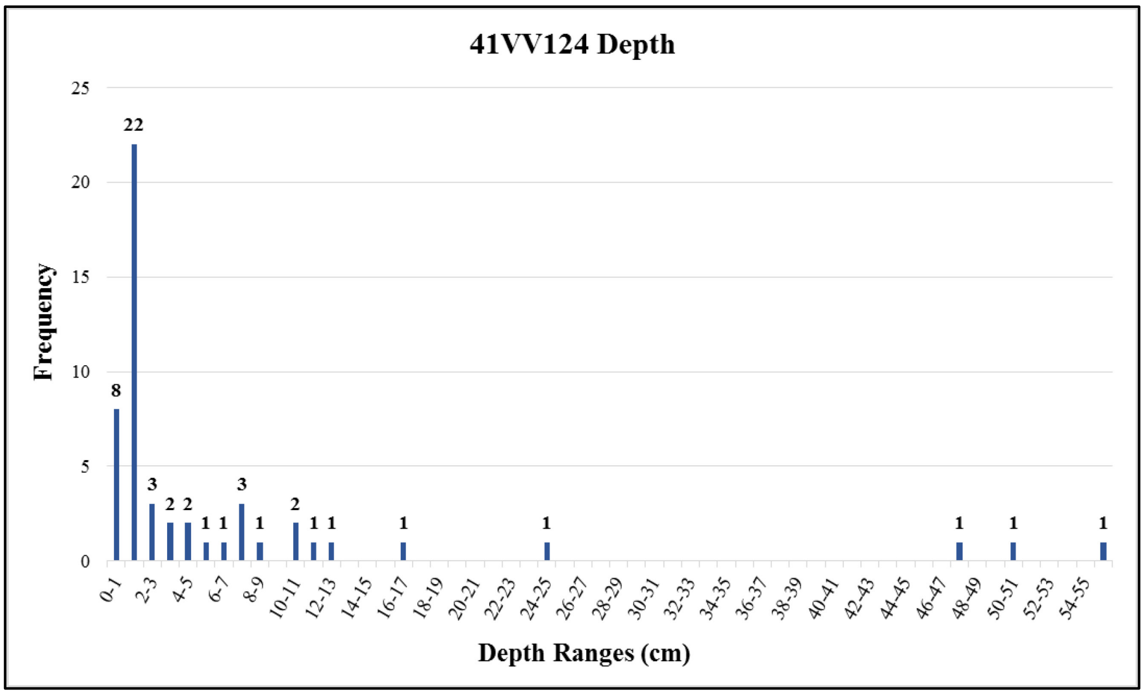


Figure 6.17. 41VV124 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). Two of the 54 bedrock features were fractured, so 52 features were considered for the Axis-1 measurement. The maximum length of Axis-1 is 34.8 cm and the minimum length is 6.1 cm. The mean length for Axis-1 is 11.9 cm and the standard deviation is 4.6 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.7968; n=52; p=5.02E-07), due to the multiple peaks and an extreme outlier with a length measurement of 34.0-35.0 cm (Figure 6.18). The peaks in length measurement are at 6.0-7.0 cm, 11.0-12.0 cm, and 15.0-16.0 cm.

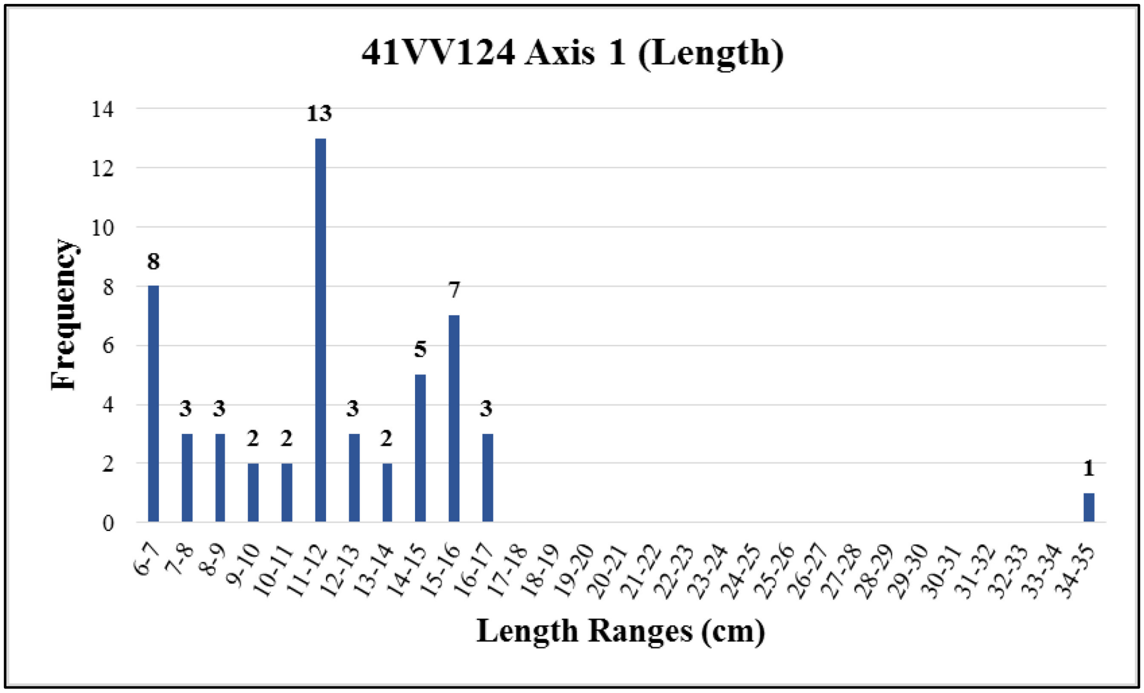


Figure 6.18. 41VV124 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). Two of the 54 bedrock features were fractured, so 52 features were considered for the Axis-2 measurement. The maximum width measures 16.1 cm and the shortest width measurement is 4.9 cm. The mean length for Axis-2 is 9.9 cm and the standard deviation is 3.2 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed, although it is extremely close (W=0.9553; n=52; *p*=0.049). The frequencies are evenly spread across large width ranges with a small peak at 9.0-10 cm (Figure 6.19).

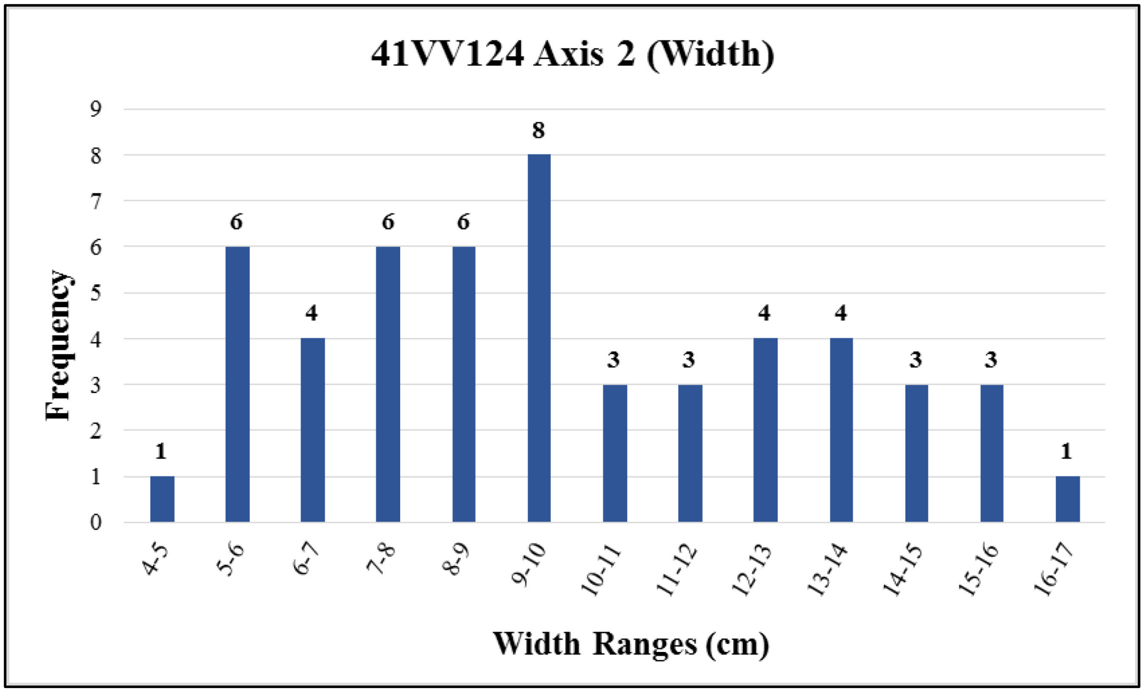


Figure 6.19. 41VV124 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV124 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.6 cm. The mean ratio is 1.2 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.733; n=52; *p*=2.19E-08). The length-width ratio histogram (Figure 6.20) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

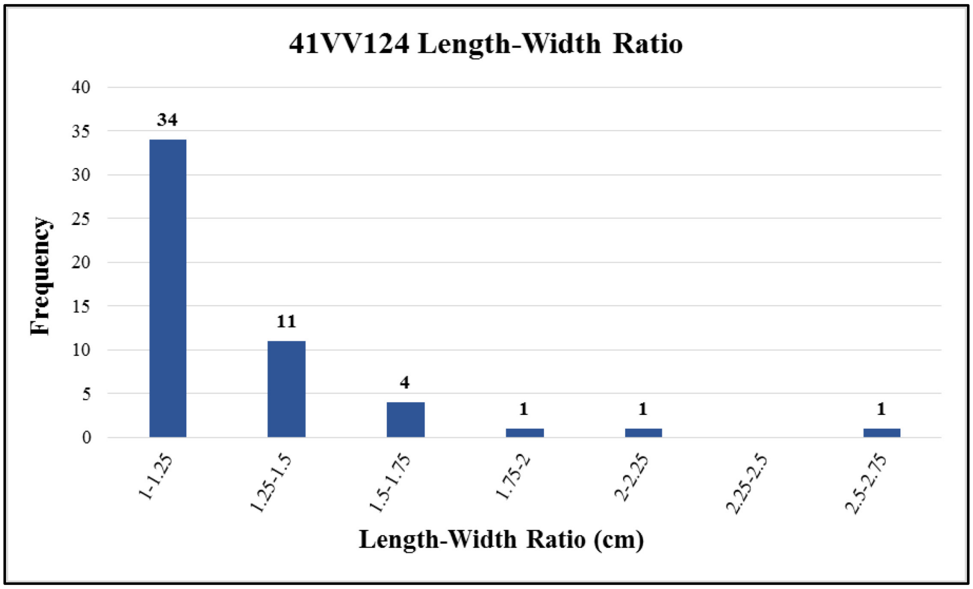


Figure 6.20. 41VV124 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV1342 – Ryes 'N Sons Retreat

41VV1342 has a total of 45 bedrock features spread across roof fall boulders in the site. The descriptive statistics for each measurement are provided in Table 6.6 and each variable is discussed in more detail below.

Table 6.6. Descriptive Statistics for 41VV1342 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	2.90	12.21	9.43	1.31
Standard Error	0.26	0.58	0.37	0.04
Median	2.69	11.53	9.22	1.20
Standard Deviation	1.75	3.75	2.43	0.28
Sample Variance	3.05	14.07	5.89	0.08
Kurtosis	1.58	-0.07	-0.71	0.21
Skewness	1.12	0.65	-0.18	1.05
Range	8.07	15.22	9.21	1.06
Maximum	8.09	21.40	13.68	2.06
Minimum	0.02	6.19	4.47	1.01
Count	45	42	42	42

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 45 bedrock features at 41VV1342 were whole enough to yield a complete depth measurement. Bedrock feature depths range from 0.02-8.1 cm, have a mean of 2.9 cm and a standard deviation of 1.75 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.914; n=45; *p*=0.003), which is likely due to the sharp drop off in frequencies after the most common depth range (Figure 6.21). The most common depth are features between 2.0-3.0 cm in depth and the rest are spread in low frequencies across a broad range of depths.

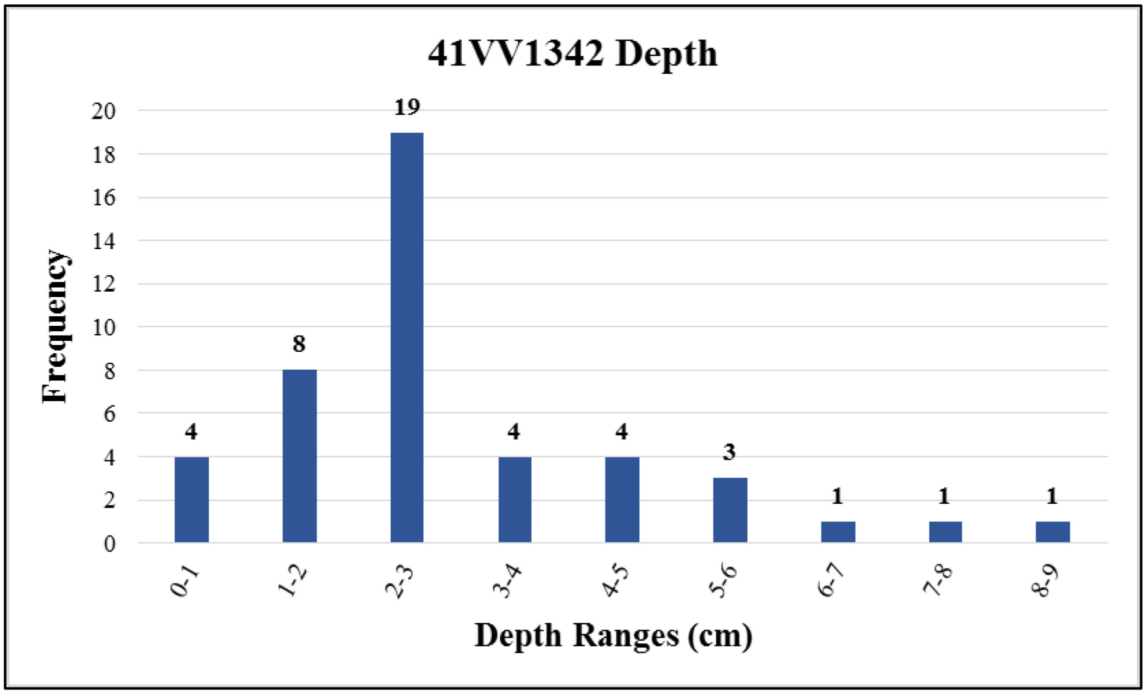


Figure 6.21. 41VV1342 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). Three of the 45 bedrock features were fractured, so 42 features were considered for the Axis-1 measurement. The maximum length of Axis-1 is 21.4 cm and the minimum length is 6.2 cm. The mean length for Axis-1 is 12.2 cm and the standard deviation is 3.6 cm. The Shapiro-Wilk test for normality shows these data are normally distributed (W=0.9563; n=42; *p*=0.108), although there are multiple peaks

(Figure 6.22). The most common lengths for Axis-1 are 8.0-9.0 cm, 11.0-12.0 cm, and 12.0-13.0 cm.

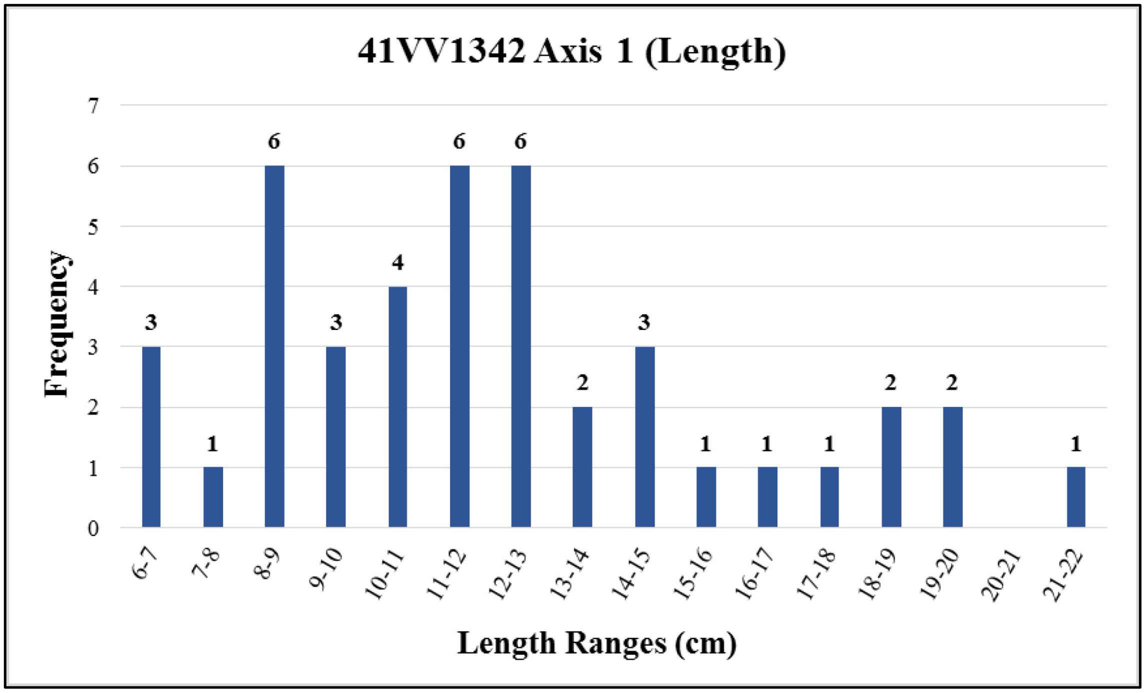


Figure 6.22. 41VV1342 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). Three of the 45 bedrock features were fractured, so 42 features were considered for the Axis-2 measurement. The maximum width measures 13.7 cm and the shortest width measurement is 4.5 cm. The mean length for Axis-2 is 9.4 cm and the standard deviation is 2.43 cm. The Shapiro-Wilk test for normality shows these data are also normally distributed (W=0.9714; n=42; *p*=0.3673). The most common width range is 8.0-9.0 cm with other small peaks occurring at 10.0-11.0 cm and 12.0-13.0 cm (Figure 6.23).

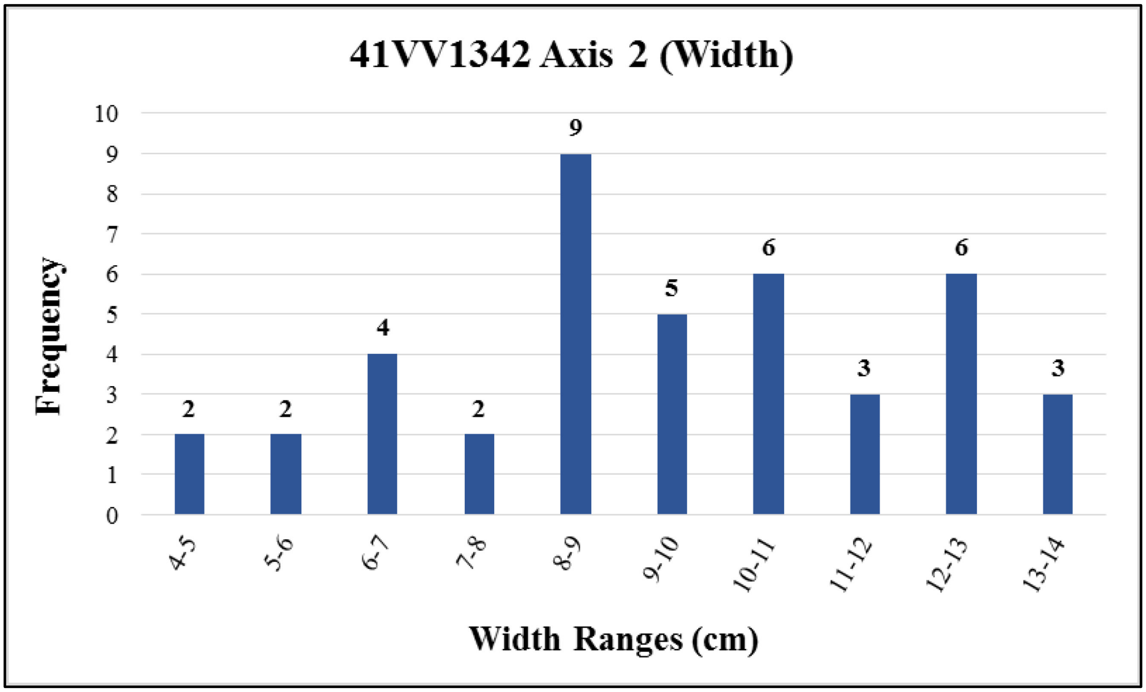


Figure 6.23. 41VV1342 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV1342 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.1 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.87561; n=42; *p*=0.0003). The length-width ratio histogram (Figure 6.24) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

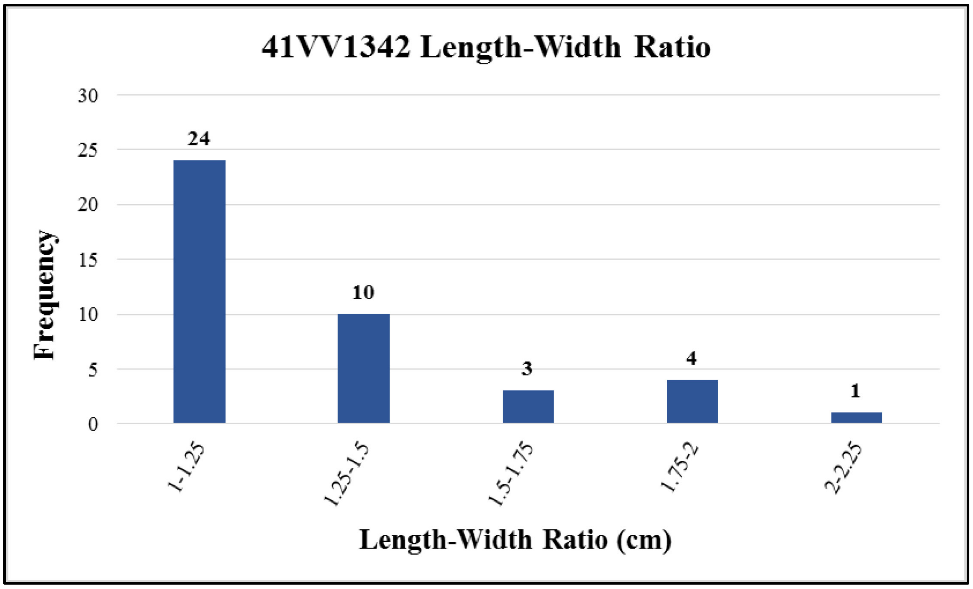


Figure 6.24. 41VV1342 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV167 – Eagle Cave

41VV167 has a total of 38 bedrock features. The descriptive statistics for each measurement are provided in Table 6.7 and each variable is discussed in more detail below.

Table 6.7. Descriptive Statistics for 41VV167 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.00	13.86	11.14	1.28
Standard Error	0.50	0.74	0.64	0.05
Median	1.89	13.22	10.66	1.14
Standard Deviation	3.05	4.54	3.95	0.28
Sample Variance	9.33	20.64	15.62	0.08
Kurtosis	7.94	1.23	3.00	1.20
Skewness	2.64	0.77	1.21	1.24
Range	14.46	21.79	21.51	1.16
Maximum	15.01	27.78	25.06	2.16
Minimum	0.56	5.99	3.55	1.00
Count	38	38	38	38

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 38 bedrock features at 41VV167 were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.6-15.01 cm, have a mean of 3.0 cm and a standard deviation of 3.1 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.6932; n=38; p=1.28E-07), which is likely due to the three outliers greater than 6.0 cm in depth (Figure 6.25). The most common depth are features 1.0-2.0 cm deep.

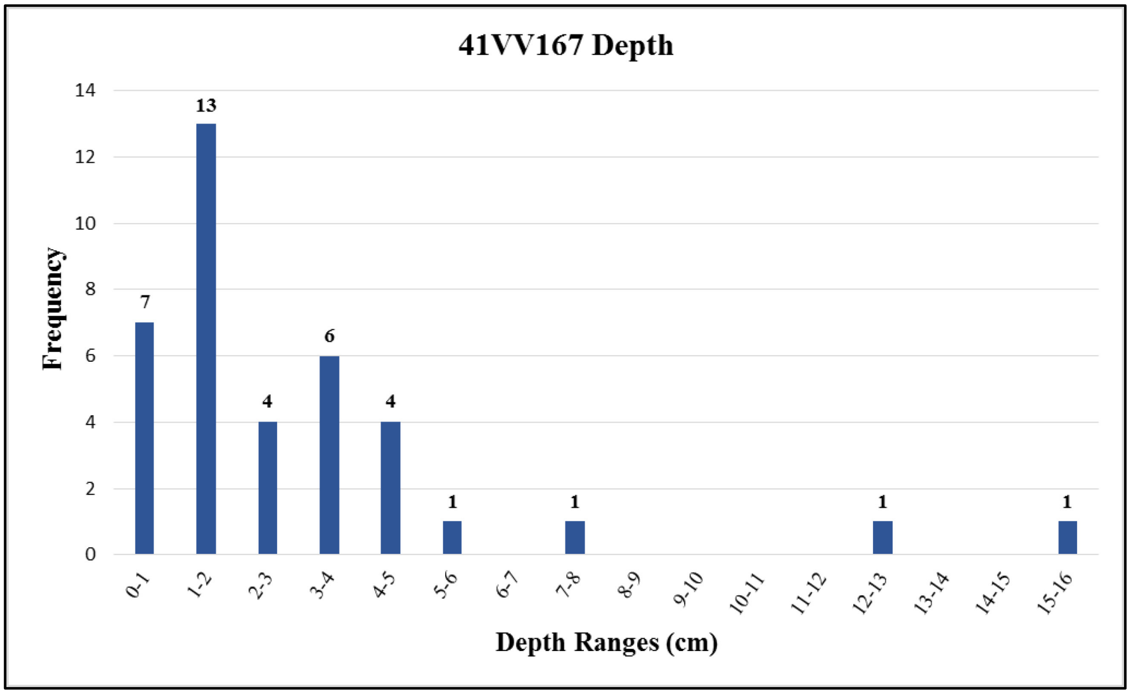


Figure 6.25. 41VV167 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). All 38 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 27.8 cm and the minimum length is 6.0 cm. The mean length for Axis-1 is 13.9 cm and the standard deviation is 4.5 cm. The Shapiro-Wilk test for normality shows these data are normally distributed (W=0.9631; n=38; p=0.2397). The most common length for Axis-1 is between 11.0-12.0 cm and the majority of the remaining features are spread relatively evenly between 8.0-11.0 cm and 12.0-18.0 cm (Figure 6.26).

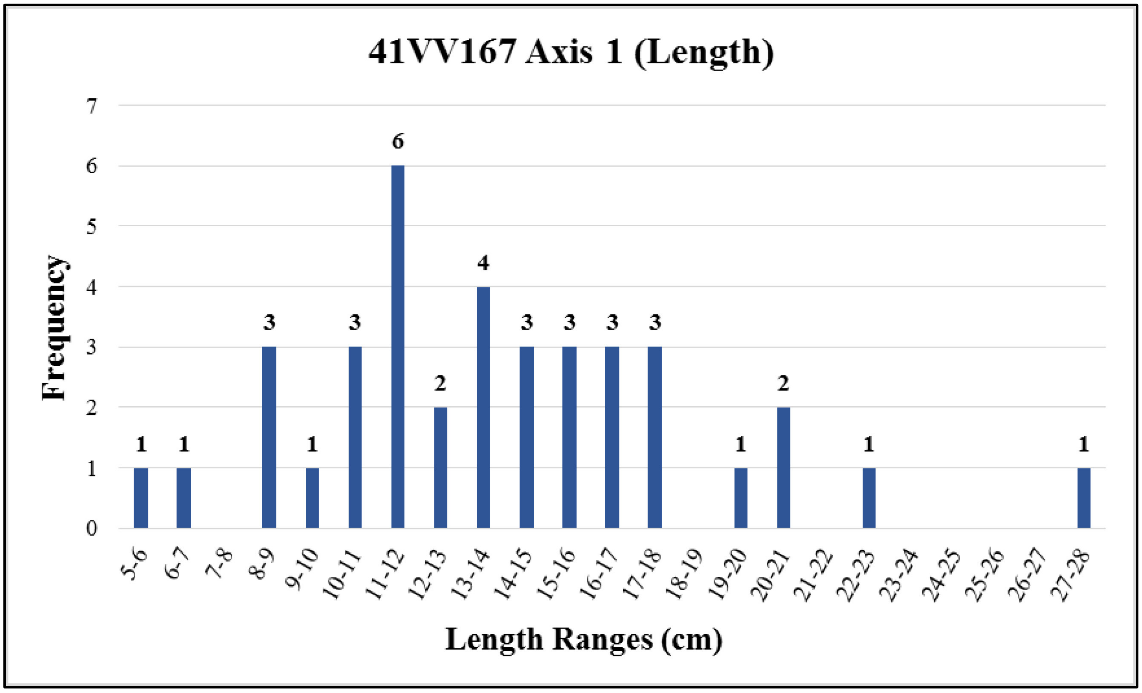


Figure 6.26. 41VV167 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 38 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 25.1 cm and the shortest width measurement is 3.6 cm. The mean length for Axis-2 is 11.1 cm and the standard deviation is 3.95 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9241; n=38; p=0.0131), which is likely due to the steep drop off in frequency after the most common width and the extreme outlier at 25.0-26.0 cm long (Figure 6.27). The most common width range is 11.0-12.0 cm with other small peaks occurring at 8.0-10.0 cm.

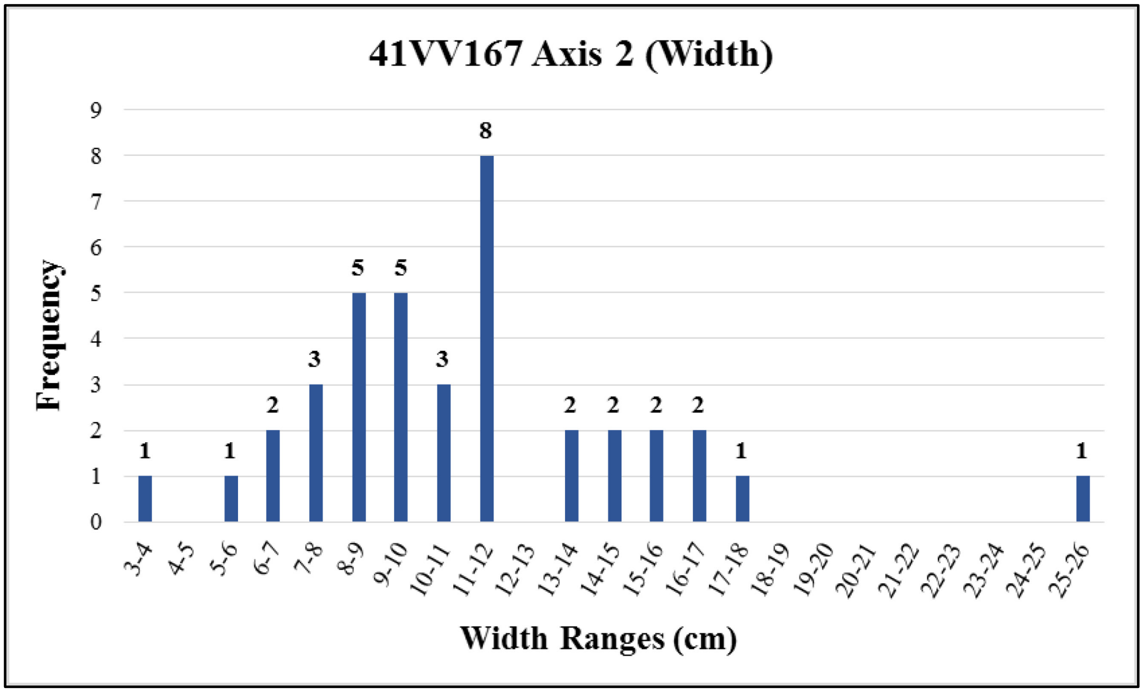


Figure 6.27. 41VV167 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV167 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.1 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8518; n=38; p=0.00014). The length-width ratio histogram (Figure 6.28) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

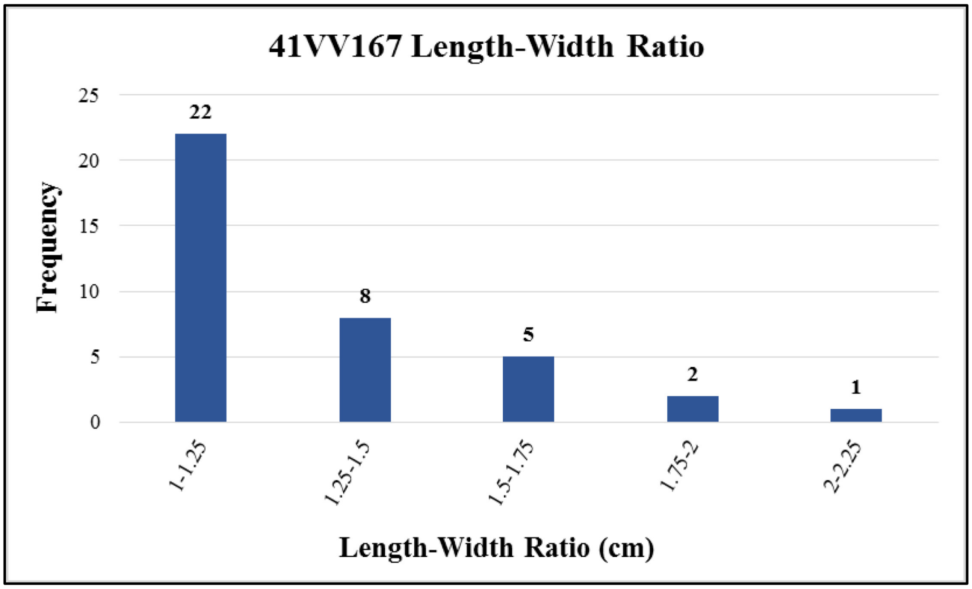


Figure 6.28. 41VV167 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV164 – Kelley Cave

41VV164 has a total of 27 bedrock features. The descriptive statistics for each measurement are provided in Table 6.8 and each variable is discussed in more detail below.

Table 6.8. Descriptive Statistics for 41VV164 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	2.20	14.33	10.82	1.33
Standard Error	0.21	0.96	0.55	0.06
Median	2.18	13.86	10.70	1.24
Standard Deviation	1.08	5.01	2.88	0.31
Sample Variance	1.18	25.10	8.28	0.09
Kurtosis	-0.97	1.31	0.21	3.51
Skewness	0.18	1.07	-0.05	1.62
Range	3.68	22.23	12.65	1.33
Maximum	4.09	28.72	16.78	2.35
Minimum	0.42	6.49	4.14	1.02
Count	27	27	27	27

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. All 27 bedrock features at 41VV164 were whole and yielded a complete depth measurement. Bedrock feature depths range from 0.4-4.1 cm, have a mean of 2.2 cm and a standard deviation of 1.8 cm. A Shapiro-Wilk test shows these data are normally distributed (W=0.9602; n=27; p=0.3733). Notably, this is the only site with a normally distributed depth measurement, which means 41VV164 is the only site that has no extreme depths and the features mostly cluster in the same depth range. The most common feature depth ranged between 1.0-2.0 cm and the remainder of the features are relatively evenly spread between 0.0-1.0 cm and 2.0-4.5 cm (Figure 6.29).

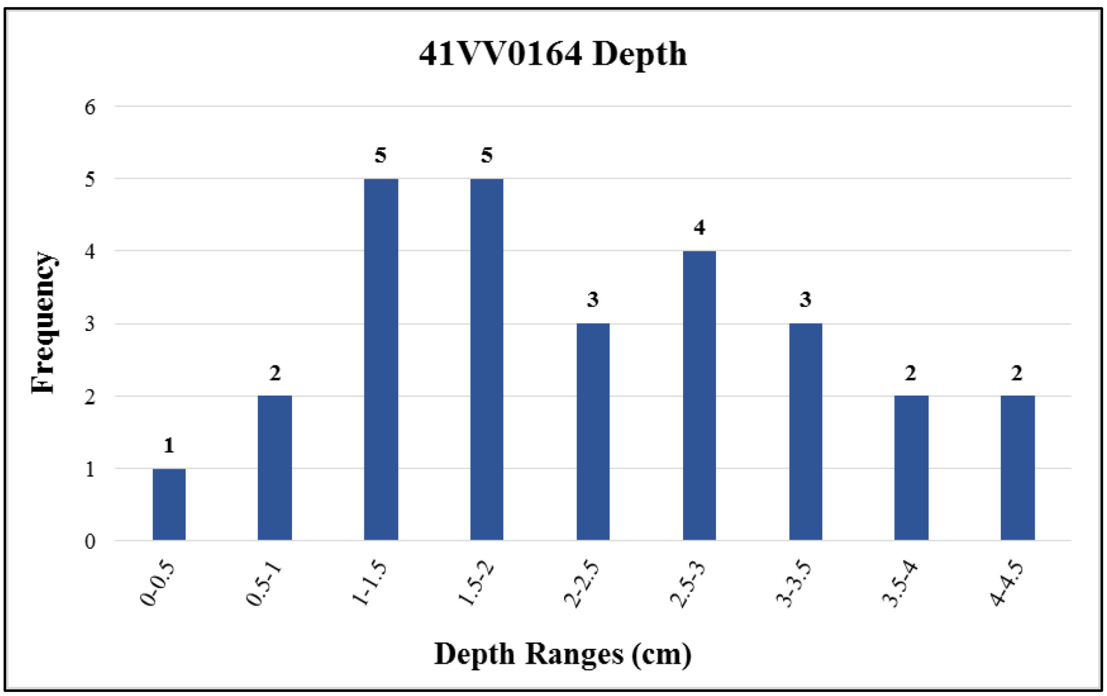


Figure 6.29. 41VV164 bedrock feature depth histogram with measurement interval of 0.5 cm.

Axis-1 Measurement (Length). All 27 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 28.8 cm and the minimum length is 6.5 cm. The mean length for Axis-1 is 14.3 cm and the standard deviation is 5.0 cm. The Shapiro-Wilk test for normality shows these data are normally distributed (W=0.9285; n=27; p=0.0634). The data are bimodal and the most common lengths for Axis-1 are between 11.0-12.0 and 15.0-16.0 cm (Figure 6.30).

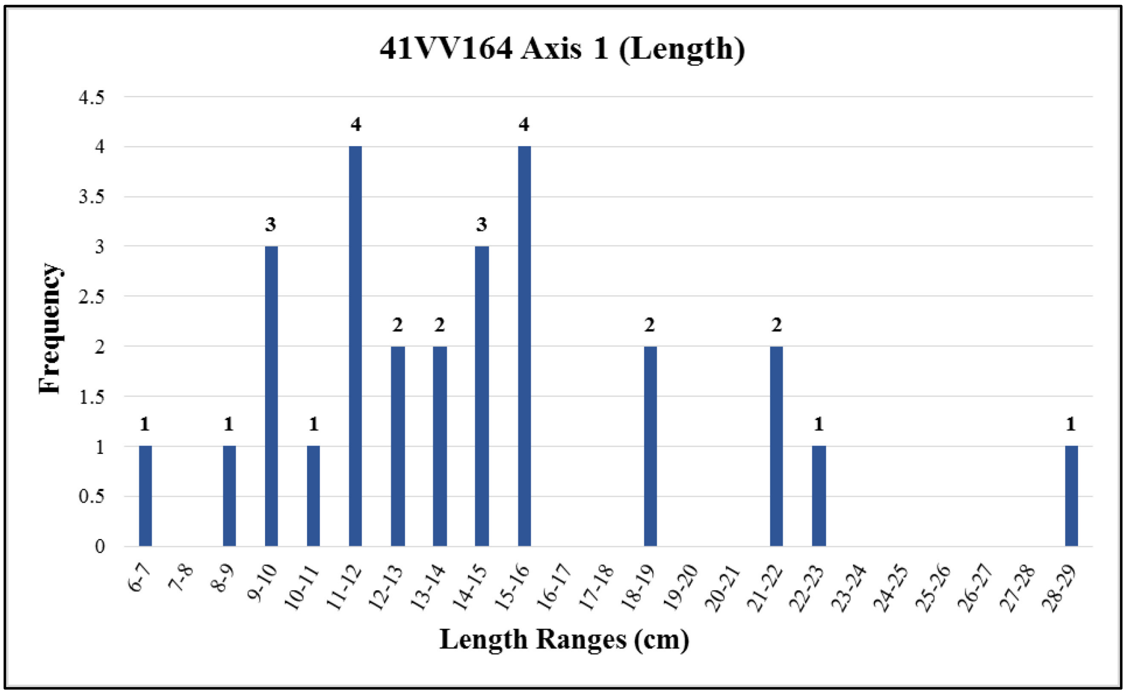


Figure 6.30. 41VV164 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 27 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 16.8 cm and the shortest width measurement is 4.1 cm. The mean length for Axis-2 is 10.8 cm and the standard deviation is 2.9 cm. The Shapiro-Wilk test for normality shows these data are also normally distributed (W=0.9898; n=27; p=0.9934). These data are strongly unimodal and the distribution forms a bell curve (Figure 6.31). The most common width range is 10.0-11.0 cm.

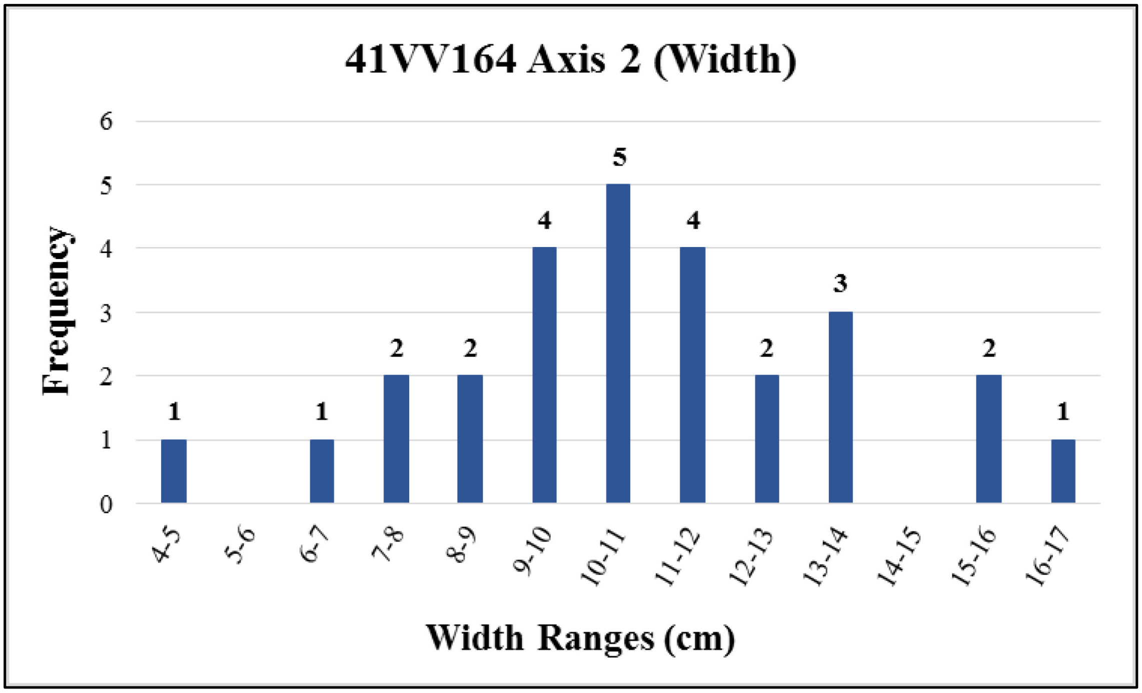


Figure 6.31. 41VV164 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV164 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.4 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8499; n=27; p=0.00115). The length-width ratio histogram (Figure 6.32) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

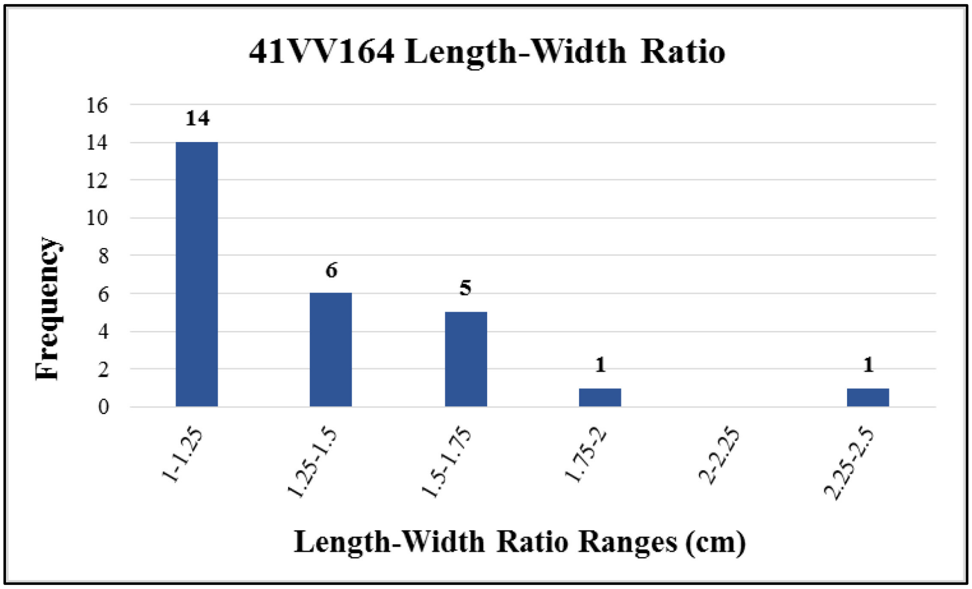


Figure 6.32. 41VV164 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV1284 – Running Deer

41VV1284 has a total of 23 bedrock features, the lowest amount of all the rockshelters analyzed in this study. The descriptive statistics for each measurement are provided in Table 6.9 and each variable is discussed in more detail below.

Table 6.9. Descriptive Statistics for 41VV1284 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.02	13.95	12.09	1.17
Standard Error	0.51	0.88	0.79	0.02
Median	2.62	12.98	11.11	1.16
Standard Deviation	2.41	4.21	3.79	0.10
Sample Variance	5.83	17.74	14.36	0.01
Kurtosis	4.07	0.95	1.93	0.44
Skewness	1.71	1.26	1.41	0.77
Range	10.73	14.77	14.66	0.39
Maximum	10.74	23.90	21.79	1.43
Minimum	0.01	9.14	7.13	1.04
Count	22	23	23	23

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. At 41VV1284, 22 of the 23 features were measured for a completed depth measurement. Bedrock feature depths range from 0.01-10.7 cm, have a mean of 3.0 cm and a standard deviation of 2.4 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8615; n=22; p=0.006), which is likely due to the one outlier with a depth 10.0-11.0 cm. The most common feature depth ranged between 2.0-3.0 cm (Figure 6.33).

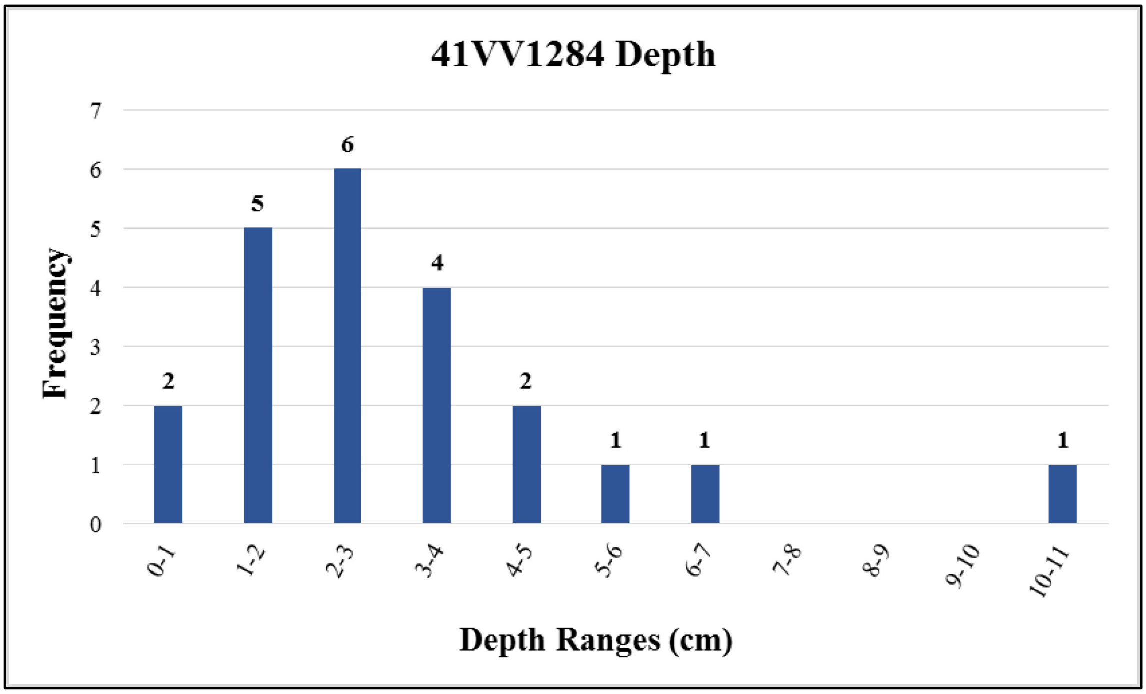


Figure 6.33. 41VV1284 bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). All 23 bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 23.9 cm and the minimum length is 9.1 cm. The mean length for Axis-1 is 13.6 cm and the standard deviation is 4.2 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.856; n=23; p=0.004). The most common length for Axis-1 is between 11.0-12.0 cm but there is also a small peak around 23.0-24.0 cm (Figure 6.34).

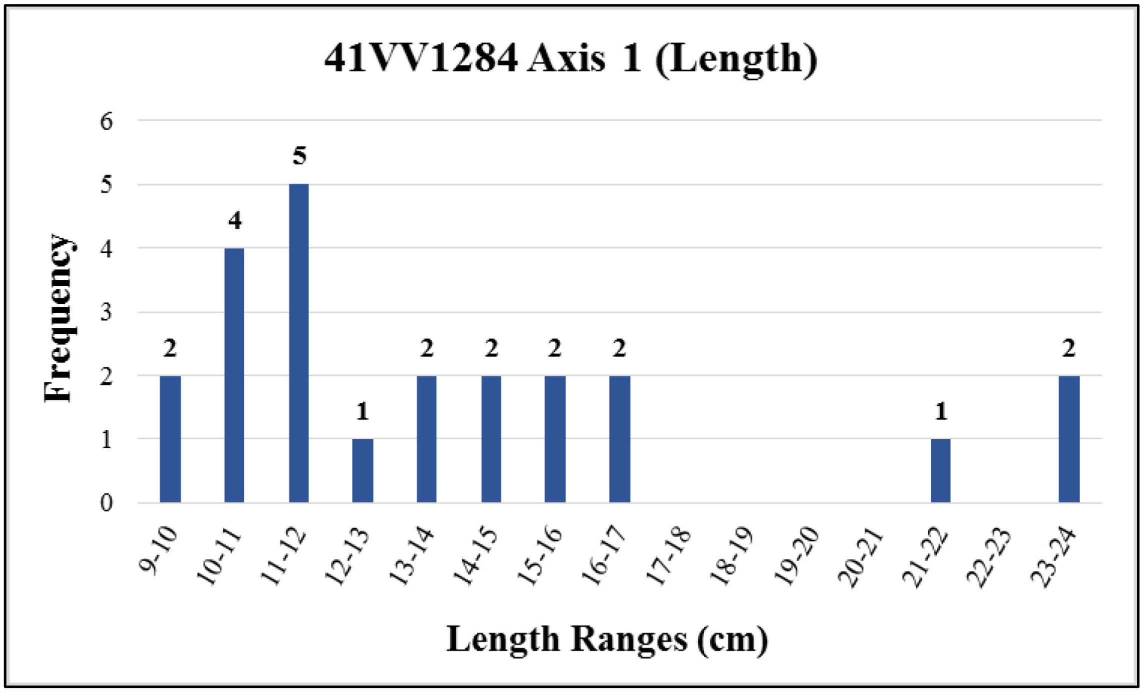


Figure 6.34. 41VV1284 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 23 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 21.8 cm and the shortest width measurement is 7.1 cm. The mean length for Axis-2 is 12.1 cm and the standard deviation is 3.8 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.8592; n=23; *p*=0.004). The most common width range is 12.0-13.0 cm with another peak around 9.0-11.0 cm (Figure 6.35).

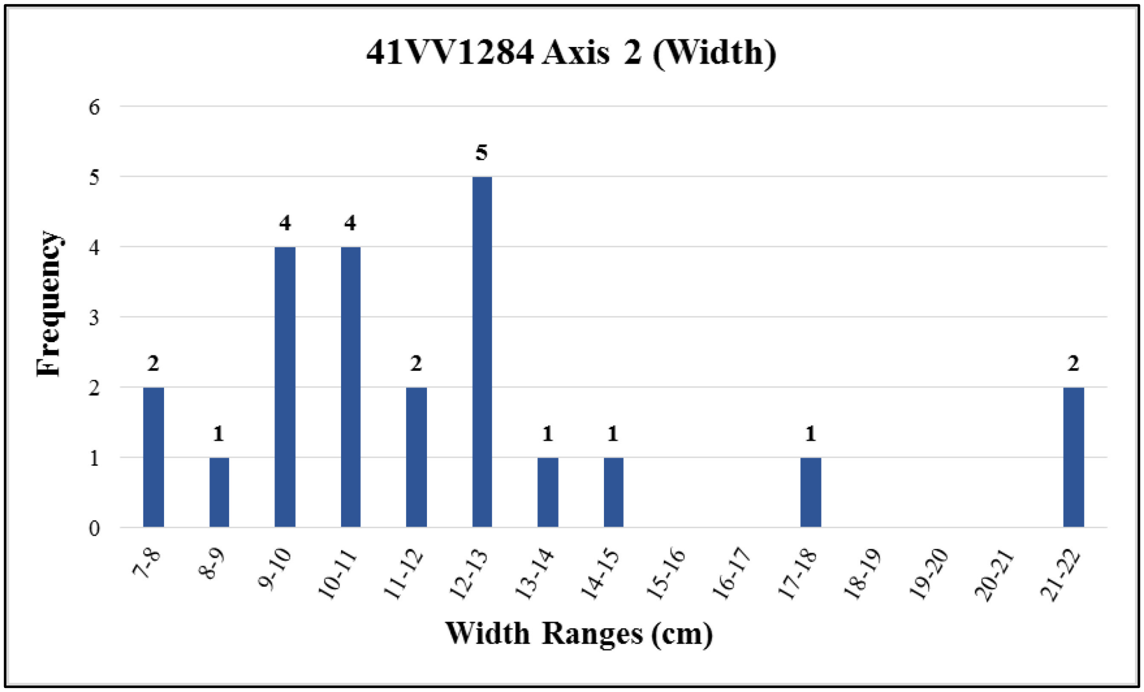


Figure 6.35. 41VV1284 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV1284 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 1.4 cm. The mean ratio is 1.2 cm and the standard deviation is 0.1 cm. A Shapiro-Wilk test shows these data are normally distributed (W=0.9363; n=23; p=0.1494). Interestingly, this is the only normally distributed length-with ratio data set. This is likely because of the features are within 0.5 cm of one another (Figure 6.36) but still the majority have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

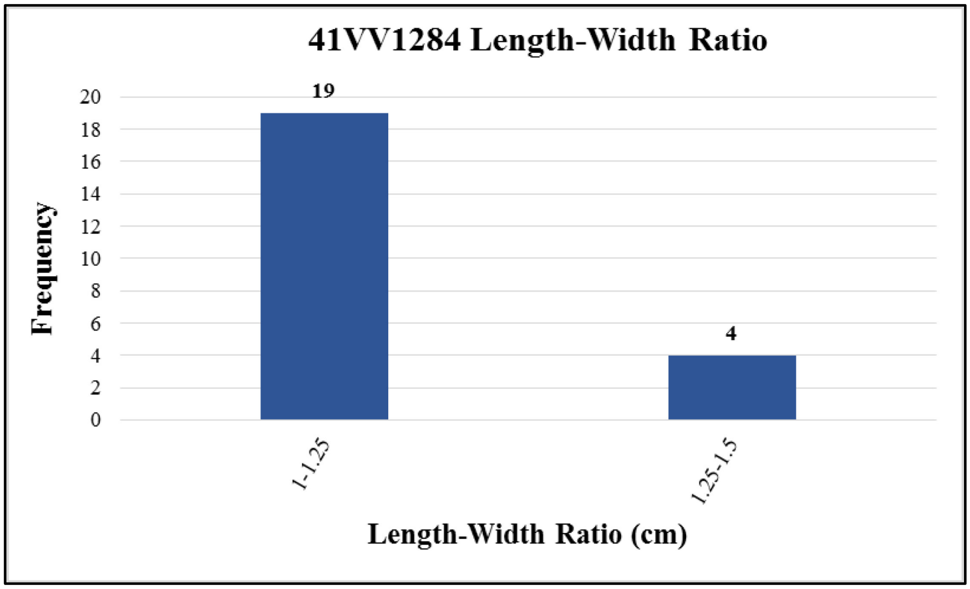


Figure 6.36. 41VV1284 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

41VV890

41VV890 has a total of four bedrock features, the lowest amount of all the sites analyzed in this study. The descriptive statistics for each measurement are provided in Table 6.10 and each variable is discussed in more detail below.

Table 6.10. Descriptive Statistics for 41VV890 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	2.80	19.64	14.70	1.30
Standard Error	0.37	4.26	2.56	0.09
Median	2.67	20.14	14.56	1.38
Standard Deviation	0.74	8.53	5.12	0.18
Sample Variance	0.54	72.72	26.22	0.03
Kurtosis	-1.36	-3.59	-4.92	3.85
Skewness	0.72	-0.20	0.06	-1.95
Range	1.63	18.36	10.39	0.38
Maximum	3.74	28.31	20.02	1.41
Minimum	2.12	9.95	9.63	1.03
Count	4	4	4	4

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. At 41VV890, all four of the bedrock features were measured for a completed depth measurement. Bedrock feature depths range from 2.1-3.7 cm, have a mean of 2.8 cm and a standard deviation of 0.7 cm. A Shapiro-Wilk test for normality could not be applied to this small data set. All features were relatively close in depth with two features between 2.0-3.0 cm and two between 3.0-4.0 cm (Figure 6.37).

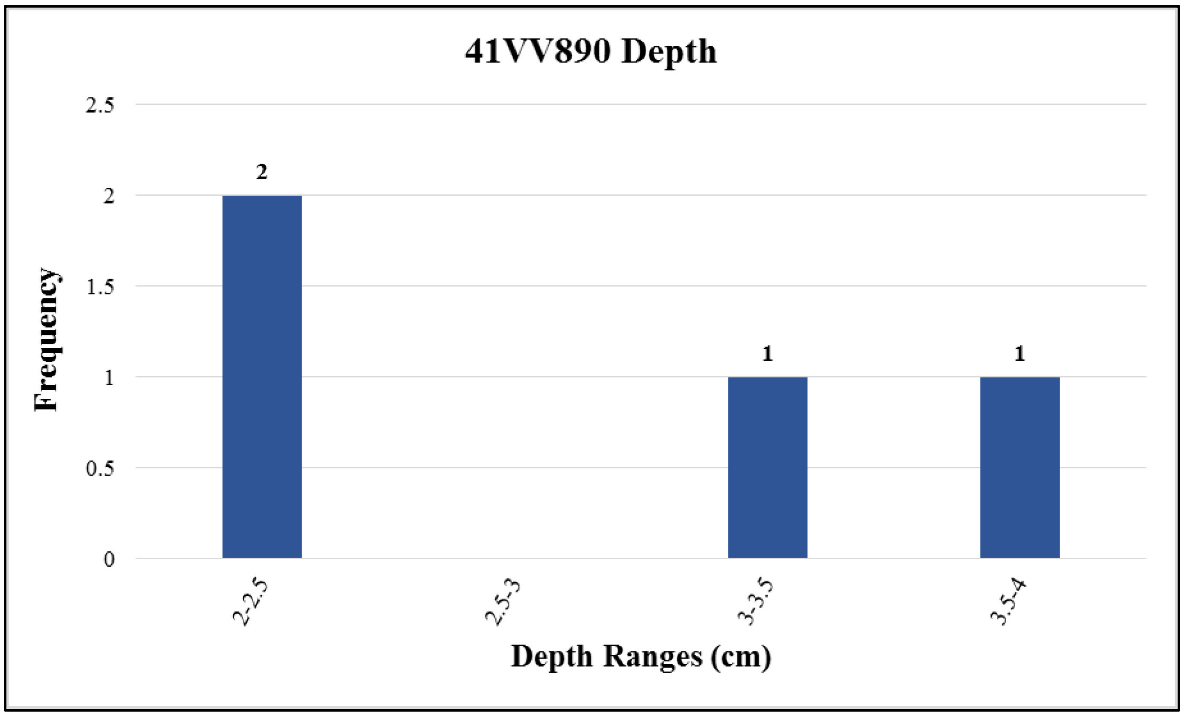


Figure 6.37. 41VV890 bedrock feature depth histogram with measurement interval of 0.5 cm.

Axis-1 Measurement (Length). All four bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 28.3 cm and the minimum length is 9.95 cm. The mean length for Axis-1 is 19.6 cm and the standard deviation is 8.5 cm. A Shapiro-Wilk test for normality could not be applied to this small data set. The length measurements are evenly spread across different width ranges (Figure 6.38).

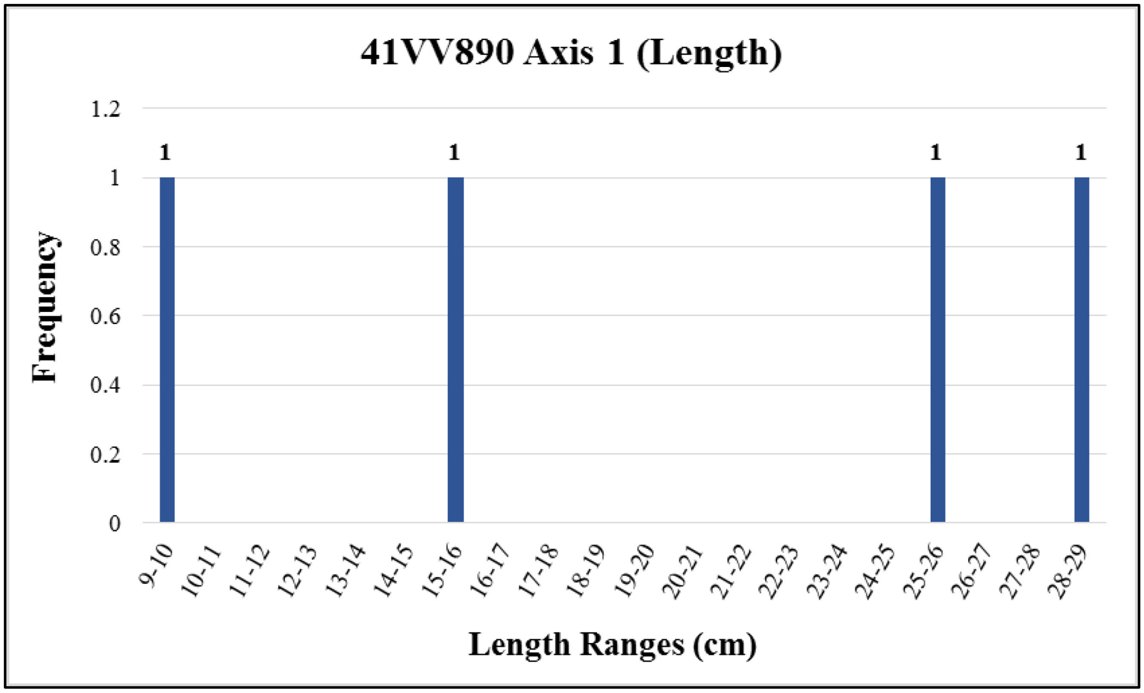


Figure 6.38. 41VV890 bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). All 4 bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 20.2 cm and the shortest width measurement is 9.6 cm. The mean length for Axis-2 is 14.7 cm and the standard deviation is 5.1 cm. A Shapiro-Wilk test for normality could not be applied to this small data set. Similar to length, the width measurements are also evenly spread across different width ranges (Figure 6.39).

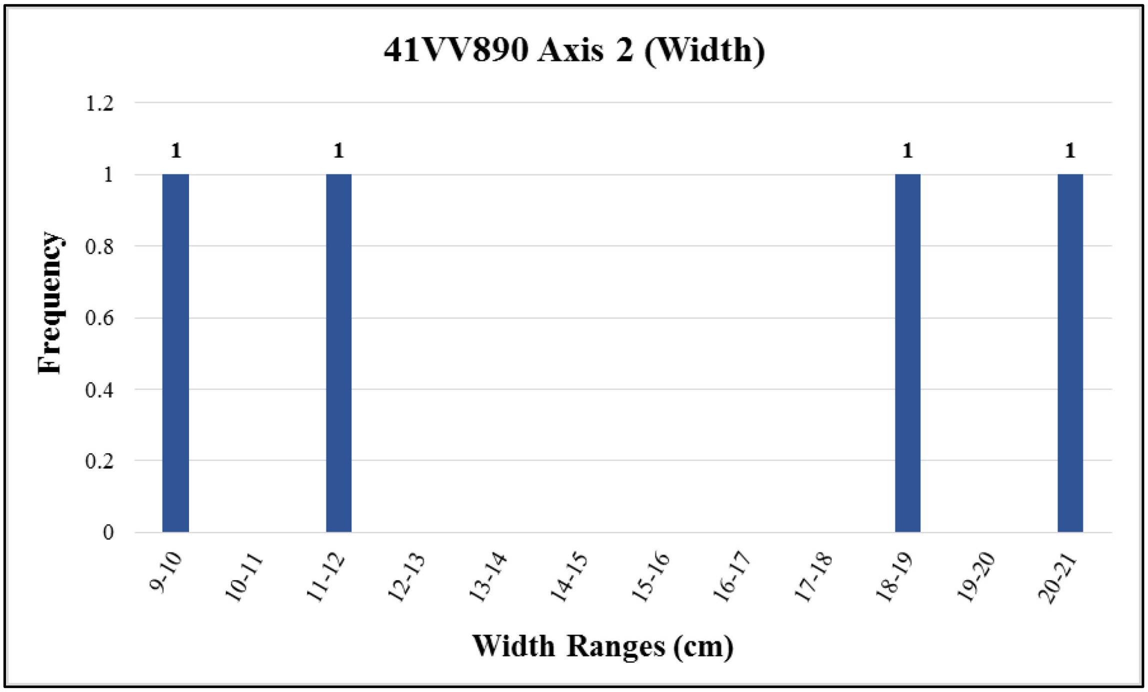


Figure 6.39. 41VV890 bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value at 41VV890 is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 1.4 cm. The mean ratio is 1.3 cm and the standard deviation is 0.2 cm. A Shapiro-Wilk test for normality could not be applied to this small data set. Three of the four features are slightly more ovoid with the length-width ratio measuring between 1.25-1.5 cm (Figure 6.40).

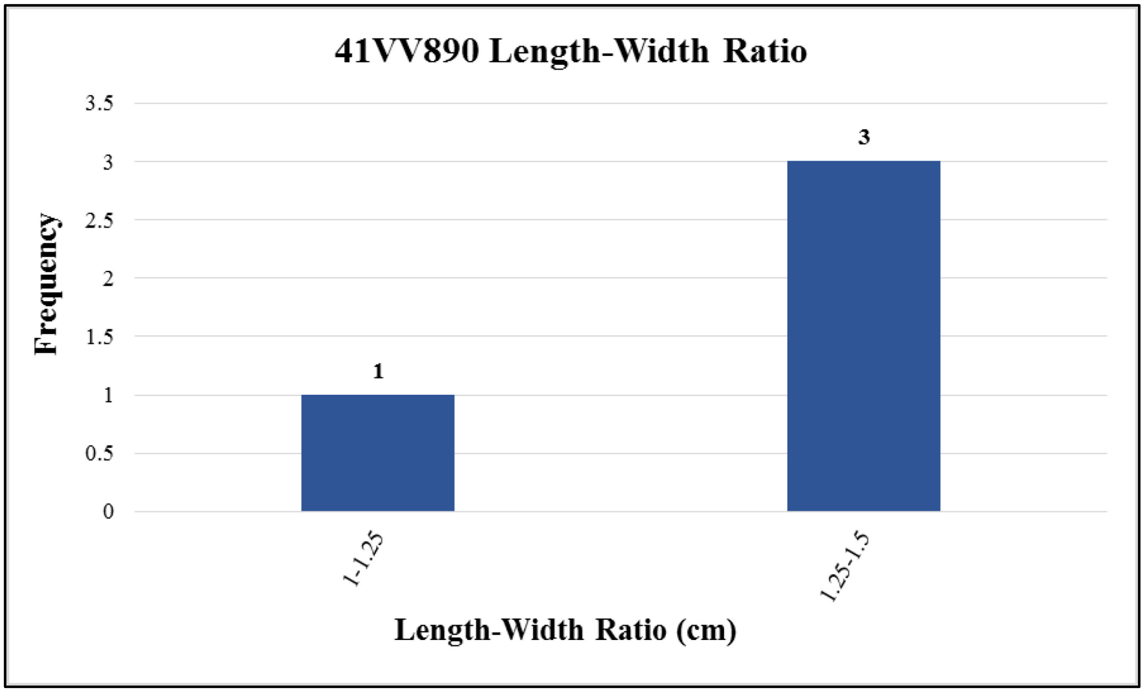


Figure 6.40. 41VV890 bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

Individual Sites: Summary and Comparison

The majority of the sites have relatively similar distributions of depth, length, width, and length-width ratio measurements. Since the majority of these samples have a non-normal distribution, SPSS was used to conduct a Kruskal-Wallis test for independent samples. This analysis was applied to the all of the site data along with pair-wise comparisons. These data are presented in tables for each of the measurements: depth, Axis-1, Axis-2, and length-width ratio (Figures 6.41, 6.42, 6.43, and 6.44). The adjusted significance (p-value) is reported for the pair-wise comparisons, which is considered a more conservative significant value calculation. The significant values are presented in each of the matrices and the highlighted values are lower than the critical value ($p<0.05$).

For the depth measurement, the Kruskal-Wallis test showed there was a significant difference in depth in the whole data set (H=18.615; *df*=9; *p*=.029). However, most of the sites had no significant different in the distribution of depths (Figure 6.41). The only exception is 41VV165 and 41VV2010 with a significant p-value of .009, which is highly significant.

KW Test	75	124	164	165	166	167	890	1284	1342	2010
75	-									
124	1.000	-								
164	1.000	1.000	-							
165	.215	1.000	1.000	-						
166	1.000	1.000	1.000	1.000	-					
167	1.000	1.000	1.000	1.000	1.000	-				
890	1.000	1.000	1.000	1.000	1.000	1.000	-			
1284	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-		
1342	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-	
2010	1.000	1.000	1.000	.009	1.000	1.000	1.000	1.000	1.000	-

Figure 6.41. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for depth measurements between sites.

In regards to the length and width measurements, the sites have some significant variation within the overall data set: Axis-1 (H=24.456; *df*=9; *p*=.004) and Axis-2 (H=28.81; *df*=9; *p*=.001). While a few site combinations are statistically different at the normal significance level, no sites are significantly different at the adjusted significance level (Figure 6.42) For Axis-2, 41VV166 and 41VV1284 varied at a significant level of .031 (Figure 6.43).

KW Test	75	124	164	165	166	167	890	1284	1342	2010
75	-									
124	1.000	-								
164	1.000	1.000	-							
165	1.000	1.000	1.000	-						
166	.183	1.000	.342	.181	-					
167	1.000	1.000	1.000	1.000	.215	-				
890	1.000	1.000	1.000	1.000	1.000	1.000	-			
1284	1.000	1.000	1.000	1.000	.902	1.000	1.000	-		
1342	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-	
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-

Figure 6.42. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for Axis-1 measurements between sites.

KW Test	75	124	164	165	166	167	890	1284	1342	2010
75	-									
124	1.000	-								
164	1.000	1.000	-							
165	1.000	1.000	1.000	-						
166	1.000	1.000	.580	.855	-					
167	1.000	1.000	1.000	1.000	.506	-				
890	1.000	1.000	1.000	1.000	.901	1.000	-			
1284	.074	.585	1.000	1.000	.031	1.000	1.000	-		
1342	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.304	-	
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.187	1.000	-

Figure 6.43. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for Axis-2 measurements between sites.

The length-width ratio measurements have significant variation (H=27.41; *df*=9; *p*=.001) throughout the whole data set, however only one pair-wise comparison resulted in significantly different length-width ratio measurement distributions (Figure 6.44). 41VV124 and 41VV75 are significantly different with a p-value of .017.

KW Test	75	124	164	165	166	167	890	1284	1342	2010
75	-									
124	.017	-								
164	1.000	1.000	-							
165	1.000	.488	1.000	-						
166	.168	1.000	1.000	1.000	-					
167	1.000	1.000	1.000	1.000	1.000	-				
890	1.000	1.000	1.000	1.000	1.000	1.000	-			
1284	.833	1.000	1.000	1.000	1.000	1.000	1.000	-		
1342	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-	
2010	.164	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-

Figure 6.44. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for length-width ratio measurements between sites.

Regional Sub-Groups Quantitative Distribution

The sites chosen for this study were spread out across the region in an attempt to obtain a representative sample of bedrock feature variation. This section groups sites that are in similar areas of the region together to compare bedrock features between different sub-regions. The farthest west sites are in the Eagle Nest Canyon group, the sites in the center of the region are in the Pecos River group, and the sites farthest east are in the Devils River group. Although located in the center of the region, 41VV75 was left out of the Pecos River group due to its large sample size that would overshadow the other two sites.

Eagle Nest Canyon Group

The five sites included in the Eagle Nest Canyon group are 41VV164, 41VV165, 41VV166, 41VV167, and 41VV890. The descriptive statistics for each measurement are provided in Table 6.11 and each variable is discussed in more detail below.

Table 6.11. Descriptive Statistics for Eagle Nest Canyon Group Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.1	13.3	10.3	1.3
Standard Error	0.2	0.3	0.2	0.0
Median	2.1	12.4	9.8	1.2
Standard Deviation	4.0	5.4	3.4	0.3
Sample Variance	15.8	28.9	11.9	0.1
Kurtosis	17.3	2.4	1.2	2.0
Skewness	3.9	1.1	0.5	1.5
Range	29.4	34.6	23.2	1.4
Maximum	29.5	36.6	25.1	2.4
Minimum	0.0	2.0	1.9	1.0
Count	260	260	260	260

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. In the Eagle Nest Canyon group, 260 bedrock features were measured for a full depth value. Bedrock feature depths range from 0.0-29.5 cm, have a mean of 3.1 cm and a standard deviation of 4.0 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.5332; n=260; p=0.0). The data are heavily right-skewed with a series of deeper outliers (Figure 6.45). The most common depth range in Eagle Nest Canyon is 1.0-2.0 cm.

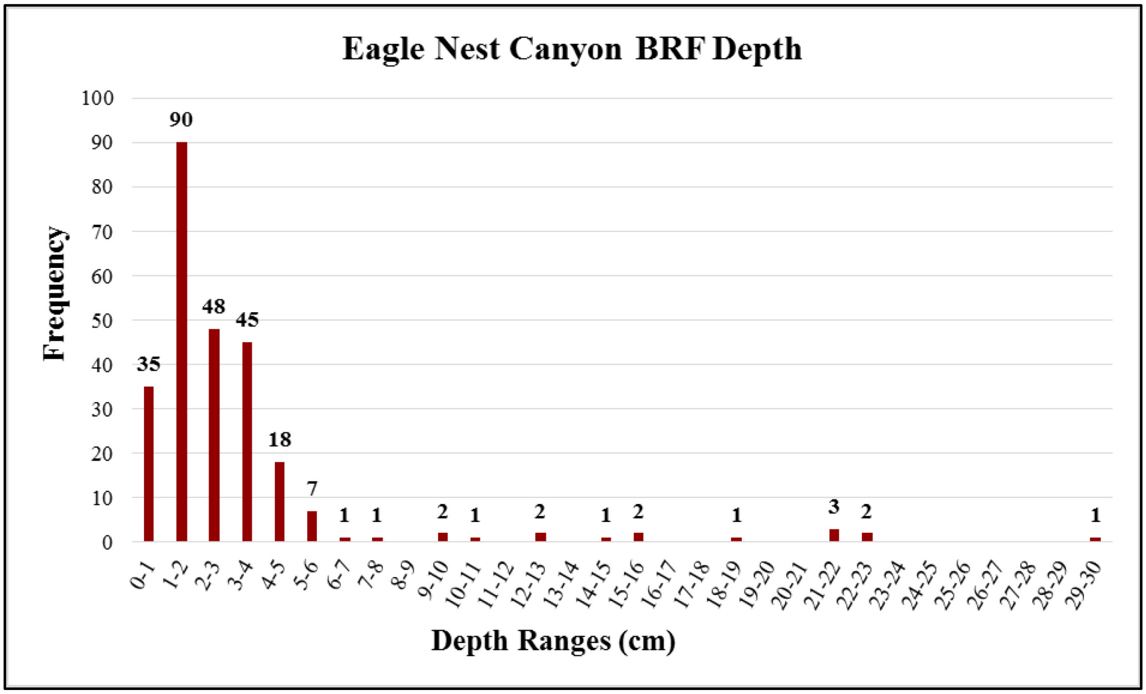


Figure 6.45. Eagle Nest Canyon bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). Two hundred and sixty bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 36.6 cm and the minimum length is 2.0 cm. The mean length for Axis-1 is 13.3 cm and the standard deviation is 5.4 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9355; n=260; p=3.07E-09). The most common length for Axis-1 is 11.0-12.0 cm but there are other small peaks around 9.0-10.0 cm, 14.0-15.0 cm, and 17.0-18.0 cm (Figure 6.46).

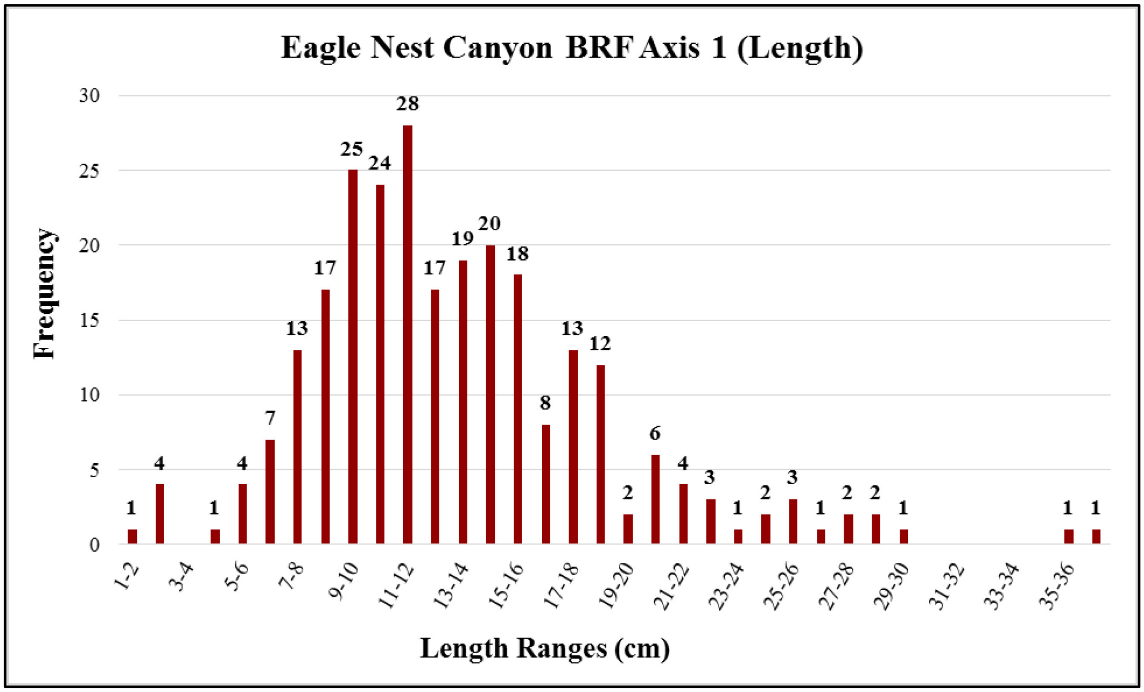


Figure 6.46. Eagle Nest Canyon bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). Two hundred and sixty bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 25.1 cm and the shortest width measurement is 1.9 cm. The mean length for Axis-2 is 10.3 cm and the standard deviation is 3.4 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.89805; n=260; p=0.00125), likely because of the outlier in the longest category. The most common width ranges are 8.0-9.0 cm and 9.0-10.0 cm (Figure 6.47).

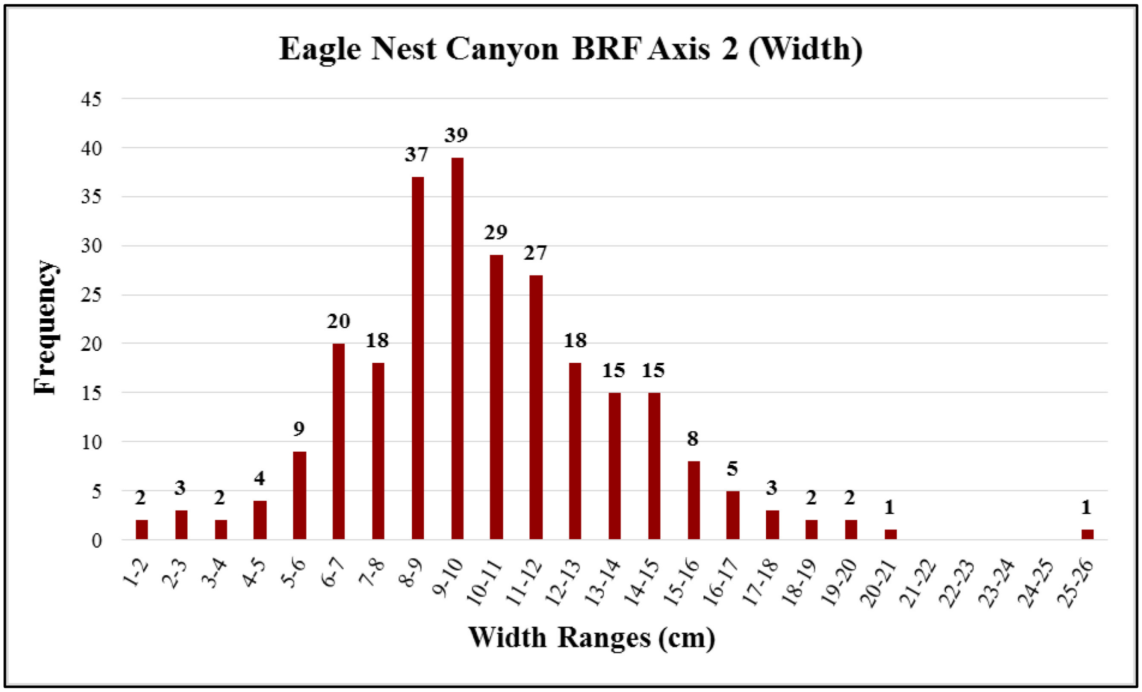


Figure 6.47. Eagle Nest Canyon bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value in Eagle Nest Canyon is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.4 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.84; n=260; *p*=1.11E-15). The length-width ratio histogram (Figure 6.48) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

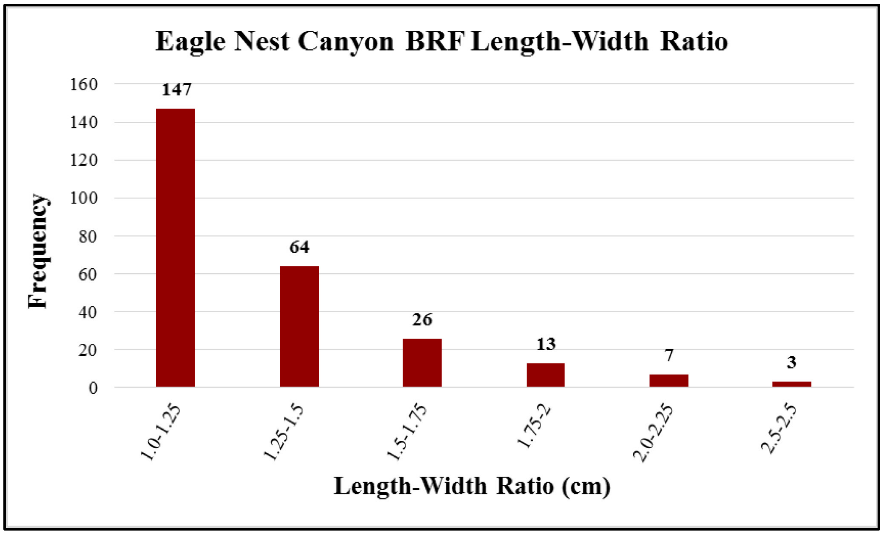


Figure 6.48. Eagle Nest Canyon bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

Pecos River Group

The two sites included in the Pecos River group are 41VV124 and 41VV2010. Although 41VV75 is located in the same vicinity, the large sample size would over power any trends seen in the other sites. Therefore, 41VV75 will be considered alone and compared against the other sub-groups. The descriptive statistics for each measurement are provided in Table 6.12 and each variable is discussed in more detail below.

Table 6.12. Descriptive Statistics for Pecos River Group Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	4.5	12.2	9.8	1.3
Standard Error	0.6	0.4	0.3	0.0
Median	2.5	11.5	9.5	1.2
Standard Deviation	7.7	4.6	3.0	0.3
Sample Variance	59.1	21.0	8.9	0.1
Kurtosis	30.0	5.2	3.5	3.6
Skewness	5.2	1.7	1.2	1.9
Range	55.5	30.9	20.6	1.6
Maximum	56.0	34.8	24.3	2.6
Minimum	0.5	3.9	3.7	1.0
Count	141	141	141	141

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. In the Pecos River group, 141 bedrock features were measured for a full depth value. Bedrock feature depths range from 0.5-56.0 cm, have a mean of 4.5 cm and a standard deviation of 7.7 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.4068; n=141; p=0.0). The data are heavily right-skewed with a series of deeper outliers (Figure 6.49). Similar to the sites in Eagle Nest Canyon, the most common depth range in the Pecos River group is 1.0-2.0 cm. Further, 41VV75 (Figure 6.1) also has 1.0-2.0 cm as the most common depth range. The Pecos River group has three features that are at least 16 cm deeper than any feature in Eagle Nest Canyon but it only has three features in the range of 12.0-25.0 cm while Eagle Nest Canyon has 11 features in this range (Figure 6.45). The Pecos River group depth range matches 41VV75's depth range more closely.

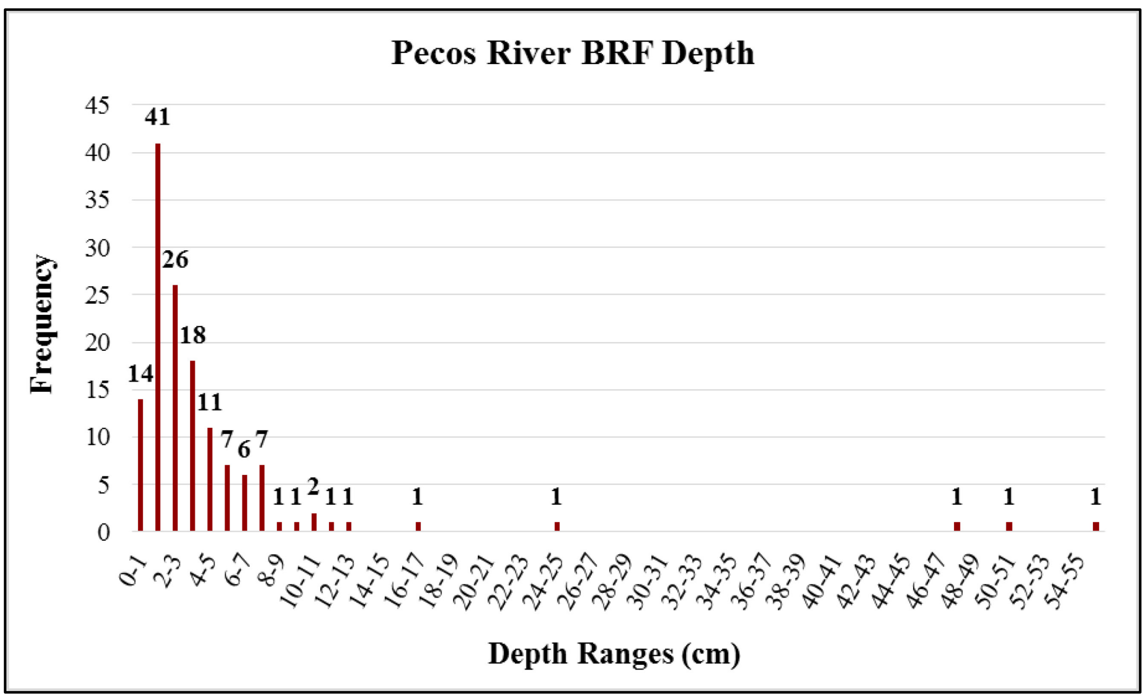


Figure 6.49. Pecos River bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). One hundred and forty-one bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 34.8 cm and the minimum length is 3.9 cm. The mean length for Axis-1 is 12.2 cm and the standard deviation is 4.6 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.8901; n=141; p=8.51E-09). The most common length for Axis-1 is 11.0-12.0 cm but there are other small peaks around 6.0-7.0 cm and 9.0-10.0 cm (Figure 6.50). The 11.0-12.0 cm range was also the most common length for Axis-1 at sites in Eagle Nest Canyon and while the most common length at 41VV75 is 13.0-14.0 cm (Figure 6.2).

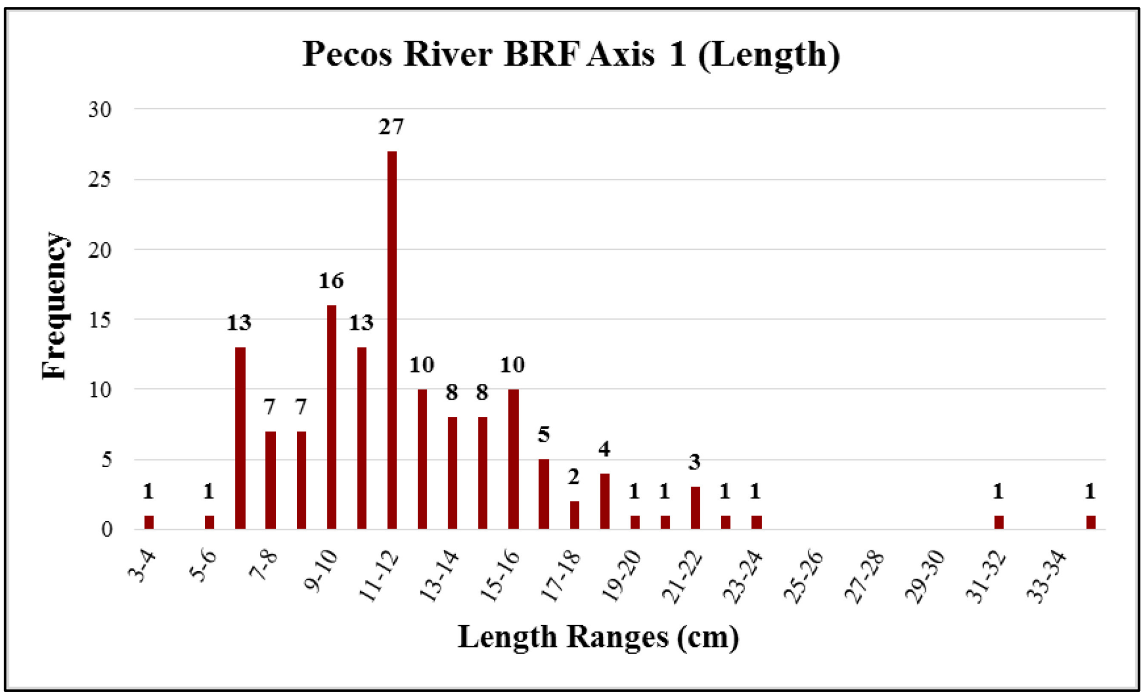


Figure 6.50. Pecos River bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). One hundred and forty-one bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 24.3 cm and the shortest width measurement is 3.7 cm. The mean length for Axis-2 is 9.8 cm and the standard deviation is 3.0 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9406; n=141; *p*=1.08E-05). Even though the majority of the data are distributed in a bell curve, there is one outlier near 24.0-25.0 cm wide and a frequency that increases rapidly in the shortest width ranges (Figure 6.51). The most common width range is 9.0-10.0 cm, which is also the case for 41VV75 (tied with 8.0-9.0 cm) and the Eagle Nest Canyon group.

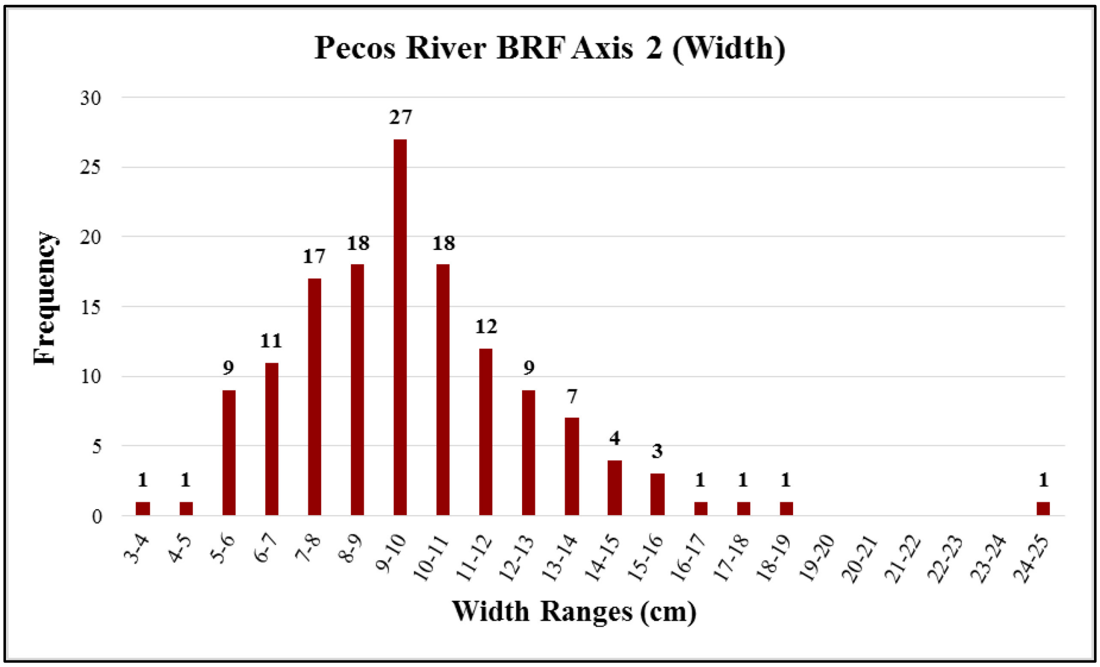


Figure 6.51. Pecos River bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value in the Pecos River Group is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.6 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.7846; n=141; *p*=4.03E-13). The length-width ratio histogram (Figure 6.52) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening which is similar for both 41VV75 and the features in the Eagle Nest Canyon group.

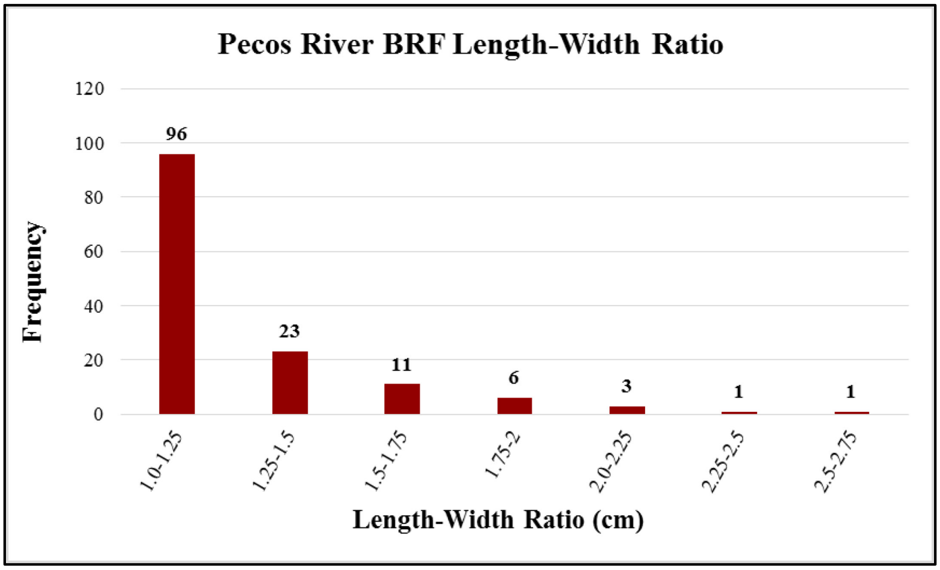


Figure 6.52. Pecos River bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

Devils River Group

The two sites included in the Devils River group are 41VV1284 and 41VV1342. The descriptive statistics for each measurement are provided in Table 6.13 and each variable is discussed in more detail below.

Table 6.13. Descriptive Statistics for Devils River Group Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.0	12.8	10.4	1.3
Standard Error	0.2	0.5	0.4	0.0
Median	2.7	11.9	10.2	1.2
Standard Deviation	2.0	4.0	3.2	0.2
Sample Variance	3.9	15.8	10.4	0.1
Kurtosis	2.9	0.6	3.2	1.9
Skewness	1.4	0.9	1.2	1.5
Range	10.7	17.7	17.3	1.1
Maximum	10.7	23.9	21.8	2.1
Minimum	0.0	6.2	4.5	1.0
Count	67	65	65	65

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. In the Devils River group, 67 bedrock features were measured for a full depth value. Bedrock feature depths range from 0.0-10.7 cm, have a mean of 3.0 cm and a standard deviation of 2.0 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.9011; n=67; p=6.13E-15). The data are right-skewed with a steep drop off after the most common depth range (2.0-3.0 cm) and a few outliers deeper than 7.0 cm (Figure 6.53). The most common bedrock feature depth range is one centimeter greater than the other sub-regions discussed previously; however, the features in the Devils River group are much shallower overall.

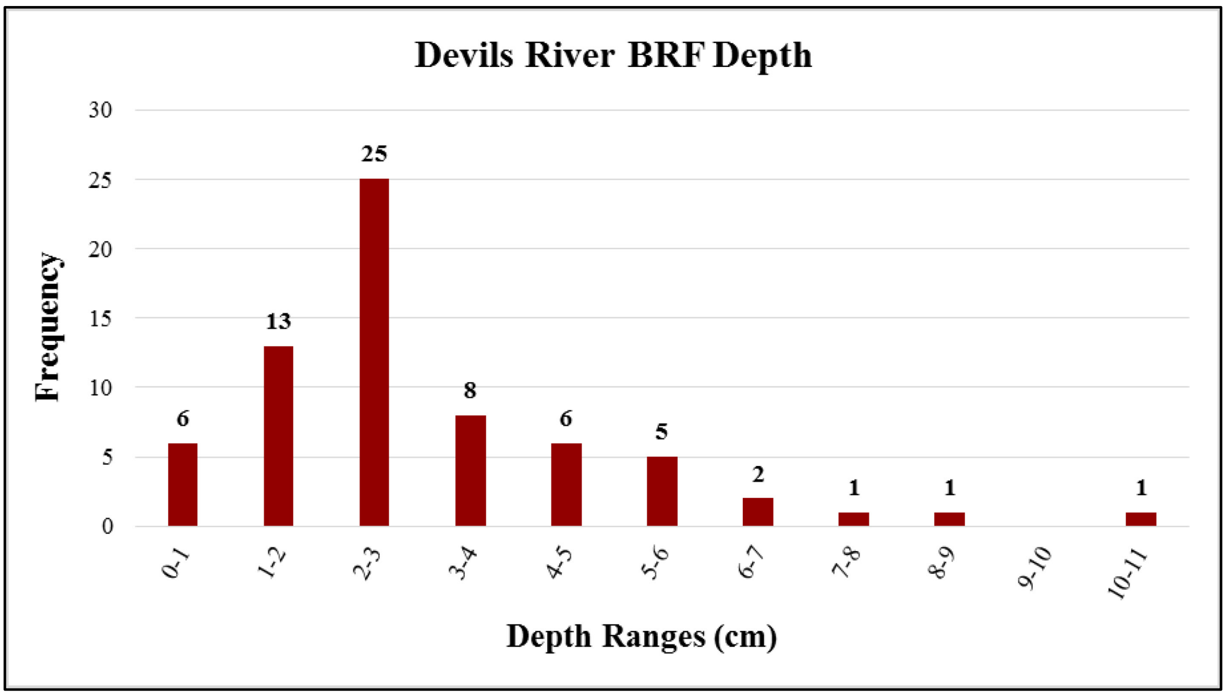


Figure 6.53. Devils River bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). Sixty-five bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 23.9 cm and the minimum length is 6.2 cm. The mean length for Axis-1 is 12.8 cm and the standard deviation is 4.0 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9402; n=65; p=0.004). The most common length for Axis-1 is 11.0-12.0 cm (Figure 6.54), which is also the case for both the Eagle Nest Canyon and Pecos River groups.

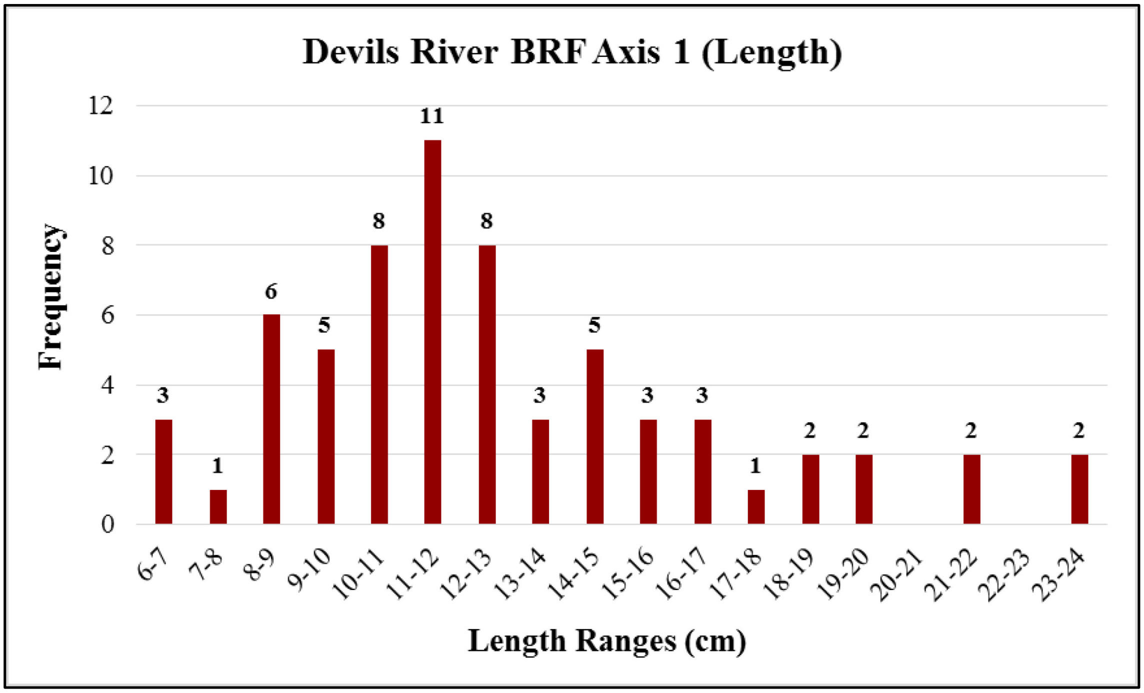


Figure 6.54. Devils River bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). Sixty-five bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 21.8 cm and the shortest width measurement is 4.5 cm. The mean length for Axis-2 is 10.4 cm and the standard deviation is 3.2 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9156; n=65; p=0.0003). Three different width ranges are tied for the most frequent occurrence: 8.0-9.0 cm, 10.0-11.0 cm, and 12.0-13.0 cm (Figure 6.55). These peaks are around the same width as the previously discussed groups.

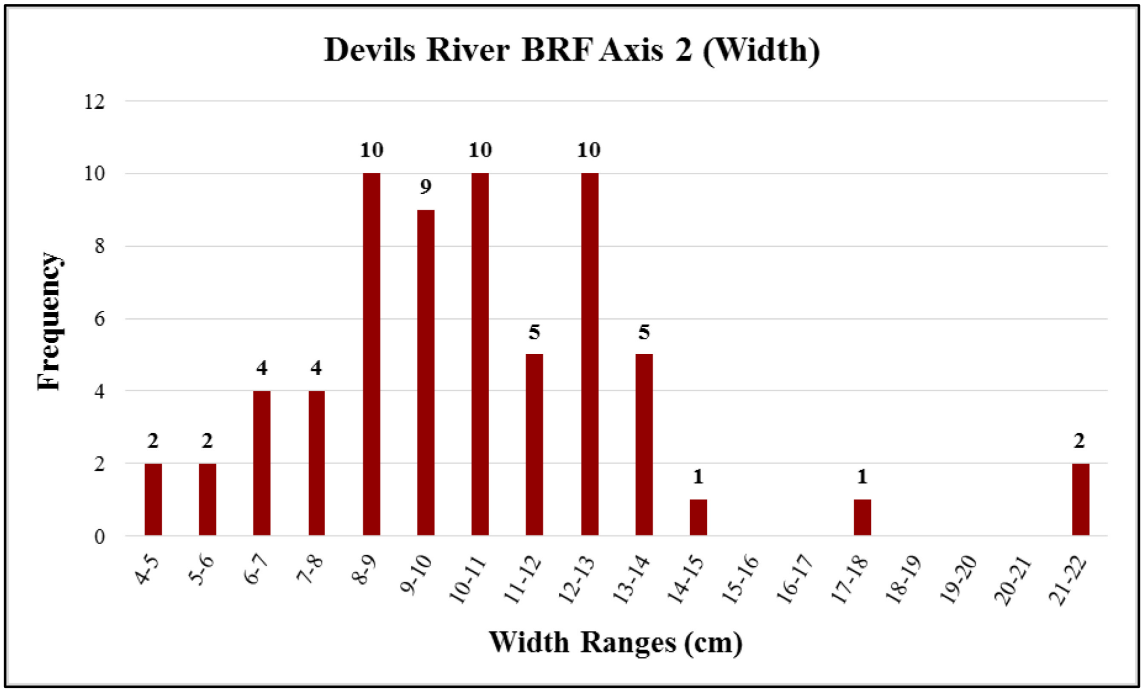


Figure 6.55. Devils River bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value in the Devils River Group is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 2.1 cm. The mean ratio is 1.3 cm and the standard deviation is 0.2 cm. A Shapiro-Wilk test shows these data are not normally distributed ($W=0.8307$; $n=65$; $p=3.81E-07$). The length-width ratio histogram (Figure 6.56) shows that a majority of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening which is similar for features in Eagle Nest Canyon, the Pecos River group, and the 41VV75 group.

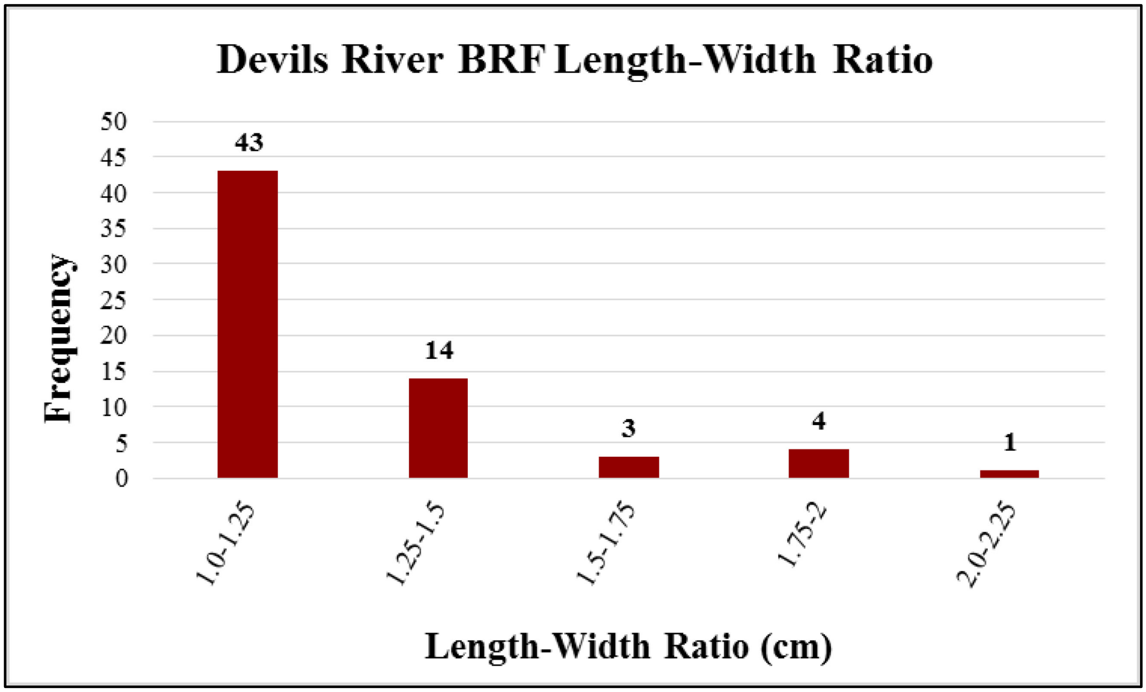


Figure 6.56. Devils River bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

Sub-Regional Groups: Summary and Comparison

Similar to comparing the sites against one another, a Kruskal-Wallis test for independent samples was used for the entire data set and post-hoc pair-wise comparisons for each sub-regional group. For the overall tests, significant variation was found for depth (H=8.912; *df*=3; *p*=.030), Axis-2 (H=7.931; *df*=3; *p*=.047), and length-width ratio (H=20.27; *df*=3; *p*=.0001). There was not significant variation found for the Axis-1 measurement (H=6.27; *df*=3; *p*=.099). As such, no post-hoc pair-wise comparisons were completed for Axis-1. For depth, only the Pecos River group and the Eagle Nest Canyon group differed significantly (Figure 6.57). With the adjusted significance levels, no groups resulted in statistically varied Axis-2 measurement distributions (Figure 6.58). Only one group, the Pecos River Group and 41VV75, significantly differed for the length-width ratio (Figure 6.59).The significant values of the post-hoc tests are presented below in matrices with highlighted values indicating a significant difference in distribution (p<0.05).

KW Test	Devils Group	Eagle Nest Canyon	Pecos Group	41VV75
Devils Group	-			
Eagle Nest Canyon	0.523	-		
Pecos Group	1.000	0.031	-	
41VV75	1.000	0.541	0.81	-

Figure 6.57. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for depth measurements between sub-regional groups.

KW Test	Devils Group	Eagle Nest Canyon	Pecos Group	41VV75
Devils Group	-			
Eagle Nest Canyon	1.000	-		
Pecos Group	0.772	0.636	-	
41VV75	0.36	0.108	1.000	-

Figure 6.58. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for Axis-2 measurements between sub-regional groups.

KW Test	Devils Group	Eagle Nest Canyon	Pecos Group	41VV75
Devils Group	-			
Eagle Nest Canyon	1.000	-		
Pecos Group	1.000	0.21	-	
41VV75	0.157	0.075	0.000	-

Figure 6.59. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for length-width ratio measurements between sub-regional

Regional Data Quantitative Distribution

Although the previous discussion has focused on comparing smaller analytical units, one of the benefits of collecting a large sample is the ability to analyze general patterns across the region. This section first characterizes the regional data through descriptive statistics and histograms for each measurement variable. Then a cluster analysis is conducted to reveal any morphological groups that may exist in the data set. Caution must be taken with cluster analyses as resulting groups may not reflect actual variation (Shennan 1988:197). To validate the clusters, a discriminant function analysis is used to check the appropriate assignments of bedrock features to their corresponding clusters (Shennan 1988:196). This method has been conducted on other archaeological collections and has yielded excellent results (e.g., Kerr 2000). Finally, in light of the discriminant function analysis, Kruskal-Wallis tests and non-parametric post-hoc pair-wise comparisons are used to determine which variables are key characteristics for each cluster and if the distributions significantly differ between the clusters.

Descriptive Statistics and Histograms

The regional data set includes 824 bedrock features from 10 sites. The descriptive statistics for each measurement are provided in Table 6.14 and each variable is discussed in more detail below.

Table 6.14. Descriptive Statistics for Regional Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	3.8	13.0	9.9	1.3
Standard Error	0.2	0.2	0.1	0.0
Median	2.3	12.2	9.6	1.2
Standard Deviation	6.4	4.8	3.1	0.3
Sample Variance	41.1	22.6	9.8	0.1
Kurtosis	42.3	2.7	2.2	2.9
Skewness	6.0	1.1	0.8	1.6
Range	58.0	34.6	23.2	2.3
Maximum	58.0	36.6	25.1	3.2
Minimum	0.0	2.0	1.9	1.0
Count	817	788	788	788

* Modes for each variable were not indicated due to lack of duplicated values.

Maximum Depth Measurement. In the regional data set, 817 bedrock features were measured for a full depth value. Bedrock feature depths range from 0.0-58.0 cm, have a mean of 3.8 cm and a standard deviation of 6.41 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.3864; n=817; p=0.0). The data are strongly right-skewed with a steep rise from 0.0-1.0 cm to 1.0-2.0 cm in depth (Figure 6.60). The most common bedrock feature depth range is 1.0-2.0 cm.

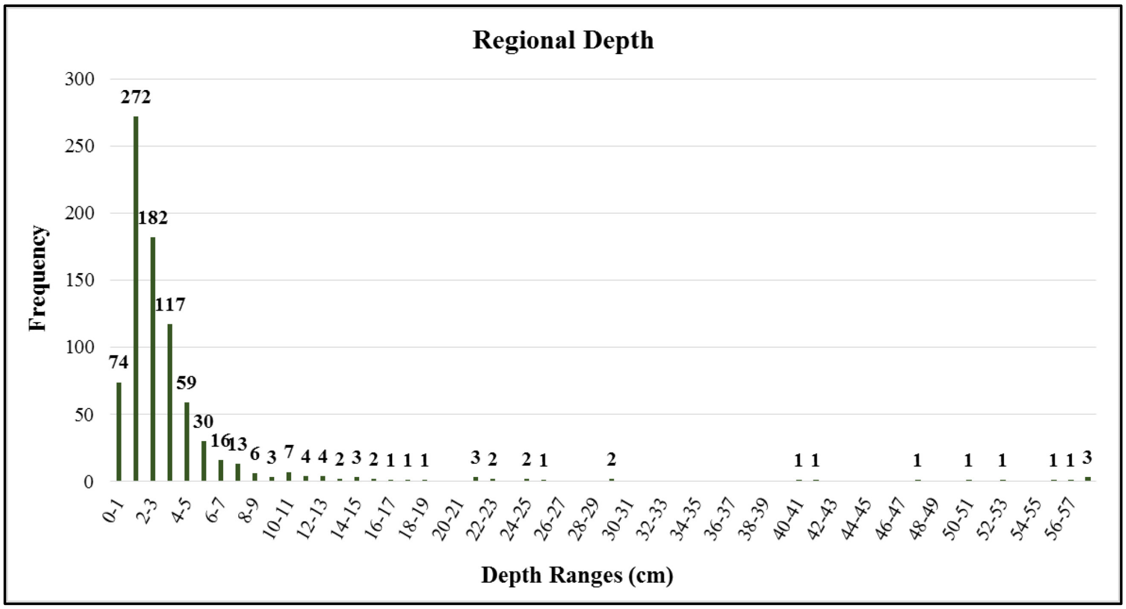


Figure 6.60. Regional bedrock feature depth histogram with measurement interval of 1.0 cm.

Axis-1 Measurement (Length). Seven hundred and eighty-eight bedrock features were able to be measured for the Axis-1 measurement. The maximum length of Axis-1 is 36.6 cm and the minimum length is 2.0 cm. The mean length for Axis-1 is 13.0 cm and the standard deviation is 4.8 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9414; n=817; p=0.0). The most common length for

Axis-1 is 11.0-12.0 cm (Figure 6.61), and the data are roughly in the shape of a bell curve with a slight tail out to the right.

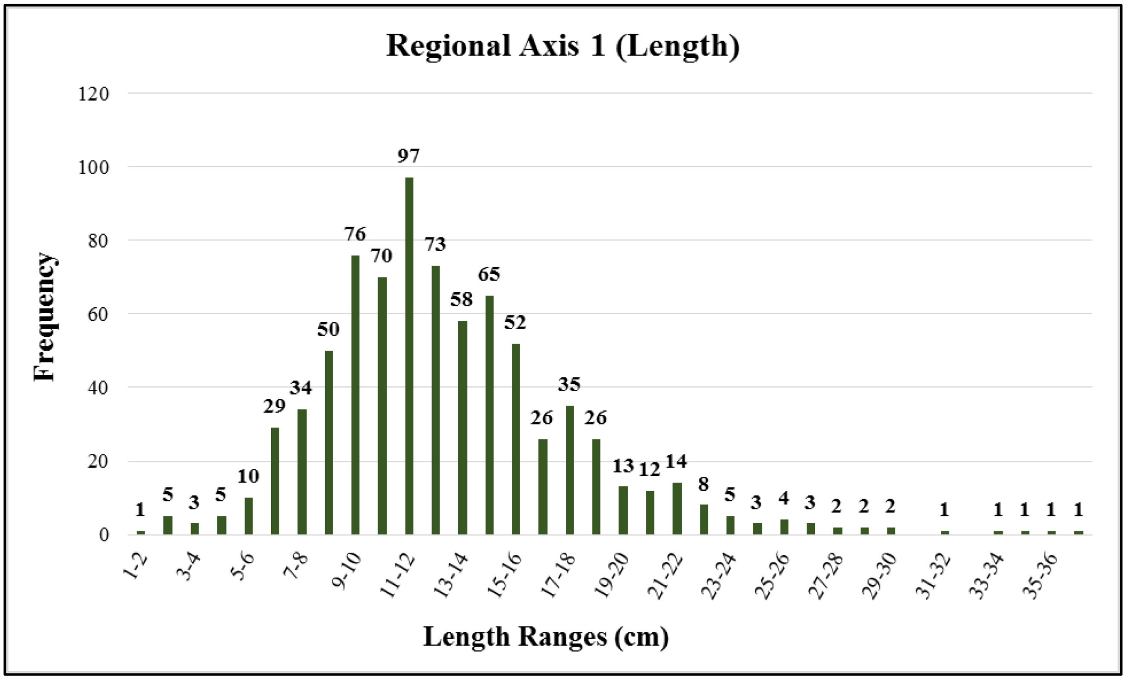


Figure 6.61. Regional bedrock feature Axis-1 (length) histogram with measurement interval of 1.0 cm.

Axis-2 Measurement (Width). Seven hundred and eighty-eight bedrock features were able to be measured for the Axis-2 measurement. The maximum width measures 25.1 cm and the shortest width measurement is 1.9 cm. The mean length for Axis-2 is 9.9 cm and the standard deviation is 3.1 cm. The Shapiro-Wilk test for normality shows these data are not normally distributed (W=0.9654; n=817; p=1.06E-12). The most common width range is 9.0-10.0 cm (Figure 6.62). These data are also roughly distributed in a bell curve but they have a slight tail on the right hand side of the graph.

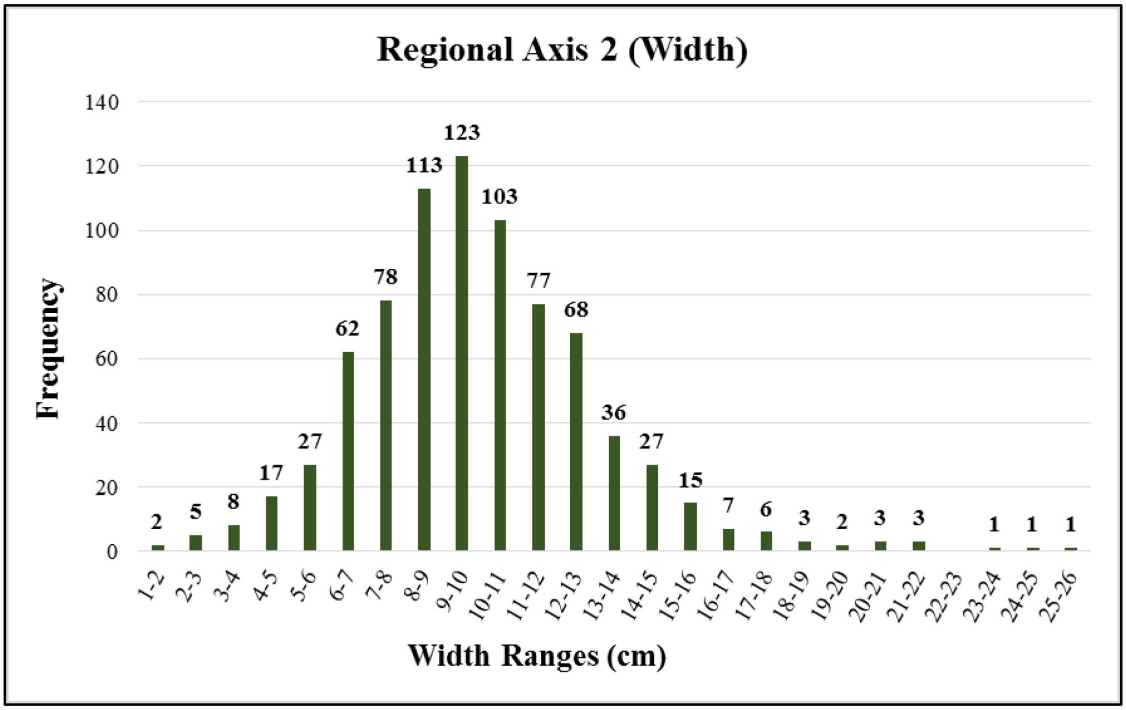


Figure 6.62. Regional bedrock feature Axis-2 (width) histogram with measurement interval of 1.0 cm.

Length-Width Ratio Measurement. The minimum length-width value in the regional data set is 1.0 cm, which represents a circular opening, and the maximum length-width ratio is 3.2 cm. The mean ratio is 1.3 cm and the standard deviation is 0.3 cm. A Shapiro-Wilk test shows these data are not normally distributed (W=0.8436; n=817; p=0.0). The length-width ratio histogram (Figure 6.63) shows that over half of the features have a ratio between 1.0 cm and 1.25 cm which equates to a round or slightly sub-round opening.

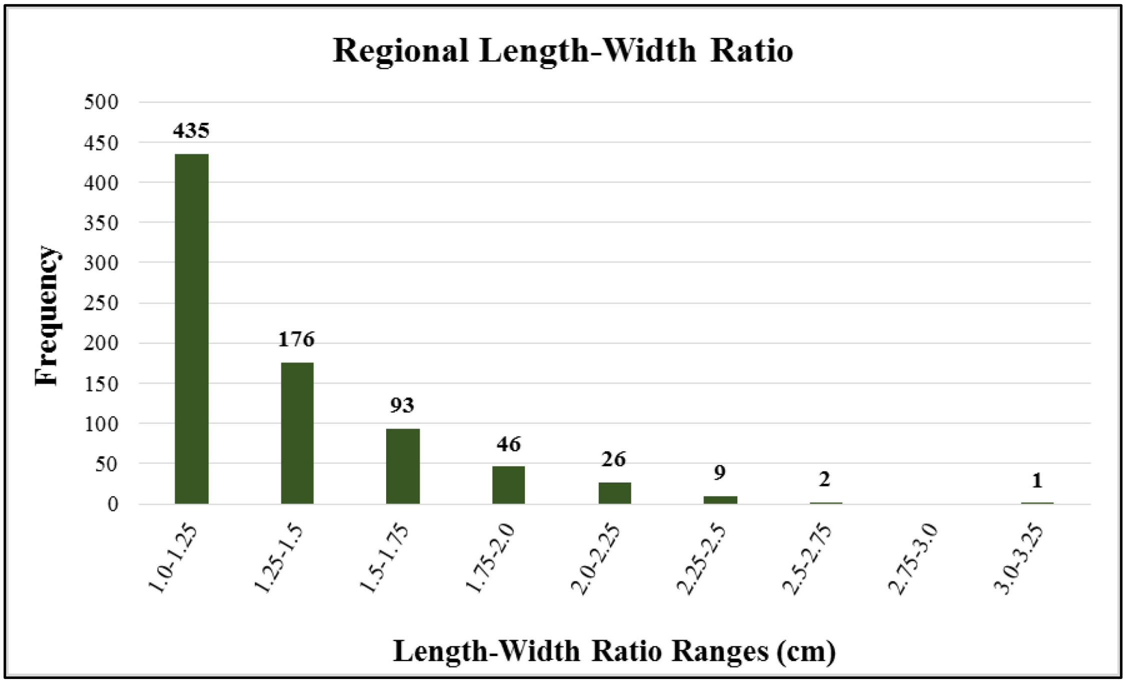


Figure 6.63. Regional bedrock feature length-width ratio histogram with measurement interval of 0.25 cm.

Regional Data Cluster Analysis

In order to systematically analyze the regional data set of bedrock features and attempt to split them into independent groups, a cluster analysis was performed on 787 bedrock features. These features were chosen because they had all three measurements used for the cluster analysis variables: depth, Axis-1 (length), and Axis-2 (width). SPSS was used to conduct the analysis and the result is a dendrogram (Figure 6.64) revealing broad patterns in the morphological variability of bedrock features. The cluster analysis produced 4 groups and no outliers.

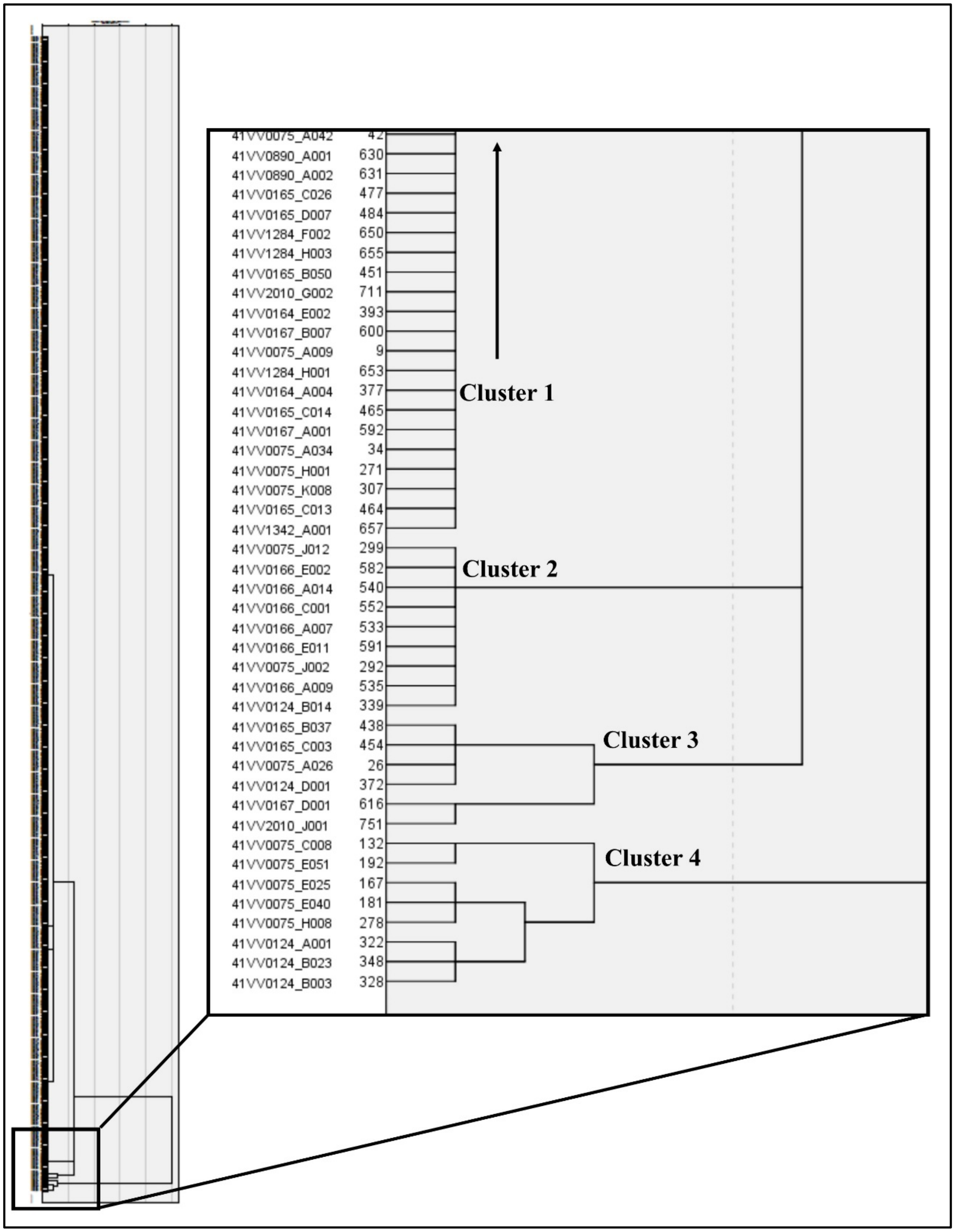


Figure 6.64. Cluster analysis dendrogram of Lower Pecos bedrock features. See Table App C.1 for feature numbers in each cluster.

Cluster 1 is the largest group (n=764) and creates the majority of the dendrogram. There are four smaller groups that comprise Cluster 1 that meet up at a very close level to the original specimens, indicating the variation is not as great between the groups. Cluster 2 (n=9) is located directly beneath Cluster 1 and joins the previous group at a secondary level. Cluster 3 (n=6) is related to the previous two clusters in a similar way and is comprised of two separate smaller groups. The final group located at the bottom of the dendrogram, Cluster 4 (n=8), is located furthest away from the other groups on its own clade and is comprised of two smaller groups. Due to the size of the dendrogram, an inset is provided in Figure 6.64 of the bottom three clusters with everything above belonging in Cluster 1. Appendix C provides a table of feature numbers in each cluster (Table App C.1).

Table 6.15 provides the coefficient of variation value for each of the measurements, which shows the variability of each variable within each group. Average sample variation is also provided to show how variable each cluster is as a whole. Extremely high variable measurements are highlighted in yellow and low variability values are outlined with a black line and have a green background. These low values help show which measurement is the most characteristic variable for each cluster.

Table 6.15. Coefficient of Variation for each Metric Variable.

	Depth	**Axis 1**	**Axis 2**	**LW**	**∑**	**$\bar{x}$**
Cluster 1	85.7	34.6	29.9	23.1	173.3	43.33
Cluster 2	12.7	18.1	14.3	16.7	61.8	15.45
Cluster 3	83.1	9.9	32.2	40.0	165.2	41.30
Cluster 4	13.8	23.8	22.9		60.6	20.18

Cluster 1 (Table 6.16) consists of bedrock feature with a fairly wide range of depth, Axis-1, Axis-2, and length-width measurements. This cluster is the most variable of all the groups as a whole (Table 6.15). The other clusters have at least one readily recognizable variable with low variability that can be used to characterize the group but Cluster 1 appears to be an amalgamation of highly variable features. Cluster 1 bedrock feature depths range from 0.0-18.6 cm, have a mean of 2.8 cm and, a standard deviation of 2.4 cm. Axis-1 measurements range from 2.0-29.2 cm in length and Axis-2 measurements range from 1.9-21.8 cm wide. The length-width ratio is also varied with measurements ranging from 1.0-2.5 cm, representing circular, extremely ovoid features, and shapes in-between.

Cluster 2 (Table 6.17) consists of features that are definitively deeper than the majority of the features with a minimum depth measurement of 21.4 cm and a maximum of 29.5 cm. Cluster 2 has much smaller ranges of Axis-1 and Axis-2 measurements than Cluster 1. The maximum length of Axis-1 is 23.6 cm and the minimum length is 14.6 cm. The maximum width of Axis-2 is 17.7 cm and the minimum width is 10.3 cm. The length-width ratio is also slightly more restricted with a range of 1.0-1.7 cm. Table 6.15 shows that depth and Axis-2 have low variability and help define the cluster. This group also has the lowest overall variability of all four clusters.

Table 6.16. Descriptive Statistics for Cluster 1 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	LW Ratio
Mean	2.8	12.7	9.7	1.3
Standard Error	0.1	0.2	0.1	0.0
Median	2.2	12.1	9.5	1.2
Standard Deviation	2.4	4.4	2.9	0.3
Sample Variance	5.6	19.1	8.3	0.1
Kurtosis	10.8	1.1	1.1	1.4
Skewness	2.8	0.8	0.4	1.3
Range	18.6	27.3	19.9	1.6
Maximum	18.6	29.2	21.8	2.5
Minimum	0.0	2.0	1.9	1.0
Count	764	764	764	764

* Modes for each variable were not indicated due to lack of duplicated values.

Table 6.17. Descriptive Statistics for Cluster 2 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	24.4	17.1	14.0	1.2
Standard Error	1.0	1.0	0.7	0.1
Median	22.9	15.6	14.1	1.1
Standard Deviation	3.1	3.1	2.0	0.2
Sample Variance	9.9	9.3	3.8	0.1
Kurtosis	-0.4	1.5	2.6	0.6
Skewness	1.0	1.5	0.0	1.2
Range	8.1	9.0	7.4	0.7
Maximum	29.5	23.6	17.7	1.7
Minimum	21.4	14.6	10.3	1.0
Count	9	9	9	9

* Modes for each variable were not indicated due to lack of duplicated values.

Cluster 3 appears to be largely determined by the Axis-1 length (Table 6.15). All of the features included in this group have extremely long length measurements, occasionally accompanied by long width measurements, but not always. The maximum Axis-1 measurement is 36.6 cm and the minimum is 27.8 cm (Table 6.18). The maximum

Axis-2 width is 25.1 cm while the minimum 10.3 cm. These values are somewhat equivalent with other clusters. The depth values are also fairly variable with the minimum depth measurement at 1.1 cm and the maximum at 15.0 cm. Cluster 3 has the widest range of length-width ratios at 1.1-3.2 cm.

Cluster 4 (Table 6.19) is a group that is located furthest away from all three other clusters. The determining factor for this cluster are the depth values for each of the bedrock features (Table 6.15) and it also has a lower overall variability measurement. The minimum depth measurement is 41.0 cm and the maximum depth is 58.0 cm. The Axis-1 and Axis-2 measurement ranges are similar to other clusters with a range of 12.0-25.0 cm for Axis-1 and 11.5-23.4 cm for Axis-2. The length-width ratio is very restricted with a range of 1.0-1.1 cm, meaning all of these deep features have almost perfectly circular openings.

Table 6.18. Descriptive Statistics for Cluster 3 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	5.9	33.3	18.0	2.0
Standard Error	2.0	1.3	2.4	0.3
Median	4.3	34.1	17.2	2.1
Standard Deviation	4.9	3.3	5.8	0.8
Sample Variance	23.6	10.6	34.2	0.7
Kurtosis	3.2	0.5	-1.5	-0.8
Skewness	1.7	-1.0	0.1	0.2
Range	13.9	8.8	14.8	2.1
Maximum	15.0	36.6	25.1	3.2
Minimum	1.1	27.8	10.3	1.1
Count	6	6	6	6

* Modes for each variable were not indicated due to lack of duplicated values.

Table 6.19. Descriptive Statistics for Cluster 4 Bedrock Features*.

	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
Mean	51.3	18.9	17.9	1.1
Standard Error	2.5	1.6	1.5	0.0
Median	53.5	19.9	18.6	1.1
Standard Deviation	7.1	4.5	4.1	0.0
Sample Variance	50.1	20.0	17.1	0.0
Kurtosis	-1.4	-1.2	-1.3	-1.7
Skewness	-0.6	-0.3	-0.3	0.0
Range	17.0	13.0	11.9	0.1
Maximum	58.0	25.0	23.4	1.1
Minimum	41.0	12.0	11.5	1.0
Count	8	8	8	8

* Modes for each variable were not indicated due to lack of duplicated values.

Discriminant Function Analysis

SPSS was used to run a discriminant function analysis with the same 787 bedrock features used in the cluster analysis. As mentioned previously, this test is beneficial for testing the cluster analysis results to see if the groups indicated have value. Since the cluster analysis found four major groups, the discriminant function analysis was calculated using those four groupings as *a priori* groups. The discriminant function test resulted in 766 hits and 21 misses, or approximately 97% correctly classified and 3% misclassified when compared to the cluster analysis groupings. The majority of the misclassified features came from Cluster 1 and were either identified as belonging to Cluster 2 or 3 (Table 6.20). Further, one bedrock feature originally from Cluster 3 was misclassified as matching requirements for Cluster 1.

Table 6.20. Misclassified Bedrock Features from Discriminant Function Analysis.

Original Cluster	Reassigned Cluster	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	LW Ratio	Feature ID
3	1	15.0	27.8	25.1	1.1	41VV0167_D001
1	2	15.6	13.6	13.3	1.0	41VV0166_E001
1	2	14.9	13.6	12.5	1.1	41VV0166_E003
1	2	16.4	15.3	15.1	1.0	41VV0124_C005
1	2	18.6	15.0	14.3	1.0	41VV0165_E007
1	2	18.0	17.4	16.0	1.1	41VV0075_E092
1	3	3.2	23.8	11.9	2.0	41VV0075_A067
1	3	3.6	23.0	12.2	1.9	41VV2010_J011
1	3	1.1	23.6	11.6	2.0	41VV2010_G012
1	3	2.7	29.2	12.3	2.4	41VV0075_M4001
1	3	1.7	28.7	12.2	2.4	41VV0164_E006
1	3	3.4	29.0	13.3	2.2	41VV0165_C002
1	3	5.3	26.8	12.0	2.2	41VV0075_E001
1	3	3.6	26.0	10.8	2.4	41VV0165_E015
1	3	4.2	26.1	13.0	2.0	41VV0075_A048
1	3	3.9	26.7	14.2	1.9	41VV0165_C017
1	3	3.1	27.4	13.0	2.1	41VV0165_C020
1	3	2.0	25.4	12.6	2.0	41VV0075_A042
1	3	2.3	28.3	20.0	1.4	41VV0890_A002
1	3	3.6	23.0	13.9	1.7	41VV0075_A034
1	3	7.0	25.4	14.0	1.8	41VV0165_C013

It is not surprising that Cluster 1 had the majority of misclassified features because that group had the broadest range of variation for all four measurements (Table 6.15). As seen in Figure 6.65, the features misclassified as belonging to Cluster 2 are the five deepest features in Cluster 1. This not only shows these two clusters overlap to some extend on the outer edges, but it also demonstrates that depth is a major factor in the creation of Cluster 2. While this chart also shows that the deepest features grouped in Cluster 4, are typically circular at the opening, the second deepest group, grouped in Cluster 2, has more variability in the opening shape.

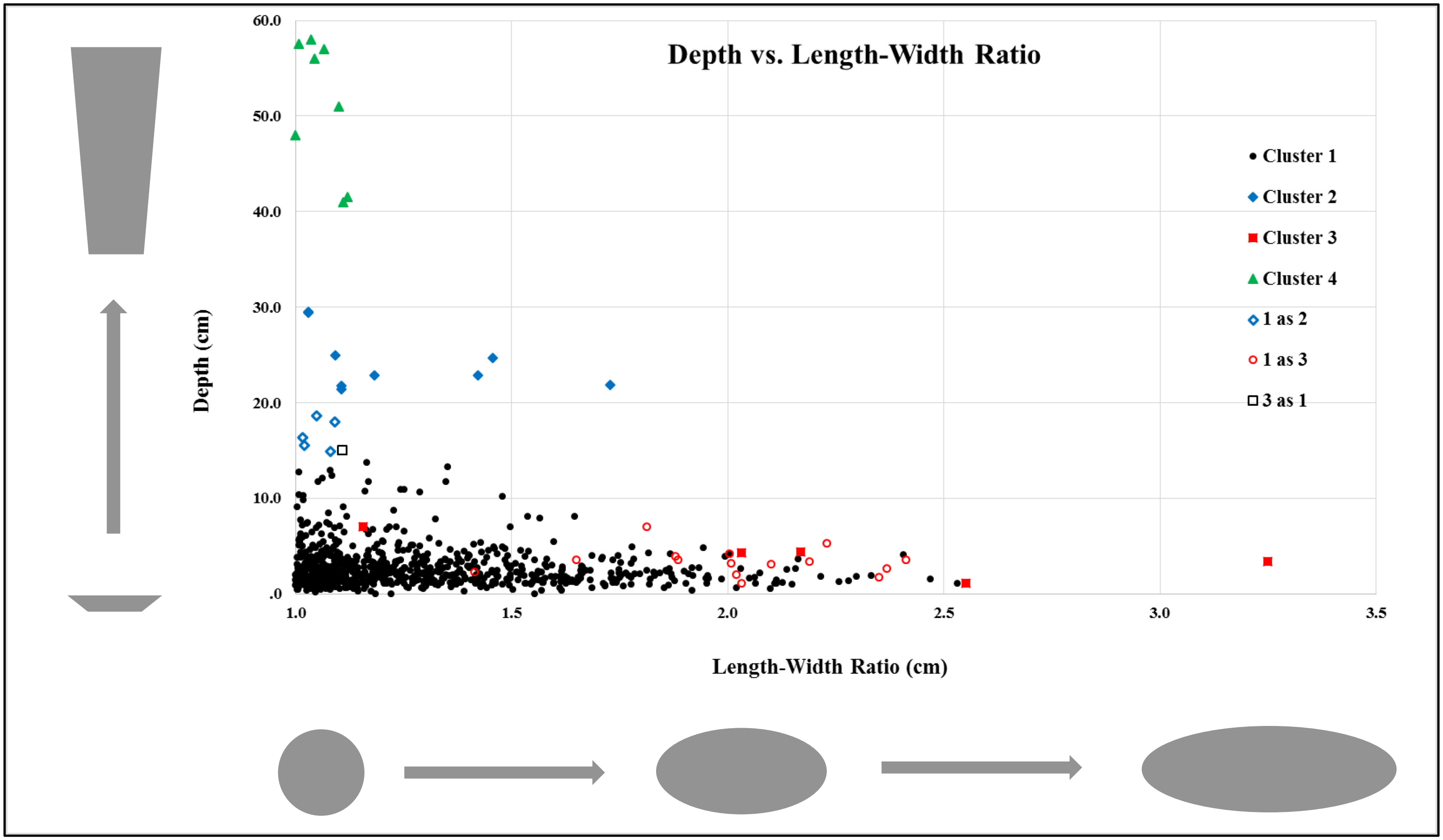


Figure 6.65. Depth vs. length-width ratio scatter plot.

The other large misclassification consisted of 15 features that were originally in Cluster 1 but were placed in Cluster 3 by the discriminant function analysis. This misclassification can be better understood by looking at the Axis-1 measurements (Figure 6.66). Cluster 3 is driven by abnormally long Axis-1 lengths and the misclassified features are grouped together on the far right end of the Cluster 1 features. In addition to showing how Cluster 3 is separated from the rest of the features, Figure 6.65 illustrates similar patterns with overlapping length and width measurements for bedrock features in Clusters 1, 2, and 4. One might expect that feature opening size would increase with depth but this supposition does not appear to be supported. It should also be noted that since the most distinctive characteristic of Axis-1 is the longer of the two axes, no feature points should be located on the left side of the dotted line running diagonally across the graph. This line also gives an indication of length-width ratio (e.g., opening shape). Features closer to the line have more equal Axis-1 and Axis-2 measurements and are more circular at the opening. In light of this, re-examination of the Cluster 1 features that were misclassified as Cluster 3 show they are all relatively far away from the equal Axis line. This could also be contributing to their misclassification as Cluster 3 features.

The final misclassification, one feature originally put in Cluster 3 that was identified as Cluster 1 by the discriminant function analysis, is slightly more anomalous and unclear. The Axis-1 length for this feature is shorter than the original Cluster 3 features but is equal or greater than 11 of the newly classified Cluster 3 features that were discussed above. This feature is slightly deeper than the other original Cluster 3 features (Figure 6.65) and it also is located closer to the equal Axis measurement line, indicating the opening shape is more circular (Figure 6.66).

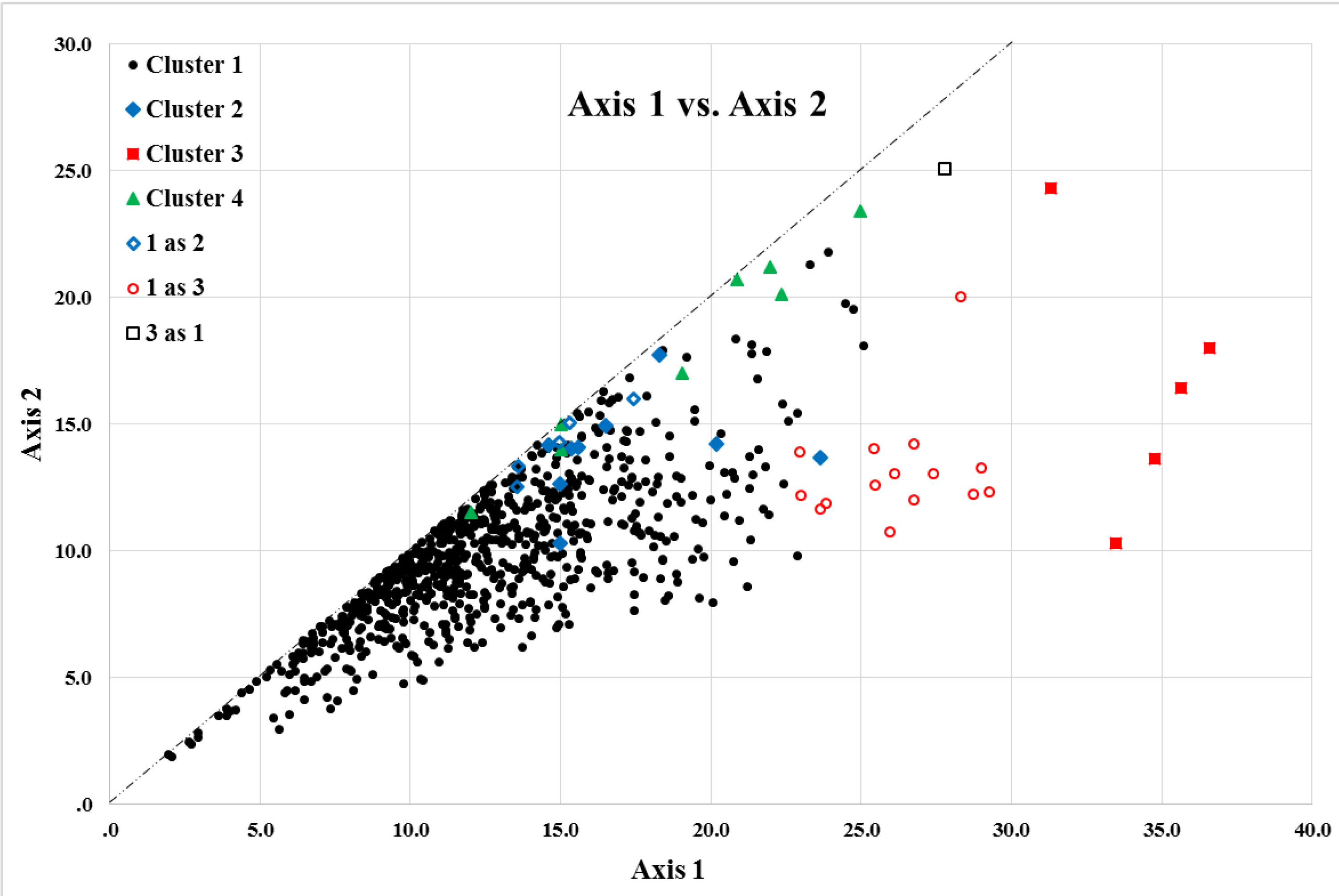


Figure 6.66. Axis-1 vs. Axis-2 scatter chart. Dotted line indicates equal axes measurements.

Kruskal-Wallis and Post-hoc Tests

Although the previous analyses and graphics give a good sense of how the data are distributed, there are varying amounts of overlap that were highlighted by the misclassifications of the discriminant function analysis. In order to determine which variables are key attributes for each cluster, a Kruskal-Wallis test and multiple post-hoc pair-wise comparisons were conducted in SPSS. Non-parametric tests were chosen based on the non-normal distributions of some clusters. The Kruskal-Wallis test resulted in highly significant differences between the groups for each measurement (Table 6.21), which was not surprising based on the visual examination of clusters in the scatter plots and the high success rate of the discriminate function analysis.

Table 6.21. Kruskal-Wallis Results for each Metric Variable.

	Depth	**Axis 1**	**Axis 2**	**LW Ratio**
H-stat	54.313	39.672	47.459	15.484
df	3	3	3	3
p-value	0.000	0.000	0.000	0.001

Since there was variation between all of the groups, post-hoc Kruskal-Wallis pair-wise comparisons were conducted to find which clusters differed for each measurement. The results of these tests are shown below in matrices with adjusted p-values presented. Once again, highlighted values indicate groups with distributions that vary significantly from one another (p<0.05). P-values that are not highlighted indicate that the clusters are relatively similar in regard to the chosen variable.

Maximum Depth Measurement. There are two groups (Cluster 1 and 2, and Cluster 1 and 4) that significantly differ in depth measurements (Figure 6.67). All other combinations do not have significantly different depth distributions.

KW Test	1	2	3	4
1	-			
2	0.000	-		
3	0.207	0.632	-	
4	0.000	1.000	0.594	-

Figure 6.67. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for depth measurements between clusters.

Axis-1 Measurement. Three groups have significantly different Axis-1 measurement distributions (Figure 6.68). Cluster 1 is in all three of these groups and differs from each of the other clusters. This is likely due to the huge variation of length measurements in Cluster 1.

KW Test	1	2	3	4
1	-			
2	0.006	-		
3	0.000	1.000	-	
4	0.005	1.000	1.000	-

Figure 6.68. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for Axis-1 measurements between clusters.

Axis-2 Measurement. In this test, three group combinations resulted in significantly different measurement distributions. Again, Cluster 1 is significantly different than all other three clusters (Figure 6.69). These differences are likely due to the extreme values of Cluster 1 in the shortest width ranges. Overall, however, the width measurements are less variable across the clusters and most of the groups have statistically similar width distributions.

KW Test	1	2	3	4
1	-			
2	0.000	-		
3	0.003	1.000	-	
4	0.000	1.000	1.000	-

Figure 6.69. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for Axis-2 measurements between clusters.

Length-Width Ratio Measurement. Length-width ratio distributions are relatively similar measurement across all of the groups. The only groups to significantly differ are Cluster 1 and 4 and Cluster 3 and 4 (Figure 6.70). These groups likely differ because of the wide range of length-width ratios in Cluster 1 and Cluster 3, while Cluster 4 has a very limited range.

KW Test	1	2	3	4
1	-			
2	1.000	-		
3	0.115	0.145	-	
4	0.013	0.456	0.001	-

Figure 6.70. Significant values from post-hoc Kruskal-Wallis pair-wise comparisons for length-width ratio measurements between clusters.

Summary of Quantitative Analyses

The previous analyses provide a variety of information about the morphological variation of bedrock features across the Lower Pecos. At the site level, there is not much significant variation in measurement distributions which could have implications for the types of grinding/pounding activities occurring in these sites. At the sub-regional level, there also does not appear to be great differences in bedrock features measurements. The exception to this is 41VV75, which is an impressive and special data set in many ways. In the full regional data set, there appear to be at least four clusters of “distinctive types” of bedrock features. The validity of these clusters were tested with a discriminant function analysis and then compared individually for each measurement to determine where the differences occurred. The following chapter will provide a discussion about the morphological variation of bedrock features in light of spatial patterning of morphologies across the region, use-wear, bedrock features theories of manufacture and development, and ethnographic accounts.

VII. LOWER PECOS BEDROCK FEATURE VARIATION: DISCUSSION AND HYPOTHESES

As shown in the previous chapter, there is a fair amount of variation in the documented bedrock feature morphology, but this variation seems to be distributed relatively evenly across the region. Kruskal-Wallis tests showed no significant difference in the morphological distribution between sites or sub-regions. The cluster analysis identified four groupings of features that were found to be significantly different overall. The largest group (Cluster 1) encompassed a large range of depth, length, and width measurements, and likely represents a feature type that was multi-purpose in function. The other three clusters are much smaller in size, and signify that these features were more specialized and likely had specific uses tied to their morphology. This chapter attempts to interpret the morphological variation of bedrock features through multiple lines of evidence, including: 1) examining cluster patterning across space, both between and within sites; 2) characterizing the use-wear patterns of each cluster; 3) considering the development or manufacture of these features and the implications about how the technology was used; and 4) comparing the morphological clusters to the ethnographic information reviewed in Chapter 3.

Spatial Patterning of Bedrock Feature Clusters

Although there are no significant differences detected between the overall morphological distribution of features between the sites or sub-regions in my limited sample, the distribution of clusters across my studied sites has not yet been explored. Unsurprisingly, all ten sites have features that are included in the Cluster 1 group. In fact, four of ten sites have only features that fall into Cluster 1 (Table 7.1). The other three clusters are more restricted in their distributions. Cluster 2 occurs at three sites, Cluster 3 occurs at five sites, and Cluster 4 only occurs at two sites. These data suggest that across the region, the majority of the food-processing that occurred could be completed in a non-specialized, Cluster 1-type feature. This could be due to the relatively small amounts of food being processed in most features or to the predominance of certain foods that did not need a specialized surface. Since Cluster 1 is so variable and widespread across all sites, the following discussion will focus on how the "specialty" features (Clusters 2, 3, and 4) are distributed.

Table 7.1. Cluster Distributions across Study Sites.

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
41VV75	X	X	X	X
41VV124	X	X	X	X
41VV164	X			
41VV165	X		X	
41VV166	X	X		
41VV167	X		X	
41VV890	X			
41VV1284	X			
41VV1342	X			
41VV2010	X		X	

Cluster 2 occurs at 41VV75 (n=2), 41VV124 (n=1), and 41VV166 (n=6). At 41VV75, both Cluster 2 features occur in Area J in relatively close proximity to one another (Figure 5.92). One of these features (J012) has an associated feature (J011) that shares a rim with it, and was likely used in tandem. At 41VV124, the Cluster 2 feature

(B014) occurs in Area B (Figure 5.152). B014 does not have any features immediately adjacent (sharing a rim), but it is located at the western end of a small feature cluster. At 41VV166, there are six total Cluster 2 features, located in Areas A, C, and E (A007, A009, A014, C001, E002, and E011) (Figures 5.39, 5.43, and 5.47). A007 and A009 are next to each other, and each one has a feature they share a rim with. A014 is approximately 30 cm away from the other two, and has an elongated rim extending out towards the east. C002 has a few small features surrounding it, but none connected to it. E002 and E011 are located approximately 30 cm apart. E002 has a small feature immediately adjacent to it, although they are not connected.

At each site that Cluster 2 features occur, many have an extended rim or other features they share a rim with. It is likely these shallower, adjacent areas/features were used in conjunction with the processing activity occurring in the deeper features. One scenario is that once meal was sufficiently pounded in the deeper feature, material was removed and placed onto the surrounding, extended rim or adjacent feature for further processing. Or vice versa, nuts or pods were placed on the shallow surface to crack away the hull and the meat was pushed into the deeper, adjacent feature for pulverizing. Interestingly, seven of eight features are conical in profile shape, while the remaining feature is straight walled. This suggests Cluster 2 features were used with a rotary motion with the bottom of the pestle stationary at the bottom of the feature or a straight up and down pounding motion. Either one of these motions could result in a conical feature, but rotary motions were not likely used in straight-walled features.

Cluster 3 features occur at 41VV75 (n=1), 41VV124 (n=1), 41VV165 (n=2), 41VV167 (n=1), and 41VV2010 (n=1). At 41VV75, the Cluster 3 feature (A026) is located on the southern end of Area A (Figure 5.73). A026 is a shallow feature with a long working surface extending away from the main concavity, and another feature (A025) immediately next to it. The Cluster 3 feature at 41VV124 (D001) is located in Area D, directly beneath the rock art panel (Figure 5.156). The closest feature to D001 is approximately 50 cm away. At 41VV165, the Cluster 3 bedrock features (B037 and C003) are located in Areas B and C (Figures 5.22 and 5.24). B037 has an elongated, gradient rim, and is surrounded by multiple smaller features. C003 also has a gradient, gentle rim, and smaller features surrounding it. At 41VV167, the Cluster 3 feature (D001) is located in Area D (Figure 5.59), and is an isolated feature in the canyon bottom. At 41VV2010, the Cluster 3 feature (J001) is located in Area J (Figure 5.137). J001 has an extended, gradient rim, and has shallower features immediately adjacent to it. The majority of features in Cluster 3 are elliptical in shape, and have gradient, gentle rims. A long Axis-1 measurement is the most characteristic attribute for features in Cluster 3 (creating an elliptical opening). All of the features included in Cluster 3 have the largest recorded openings in the entire data set, and most are relatively shallow. These wide, shallow areas would allow for broad, forceful strokes—useful for a variety of processing activities.

Cluster 4 features occur at 41VV75 (n=5) and 41VV124 (n=3). It should be noted that all four clusters are present at each site (Table 7.1). At 41VV75 the Cluster 4 features (C008, E025, E040, E051, and H008) are located in Areas C, E, and H (Figures 5.77, 5.81, and 5.88). C008 has a few small features nearby, but none immediately next to it. E025, E040, and E051 are located on the southeastern side of Area E, and are relatively close to one another. None of these features have elongated rims or other features sharing a rim with them. However, there are numerous smaller features surrounding the Cluster 4 features at 41VV75 that could have been used in tandem with the deep features. Similarly, H008 does not have any features connected to it, but there are numerous smaller features in the immediate vicinity. At 41VV124 the Cluster 4 features occur in Areas A and B (A001, B003, and B023) (Figures 5.149 and 5.152). A001 is unique because the feature extends completely through a large boulder. There are a series of smaller features surrounding the opening of A001, but detailed documentation of the feature opening was difficult because the boulder is upside down and hard to access. B003 and B023 are both located on the floor of the shelter towards the rear wall, but they are relatively isolated from any other bedrock features.

It is interesting that most Cluster 4 features do not have any connected features. This lack of direct association contrasts to the deeper features in Cluster 2, which typically have connected features. Further, Cluster 4 was the most isolated in the dendrogram (Figure 6.64), and is completely different than any of the other clusters across all variables. All of the Cluster 4 features have a minimum depth of 41 cm, but due to the depth of the features and the presence of sediments, I could not determine the actual depth of several of these features. In terms of use, the Cluster 4 features are so deep that it is difficult to reach the bottom, let alone trying to remove pounded material. In contrast to the conical profiles of Cluster 2 features, all Cluster 4 features are straight walled, suggesting intentional manufacture or maintenance of this specific shape. All of these previous observations indicate that Cluster 4 features are highly specialized, with a different overall function that may not relate to classic food processing/pounding activities. Potential functional interpretations of these features are presented later in this chapter.

Summary of Bedrock Feature Cluster Patterning and Distribution

Cluster 1 is spread across the region in a variety of configurations, ranging from isolated features to multiple features sharing rims. I did not attempt to interpret the spatial distribution of Cluster 1 features because the sample size is large and all four measurements are highly variable. However, a more detailed analysis of Cluster 1 should be pursued with future research. Cluster 2 feature distribution is more restricted, only located at three sites. These deep features typically have smaller features in direct association, possibly indicating they were used in tandem. Cluster 3 features are located at four sites in the region, and are characterized as having the largest orifice of all the groups, and were likely utilized with broad reciprocal, or circular strokes. Features that are part of the most distinct group, Cluster 4, are only present at two sites. These features likely had specialized functions that may not relate to the typical activities (e.g., grinding or pounding) associated with bedrock features.

Interpretations of Bedrock Feature Variation and Function

This section explores three avenues for interpreting how the bedrock feature cluster types may have been used. First, I analyze use-wear characteristics to determine if there are macroscopic wear patterns within each cluster, which might indicate what types of materials were processed. Second, using the observed use-wear patterns, I discuss the theoretical ideas and implications regarding development vs. manufacture theory in the formation of bedrock features. Finally, I provide hypotheses regarding bedrock feature function using the ethnographic accounts discussed in Chapter 3.

Use-wear Characteristics for Bedrock Feature Clusters

As detailed in previous chapters, I documented use-wear attributes for hundreds of individual bedrock features. I recorded the macroscopic use-wear patterns for the rim, walls, and base of each feature. The methods for recording use-wear are discussed in Chapter 4. Definitions of use-wear characteristics are presented in Appendix A (Table App A.2). Below, I only characterize the most prominent use-wear patterns for the rims, walls, and base within each cluster.

Cluster 1 Use-wear Patterns. Use-wear analyses were conducted on 439 of the 764 features in the Cluster 1 group. Cluster 1 use-wear attributes are presented in Table 7.2 for rims, Table 7.3 for walls, and Table 7.4 for feature bases.

Table 7.2. Cluster 1 Rim Use-wear Patterns.

Rim Use-Wear	Frequency	Percentages
Rounded	260	59%
Gradual and Rounded	36	8%
Gradual	84	19%
Rugged	34	8%
Abrupt	16	4%
Fractured	4	1%
No Data/ Obscured	5	1%
Total	**439**	**100%**

Table 7.3. Cluster 1 Wall Use-wear Patterns.

Wall Use-Wear	Frequency	Percentages
Rugged	49	11%
Rugged with High Points Leveled	145	33%
Rugged with High Points Leveled and Rounded	41	9%
Rugged with Rounded Bumps	79	18%
Mostly Leveled with Rounded Bumps	77	18%
Completely Leveled	43	10%
No Data/Obscured	5	1%
Total	**439**	**100%**

Table 7.4. Cluster 1 Base Use-wear Patterns.

Base Use-Wear	Frequency	Percentages
Rugged	64	15%
Rugged with High Points Leveled	112	26%
Rugged with High Points Leveled and Rounded	42	10%
Rugged with Rounded Bumps	70	16%
Mostly Leveled with Rounded Bumps	67	15%
Completely Leveled	56	13%
Broken Through	3	1%
Central Peck	10	2%
Irregular	1	0%
No Data/Obscured	14	3%
Total	**439**	**100%**

The most common rim shape for features in Cluster 1 is a gently rounded rim (59%). This suggests that once the feature concavities were created, subsequent motions did not re-shape the rims. In other words, the processing of the meal/ground material was mainly confined to the feature interior. The rounding of the rim likely resulted from processed materials moving over the rim surface, possibly during collection of finished product. In contrast, 19% of the features had gradual rims that grade gently into the surrounding unmodified bedrock. This pattern suggests that processing of the meal/ground material was not confined to the interior of the features, and materials were processed onto and over the rim repeatedly, resulting in a smoothed rim. It is possible these types of features were used during a final stage in the processing activities that allowed for easy collection of the ground materials via the gently sloped rim. It should also be noted that 8% of the Cluster 1 features have rims that are rounded in some parts and gradual in others. Said differently, there are not uniform use-wear patterns for Cluster 1 rims.

The most common use-wear pattern found on the walls of Cluster 1 features is rugged with leveled high points (33%), suggesting the area was first pecked to roughen the surface, and then uneven high points were leveled to the same elevation through use. This wear pattern could have resulted from significant amounts of stone on stone contact (e.g., during fiber extraction), or if the processed material was hard in nature (e.g., seeds). Another common Cluster 1 use-wear pattern was rugged walls with rounded high points (18%). In these instances, the surfaces were initially pecked, and then some sort of “soft” material was processed that smoothed the highs and lows of the peck marks. As the substance moved across the surface and around the high points, the surfaces became rounded. Softer materials potentially include a variety of plants (e.g., baked agave or sotol, nut meats, fruits) and animal tissue. Another equally common use-wear pattern for feature walls in Cluster 1 is a mostly leveled surface with some rounded high points (18%). The rounded high points are remnants of the original pecking (i.e., roughening) of the feature, but due to the heavy utilization of the surface these have been nearly flattened. The surface leveling occurs with stone on stone contact, or more abrasive agents (e.g., ochre or hard seeds) being processed.

In regards to the use-wear patterns on feature bases in Cluster 1, the most common attribute was a rugged surface with leveled high points (26%). Since a majority of the features in Cluster 1 are relatively shallow, it is not surprising the dominant use-wear pattern is the same for both the walls and the bases. In very shallow features the walls and the base are fairly continuous, and is becomes difficult to differentiate these two parts of the feature. Also similar to the Cluster 1 feature walls, the second most common use-wear pattern is rugged surfaces with rounded high points (16%). Not far behind are surfaces that are completely rugged/pecked (15%) and mostly leveled surfaces with rounded bumps (15%).

Cluster 2 Use-wear Patterns. Use-wear analyses were conducted on eight of the nine bedrock features in the Cluster 2 group. These attributes are presented in Table 7.5 for rims, Table 7.6 for walls, and Table 7.7 for feature bases.

Table 7.5. Cluster 2 Rim Use-wear Patterns.

Rim Use-Wear	Frequency	Percentages
Rounded	5	63%
Abrupt	3	38%
Total	**8**	**100%**

Table 7.6. Cluster 2 Wall Use-wear Patterns.

Wall Use-Wear	**Frequency**	**Percentages**
Rugged, High Points Leveled and Rounded	1	12.5%
Mostly Leveled with Rounded Bumps	6	75%
Completely Leveled	1	12.5%
Total	**8**	**100%**

Table 7.7. Cluster 2 Base Use-wear Patterns.

Base Use-Wear	**Frequency**	**Percentages**
Rugged, High Points Leveled and Rounded	1	13%
Mostly Leveled with Rounded Bumps	3	38%
Rugged with Rounded Bumps	1	13%
Broken Through	2	25%
Obscured	1	13%
Total	**8**	**100%**

The rim shapes for features in Cluster 2 are split almost evenly between abrupt (38%) and rounded (63%). Similar to Cluster 1, rounded rims in Cluster 2 suggest materials may have been moving over them, smoothing the surface over time. In contrast, abrupt rims have sharp edges where the concavity meets the surrounding bedrock. The motions used in the features with abrupt rims likely did not include pulling the ground material out over the rim. It is also possible these features simply represent newer features that still possess attributes associated with feature construction.

For the wall use-wear patterns, 75% of Cluster 2 had mostly leveled surfaces with rounded bumps. This suggests that materials being processed in these relatively deep features were somewhat abrasive nature, and that the individuals using these features did not feel the need to re-peck the sides of the shaft to roughen the surface. One of the features is still fairly rugged with leveling and rounding just starting to form on the high points, which could represent a newer feature, or one that was not as intensively used. In many of the features, all portions of the walls were mostly leveled, suggesting motions were used that increased the contact between the hand-held implement and the walls. This levelling could have resulted from a stirring (rotary) motion, or possibly that large quantities of material were being processed, almost completely filling up the feature.

Similar to the majority of the Cluster 2 feature walls, the most common base use-wear pattern is a surface that is mostly leveled with rounded high points (38%). Two of the features are missing their bases, possibly worn through, but the remainder show signs of pecking and then use, likely with a pounding motion due to the depth of the features.

Cluster 3 Use-wear Patterns. Use-wear analyses were conducted on three of the six bedrock features in the Cluster 3 group. These attributes are presented in Table 7.8 for rims, Table 7.9 for walls, and Table 7.10 for feature bases.

Table 7.8. Cluster 3 Rim Use-wear Patterns.

Rim Use-Wear	**Frequency**	**Percentages**
Rounded	1	33%
Gradual	2	67%
Total	**3**	**100%**

Table 7.9. Cluster 3 Wall Use-wear Patterns.

Wall Use-Wear	Frequency	Percentages
Rugged, High Points Leveled	2	67%
Mostly Leveled with Rounded Bumps	1	33%
Total	**3**	**100%**

Table 7.10. Cluster 3 Base Use-wear Patterns.

Base Use-Wear	Frequency	Percentages
Rugged, High Points Leveled	2	67%
Mostly Leveled with Rounded Bumps	1	33%
Total	**3**	**100%**

Although only three of the features in Cluster 3 had use-wear attributes formally recorded, by looking at the photos and other notes, the most common rim shape is a gradual sloping surface to the surrounding bedrock. As noted above in the spatial patterning section, the elongated shape of these features is likely caused by a long reciprocal stroke, and this extends to the rim shape. The upper stone and processed materials likely were pushed back and forth over rim areas, helping to cause a gradual slope. The walls of features in Cluster 3 are mostly rugged with leveled high points, suggesting that after the feature was pecked, it was then used in an activity with stone on stone contact or an abrasive material. The base of the features in Cluster 3 have the same distribution of use-wear attributes as the walls.

Cluster 4 Use-wear Patterns. Use-wear analyses were conducted on seven of the eight bedrock features in the Cluster 4 group. These attributes are presented in Table 7.11 for rims, Table 7.12 for walls, and Table 7.13 for feature bases.

Table 7.11. Cluster 4 Rim Use-wear Patterns.

Rim Use-Wear	Frequency	Percentages
Abrupt	2	29%
Rounded	5	71%
Total	**7**	**100%**

Table 7.12. Cluster 4 Wall Use-wear Patterns.

Wall Use-Wear	Frequency	Percentages
Upper Walls Rugged, Lower Walls Leveled	3	43%
Completely Leveled	2	29%
Rugged with Rounded Bumps	2	29%
Total	**7**	**100%**

Table 7.13. Cluster 4 Base Use-wear Patterns.

Base Use-Wear	Frequency	Percentages
Obscured by Sediement	6	86%
Broken Through	1	14%
Total	**7**	**100%**

The rim shapes for Cluster 4 features are similarly distributed to the other group of deep features (Cluster 2). The most common rim shape is rounded (71%), but a couple features have abrupt rims. Although these features are incredibly deep, there is still activity happening around the rim to create a gently rounded surface. The most common use-wear pattern on the walls of Cluster 4 features are rugged upper walls and mostly leveled lower walls (43%). This pattern suggests the upper walls did not come into contact with either the processing implement or the material being processed. Similar to the walls in Cluster 2 features, the lower half of these features must have been relatively full of semi-abrasive materials. This also suggests a pounding motion was utilized rather than a rotary or gyratory motion since the upper walls showed little signs of wear. In contrast, two of the features in Cluster 4 are leveled on all portions of the walls throughout the shaft, suggesting a rotary motion may have caused the leveling. The final two features in Cluster 4 are fairly rugged with some rounding of the highpoints, indicating a softer material was processed in these features or these features were not as heavily utilized. I could not record basal use-wear for any of the features in Cluster 4 because they are either obscured by sediment or broken.

Summary of Use-wear Characteristics. The use-wear patterns observed for bedrock features between Clusters 1, 2, 3 and 4 indicate differential motions and/or substances being processed in each cluster type. In the shallower features (Clusters 1 and 3), the most common use-wear characteristics on the walls and base are rugged surfaces with leveled high points. In the mid-sized deep features (Cluster 2), there is not as much high point leveling relative to Clusters 1 and 3, but entire surfaces are leveled and smooth. This trend is continued for the deepest features (Cluster 4), with some interesting features that only have the lower portions leveled. Of note, pecking was documented on the walls and bases of features throughout the different clusters, even when leveled surfaces were more common.

Based on the use-wear patterns and the morphology, there seem to be two generalized groups—Cluster 1 and 3 are most similar while Cluster 2 and 4 are also relatively alike. To test this hypothesis and provide support from a variable independent of the Cluster analysis, I conducted a Chi-square Test of Independence for the frequency of use-wear patterns in each of these general groups (Clusters 1 and 3, Clusters 2 and 4). The Chi-square tests comparing the rim (Table 7.14), wall (Table 7.15), and base (Table 7.16) use-wear for these two general groups show that they are significantly different in regards to use-wear.

Table 7.14. Chi-Square Test of Independence for Rim Use-wear

	chi-sq	p-value	x-crit	sig	Cramer V
Pearson's	29.52018	1.74101E-06	7.814728	yes	0.255558

Table 7.15. Chi-Square Test of Independence for Wall Use-wear

	chi-sq	p-value	x-crit	sig	Cramer V
Pearson's	98.45462	3.34006E-21	7.814728	yes	0.466712

Table 7.16. Chi-Square Test of Independence for Base Use-wear

	chi-sq	p-value	x-crit	sig	Cramer V
Pearson's	80.03691	8.24393E-16	11.0705	yes	0.428452

I calculated adjusted residuals (e.g., Haberman 1973) to determine which use-wear patterns were significantly different. Said differently, there are a few use-wear patterns that are especially common for each of the two general bedrock feature groups (Clusters 1 and 3, Clusters 2 and 4). For ease of comparison, I lumped some of the use-wear together that imply similar functional activities. For example, all of the wall and base use-wears that have rugged surfaces with any modification on the high points have been put into one category, while mostly leveled and completely leveled surfaces represent another pattern. These results are presented in Table 7.17 (rim), Table 7.18

(walls), and Table 7.19 (base). Highlighted values indicate use-wear patterns that occur in significant abundance for each group. The adjusted residuals for the wall use-wear are particularly interesting. Cluster 1 and 3 have significantly more rugged surfaces with some sort of light modification of high points. Alternatively, Cluster 2 and 4 have more complete leveling of the surfaces or a combination of rugged and level throughout the feature. Of note, the rugged category was no significantly different. These data help support my hypothesis that the various clusters represent different functional types of bedrock features, but both likely were the product of intentional manufacture through pecking.

Table 7.17. Adjusted Residuals for Rim Use-wear

	Cluster 1 & 3	Cluster 2 & 4
Rounded & gradual	2.371	-2.371
Abrupt	-5.369	5.369
Rugged	1.123	-1.123
Fractured	0.372	-0.372

Table 7.18. Adjusted Residuals for Wall Use-wear

	Cluster 1 & 3	Cluster 2 & 4
Rugged	1.405	-1.405
Rugged, leveling and/or rounding	3.150	-3.150
Mostly or completely leveled	-2.718	2.718
Upper walls rugged, lower walls leveled	-9.380	9.380

Table 7.19. Adjusted Residuals for Base Use-wear

	Cluster 1 & 3	Cluster 2 & 4
Rugged	1.184	-1.184
Rugged, leveling and/or rounding	1.560	-1.560
Mostly or completely leveled	-0.526	0.526
Broken Through	-8.852	8.852
Central Peck	0.437	-0.437
Irregular	0.137	-0.137

As discussed in Chapter 2, use-wear patterns are representative of the more recent activities that happened on the surface (Adams 2002). However, these wear patterns take time and repetitive actions to develop and the observed use-wear likely reflects accumulated habitual use patterns that developed over long periods of time. The use-wear data, combined with the morphological clusters, demonstrates that a wide variety of food-processing occurred. Various types of vegetable materials and animal tissue were likely processed in the shallow features, along with possible usage for processing fibers from baked or unbaked agave, yucca, or sotol leaves. The intermediate deep features were likely used for processing large quantities of plant materials, such as mesquite pods. The deepest features could also be used for processing large amounts of semi-abrasive material, based on the leveled walls. However, my analysis does not explain why these features are so deep. With such deep features, how was material extracted from the bottom of these deep features? Is it possible these features were not used for grinding or pounding food? Hypotheses for these questions are proposed in the following sections.

Manufacture vs. Development

One of the major theoretical questions about bedrock features is how they formed. Two theories were introduced in Chapter 2: 1) that features develop through time and use; or 2) that features are purposefully manufactured to specific shapes and sizes. In Texas, the most common speculation[1] is that features develop through time. In other words, a person begins with an unmodified surface, and through time and use a shallow depression is created. However, new experimental research (e.g., Buonasera 2015) indicates an increase in processing efficiency can be achieved by manufacturing a feature prior to use. These are important issues to consider as they hold implications for how indigenous peoples utilized this technology.

If bedrock features develop through time, we would have to assume that the deepest features recorded during this project are either the oldest, or the most heavily used. However, this explanation is likely an oversimplification. For instance, if features are developing through time, we must then ask why are the majority of the features shallow in depth (e.g., 1-2 cm)? Perhaps these features are very young, or were not utilized very often. To better answer this question, experimental archaeology is warranted. How long does it take for a feature to reach certain depths through use during processing activities? Typically, indigenous peoples using bedrock features and other ground stone technology tried to keep enough of the material being processed in the feature so the hand stone would not fracture the lower surface or break parts of the rock into the processed meal (e.g., Ortiz 1991:73). By that logic, it could take decades or centuries for one feature to become even a couple centimeters deep, let alone the 40 cm and deeper features I observed in the Lower Pecos.

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[1] As stated previously, there has been very little published bedrock feature research in Texas. However, this has not deterred archaeologists from informal discussions regarding bedrock features.

On the other hand, if bedrock features are manufactured to a specific shape and depth, this can provide data for addressing research questions that go beyond just food processing. For example, if experimental research shows that it takes a minimal amount of time to peck out a feature that is only a few centimeters in depth, but it increases the efficiency of the processing activity, we can use optimal foraging models to study bedrock feature use (e.g., Buonasera 2015). Further, we can begin to address bedrock features in terms of social interactions and potential re-use of sites and seasonality. For the deeper bedrock features, perhaps these were created through the help of multiple people and were used specifically for greater quantities of food. If large amounts of time were invested in creating specialized, deep features, the manufacturers may have intended to return back to these locations for specific purposes. This could have been useful when multiple familial bands came together at certain times of the year, possibly during harvest times for plants such as mesquite. We might not know how old these features are, or even how often they may have been revisited through the years, but we can start to model potential behavior based on optimality theories for foraging peoples.

At this time, I propose that the majority of the bedrock features in the Lower Pecos were pecked out, or manufactured, to a desired shape and size. This is based on the distribution of feature morphologies and the macroscopic use-wear seen on these features. Although there are a fair amount of deeper features, they are still far outnumbered by the shallow, more general-use features. Further, since pecking was observed throughout all four clusters of features, we know the indigenous peoples were at the *very least* re-surfacing these areas for a more optimal performance. Most interesting are the deep features in Cluster 4 that have rugged upper walls and leveled lower walls. I think it is clear that the features did not develop through time, otherwise we might expect for more of the upper surfaces to have leveling. This is not to say that features could not have become slightly deeper or changed through use, this undoubtedly occurred, but my analysis indicates the driving factor in bedrock feature form was through intentional manufacture and shaping.

Experiments to Understand Bedrock Feature Production. Experimentation to explore these topics is just beginning (e.g., Buonasera 2012, 2014; Murray 2014), and such projects are no small undertaking. Pecking out a bedrock feature that is 30 cm in depth could take days or even weeks. On the other hand, processing food until a bedrock feature *reaches* 30 cm in depth might take years. However, we will not know until such experimental projects are completed. Previous research that can help inform these new experiments includes an important work exploring how portable stone mortars and bowls were produced (Schneider and Osborne 1996). Schneider and Osborne used two different methods to create a stone mortar, first by only pecking out the feature and then by attempting to use the "central plug" method. They provide archaeological examples of stone mortars that have been found with evidence of both manufacture procedures and ethnographic evidence (Holmes 1897, cited in Schneider and Osborne 1996) which detailed the central plug method. This method includes pecking a circular groove around the unwanted portion of rock so it could be easily isolated and undercut. Using a chisel-like implement, this plug was then removed with a few hard blows (Holmes 1897, cited in Schneider and Osborne 1996). Interestingly, a possible example of this method in the Lower Pecos is found on a bedrock surface at 41VV50 (Crab Shelter) on the Devils River (Figure 7.1). On a boulder outside of the dripline of the shelter are three concavities, seemingly at different stages of production. In the background is a typical looking bedrock feature. In the foreground is a pecked ring with a limestone plug still in the middle, and in the center of the photo is a concavity with a small part of the plug still intact. While this case may be the result of weathering and not cultural manufacture, it is none the less intriguing.

Figure 7.1. Possible central plug manufactured bedrock features at 41VV50. Photo courtesy of Jack Johnson.

In my own small experimental archaeological project, I pecked a circular bedrock feature that was 11 cm across both axes and 2 cm deep on a large limestone slab (Figure

7.2). The experimental feature has approximately similar dimensions to many of the archaeological examples recorded in this project. Manufacturing this feature only took me an hour and 38 minutes to complete, with an average of 161 strikes per minute. I used two different hand stones: a quartzite cobble and a sharpened chert nodule. This resulted in a feature with gentle sloping, dished walls and a very rugged macroscopic surface.

Figure 7.2. Two centimeter deep experimental bedrock feature produced in approximately 1.5 hours.

Overall, spending approximately 1.5 hours to create a feature is not a large time investment. Further, indigenous peoples who were more adept at this activity could likely manufacture this size of feature in less time. Although my small experiment does not provide sufficient data to fully evaluate bedrock feature manufacture and morphology in the Lower Pecos, it points to the need for more rigorous, detailed experimentation on this topic.

Ethnographic and Archaeological Considerations for Lower Pecos Bedrock Features

Based on the ethnographic accounts reviewed in Chapter 3, many different foods may have been processed in Lower Pecos bedrock features. In addition, there may be ritualistic or sacred connotations that are inherent in the technology. These considerations are reviewed below, along with corresponding evidence from the Lower Pecos archaeological record.

Ground Stone Technology and Food Processing. The variable features in Cluster 1 and 3 were likely utilized for a wide variety of plant and animal tissue materials based on ethnographic information. They could have been used to crush and grind fruits such as prickly pear tunas, yucca fruits, hackberry, and persimmon. This is similar to Rea's (1997) and Castetter and Underhill's (1935) reports on the Pima and Papago grinding banana yucca fruits on a metate. Other soft substances such as baked agaves and sotol could have been smashed and pounded into small cakes in the shallow features, then set out to dry in the sun. Harder materials such as nuts (pecans and walnuts) and seeds (grasses and cactus seeds) were also likely ground in these shallow features. The use-wear patterns observed for Cluster 1 features largely support the ethnographic examples.

Based on ethnographic accounts from the Seri (Felger 1977), the features in Cluster 2 and perhaps Cluster 4 were likely utilized predominantly for mesquite processing. The larger depths would allow for substantial quantities of mesquite pods to be processed, and pounding appears to be the most efficient method to break up the different parts of the pod. The use-wear observed on several of the Cluster 4 features support this pounding motion. It is possible that once sufficient pulverizing in the deep mortar was accomplished, various products of the mesquite (endocarp flour, the inner seeds, etc.) were then ground on shallower surfaces, as documented with the Seri and Apache (e.g., Castetter and Opler 1936; Felger 1977). Based on information from the Mono (McCarthy 1985:117), various seeds were also processed in deeper features, but typically with a circular motion that pressed the seeds against the sides of the mortar. This could help account for the extensive leveling of the walls within the features in Cluster 2, and some of the features in Cluster 4. Overall, it is difficult to determine exactly what food was processed in each type of feature, and previous researchers have warned against making these kinds of specific correlations of form equals specific function (Adams 2002:6-7). Further, the use-wear shows that multiple different actions and materials were being processed in Lower Pecos bedrock features.

Ground Stone Technology and Fermentation. Within the Lower Pecos, Greer (1965) was the first to connect bedrock mortars with agave fermentation. In his analysis of burned rock middens, Greer (1965:50-51) noted deep bedrock mortars that could have served as fermenting vats for liquid from baked agaves. Figure 7.3 is an example Greer (1965:51) gives of deep mortars connected by a trough, possibly allowing for liquid and impurities to flow from one side to the other. Despite the few accounts describing the use of bedrock features as fermentation chambers in Mexico discussed in Chapter 3, it is unknown whether this was a common use for deep mortars in the Lower Pecos. However, it is clear that ground stone played a role in the production of alcoholic beverages because these features were likely used for mashing and pulverizing the baked pulp, even if fermentation occurred elsewhere (e.g., Bruman 2000). Therefore, either the actual fermentation process or the processing of baked plants to be fermented represents one of the activities likely completed with the help of ground stone implements in the Lower

Pecos. Although I do not have the data to test this hypothesis, fermentation and alcohol production should be considered as a possibility when examining the morphologies of ground stone technologies.

Figure 7.3. Two different sets of bedrock mortars connected by a trough at a site on the Devils River in Val Verde County. Greer hypothesizes these were used to ferment agaves beverages. Photos courtesy of John Greer.

It is interesting that the deepest features in my data set (Cluster 4) are morphologically distinct from the rest of the features, and that they only occur at two of the studied sites. Beyond the presence of the Cluster 4 features, these two sites (41VV75 and 41VV124 [White Shaman]), are admittedly unique. Both sites are located near the Pecos and Rio Grande confluence, which was likely an important location on the landscape for Lower Pecos foragers. 41VV75 is a large rockshelter with thousands of pictographs in various styles covering the back walls, a massive amount of burned rock, and an unprecedented number of bedrock features. These data alone indicate the site was used likely revisited by groups over a several thousand year period. It is possible this location may have served as a place for seasonal/annual/generational gatherings (e.g., Turpin 2004). The White Shaman site, although much smaller in size and total amount of cultural material, has a pictograph panel that has been studied extensively. Recent interpretations of the rock art panel by Boyd (2003, 2012, 2016) demonstrate this rockshelter was a very sacred place on the landscape. Both of these sites were likely the location of ceremonies, rituals, and celebrations which may have included the production and use of a fermented drink contained in the deep bedrock features. At this point discussion is largely hypothetical. Experimentation is needed to test hypotheses regarding how fermenting alcoholic liquids might be achieved in bedrock features and residue analyses should search for signatures for fermented materials in the archaeological specimens.

Ground Stone Technology and Burials. In the Lower Pecos, ground stone items (manos and metates) have been reported in numerous burials (Table 7.20). Based on ethnographic data and theories on division of labor, we might expect females to have more ground stone items accompanying them in death than males. As Table 7.20 shows, eight female burials have associated manos and metates, which could symbolize that these women used these tools frequently in life. Both Seri (Felger and Moser 1971:Figure 1) and Miwok (Ortiz 1991) women describe bedrock mortars and hand stones being passed down from mother to daughter to stay within a matrilineal line of ownership

Table 7.20. Burials from Rockshelter Deposits in the Lower Pecos. Table adapted from Turpin et al. 1986:Table 1.

Site	No.	Age/Sex	Comments/Burial Items
41VV74 - Fate Bell Shelter	4		Possible cremation, stone and brush covered pit, matting and a **mano**
	6a	Adult Female (55)	Flexed, **3 manos**
	6b	Adult Male (55)	Flexed, large **metate** covering
	6c	Adult Male	Flexed, on back, cracked skull, **metate**, dart point
	6d	Adult Female	Flexed, rock covering, **mano and metate**
41VV82 - Coontail Spin	1-2	Adult Females	Flexed, **metates and manos**
41VV112 - Shumla Cave #1	1	Adult Female	Flexed, wrapped in beaver robe, a **mano**
	2	Adult Female	Flexed, wrapped in beaver robe, **metates**
41VV113 - Shumla Cave #5	1	Adult Female	Flexed in a lined pit, worn mats with netting, **metate**
	2	Infant	Wrapped in matting, **under a mano and metate** in a twig lined pit, broken cradleboard and fur blanket
	5	Adult	Cremation, wrapped in mats **under a mano and metate**, bison hair robe, fiber bracelet, covered in prickly pear
	6	Infant	Wrapped in mat with fawn skin and fur robe, **metate, mano**, and broken cradleboard
	8	Adult Male	Under twigs, **2 manos, 2 metates with pigment stains**, mat, fishnet, baskets, pouch with numerous items, fiber and stone raw material, fur robe, feather cord, hair cord, rattlesnake vertebra necklaces, bone tools, pigments, drawing implements, tatoo needles, Ensor dart point
Old Shumla	1	Infant	In a basket, **metate**
41VV237	1-2	Adults, male and female?	Flexed, seated together, digging stick, grass basket with prickly pears, **metate**, cane mat
	3	Infant	Flexed, membrane shroud, net, basket, mat, deer hide, **metate**, human hair cordage
Unprovenienced	1	Infant	Flexed, stick and grass cradle nest, 3 layers of matting, wrapping in fur blanket, bound with hair rope, **covered with a metate** and rock

While this may have been the case for Lower Pecos foragers as well, ground stone artifacts have been found in association with four males burials. The most intriguing is Burial #8 from 41VV113-Shumla Cave #5. This male individual had two manos, two metates with pigment stains, drawing implements, a rattlesnake vertebrae necklace, tattoo needles, and more (Turpin et al. 1986). This individual seems to have more elaborate grave goods in comparison to other burials in the region, and many of these items suggest he may have had the status of an artist and/or shaman (Martin 1933; Schuetz 1961). Further, five infants were also accompanied by a metate. In most cases, the metate was placed over the body, covering the infant (Turpin et al. 1986). Infants could not have used manos and metates to process food during their short lifetimes, so the presence of these items in their graves may be related to the fertility metaphors discussed in Chapter 3. It is possible that the act of placing a metate over the child was thought of as placing the infant back into the womb.

Spatial Patterning of Bedrock Features on Contiguous Surfaces. The general clustering or proximity of features to one another should also be briefly considered. For this project, I did not attempt to do an in-depth spatial analysis of bedrock features located on a contiguous surface (e.g., on one boulder). While this sort of analysis has proven useful for identifying sub-features or features that may have been used together (e.g., Dreyer-Lynch 2014), it was not the main focus of my research. That said, it is notable that some recorded areas within a site (i.e., contiguous limestone surfaces) have bedrock features with lots of space between them (Figure 7.4) while others have a constant undulating surface of features directly next to each other across the entirety of the bedrock or boulder (Figure 7.5).

Figure 7.4. Bedrock features at Kelley Cave that are spread apart on the boulder surface.

Figure 7.5. Bedrock features at 41VV75 that are immediately next to one another across the entire boulder.

For the very dense areas, it would not have been possible for all of the features to be used at the same time. It is possible that some of the features that are immediately next to one another were used at the same time by the same individual, perhaps as a way to organize the workstation. This begs the question of why are there so many small features next to one another. It is almost unbelievable that these small, shallow features were considered past their use-life, or no longer optimal for use. One possibility is the idea that individual bedrock features belonged to the individual (likely female) who created it. As mentioned previously, many ethnographic accounts (e.g., Felger and Moser 1971; Ortiz 1991) suggest features were the property of certain women. If this is the case, perhaps women created new features upon arrival at a site, even if existing features were already in place because they were not allowed to use the "property" of another woman.

VIII. CONCLUSIONS AND AVENUES FOR FUTURE RESEARCH

As stated in the introduction, the goals of this thesis are two-fold: 1) to better understand the morphological variation of bedrock features and create the first regional typology; and 2) to advance hypotheses about the roles bedrock features played for Lower Pecos foragers. To record the morphological variation of bedrock features, I recorded 824 bedrock features at ten sites spread across the region. I believe the ten sites I studied provide a reasonably representative sample of bedrock feature variation in the Lower Pecos. However, there are large areas of the region that are not included in my sample. Bedrock feature variation should be explored at sites further upstream on the Pecos and Devils Rivers as well as at open-air sites in the uplands and along the river terraces (e.g., 41VV1723 on the Rio Grande River [Johnson and Johnson 2008]). Further, previous researchers may have compiled unpublished bedrock feature measurements at other sites that can be incorporated into future analyses.

I utilized Structure from Motion photogrammetry (SfM) to document and map the bedrock features, which proved to be an efficient and accurate method. The only difficulties that I encountered with the SfM method was with extremely deep features that were too dark at the bottom for adequate photographic documentation. Methods for photographing these features have been developed (e.g., Nadel et al. 2015) but I did not have access to the necessary camera set-up. An important advantage to the SfM method is that I can perform further analyses beyond those presented in this thesis. These analyses can be conducted in any GIS software and include volume, slope of the feature walls, and density or nearest neighbor algorithms. These data can help refine our understandings of the morphological variation of bedrock features and how they were used.

Lower Pecos Bedrock Feature Morphological Variation

Overall, there was less morphological variation in Lower Pecos bedrock features than I had originally expected at the beginning of this project. Statistical analyses conducted on 787 features at 10 sites resulted in the identification of four distinct clusters, or types. Cluster 1 is comprised of 97% of the total number of analyzed bedrock features. This staggering result could have several implications: 1) more attributes should be added to future analyses to possibly identify significantly different sub-groups; or 2) most bedrock features in the Lower Pecos are part of a continuum that were used for multiple purposes and items. Cluster 1 features have a large range of depth (from very shallow [0.1 cm] to moderately deep [18.6 cm]) and axis measurements (from 1.9-29.2 cm long) resulting in a highly variable group. Cluster 2 is characterized by relatively deep features that are mostly conical in profile. Although Cluster 2 represents a very small part of the data set, these conical mortars are a distinct grouping of features within the region. Cluster 3 features are similar in variability to features in Cluster 1, but they are grouped as a unique sub-set due to larger orifice openings. Particularly, the axis 1 measurement is longer than 25 cm in length. Cluster 3 depth measurements range from 1.0-15 cm. Cluster 4 features are incredibly deep mortars that all have straight-walled profiles and circular openings.

One of my original goals was to put forth a regional typology of bedrock features. Although the cluster analysis resulted in four highly different morphological groups, Cluster 1 includes an incredibly large range of feature sizes and makes up the majority of the data set. Until Cluster 1 is examined more thoroughly for intra-cluster pattering, I think it is premature to create a formal typology. Clusters 1 and 3 are both highly variable and elude a classification that can encompass all of the morphological and metric variation. Other groups (Cluster 2 and 4) are less variable and likely represent a true morphological and functional type. At this time, I will tentatively classify features in Cluster 1 and 3 as general grinding surfaces, features in Cluster 2 as conical mortars, and features in Cluster 4 as cylindrical mortars.

In order to provide hypotheses about the four bedrock feature clusters and their potential functions, I considered multiple lines of evidence: 1) macroscopic use-wear attributes; 2) experimental procedures concerning development vs. manufacture; and 3) ethnographic accounts of bedrock features use. Each of the four clusters I defined has a distinct set of macroscopic use-wear patterns. Clusters 1 and 3 mostly have rugged bases with leveled or rounded high points, suggesting a wide variety of activities took place in these features. Cluster 2 contained features that have mostly leveled and smooth surfaces with some rounded high points. This use-wear pattern suggests harder materials were being processed in these features. The use-wear in Cluster 4 features was very similar to that of Cluster 2 except there was an interesting combination of extensive leveling on the lower walls and rugged upper walls. This suggests the feature was pecked down to roughly the current depth and then utilized with harder materials only contacting the lower walls. All four clusters had evidence of pecking. The combination of statistical groups and corresponding use-wear patterns indicates that these feature types are valid in terms of morphological variation and behavioral use.

Overall, the on-site use-wear observations correlate very closely to ethnographic accounts regarding what kinds of materials were processed—whether it is softer foods processed in shallow features and harder foods processed in larger quantities in deep features. Looking at previous experiments and my limited experimental work as well as use-wear characteristics, I hypothesize that bedrock features in the Lower Pecos were intentionally manufactured to specific depths and shapes for certain processing activities (e.g., extracting fiber from baked agave leaves or pounding mesquite pods). After examining all lines of evidence, Clusters 1 and 3 appear to be general purpose features (general grinding surfaces), used for a variety of processing activities. Cluster 2 features (conical mortars) are approaching a more specialized morphology but were also likely utilized for processing a variety of plant materials. The deepest features (Cluster 4 – cylindrical mortars) likely represent highly specialized features utilized for specific purposes that may go beyond food processing, possibly including the fermentation of baked plants and fruits.

Recommendations for Future Analyses

Based on the observed use-wear patterns, I hypothesized that bedrock features in the Lower Pecos were intentionally manufactured, as opposed to developing over long periods of time and use. One of my greatest regrets for this project is that I was unable to complete the experimental research I began that would address the question of bedrock feature formation. However, to fully explore this hypothesis, a long term, dedicated experimental project needs to be undertaken. Future experimental work should build upon Buonasera's (2015) seminal work and frame experiments with theoretical discussions regarding bedrock feature formation and hunter-gatherer technological adaptations.

The four clusters I identified are only a starting point for future analyses of Lower Pecos bedrock features. More data from a larger sample of bedrock features is needed to provide a stronger foundation for a regional typology to be built upon. That said, the largest group of features (Cluster 1) is made up of four smaller sub-groups, and is the most important cluster for truly understanding the entirety of bedrock feature variation. Future analyses should focus on characterizing sub-groups within Cluster 1 to present a more detailed typology of these features and how they may have functioned. These analyses should continue to include use-wear characteristics but also add attributes such as volume and considerations of the spatial clustering of features on a contiguous surface.

In order to evaluate the behavioral and functional implications of these features types, these analyses should be accompanied by a rigorous attempt to identify the absorbed residues in the various morphological types. Although our preliminary testing at Skiles Shelter (see Chapter 5) was not as successful as we had hoped, I still believe there is great potential for residue studies on ground stone surfaces in the Lower Pecos. To increase the chances of success, these studies should focus on extremely well protected features in dry rockshelters, and analyses should attempt to identify a wide range of residues.

Summary

In conclusion, this study represents the most systematic and holistic study of bedrock feature morphology and their potential uses yet accomplished in the Lower Pecos Canyonlands. I have provided data indicating there are at least four distinct types of bedrock features. I examined the four clusters of features through multiple lines of evidence –their patterning across the region, their respective use-wear patterns, and ethnographic accounts. These data show that while most of the features were likely for general use, other feature types (e.g., Cluster 4, cylindrical mortars) were highly specialized and only occurred at certain sites. This pattern could have implications about general lifeways for Lower Pecos hunter-gatherers. Perhaps these foraging peoples were using the many sites with unspecialized features for a majority of the year, but sites with specialty features could signal use during certain times, such as a harvest or large social gathering. These theoretical ideas along with experimental work can help archaeologists push our interpretations of ground stone bedrock feature technology past just food processing and into theories regarding site reuse and optimal technological adaptations.

Perhaps of the greatest importance, I have produced a large baseline dataset for future researchers to expand upon and test my hypotheses. Ground stone bedrock features are a common, ubiquitous feature across the landscape in the Lower Pecos, and undoubtedly hold potential for informing multiple facets of hunter-gatherer lifeways. We just have to keep pecking away at it.

APPENDIX SECTION

APPENDIX A: TERMINOLOGY DEFINITIONS

This section provides definitions for the general attribute data (Table App A.1) and use-wear observations (Table App A.2) collected during field inspection. The majority of these classifications, such as the opening shape, profile shape, base shape, and the inclination, were assigned by simple visual inspection. The “type” category was assigned based on depth classes that were assigned arbitrarily (Table App A.1). Sometimes when a feature’s depth could not be visually assessed easily, a small measuring tape was used to obtain a quick depth value. Use-wear data was collected for all areas of the feature: the rims, walls, and base. The terms used to describe the rim are in reference to the actual shape or character of the rim, while the terms used for the walls and base are describing the macroscopic character of the limestone in those areas. On shallow features, the walls and base grade into one another and the use-wear is typically very similar. Conversely, deeper features that have more distinct bases and often have differing use-wear than the walls. Although these designations are relatively subjective, these kinds of terms are widespread throughout bedrock feature research and defining my use of them will make my data relatable to other researchers.

Table App A.1. General Attribute Terminology Definitions.

Category	Term	Definition
Type	Shallow	Depth is less than 3 cm
	Cup	Depth is greater than 3 cm, but less than 7 cm
	Mortar	Depth is greater than 7 cm
	Flat	Very little to no concave surface, usually shiny and slick
	Pecked Area	Distinct peck marks with no subsequent use, can be amorphous
	Other	Morphology that does not fit into previous categories
Opening	Round	Circular at the mouth
	Ovoid	One axis is longer than the perpendicular axis, making the opening ovoid
	Oblong	One axis is much longer than the perpendicular axis, making the opening oblong
	Other	Morphology that does not fit into previous categories (e.g., triangular)
Profile	Flat	Little to no concavity in profile
	Dished	Gently sloping walls
	Conical	Steeply sloping walls, creating a cone in profile
	Straight-sided	Walls are mostly vertical, straight up and down
	Other	Morphology does not fit into the previous categories (e.g., irregular)
Base	Concave	Base is generally rounded
	Flat	Base is broad and flat
	Pointed	Base comes to an abrupt point
	Tapered	Base is narrow, but not pointed
	Other	Morphology does not fit into the previous categories (e.g., irregular)
Inclination	Horizontal	Feature is on a flat surface
	Gentle	Feature is on a gently sloping surface
	Moderate	Feature is on a moderately sloping surface
	Steep	Feature is on a steeply sloping surface

Table App A.2. Use-wear Terminology Definitions.

Area	Term	Definition
Rim	Rounded	Rim is a rounded smooth topographic change
	Gradual/Ephermeral	Rim grades into the rock surface surrounding the feature
	Rugged	Rim is uneven or rough
	Abrupt	Rim and surrounding rock meet at an abrupt, sharp angle
Walls and Base	Rugged	Surface is pecked with rough bumps
	Leveled	High points are cut off to the same elevation or the entire surface is completely smoothed to the touch
	Rounding	High points have rounded smooth edges; gentle bumps
	Sheen	Polish or shine on rock surface or high points
	Striations	Linear marks or gouges in the rock surface

APPENDIX B: BEDROCK FEATURE ATTRIBUTE AND METRIC DATA TABLES

41VV164 – Kelley Cave

Table App B.1. Attribute Data and Use-wear Observations for Bedrock Features at Kelley Cave.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Shallow	Round	Slightly Dished	Concave	Steep	Slight rim, Rounded on leveled high points with some sheen	Leveled on high points with sheen and some rounding	Same as walls
A002	Flat	Irregular	Flat	Flat	Steep	Rim is gradual, the broken edge is highly polished and rounded	Rugged with high points leveled and some sheen	Same as walls
A003	Shallow	Ovoid	Dished	Concave	Steep	Rounded rim, some sheen	Rugged with high points leveled	Same as walls
A004	Shallow	Oblong	Dished	Concave	Steep	NE rim is gradual, elswhere rounded	Rugged with sheen on leveled high points, NE wall is smoothed to the touch	Same as majority of walls
A005	Cup	Round	Dished	Concave	Moderate	SE rim is ubrupt, elsewhere gradual	Somewhat rugged with high points leveled	Rugged with highest points leveled
A006	Pecked Area	Round	Slightly Dished	Concave	Steep	Rugged	Rugged	Rugged
B001	Cup	Round	Slightly Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B002	Cup	Round	U-Shaped	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B003	Cup	Round	U-Shaped/Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B004	Cup	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
C001	Shallow	Ovoid	Dished	Concave	Moderate	Rounded, but slight	Rugged with some rounding on high points	Same as walls
D001	Shallow	Ovoid	Conical (Irregular)	Tapered	Steep	South rim gradual, elsewhere is rugged and slightly rounded	rugged overall with some rounding	Small central depression, leveled and rounded
D002	Shallow	Ovoid	Dished	Concave	Steep	Ephemeral rims, SE rim is slightly rounded	Rugged	Rugged
D003	Shallow	Round	Slightly Dished	Concave	Steep	Mostly rugged rims, ephemeral	Rugged	Rugged
D004	Shallow	Round	Slightly Dished	Concave	Steep	NE/NW rim is rounded, elsewhere is gradual	Rugged with some rounding	Same of walls

Table App B.1. Kelley Cave Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
D005	Shallow	Round	Slightly Dished	Concave	Steep	N, W, and SW rims are rough but rounded, elsewhere is gradual	Extremely rugged	Extremely rugged
D006	Shallow	Round	Slightly Dished	Concave	Steep	Ephemeral rims	Rugged	Rugged
D007	Flat	Irregular	Flat	Flat	Steep	Rugged	Rugged	Rugged
E001	Shallow	Round	Dished	Concave	Horizontal	Slightly rounded, somewhat gradual	Rugged, most high points are leveled	Bumpy, but overall smooth
E002	Shallow	Ovoid/Irregular	Dished	Concave	Horizontal	Mostly gradual	Rugged, most high points are leveled, some possible striations on south wall	Rugged, pecked with high points leveled
E003	Shallow	Ovoid	Dished	Concave	Horizontal	Abrupt, shares a rim with E004	Rugged with leveled high points	Same as walls
E004	Cup	Round	Dished	Concave	Horizontal	Gradual	Leveled	Leveled
E005	Shallow	Round	Dished	Concave	Horizontal	N & E rim are abrupt and rugged, S & W rim is gradual	Leveled and rounded	Mostly leveled, some peck marks visible in base
E006	Shallow	Ovoid/Irregular	Dished	Concave	Horizontal	NE rim is gradual, elswhere rounded	Rugged with some leveling and rounding	Rugged with high points leveled
E007	Shallow	Round	Slightly Dished	Concave	Horizontal	Gradual	Rugged with some leveling	Rugged with high points leveled
M1001	Shallow	Oblong	Dished	Concave	Horizontal	Slightly rounded	Upper walls are more leveled, lower walls are more rugged with overall rounding/smoothing or large high areas	Depression at base is rugged with some rounding
M1002	Cup	Round	Conical	Tapered	Horizontal	Rounded	Multiple striations oriented vertically on the walls, leveled	Deepest pecked depression is mostly leveled.

Table App B.2. Metric Data for Kelley Cave Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	1.7	14.5	10.8	1.3
A002	0.6	12.3	9.5	1.3
A003	2.9	15.9	15.5	1.0
A004	4.0	22.6	15.1	1.5
A005	1.8	18.3	11.3	1.6
A006	0.4	6.5	4.1	1.6
B001	4.1	11.3	10.4	1.1
B002	2.9	9.5	8.2	1.2
B003	3.0	9.3	8.7	1.1
B004	3.5	14.1	13.7	1.0
C001	1.2	9.8	6.4	1.5
D001	2.2	11.1	7.1	1.6
D002	2.4	15.7	10.7	1.5
D003	1.0	14.0	13.8	1.0
D004	2.8	15.2	12.4	1.2
D005	2.3	11.0	10.4	1.1
D006	1.5	12.3	11.2	1.1
D007	0.6	10.5	9.2	1.1
E001	1.5	11.3	9.6	1.2
E002	3.1	21.5	16.8	1.3
E003	1.4	15.7	9.7	1.6
E004	3.4	18.6	13.7	1.4
E005	1.2	13.9	11.8	1.2
E006	1.7	28.7	12.2	2.4
E007	1.7	13.1	10.5	1.2
M1001	2.6	21.7	11.6	1.9
M1002	4.0	8.4	7.7	1.1

Table App B.3. Attribute Data and Use-wear Observations for Bedrock Features at Skiles Shelter.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B001	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B002	Shallow	Round	Dished	Concave	Moderate	N/A- weathered	N/A- weathered	N/A- weathered
B003	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B004	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B005	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B006	Shallow	Irregular	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B007	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B008	Shallow	Round	Dished	Concave	Horizontal	Rugged with some rounding	Rugged	Rugged
B009	Shallow	Round/Ovoid	Dished	Concave	Horizontal	Rounded with sheen and leveling	Rounding with sheen and leveling of high points	Same as walls
B010	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged	Rugged with some sheen	Same as walls
B011	Flat	Roundish	Dished	Concave	Moderate	Rounded with leveling	Rounding and leveling of high points	Same as walls
B012	Shallow	Round	Dished	Concave	Moderate	Rugged with some sheen	Rugged with some sheen on high points	Rugged
B013	Shallow	Round/Ovoid	Dished	Concave	Moderate	Rounded	Leveled and rounded on high points, possible striation perpendicular to long axis	Leveled and rounded on high points
B014	Shallow	Round/Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B015	Shallow	Round	Dished	Concave	Horizontal	Rugged and leveled	Rugged and leveled high points	Same as walls
B016	Shallow	Oblong	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B017	Shallow	Round/Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B018	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B019	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B020	Shallow	Round	Dished	Concave	Horizontal	Rounded, leveling and sheen	Rugged, some leveling	Same as walls
B021	Shallow	Round/Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B022	Shallow	Round/Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B023	Shallow	Round	Dished	Concave	Horizontal	Leveled with sheen	Rugged, some leveling	Same as walls

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
B024	Cup	Round	Dished	Concave	Horizontal	Rounded, leveling and sheen	Leveling and sheen on high points	Leveled high points
B025	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B026	Shallow	Ovoid	Dished	Concave	Moderate	N/A- weathered	N/A- weathered	N/A- weathered
B027	Shallow	Round	Dished	Concave	Slight	Sheen on high points	Rugged with some leveling	Rugged with some leveling
B028	Shallow	Round Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B029	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	Rugged, some leveling	Same as walls
B030	Cup	Ovoid	Dished	Concave	Horizontal	Rounded, but rugged frrom erosion	Leveling and sheen on high points	Sheen
B031	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	Some leveling	Rugged
B032	Cup	Ovoid	Dished	Concave	Horizontal	Rugged, but mostly round	Leveling	Leveling
B033	Shallow	Round	Dished	Concave	Horizontal	Rounded	Leveling and sheen on high points	Same as walls
B034	Shallow	Round	Dished	Concave	Horizontal	Rounded with leveling	Leveling of high points	Leveling of high points
B035	Shallow	Round	Dished	Concave	Horizontal	Rounded with leveling and sheen	Leveling of high points	Leveling of high points
B036	Shallow	Round	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling of high points
B037	Shallow Irregular	Oblong/Irregular	Dished/Irregular	2 low spots	Horizontal	Rounded with sheen	Leveling of high points	Leveling of high points
B038	Shallow	Round	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling and sheen on high points
B039	Shallow	Round	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling of high points
B040	Shallow	Round	Dished	Concave	Horizontal	Rounded	Leveling of high points	Leveling of high points
B041	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling of high points
B042	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling of high points
B043	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Leveling of high points	Leveling of high points
B044	Shallow	Round	Dished	Concave	Horizontal	Rugged	Rugged with leveling of high points	Rugged
B045	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged	Rugged with leveling of high points	Same as walls
B046	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged	Rugged with leveling of high points	Leveling on high points

Table App B.3. Skiles Shelter Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
B047	Shallow	Round	Dished	Concave	Horizontal	Rounded	Some leveling on high points	Leveling on high points
B048	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded with sheen	Leveling of high points	Leveling on high points
B049	Cup	Round/Ovoid	Conical	Concave	Horizontal	Rounded	Leveling of high points and some ruggedness	Leveling on high points
B050	Cup	Irregular/Ovoid	Dished	Concave	Horizontal	Rounded and rugged	Leveling of high points	Leveling of high points
C001	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded with leveling and sheen	Leveling and sheen on high points	Leveling and sheen on high points
C002	Cup	Ovoid	Dished	Concave	Horizontal	Rounded with leveling and sheen	Leveling and sheen on high points	Leveling and sheen on high points
C003	Cup	Ovoid	Dished	Concave	Horizontal	Gradual with leveling	Pecked with leveling and sheen on high points	Same as walls
C004	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Leveling and sheen on high points	Same as walls
C005	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged	Rugged	Rugged
C006	Cup	Round	Conical	Tapered	Horizontal	Rounded	Leveling with some possible striations	Leveling and sheen on high points
C007	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Leveling of high points	Leveling and sheen on high points
C008	Cup	Ovoid	Dished/Slightly Conical	Concave/Tapered	Horizontal	South rim is gradual, elsewhere is rounded	Rugged with leveling and rounding of high points	Same as walls
C009	Cup	Round/Ovoid	Dished/Conical	Concave/Tapered	Horizontal	Rounded with leveling and sheen	Leveling of high points	Rugged with rounded high points
C010	Cup	Round/Irregular	Dished	Concave	Horizontal	Rounded	Some leveling of high points	Rugged and pecked
C011	Cup	Ovoid	Dished	Concave	Horizontal	Rounded	Leveling and sheen of high points	Leveling of high points
C012	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged with leveling of high points	Rugged with leveling of high points
C013	Cup	Irregular/Ovoid	Conical	Concave	Horizontal	Rounded	Leveling of larger areas, some pecked areas	Rugged with leveling and rounding
C014	Cup	Round	Dished/Slightly Conical	Concave/Tapered	Horizontal	Rounded	Almost completely leveled with possible striations	Pecked, high points leveled with sheen.

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
C015	Shallow	Irregular/Round	Dished	Concave	Horizontal	Rounded	Pecked with leveling of high points	Same as walls
C016	Shallow	Round	Dished	Concave	Horizontal	Rounded	Pecked with leveling of high points	Same as walls
C017	Cup	Irregular/Ovoid	Dished/Conical	Concave/Tapered	Horizontal	Rounded	Striations perpendicular to walls, upper walls completeled leveled, lower walls pecked with leveled high points	Pecked, high points leveled with sheen.
C018	Shallow	Ovoid	Irregular	Concave	Horizontal	N & W rims are rugged, E & S rims are gradual/slightly rounded	Pecked with high points leveled	Same as walls
C019	Cup	Round	Dished	Concave	Horizontal	Rounded	Rugged with some high points leveled	Same as walls
C020	Cup	Irregular/Oblong	Dished/Irregular	Concave	Horizontal	Rounded	Rugged	Rugged with some leveling of high points
C021	Shallow	Round	Dished	Concave	Horizontal	Slightly rounded	E wall leveled and rounded, elsewhere rugged with high points leveled	Rugged with leveling of high points
C022	Shallow	Irregular	Dished	Irregular (broken)	Horizontal	Rounded	Leveled on upper walls, pecked on lower walls	Rugged
C023	Shallow	Round	Dished	Concave	Horizontal	Gradual	Rugged with high points leveled	Leveled
C024	Shallow	Round	Dished	Concave	Horizontal	Rugged to gradual	Rugged overall with some rounding of high points	Rugged/pecked with some leveling of high points
C025	Shallow	Round	Dished	Concave	Horizontal	Rugged to gradual	Rugged with some rounding of high points	Rugged/pecked with some leveling of high points
C026	Cup	Round/Irregular	Dished	Concave	Horizontal	rounded	Some parts almost completely leveled, others rugged with high points leveled	Rugged with high points leveled and rounded

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
D001	Cup	Round	Dished	Concave	Horizontal	Some rounded, some abrupt	Rugged with leveling and sheen	Same as walls
D002	Cup	Round	Dished	Concave	Horizontal	Rounded with sheen	Leveling with sheen on high pointes	Same as walls
D003	Shallow	Round	Dished	Concave	Moderate	Rounded	Rugged with light leveling of high points	Rugged
D004	Cup	Oblong	Dished/Slightly Conical	Concave	Moderate	SE rim is abrupt, elsewhere gradual	Rugged with some leveling of high points	Same as walls
D005	Shallow	Oblong	Dished	Concave	Moderate	Gradual	Rugged with some leveling of high points	Rugged/pecked, depressions present
D006	Shallow	Round	Dished	Concave	Moderate	Ephemeral	Rugged with some leveling of high points	Same as walls
D007	Cup	Oblong	Dished/Irregular	Concave	Moderate	Round to gradual	Rugged with some leveling of high points	Rugged/pecked but some leveled areas
D008	Shallow	Round	Dished	Concave	Moderate	Gradual	Rugged with large amounts leveled and some sheen	Bumpy but overall leveled and rounded
D009	Shallow	Ovoid	Dished	Concave	Moderate	Rounded	Rugged with leveling of high points	Same as walls
D010	Flat	Flat	Flat	Flat	Moderate	Rugged	Rugged with high points leveled and sheen	Same as walls
E001	Cup	Ovoid	Conical	Concave/Tapered	Horizontal	Rounded	Rugged	Rugged
E002	Cup	Ovoid	Conical	Concave/Tapered	Horizontal	Rounded	Rugged with rounding and sheen	Same as walls
E003	Cup	Round	Straight Walled	Concave	Horizontal	Rugged	Rugged	Rugged
E004	Cup	Round	Conical	Concave/Tapered	Horizontal	Rounded	Leveling of high points	Rugged
E005	Cup	Round	Dished/Slightly Conical	Concave	Horizontal	Rounded	Rugged with some leveling and rounding of high points	Same as walls
E006	Shallow	Round	Dished	Irregular, pecked	Horizontal	Rugged	Rugged with some leveling and rounding of high points	Same as walls

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E007	Mortar	Round/Oblong	Straight Walled	Concave/Tapered	Horizontal	Rounded	Rugged with small amounts of rounding and sheen	Same as walls
E008	Shallow	Round	Conical	Concave/Tapered	Horizontal	Rounded	Rugged with some rounding and sheen on high points	Same as walls
E009	Shallow	Irregular/Round	Dished	Irregular	Horizontal	Rugged	Rugged with some rounding	Rugged
E010	Shallow	Irregular	Dished	Concave	Horizontal	Rounded to gradual	Leveled and rounded on high points	Same as walls
E011	Mortar	Round	Straight Walled	Concave	Horizontal	Rounded	Rugged with some rounding of high points	Same as walls
E012	Shallow	Oblong/Irregular	Dished	Concave	Moderate	Rounded	Rugged with some leveling of high points and sheen	Rugged
E013	Cup	Oblong	Dished/Conical	Concave/Tapered	Moderate	Rounded	Rugged with rounding on high points	Rugged
E014	Flat	Oblong	Slightly Dished	Concave/Irregular	Moderate	Rugged	Rugged with leveling of high points	Same as walls
E015	Shallow	Irregular/Oblong	Dished	Irregular/Oblong	Moderate	Rounded	NE end extensively leveled, elsewhere high points leveled	Rugged, high points rounded
E016	Shallow	Round	Conical	Tapered	Moderate	Rugged	Rugged, sheen on high points	Same as walls
E017	Shallow	Round	Dished	Concave	Horizontal	Rugged	Rugged with some leveling and rounding of high points	Same as walls
E018	Mortar	Oblong	Conical	Tapered	Horizontal	Somewhat abrupt	Rugged with some leveling of high points	Same as walls
E019	Shallow	Round	Dished/Irregular	Irregular	Horizontal	Rugged	Rugged with some rounding of high points	Same as walls
E020	Cup	Round	Dished/Slightly Conical	Concave/Tapered	Horizontal	Rounded and abrupt	Rugged with high points rounded and leveled	Same as walls
E021	Shallow	Oblong	Dished	Irregular (pecked)	Horizontal	Somewhat rounded	Some overall leveling, rounded tops	Same as walls

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E022	Cup	Round	Dished	Concave/Tapered	Horizontal	Rounded	Rugged with high points leveled	Same as walls
E023	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	All highs leveled and smoothed, sides are rounded	Same as walls
E024	Flat	Flat	Flat	Flat	Horizontal	Rounded	Leveled high points	Same as walls
E025	Flat	Flat	Flat	Flat	Horizontal	Ephemeral	Rugged with some leveling and rounding of high points	Same as walls
F001	Shallow	Round	Dished	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding	Rugged with high points leveled
F002	Shallow	Oblong	Dished/Irregular	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding	Rugged with some rounding
F003	Shallow	Round	Dished	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding	Rugged with some leveling and rounding
F004	Shallow	Round	Dished	Concave	Moderate	Rounded with some gradual spots	Bumpy, but rounded	Smoothed bumps with some leveling of high points
F005	Shallow	Round	Dished	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding of high points	Rugged
F006	Shallow	Ovoid	Dished	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding and leveling of high points	Rugged
F007	Shallow	Ovoid	Dished	Concave	Moderate	Rounded with some gradual spots	Rugged with some rounding	Rugged with some leveling and rounding
F008	Shallow	Round	Dished	Concave	Moderate	Rounded	Rugged with some rounding	Rugged with some leveling and rounding
F009	Shallow	Round	Dished	Concave	Moderate	Rounded	Rugged with some rounding	Same as walls

Table App B.3. Skiles Shelter Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
M1001	Cup	Round	Dished	Concave	Horizontal	Rounded	Rugged	Rugged with leveling of high points
M1002	Cup	Ovoid	Dished/Conical	Concave	Horizontal	Two abrupt rims, elsewhere it is gradual	Rugged with some leveling	Rugged
M1003	Shallow	Round	Dished	Concave	Horizontal	Abrupt	Rugged	Rugged with leveling of high points
M1004	Cup	Round	Dished	Concave	Horizontal	Gradual	Rugged	Rugged
M1005	Cup	Round	Dished	Concave	Horizontal	Abrupt	Rugged with high points leveled	Leveled

Table App B.4. Metric Data for Skiles Shelter Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	1.5	16.8	9.2	1.8
B001	0.3	4.6	4.5	1.0
B002	1.1	9.6	6.2	1.5
B003	1.5	7.1	6.4	1.1
B004	1.2	9.2	7.5	1.2
B005	1.4	8.0	7.2	1.1
B006	1.1	7.4	6.5	1.1
B007	1.7	7.8	7.4	1.0
B008	1.2	10.6	8.7	1.2
B009	0.8	9.9	8.7	1.1
B010	1.0	15.3	7.1	2.1
B011	0.5	7.3	6.3	1.2
B012	1.2	11.5	10.1	1.1
B013	1.0	15.3	11.8	1.3
B014	1.2	11.2	8.4	1.3
B015	2.1	8.3	6.4	1.3
B016	1.5	14.9	11.3	1.3
B017	1.9	17.3	13.6	1.3
B018	0.5	5.5	5.5	1.0
B019	2.1	12.5	11.8	1.1
B020	5.5	12.5	12.3	1.0
B021	1.8	11.6	7.9	1.5
B022	1.5	12.5	10.0	1.2
B023	1.5	12.0	6.9	1.7
B024	3.8	18.2	15.1	1.2
B025	2.1	13.9	11.7	1.2
B026	0.3	6.7	4.8	1.4
B027	2.8	15.5	13.6	1.1
B028	2.9	12.3	11.1	1.1
B029	2.7	10.6	9.4	1.1
B030	3.1	12.7	9.3	1.4
B031	0.8	6.7	6.3	1.1
B032	3.9	18.1	10.6	1.7
B033	1.2	8.0	6.1	1.3
B034	1.4	8.9	8.8	1.0
B035	0.2	2.9	2.8	1.0

Table App B.4. Skiles Shelter Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
B036	0.6	6.4	5.7	1.1
B037	4.3	36.6	18.0	2.0
B038	1.7	11.1	8.7	1.3
B039	1.0	8.4	8.0	1.0
B040	1.0	8.7	5.1	1.7
B041	0.6	7.9	6.3	1.3
B042	0.7	7.6	4.1	1.9
B043	1.5	15.5	11.0	1.4
B044	1.7	10.6	10.0	1.1
B045	0.9	13.0	7.0	1.9
B046	2.7	15.7	13.0	1.2
B047	0.9	10.2	10.0	1.0
B048	1.1	12.1	8.3	1.5
B049	4.2	17.2	14.3	1.2
B050	3.4	20.8	18.4	1.1
C001	1.4	20.4	13.1	1.6
C002	3.4	29.0	13.3	2.2
C003	4.4	35.6	16.4	2.2
C004	1.3	14.6	13.0	1.1
C005	0.9	18.8	13.0	1.5
C006	9.1	17.9	16.1	1.1
C007	0.9	10.3	9.1	1.1
C008	3.3	19.5	15.1	1.3
C009	4.0	17.2	14.7	1.2
C010	3.5	16.7	14.8	1.1
C011	3.4	17.0	12.7	1.3
C012	1.4	12.8	11.4	1.1
C013	7.0	25.4	14.0	1.8
C014	4.7	22.9	15.4	1.5
C015	1.7	14.4	10.7	1.3
C016	2.3	13.4	12.5	1.1
C017	3.9	26.7	14.2	1.9
C018	1.6	18.3	10.6	1.7
C019	2.9	14.9	14.1	1.1
C020	3.1	27.4	13.0	2.1
C021	2.2	13.1	9.5	1.4

Table App B.4. Skiles Shelter Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
C022	1.7	11.0	5.6	1.9
C023	1.6	12.1	11.3	1.1
C024	1.6	10.6	9.8	1.1
C025	1.5	9.1	8.3	1.1
C026	5.1	24.5	19.8	1.2
D001	4.2	17.3	12.6	1.4
D002	3.7	14.8	13.4	1.1
D003	1.4	11.4	10.4	1.1
D004	3.8	18.2	12.6	1.4
D005	2.3	14.1	10.6	1.3
D006	1.1	16.3	15.9	1.0
D007	5.1	24.7	19.5	1.3
D008	1.9	17.5	11.0	1.6
D009	1.2	17.6	10.7	1.6
D010	0.9	13.8	9.2	1.5
E001	5.2	17.1	14.4	1.2
E002	4.6	11.6	9.2	1.3
E003	5.0	12.2	11.2	1.1
E004	3.8	9.4	8.9	1.1
E005	3.2	9.4	9.1	1.0
E006	2.0	11.2	9.1	1.2
E007	18.6	15.0	14.3	1.0
E008	2.5	11.1	9.1	1.2
E009	1.6	9.8	8.8	1.1
E010	3.1	10.9	9.9	1.1
E011	10.2	19.0	12.8	1.5
E012	3.1	14.0	11.7	1.2
E013	3.6	14.3	11.0	1.3
E014	1.5	21.8	13.3	1.6
E015	3.6	26.0	10.8	2.4
E016	1.6	11.2	9.3	1.2
E017	1.3	5.7	5.2	1.1
E018	12.4	15.7	14.5	1.1
E019	1.1	7.9	6.5	1.2
E020	5.5	13.7	12.9	1.1
E021	1.6	8.9	8.5	1.0
E022	4.6	15.5	12.5	1.2
E023	2.1	15.9	11.1	1.4
E024	0.7	10.9	8.7	1.3
E025	1.9	10.2	5.6	1.8

Table App B.4. Skiles Shelter Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
F001	0.9	13.4	10.3	1.3
F002	1.8	18.5	8.0	2.3
F003	1.9	9.6	8.2	1.2
F004	0.7	10.6	8.2	1.3
F005	2.1	12.9	11.9	1.1
F006	2.1	20.4	11.4	1.8
F007	1.5	11.6	8.8	1.3
F008	1.7	10.7	10.3	1.0
F009	0.7	7.8	6.8	1.1
M1001	3.9	13.2	12.7	1.0
M1002	3.6	15.4	10.4	1.5
M1003	1.1	7.1	6.8	1.0
M1004	2.8	9.4	8.9	1.1
M1005	3.3	9.9	8.4	1.2

Table App B.5. Attribute Data and Use-wear Observations for Bedrock Features at Horse Trail Shelter.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Cup	Round	Dished	Concave	Horizontal	Gently rounded	Mostly leveled	Mostly leveled but some remnant pecks visible
A002	Cup	Round	Conical/Straight	Concave	Horizontal	Rounded	Mostly leveled with some slight rounded bumps	More rugged, pecked with high points leveled
A003	Cup	Round	Conical/Straight	Concave	Horizontal	Rounded	Mostly leveled with some slight rounded bumps	Mostly leveled
A004	Cup	Round	Conical/Straight	Concave	Horizontal	Rounded	Mostly leveled with some slight rounded bumps	Mostly leveled
A005	Cup	Slightly Oblong	Dished	Concave	Horizontal	NW-SW rim is abrupt, elsewhere is rounded	Rugged but bumps are rounded, some high points leveled	Mostly leveled with some rounding
A006	Cup	Round	Dished	Concave	Horizontal	NW-SW rim is abrupt, elsewhere is rounded	Rugged but bumps are rounded, some high points leveled	Mostly leveled with some rounding
A007	Mortar	Round	Conical	Tapered (Almost Pointed)	Horizontal	Mostly abrupt	Upper walls are completely leveled, lower walls have some rounded bumps but mostly leveled	Leveled with few small rounded bumps
A008	Cup	Round	Dished	Concave	Horizontal	Gently rounded	Somewhat bumpy but all are rounded	Somewhat leveled with remnant pecks visible
A009	Mortar	Round	Conical	Pointed	Horizontal	Mostly abrupt	Completely leveled, smooth to the touch	Mostly leveled with some rounded bumps
A010	Cup	Ovoid/Irregular	Dished	Concave	Horizontal	Gently rounded	Rugged with rounding	Rugged with leveled high points
A011	Shallow	Irregular	Dished	Concave	Horizontal	Gradual	Rugged with rounded bumps	Rugged with rounded bumps
A012	Mortar	Round	Conical	Concave/Tapered	Horizontal	Gradual	Mostly leveled, one rugged area was rounded edges	Mostly leveled, some rounded bumps
A013	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged with rounding	Same as walls
A014	Mortar	Round	Conical	Concave	Horizontal	Somewhat abrupt	Mostly leveled with some rounded bumps on lower walls	Leveled with few small rounded bumps
A015	Cup	Round	Dished	Concave	Horizontal	Rounded	Rugged but rounded	Fairly leveled

Table App B.5. Horse Trail Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A016	Pecked Depression	Round	Dished	Concave	Horizontal	Rounded	Mostly leveled, one rounded bump	Leveled
A017	Pecked Depression	Round	Dished	Concave	Horizontal	Rounded	Leveled	Leveled
A018	Pecked Depression	Round	Dished	Concave	Horizontal	Rounded	Leveled	Leveled
B001	Cup	Round	Dished	Concave (Central Peck)	Horizontal	NW rim is gradual, elsewhere rounded	Bumpy with rounding	Leveled and rounded
B002	Cup	Round	Dished	Concave	Slight	Mostly rounded	Bumpy with rounding	Completely leveled, smooth to the touch
B003	Cup	Round	Conical/Straight	Concave	Slight	Gradual	Some leveling and rounding	Rugged with high points leveled
B004	Cup	Round	Conical	Concave	Slight	Gradual	Leveled with some rounding	Rugged with high points leveled
B005	Shallow	Round	Dished	Concave	Slight	Mostly gradual	Rounded high points	Pecked/Rugged
B006	Cup	Round	Conical	Concave	Horizontal	Rounded	Rugged with many high points leveled	Slightly rugged with much leveling
B007	Pecked Depression	Round	Conical	Concave	Slight	Mostly rounded	Mostly leveled	Leveled
C001	Mortar	Oblong	Conical	Broken Through	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
C002	Shallow	Round	Dished	Concave	Horizontal	Mostly gradual	Rounding	Leveling and rounding
C003	Cup	Round	Dished/Conical	Tapered	Horizontal	Rounded but rugged	Rugged with some rounding	Rugged with high points leveled
C004	Shallow	Ovoid	Dished	Concave	Horizontal	Slightly rounded	Leveled	Mostly leveled with remnant pecks
C005	Cup	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
D001	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rugged with some leveling and rounding of high points	Same as walls
D002	Cup	Round	Conical	Concave	Slight	Rounded	Some leveling and rounding	Rugged with rounding
D003	Shallow	Irregular/Ovoid	Dished	Concave (Central Peck)	Slight	Gradual and rugged	Fairly leveled with rounding of low bumps	Rugged with rounding
D004	Shallow	Round	Dished	Concave (Central Peck)	Horizontal	Gradual	Rugged with high points leveled and rounded	Pecked with high points leveled
D005	Shallow	Irregular	Dished	Concave	Horizontal	Mostly rounded	Rugged with light leveling and rounding	Rugged with rounding
D006	Shallow	Round	Dished	Concave	Horizontal	Mostly rounded	Rugged with some rounding	Same as walls

Table App B.5. Horse Trail Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
D007	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded but rugged	Rugged with some leveling of high points	Rugged with rounding and leveling of high points
D008	Shallow	Round	Dished	Concave/Tapered (Pecks)	Horizontal	Gradual and rugged	Rugged with rounding	Rugged with rounding
D009	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Low rounded bumps, some leveling	Pecked but rounded
D010	Shallow	Oblong	Dished	Concave	Horizontal	Gradual and rugged	Rugged with rounding	Same as walls
D011	Shallow	Round	Dished	Concave	Horizontal	Rounded	Pecked but rounded	Same as walls
D012	Shallow	Oblong	Dished/Irregular	Concave/Irregular	Horizontal	Rounded	Rugged with rounding	Same as walls
D013	Cup	Round/Irregular	Conical	Tapered	Horizontal	Rounded	Mostly leveled with some rounded bumps	Same as walls
D014	Cup	Round/Irregular	Dished	Concave	Horizontal	Rounded	Rugged with rounded high points leveled	Same as walls
D015	Shallow	Round	Dished	Concave	Horizontal	Slightly rounded	Highly pecked/rugged with some rounding	Same as walls
D016	Cup	Slightly Ovoid	Conical	Tapered	Horizontal	Mostly rounded	Fairly rugged with rounding	Mostly leveled with rounding
D017	Cup	Ovoid	Dished/Conical	Concave	Horizontal	Rounded and rugged	Mostly leveled, some rounded bumps	Pecked/Rugged
D018	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged, light rounding	Leveled and rounded
D019	Shallow	Round	Dished	Concave	Horizontal	Mostly rounded	Rugged, light rounding	Fairly rugged, some rounding
D020	Shallow	Round	Dished	Concave	Horizontal	Slightly rounded	Rugged, light rounding	Same as walls
D021	Shallow	Round	Dished	Concave	Horizontal	Slightly rounded	Rugged, light rounding	Same as walls
D022	Shallow	Slightly Ovoid	Dished	Concave	Horizontal	Rounded	Rugged, light rounding	Same as walls
D023	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Some leveling and rounding	Leveled
D024	Pecked Depression	Round	Dished	Concave	Horizontal	Gradual	Leveled	Leveled
E001	Mortar	Round	Conical	Concave	Horizontal	Abrupt	Rugged with rounded bumps and some leveleing	Leveling and rounding
E002	Mortar	Round	Conical	Broken Through	Horizontal	Somewhat rounded	Fairly leveled, some rounding	Broken Through

Table App B.5. Horse Trail Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E003	Mortar	Round	Conical	Tapered	Horizontal	Somewhat rounded	Fairly leveled	Leveled and smooth
E004	Cup	Ovoid	Dished	Concave	Horizontal	Rounded	Rounded bumps	Leveled
E005	Cup	Round	Dished/Slightly Conical	Concave	Horizontal	Rugged	Mostly leveled, rounded bumps	Leveled with few small rounded bumps
E006	Cup	Round	Conical/Straight	Concave	Horizontal	Mostly rounded	Fairly leveled, rounded bumps	Mostly leveled
E007	Shallow	Round	Dished	Concave	Horizontal	Mostly rounded	Rugged but rounded	Same as walls
E008	Pecked Depression	Round	Dished	Concave	Horizontal	Rounded	Leveled	Leveled
E009	Cup	Round	Conical/Straight	Concave	Horizontal	Rounded but rugged	Fairly leveled, rounded bumps	Leveled
E010	Shallow	Round	Dished	Concave	Horizontal	Rounded	Low rounded bumps, some leveling	Mostly leveled with rounding
E011	Mortar	N/A, broken	Conical	Tapered	Horizontal	Mostly rounded	Fairly leveled with rounding of low bumps	Rugged with rounded bumps

Table App B.6. Metric Data for Horse Trail Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	2.5	12.0	8.2	1.5
A002	3.2	9.5	8.0	1.2
A003	2.0	6.8	6.3	1.1
A004	3.2	8.9	8.4	1.1
A005	2.4	8.6	7.8	1.1
A006	2.5	8.3	6.2	1.3
A007	21.4	15.6	14.1	1.1
A008	2.7	11.2	10.5	1.1
A009	22.9	15.0	12.7	1.2
A010	3.6	18.8	12.1	1.6
A011	1.4	12.6	9.6	1.3
A012	9.1	12.6	12.6	1.0
A013	1.8	10.6	6.4	1.7
A014	22.8	20.2	14.2	1.4
A015	2.3	9.8	9.6	1.0
A016	0.6	2.1	1.9	1.1
A017	0.8	2.6	2.4	1.1
A018	0.5	2.0	2.0	1.0
B001	3.1	17.7	14.7	1.2
B002	2.9	8.7	8.1	1.1
B003	3.4	7.7	7.4	1.0
B004	4.0	8.5	8.3	1.0
B005	2.3	9.1	8.2	1.1
B006	4.6	9.8	9.2	1.1
B007	1.2	2.7	2.4	1.1
C001	21.8	23.6	13.7	1.7
C002	2.5	11.8	11.0	1.1
C003	2.7	8.6	8.3	1.0
C004	2.3	11.6	8.7	1.3
C005	1.1	6.9	5.0	1.4
D001	2.5	13.0	10.3	1.3
D002	4.5	12.7	11.9	1.1
D003	1.1	9.1	6.4	1.4
D004	2.2	10.6	8.8	1.2
D005	1.1	11.5	9.2	1.3
D006	0.7	9.5	8.3	1.1
D007	0.0	21.3	13.7	1.6
D008	1.2	9.4	9.2	1.0

Table App B.6. Horse Trail Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
D009	1.5	14.0	9.3	1.5
D010	1.7	18.3	8.9	2.1
D011	1.4	14.1	10.0	1.4
D012	4.3	16.6	9.1	1.8
D013	5.3	14.7	10.3	1.4
D014	3.7	14.3	10.2	1.4
D015	2.2	10.4	9.3	1.1
D016	3.4	10.6	8.5	1.2
D017	3.1	13.2	10.4	1.3
D018	2.1	11.8	9.7	1.2
D019	1.6	10.4	9.6	1.1
D020	1.6	10.6	9.9	1.1
D021	1.4	10.2	7.8	1.3
D022	2.1	11.0	9.2	1.2
D023	1.3	8.6	8.3	1.0
D024	1.1	5.4	3.4	1.6
E001	15.6	13.6	13.3	1.0
E002	29.5	18.3	17.7	1.0
E003	14.9	13.6	12.5	1.1
E004	2.4	13.6	7.3	1.9
E005	2.6	9.3	9.2	1.0
E006	4.9	9.6	9.2	1.0
E007	2.3	8.4	7.4	1.1
E008	1.3	7.3	7.2	1.0
E009	3.3	9.2	8.9	1.0
E010	1.2	10.1	5.8	1.7
E011	21.7	16.5	14.9	1.1

Table App B.7. Attribute Data and Use-wear Observations for Bedrock Features at Eagle Cave.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Cup	Ovoid	Dished	Concave	Horizontal	Mostly gradual	Completely leveled, smooth to the touch with some remnant pecks	Mostly leveled, some remnant pecks
A002	Shallow	Round	Flat	Flat	Horizontal	Rugged (weathering)	High points leveled, somewhat rugged	Central pecked depression in base
B001	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged	Rugged, pecked	Rugged but with some leveled high points and sheen
B002	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged and slight	Rugged with some high points leveled	Sheen on leveled high points, still rugged
B003	Shallow	Ovoid	Dished	Concave	Moderate	Rugged	Rugged with highest points leveled and some rounding	Same as walls
B004	Flat/Irregular	Irregular	Flat	Flat	Slight	Gradual	Rugged with leveled high points	Same as walls
B005	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B006	Shallow	Ovoid	Dished	Concave	Moderate	N/A- weathered	N/A- weathered	N/A- weathered
B007	Cup	Round	Dished/Slightly Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B008	Shallow	Round	Slightly Dished	Concave	Moderate	Gradual with some rounding	Rugged with some leveled high points	Same as walls
B009	Cup	Ovoid	Conical	Obscured	Horizontal	Abrupt	Rugged with leveling and a possible striation oriented vertically	N/A- weathered
B010	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B011	Mortar	Round	Conical	Tapered	Horizontal	Mostly rounded	Completely leveled, smooth to the touch, possible striations vertical on West wall	Mostly leveled, some remnant pecks
B012	Shallow	Round	Dished	Pecked	Horizontal	Gradual	Rugged	Rugged
B013	Shallow	Round	Dished	Concave	Horizontal	Rugged	Rugged	Rugged with some rounding on high points
B014	Cup	Ovoid	Dished/Slightly Conical	Concave	Horizontal	Rounded	Rugged with some leveling	Leveled

Table App B.7. Eagle Cave Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
C001	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	N/A- weathered	N/A- weathered
C002	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	N/A- weathered	N/A- weathered
C003	Flat	Round	Slightly Dished	Pecked	Horizontal	Gradual	Rugged with some leveled high points	Pecked central depression
C004	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	N/A- weathered	N/A- weathered
C005	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rugged	Rugged with some leveling
C006	Shallow	Round	Dished	Concave	Horizontal	Did not collect data	Did not collect data	Did not collect data
C007	Shallow	Round	Dished	Concave	Slight	Did not collect data	Did not collect data	Did not collect data
C008	Shallow	Round	Dished	Concave	Slight	Did not collect data	Did not collect data	Did not collect data
D001	Mortar	Round	Conical	Concave	Horizontal	Did not collect data	Did not collect data	Did not collect data
M1001	Shallow	Ovoid	Dished	Concave	Horizontal	Rugged and slight	Rugged	Rugged with central peck
M1002	Shallow	Oblong	Dished/Slightly Conical	Concave/Tapered	Horizontal	Mostly rounded, somewhat rough	Rugged	Rugged/pecked
M1003	Cup	Round	Conical	Broken Through	Horizontal	Rounded	Rugged	Rugged
M1004	Cup	Irregular/Oblong	Dished	Concave	Slight	Rounded	Rugged	Rugged
M1005	Shallow	Oblong	Dished	Concave	Slight	Very slight, ephemeral	Rugged with maybe some slight rounding	Rugged
M1006	Cup	Round	Dished	Concave	Slight	Rounded	Rugged	Rugged
M1007	Cup	Round	Dished	Concave	Slight	Rounded	Rugged	Rugged
M1008	Shallow	Round	Dished	Concave	Horizontal	Gradual	Rugged	Rugged
M2001	Cup	Round	Conical	Concave	Horizontal	Rounded	Rugged	Rugged
T001	Cup	Round	Dished	Concave	Moderate	Gradual, somewhat rounded	Rugged, lower walls have some leveling of high points	Rugged
T002	Cup	Oblong/Irregular	Dished	Concave	Moderate	Rugged	Mostly leveled with some sheen and rounding	Rugged
T003	Cup	Round/Irregular	Dished	Concave	Moderate	Gradual	Leveled with sheen in one area, the rest is rugged	Same as walls
T004	Cup	Round	Dished	Concave	Moderate	Rugged	Leveled and some rounding in some areas, elsewhere rugged	Same as walls

Table App B.8. Metric Data for Eagle Cave Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	3.4	22.4	15.8	1.4
A002	1.4	11.7	11.3	1.0
B001	1.0	17.4	9.5	1.8
B002	1.1	15.2	9.4	1.6
B003	0.7	8.3	7.7	1.1
B004	0.6	6.0	3.6	1.7
B005	1.7	11.7	10.8	1.1
B006	1.4	11.0	8.6	1.3
B007	3.9	19.2	17.7	1.1
B008	1.7	12.8	11.6	1.1
B009	4.9	17.6	11.9	1.5
B010	1.8	13.0	11.4	1.1
B011	12.8	16.4	16.3	1.0
B012	0.6	6.1	5.5	1.1
B013	2.2	14.2	14.2	1.0
B014	2.8	11.5	8.5	1.3
C001	1.6	13.0	9.1	1.4
C002	1.5	11.2	6.9	1.6
C003	0.7	8.1	7.7	1.1
C004	2.3	15.9	10.5	1.5
C005	1.6	12.6	9.2	1.4
C006	0.6	11.7	11.4	1.0
C007	1.1	9.4	8.9	1.1
C008	1.5	10.1	8.6	1.2
D001	15.0	27.8	25.1	1.1
M1001	0.7	14.5	10.0	1.4
M1002	3.7	20.7	13.1	1.6
M1003	7.4	17.3	16.9	1.0
M1004	3.7	20.7	9.6	2.2
M1005	0.9	14.0	8.0	1.8
M1006	3.5	13.4	11.8	1.1
M1007	3.8	15.1	11.7	1.3
M1008	2.2	10.1	8.8	1.1
M2001	4.7	13.7	13.2	1.0
T001	4.1	16.6	15.8	1.0
T002	5.0	11.8	11.6	1.0
T003	4.3	8.4	7.0	1.2
T004	2.0	16.3	14.6	1.1

41VV890

Table App B.9. Attribute Data and Use-wear Observations for Bedrock Features at 41VV0890.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Rugged with some rounding and leveling of high points	Same as walls, remnant pecks visible
A002	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Rugged with some rounding and leveling of high points	Rugged with rounding
A003	Cup	Round	Conical	Tapered	Horizontal	Mostly rounded	Rugged with rounding and leveling of high points	Rugged with rounding and leveling
A004	Cup	Ovoid	Conical/U-Shape	Tapered	Horizontal	Rough but rounded	Rugged with rounding and leveling of high points	Rugged with rounding and leveling

Table App B.10. Metric Data for 41VV0890 Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	2.1	25.1	18.1	1.4
A002	2.3	28.3	20.0	1.4
A003	3.0	9.9	9.6	1.0
A004	3.7	15.2	11.1	1.4

Table App B.11. Attribute Data and Use-wear Observations for Bedrock Features at 41VV75.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Shallow	Round	Dished	Concave	Gentle			
A002	Shallow	Round	Dished	Concave	Horizontal			
A003	Mortar	Ovoid	Dished	Tapered	Horizontal	Rounded	Upper walls obscured by mineral accretion, lower walls are mostly leveled	Mostly leveled
A004	Cup	Ovoid	Conical	Concave	Gentle			
A005	Shallow	Round	Dished	Concave	Moderate			
A006	Shallow	Round	Dished	Concave	Gentle			
A007	Shallow	Round	Dished	Concave	Gentle			
A008	Shallow	Round	Dished	Concave	Gentle			
A009	Shallow	Round	Dished	Concave	Horizontal			
A010	Shallow	Round	Dished	Central Pecked	Moderate			
A011	Cup	Round	Conical	Concave	Gentle			
A012	Cup	Ovoid	Conical	Concave	Gentle			
A013	Cup	Ovoid	Conical	Tapered	Horizontal			
A014	Shallow	Round	Dished	Concave	Gentle			
A015	Cup	Ovoid	Conical	Concave	Gentle	Rounded in some areas, gradual in	Rounded bumps with some leveled high points	Leveled
A016	Shallow	Oblong	Dished	Concave	Gentle			
A017	Shallow	Ovoid	Dished	Concave	Gentle			
A018	Cup	Ovoid	Conical	Concave/Tapered	Gentle	Rounded in some areas, gradual in	Rugged with high points leveled	Rugged/pecked
A019	Cup	Round	Conical	Concave	Gentle	Mostly rounded	Where not obscured, mostly leveled with some rounded bumps	Same as walls
A020	Shallow	Ovoid	Dished	Concave	Gentle			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A021	Shallow	Ovoid	Dished	Concave	Gentle			
A022	Cup	Round	Conical	Concave	Gentle			
A023	Shallow	Round	Dished	Concave	Gentle			
A024	Cup	Round	Conical	Concave	Gentle			
A025	Shallow	Ovoid	Dished	Concave	Horizontal			
A026	Shallow	Ovoid	Dished	Concave	Horizontal			
A027	Mortar	Ovoid	Conical	Tapered	Gentle	Rounded	Somewhat leveled with rounded bumps	Leveled
A028	Shallow	Round	Dished	Concave	Gentle			
A029	Cup	Round	Conical	Concave	Horizontal			
A030	Mortar	Round	Conical	Tapered	Horizontal	Mostly rounded	Somewhat leveled with rounded bumps	Leveled
A031	Cup	Ovoid	Conical	Concave	Gentle			
A032	Shallow	Round	Dished	Concave	Horizontal			
A033	Shallow	Ovoid	Dished	Concave	Horizontal			
A034	Shallow	Ovoid	Dished	Concave	Gentle			
A035	Shallow	Ovoid	Dished	Concave	Gentle			
A036	Shallow	Ovoid	Dished	Concave	Gentle			
A037	Cup	Ovoid	Conical	Concave	Gentle			
A038	Shallow	Ovoid	Dished	Concave	Gentle			
A039	Cup	Ovoid	Conical	Concave	Gentle			
A040	Cup	Ovoid	Conical	Concave	Gentle			
A041	Mortar	Round	Conical	Tapered	Horizontal	Rounded	Upper walls obscured by mineral accretion, lower walls completely leveled	Mostly leveled
A042	Shallow	Oblong	Dished	Concave	Gentle			
A043	Cup	Ovoid	Conical	Concave	Horizontal			
A044	Shallow	Ovoid	Dished	Concave	Gentle			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A045	Mortar	Ovoid	Other	Tapered	Horizontal	Rounded	Some parts obscured by mineral accretion, elsewhere walls are mostly leveled with some vertical black scratches on lower wall	Leveled
A046	Shallow	Oblong	Dished	Concave	Gentle			
A047	Shallow	Ovoid	Dished	Concave	Horizontal			
A048	Shallow	Ovoid	Dished	Concave	Gentle Incline			
A049	Shallow	Ovoid	Dished	Concave	Horizontal			
A050	Shallow	Ovoid	Dished	Concave	Horizontal			
A051	Shallow	Ovoid	Dished	Concave	Gentle			
A052	Shallow	Round	Dished	Concave	Horizontal			
A053	Shallow	Ovoid	Dished	Concave	Gentle			
A054	Shallow	Other - Bean	Dished	Concave	Horizontal			
A055	Mortar	Round	Conical	Tapered	Horizontal	Rounded	Upper walls obscured by mineral accretion, lower walls are mostly leveled	Leveled
A056	Shallow	Oblong	Dished	Tapered	Gentle			
A057	Shallow	Ovoid	Dished	Concave	Gentle			
A058	Shallow	Ovoid	Dished	Concave	Gentle	Somewhat rugged and gradual	Rugged	Rugged
A059	Shallow	Round	Dished	Concave	Horizontal	Gradual	Somewhat rugged with high points leveled	Rugged/pecked
A060	Shallow	Round	Dished	Concave	Horizontal			
A061	Cup	Ovoid	Conical	Concave	Gentle			
A062	Mortar	Ovoid	Conical	Tapered	Horizontal	Rounded	Mostly leveled with some rounded bumps	Leveled
A063	Shallow	Round	Dished	Concave	Gentle			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A064	Shallow	Ovoid	Dished	Concave	Horizontal			
A065	Shallow	Ovoid	Dished	Concave	Gentle			
A066	Cup	Ovoid	Conical	Concave	Horizontal			
A067	Cup	Other - turkey leg	Conical	Concave	Gentle			
A068	Shallow	Round	Dished	Concave	Gentle			
A069	Shallow	Ovoid	Dished	Concave	Gentle			
A070	Shallow	Ovoid	Dished	Concave	Gentle			
A071	Shallow	Ovoid	Dished	Concave	Gentle			
A072	Cup	Ovoid	Conical	Tapered	Gentle			
A073	Shallow	Round	Dished	Concave	Gentle			
A074	Shallow	Round	Dished	Concave	Gentle			
A075	Cup	Ovoid	Conical	Tapered	Gentle	Rounded	Somewhat rugged with rounded bumps	Same as walls
A076	Shallow	Ovoid	Dished	Concave	Gentle			
A077	Shallow	Ovoid	Dished	Concave	Horizontal			
A078	Shallow	Rounded	Dished	Concave	Horizontal	Gradual	Rugged, bumps mostly rounded	Somewhat leveled
A079	Cup	Ovoid	Conical	Concave	Gentle			
A080	Cup	Round	Conical	Concave	Gentle			
A081	Shallow	Round	Dished	Concave	Horizontal			
A082	Cup	Ovoid	Conical	Concave	Gentle			
A083	Shallow	Ovoid	Dished	Concave	Gentle			
A084	Shallow	Ovoid	Dished	Concave	Gentle			
A085	Shallow	Round	Dished	Concave	Gentle			
A086	Shallow	Ovoid	Dished	Concave	Gentle			
A087	Shallow	Ovoid	Dished	Concave	Gentle			

Table App B.11. 41VV75 Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A088	Shallow	Round	Dished	Concave	Horizontal			
A089	Shallow	Round	Dished	Concave	Horizontal			
A090	Mortar	Ovoid	Conical	Tapered	Gentle	Rounded	Mostly leveled with some rounded bumps	Leveled
A091	Shallow	Ovoid	Dished	Concave	Horizontal			
A092	Shallow	Ovoid	Dished	Concave	Gentle			
A093	Shallow	other- lima bean	Dished	Concave	Gentle			
A094	Cup	Round	Conical	Tapered	Gentle	Rounded	Mostly leveled	Leveled
A095	Mortar	Ovoid	Conical	Tapered	Gentle	Rounded	Mostly leveled with some rounded bumps	Leveled
A096	Cup	Round	Conical	Concave	Horizontal			
A097	Shallow	Round	Dished	Concave	Gentle			
A098	Shallow	Ovoid	Dished	Concave	Gentle			
A099	Shallow	Round	Dished	Concave	Gentle			
A100	Cup	Round	Conical	Concave	Gentle			
A101	Shallow	Oblong	Dished	Concave	Gentle			
A102	Shallow	Round	Dished	Concave	Gentle			
A103	Shallow	Round	Dished	Concave	Gentle			
A104	Cup	Other- tear drop	Conical	Concave	Gentle			
A105	Shallow	Ovoid	Dished	Concave	Gentle			
B001	Shallow	Round	Dished	Concave	Gentle	Rounded	Rugged due to weathering, intact surface is leveled and rounded	Leveled and Rounded
B002	Shallow	Round	Dished	Concave	Gentle	Rounded	Rugged with leveling of high points	Rugged with some overall rounding
B003	Cup	Ovoid	Conical	Concave/Tapered	Horizontal	Rounded	Mostly leveled, slightly rounded	Same as walls
B004	Divot	Round	Conical	Tapered	Horizontal	Rounded	Rugged due to weathering, some leveling	Leveled
B005	Cup	Round	Conical	Concave	Horizontal	Rounded	Leveling of high areas	N/A- weathered

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
B006	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Bumps rounded and leveled	Mostly leveled
B007	Cup	Ovoid	Conical/Dished	Concave	Horizontal	Rounded	Leveled and rounded	Leveled
B008	Cup	Round	Conical	Concave	Horizontal	Rounded	N/A- weathered	High points leveled and rounded
B009	Cup	Round	Conical	Concave	Horizontal	Rounded	Where intact, leveled	Mostly leveled and rounded
B010	Divet	Round	Conical	Tapered	Horizontal	Rounded	Mostly leveled	Mostly leveled
B011	Shallow	Ovoid	Dished	Concave	Gentle	Rounded	Rugged	Rugged with some rounding
B012	Divot	Round	Conical	Tapered	Gentle	Abrupt	Lower walls have high points leveled	Same as walls
B013	Divot	Round	Conical	Tapered	Gentle	Mostly rounded	Lower walls are mostly rounded	Same as walls
B014	Divot	Round	Conical	Other	Gentle	Abrupt	High points leveled	Broken weathered hole in center
B015	Divot	Round	Conical	Concave	Horizontal	Somewhat rounded	High points leveled	N/A- weathered
B016	Divot	Round	Conical	Concave	Horizontal	Somewhat rugged	High points leveled	Small holes at base
B017	Shallow	Round	Dished	Concave	Gentle	Rounded	Rugged with some gentle rounding	Rugged
B018	Cup	Round	Dished	Concave	Moderate	Rounded	Overall rounding and leveling	Same as walls
B019	Shallow	Ovoid	Conical/Dished	Tapered	Moderate	Rounded	N/A- weathered	N/A- weathered
B020	Shallow	Round	Dished	Concave	Moderate	Mostly rounded	Rounded and leveled bumps	Same as walls
C001	Cup	Ovoid	Conical	Concave	Horizontal			
C002	Cup	Round	Conical	Concave	Horizontal			
C003	Shallow	Round	Conical	Tapered	Horizontal			
C004	Pecked Area	Round	Dished	Concave	Horizontal			
C005	Mortar	Round	Obscured (rock)	Obscured	Horizontal			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
C006	Cup	Round	Conical	Concave	Horizontal			
C007	Shallow	Round	Dished	Concave	Horizontal			
C008	Mortar	Round	Conical	Obscured (rock)	Horizontal			
C009	Cup	Round	Conical	Concave	Horizontal			
C010	Shallow	Round	Dished	Concave	Horizontal			
C011	Shallow	Round	Dished	Concave	Horizontal			
C012	Shallow	Round	Dished	Concave	Horizontal			
C013	Cup	Round	Conical	Concave	Horizontal			
D001	Shallow	Round	Dished	Concave	Moderate			
D002	Shallow	Ovoid	Dished	Concave	Moderate			
D003	Shallow	other- triangular	Dished	Concave	Moderate			
D004	Shallow	Round	Dished	Concave	Moderate			
D005	Shallow	Ovoid	Dished	Concave	Moderate	Rounded	Rugged due to weathering, intact areas are leveled	Leveled
D006	Shallow	Round	Dished	Concave	Moderate			
D007	Shallow	Round	Dished	Concave	Moderate	Rugged in some areas, gradual in	Rugged with some high points leveled	Leveled
E001	Cup	Oblong	Conical	Tapered	Horizontal			
E002	Cup	Round	Conical	Tapered	Horizontal			
E003	Cup	Ovoid	Conical	Flat	Horizontal			
E004	Shallow	Ovoid	Dished	Concave	Horizontal			
E005	Shallow	Round	Dished	Concave	Horizontal	Rounded	Fairly rugged with some rounding	Same as walls
E006	Cup	Ovoid	Conical	Concave	Horizontal			
E007	Shallow	Ovoid	Dished	Concave	Horizontal			
E008	Shallow	Other - Bean	Dished	Concave	Horizontal			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E009	Cup	Round	Conical	Tapered	Horizontal	Rounded	Fairly rugged with leveled high points, fine-line black pigment present	Rugged with leveled high points
E010	Shallow	Round	Dished	Concave	Gentle			
E011	Cup	Broken	Conical	Tapered	Horizontal			
E012	Cup	Ovoid	Conical	Concave	Gentle			
E013	Cup	Ovoid	Conical	Concave	Horizontal			
E014	Unknown	Broken	Unknown	Obscured	Unknown			
E015	Shallow	Other - Diamond	Dished	Concave	Gentle			
E016	Cup	Round	Dished	Concave	Horizontal			
E017	Shallow	Ovoid	Dished	Concave	Horizontal			
E018	Cup	Ovoid	Conical	Concave	Horizontal			
E019	Shallow	Round	Dished	Concave	Gentle			
E020	Cup	Ovoid	Conical	Concave	Horizontal			
E021	Shallow	Other - Triangular	Dished	Concave	Horizontal			
E022	Cup	Other - Tear Drop	Conical	Concave	Horizontal			
E023	Shallow	Round	Dished	Concave	Horizontal			
E024	Shallow	Ovoid	Dished	Concave	Gentle			
E025	Mortar	Round	Straight Walled	Obscured	Horizontal	Mostly fractured, intact rim is	Upper walls are rugged, lower 2/3 are leveled	Obscured by sediment
E026	Shallow	Ovoid	Dished	Concave	Gentle			
E027	Shallow	Ovoid	Dished	Concave	Horizontal			
E028	Shallow	Oblong	Dished	Concave	Horizontal	Mostly rounded	Fairly rugged with some leveling of high points and rounding	Same as wall, but more leveled
E029	Shallow	Ovoid	Dished	Concave	Horizontal			
E030	Shallow	Round	Dished	Concave	Horizontal			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E031	Shallow	Round	Dished	Tapered	Horizontal			
E032	Shallow	Ovoid	Dished	Concave	Horizontal			
E033	Shallow	Round	Dished	Concave	Horizontal			
E034	Cup	Round	Conical	Tapered	Horizontal			
E035	Shallow	Ovoid	Dished	Tapered	Horizontal			
E036	Cup	Ovoid	Conical	Tapered	Horizontal			
E037	Shallow	Oblong	Dished	Concave	Horizontal			
E038	Shallow	Rounded	Dished	Concave	Horizontal	Rounded	Rugged with high points leveled	Central peck present, edges of this are rounded
E039	Cup	Other - Tear Drop	Conical	Concave	Horizontal			
E040	Mortar	Round	Straight Walled	Obscured	Horizontal	Fractured, where intact the rim is rounded	Upper walls rugged with some leveling, lower walls completely leveled	Obscured by sediment
E041	Shallow	Round	Dished	Concave	Horizontal			
E042	Shallow	Oblong	Dished	Concave	Horizontal	Rounded	Rugged with some rounding	Same as walls
E043	Shallow	Oblong	Dished	Concave	Horizontal			
E044	Shallow	Round	Dished	Concave	Gentle			
E045	Shallow	Ovoid	Dished	Concave	Horizontal			
E046	Shallow	Ovoid	Dished	Concave	Horizontal			
E047	Cup	Round	Conical	Concave	Horizontal			
E048	Shallow	Round	Dished	Concave	Gentle			
E049	Shallow	Other - Bean shaped	Dished	Concave	Horizontal			
E050	Shallow	Ovoid	Dished	Concave	Horizontal			
E051	Mortar	Round	Straight Walled	Obscured	Horizontal	Intact rim is rounded	Upper walls mostly rugged with some leveled spots, lower walls are mostly leveled with small divets	Obscured by sediment

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E052	Cup	Ovoid	Conical	Concave	Horizontal			
E053	Pecked Area	Ovoid	Other	Other	Horizontal			
E054	Shallow	Ovoid	Dished	Concave	Horizontal			
E055	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Mostly leveled with some rounded bumps	Pecked with rounded bumps
E056	Cup	Irregular	Conical/Dished	Concave	Horizontal			
E057	Shallow	Broken	Dished	Concave	Horizontal			
E058	Cup	ovoid	Dished	Concave	Horizontal			
E059	Shallow	Ovoid	Dished	Concave	Horizontal			
E060	Pecked Area	Ovoid	Irregular	Irregular	Horizontal			
E061	Cup	Round	Conical	Concave	Horizontal			
E062	Cup	Ovoid	Conical	Tapered	Horizontal			
E063	Shallow	Ovoid	Dished	Concave	Gentle			
E064	Shallow	Ovoid	Dished	Concave	Gentle			
E065	Shallow	Round	Dished	Concave	Horizontal			
E066	Shallow	Round	Dished	Concave	Horizontal			
E067	Shallow	Round	Dished	Concave	Horizontal			
E068	Shallow	Ovoid	Dished	Concave	Horizontal			
E069	Shallow	Round	Dished	Concave	Gentle			
E070	Shallow	Ovoid	Conical/Dished	Concave	Horizontal			
E071	Shallow	Round	Dished	Concave	Horizontal			
E072	Cup	Round	Conical	Tapered	Horizontal	Mostly rounded	Leveled with slight rounded bumps	Same as walls
E073	Shallow	Round	Dished	Concave	Gentle			
E074	Shallow	Round	Dished	Concave	Gentle			
E075	Shallow	Ovoid	Dished	Concave	Horizontal			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E076	Shallow	Round	Dished	Concave	Horizontal			
E077	Shallow	Round	Dished	Concave	Horizontal			
E078	Cup	Round	Conical	Tapered	Horizontal	Rounded	Rounded bumps with some leveleing	Same as walls
E079	Shallow	Round	Dished	Concave	Horizontal			
E080	Shallow	Ovoid	Dished	Concave	Horizontal			
E081	Shallow	Ovoid	Dished	Concave	Horizontal			
E082	Shallow	Round	Conical and Dished?	Concave	Horizontal			
E083	Unknown	Broken	Unknown	Concave	Horizontal			
E084	Unknown	Broken	Unknown	Concave	Horizontal			
E085	Cup	Round	Conical	Tapered	Horizontal	Somewhat rounded, some	Mostly levled but with rounded bumps	Mostly leveled
E086	Shallow	Ovoid	Dished	Concave	Gentle			
E087	Shallow	Ovoid	Dished	Concave	Horizontal			
E088	Shallow	Round	Dished	Concave	Gentle			
E089	Cup	Ovoid	Conical	Concave/Tapered	Gentle			
E090	Cup	Ovoid	Conical	Tapered	Horizontal			
E091	Shallow	Ovoid	Dished	Other	Horizontal			
E092	Mortar	Round	Conical	Obscured	Horizontal	Rounded, has polish	Completely leveled, smooth to the touch	Obscured by sediment
E093	Cup	Round	Conical	Concave	Gentle			
E094	Cup	Round	Conical	Concave	Horizontal			
E095	Cup	Round	Dished	Concave				
E096	Shallow	Round	Dished	Concave	Horizontal			
E097	Cup	Round	Conical	Tapered	Horizontal			
E098	Cup	Round	Conical	Concave	Horizontal	Rounded	Completely leveled	Same as walls

Table App B.11. 41VV75 Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E099	Shallow	Round	Conical/Dished	Concave	Horizontal			
E100	Shallow	Round	Dished	Concave	Horizontal			
E101	Cup	Round	Conical	Concave	Horizontal			
E102	Cup	Ovoid	Conical	Tapered	Horizontal			
E103	Shallow	Round	Dished	Concave	Horizontal			
E104	Cup	Round	Conical	Tapered	Horizontal			
E105	Cup	Round	Conical	Concave	Horizontal			
E106	Shallow	Round	Dished	Exfoliated	Gentle			
E107	Cup	Ovoid	Conical	Tapered	Horizontal			
E108	Cup	Round	Conical	Concave	Horizontal			
E109	Cup	Ovoid	Conical	Concave	Horizontal			
E110	Shallow	Round	Dished	Concave	Horizontal			
E111	Cup	Round	Conical	Concave	Horizontal			
E112	Cup	Broken	Conical	Concave	Horizontal			
E113	Cup	Round	Conical	Concave	Horizontal			
E114	Cup	Round	Conical/Dished	Concave	Horizontal			
E115	Cup	Ovoid	Conical	Concave	Gentle			
E116	Shallow	Ovoid	Dished	Concave	Gentle			
E117	Shallow	Round	Dished	Concave	Gentle			
E118	Cup	Ovoid	Conical	Tapered	Horizontal	Gradual	Mostly leveled with some rounded bumps	Leveled
E119	Shallow	Ovoid	Conical	Concave	Gentle			
E120	Shallow	Round	Dished	Concave	Horizontal			
E121	Cup	Ovoid	Conical	Concave	Horizontal			
E122	Shallow	Ovoid	Dished	Concave	Gentle			
E123	Shallow	Round	Dished	Concave	Gentle			

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E124	Mortar	Round	Conical/Straight walled	Tapered	Horizontal	Fractured	Leveled, faint red coloration on walls	Leveled
E125	Mortar	Round	Straight Walled	Obscured	Horizontal	Intact rim is rounded	Upper walls are completely leveled, lower walls are mostly leveled with rounded bumps	Obscured by sediment
E126	Mortar	Round	Conical/Straight walled	Tapered	Horizontal	Fractured	Mostly leveled with rounded bumps, possible vertical striations present in lower areas	Mostly leveled
E127	Cup	Broken	Other	Obscured	Horizontal			
E128	Cup	Broken	Other - likely conical	Obscured	Horizontal			
F001	Cup	Round	Conical	Tapered	Horizontal			
F002	Cup	Round	Conical	Concave	Horizontal	Rounded	Mostly leveled with rounded bumps	Same as walls
F003	Cup	Ovoid	Conical	Concave	Horizontal			
F004	Cup	Round	Conical	Tapered	Horizontal			
F005	Cup	Ovoid	Conical	Concave	Horizontal	Mostly rounded	Fairly rugged, all bumps are rounded	Same as walls
G001	Shallow	Round	Dished	Concave	Horizontal			
G002	Shallow	Round	Dished	Concave	Horizontal	Mostly rounded	Fairly rugged with some high points leveled	Pecked, bumps rounded
G003	Shallow	Round	Dished	Concave	Horizontal			
G004	Shallow	other- rectangular	Dished	Concave	Horizontal			
G005	Shallow	Round	Dished	Concave	Gentle			
G006	Shallow	Ovoid	Dished	Other	Horizontal			
G007	Shallow	Round	Dished	Concave	Horizontal			
G008	Mortar	Round	Straight Walled	Broken Through	Horizontal	Rounded	Upper walls are completely leveled, lower walls are mostly leveled with rounded bumps, some faint red coloration on lower wall	Broken through

Table App B.11. 41VV75 Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
G009	Shallow	Round	Dished	Concave	Gentle			
G010	Cup	Round	Conical	Concave	Horizontal			
G011	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual and rounded	Somewhat rugged with high points leveled	Same as walls
G012	Cup	Round	Conical	Tapered	Horizontal	Mostly rounded	Mostly leveled with some rounded bumps	Leveled
G013	Shallow	Round	Dished	Concave	Horizontal	Gradual and rounded	Fairly rugged with high points leveled	Rugged/pecked
G014	Shallow	Round	Dished	Concave	Horizontal			
H001	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Mostly leveled with some rounded bumps	Leveled
H002	Shallow	Ovoid	Dished	Concave	Horizontal			
H003	Shallow	Ovoid	Dished	Concave	Horizontal			
H004	Shallow	Round	Dished	Concave	Horizontal			
H005	Shallow	Ovoid	Dished	Concave	Horizontal			
H006	Shallow	Round	Dished	Concave	Horizontal			
H007	Shallow	Ovoid	Dished	Concave	Horizontal	Mostly gradual, some rounded	Fairly rugged with high points leveled	Same as walls
H008	Mortar	Round	Straight Walled	Obscured	Horizontal	Rounded, slightly rugged	Mostly leveled with rounded bumps, deep striations oriented vertically near bottom	Obscured by sediment
H009	Shallow	Ovoid	Dished	Concave	Horizontal			
H010	Shallow	Round	Dished	Concave	Horizontal	Rounded, some spots gradual	Mostly leveled with some rounded bumps	Mostly leveled
H011	Shallow	Ovoid	Dished	Concave	Gentle			
H012	Shallow	Ovoid	Dished	Concave	Horizontal			
H013	Shallow	Ovoid	Dished	Concave	Horizontal			
H014	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded, some spots gradual	High points leveled	Same as walls

Table App B.11. 41VV75 Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
H015	Shallow	Ovoid	Dished	Concave	Horizontal			
H016	Shallow	Round	Dished	Concave	Horizontal			
H017	Shallow	Ovoid	Dished	Concave	Gentle			
I001	Cup	Round	Conical	Concave	Gentle			
I002	Shallow	Oblong	Dished	Concave	Gentle			
I003	Shallow	Oblong	Dished	Concave	Gentle	Rounded in some areas, gradual in	Rugged with high points leveled	Same as walls
I004	Shallow	Round	Dished	Other	Gentle	Rounded	Rugged, some high points leveled	Leveled with rounded bumps
J001	Mortar	Round	Conical	Concave	Horizontal	Fractured	Leveled with rounded bumps, fine-line black pigment on walls	Somewhat pecked but high points are leveled
J002	Mortar	Ovoid	Conical	Broken Through	Horizontal	Rounded	Mostly leveled with some rounded bumps	Broken through
J003	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Mostly leveled	Mostly leveled
J004	Mortar	Ovoid	Conical	Tapered	Horizontal	Mostly rounded	Somewhat rugged with some leveling of high points	Mostly leveled
J005	Cup	Round	Conical	Concave	Horizontal			
J006	Cup	Round	Conical	Concave	Horizontal			
J007	Shallow	Round	Dished	Concave	Horizontal	Rounded	Mostly leveled with some rounded bumps	Same as walls
J008	Cup	Round	Conical	Concave	Horizontal	Rounded	Mostly leveled with some rounded bumps	Same as walls
J009	Cup	Round	Conical	Tapered	Horizontal	Rounded	Completely leveled	Same as walls
J010	Cup	Round	Conical	Tapered	Horizontal	Rounded	Mostly leveled with some rounded bumps	Same as walls
J011	Cup	Ovoid	Conical	Tapered	Horizontal			
J012	Mortar	Round	Straight Walled	Obscured	Horizontal	Rounded	Mostly leveled with rounded bumps	Obscured

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
J013	Shallow	Broken	Dished	Concave	Horizontal			
J014	Mortar	Broken	Conical	Not Present	Horizontal	Rounded	Leveled	Not present
J015	Mortar	Round	N/A - Not complete	Pointed/Tapered	Horizontal	Rounded, but rugged in some	Mostly leveled	Leveled
K001	Shallow	Oblong	Dished	Concave	Horizontal			
K002	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Leveled	Somewhat rugged with peck marks
K003	Shallow	Round	Dished	Other	Horizontal			
K004	Shallow	Round	Dished	Concave	Horizontal			
K005	Shallow	Ovoid	Dished	Tapered	Horizontal			
K006	Shallow	Ovoid	Dished	Concave	Horizontal			
K007	Shallow	Oblong	Dished	Concave	Horizontal			
K008	Cup	Round	Conical	Concave	Horizontal			
K009	Shallow	Ovoid	Dished	Concave	Horizontal			
K010	Shallow	Oblong	Dished	Concave	Horizontal			
K011	Shallow	Round	Dished	Concave	Gentle	Gradual, some parts rounded	Some rounded bumps, some leveled areas	Some peck marks that have been rounded
K012	Shallow	Ovoid	Dished	Other	Gentle			
K013	Shallow	Round	Dished	Concave	Gentle			
K014	Shallow	Ovoid	Dished	Obscured	Gentle			
K015	Cup	Ovoid	Dished	Obscured	Gentle			
M1001	Pecked Area	Other- Diamond	Flat	Flat	Horizontal	None	Pecked with large leveled areas	Same as walls
M2001	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Fairly leveled, curved fracture marks	Same as walls

Table App B.11. 41VV75 Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
M3001	Cup	Ovoid	Dished	Concave	Gentle	Abrupt	Slightly rugged with some leveling of high points, reciprical striations on surface (possibly modern)	Same as walls
M4001	Flat Slick	Oblong	Flat	Flat	Gentle	Gradual	Completely leveled, some small scattered peck marks, various reciprical striations (possibly modern)	Same as walls
M5001	Mortar	Unknown - broken	Conical	Tapered	Horizontal	Abrupt	Mostly leveled with a few rounded bumps	Same as walls
M6001	Cup	Oblong	Conical	Concave	Horizontal			
M7001	Pecked Area	Round	Dished	Flat	Gentle			
M8001	Shallow	Round	Dished	Concave	Horizontal	Gradual	Some parts rugged with some rounding, others completely leveled	Same as walls
M8002	Pecked Area	Amorphous	Rlat	Flat	Horizontal			
M9001	Pecked Area	Round	Flat	Flat	Horizontal			

Table App B.12. Metric Data for 41VV75 Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	1.9	11.3	9.9	1.1
A002	3.2	14.7	9.7	1.5
A003	10.9	13.5	10.9	1.2
A004	3.4	12.9	11.6	1.1
A005	3.9	13.4	11.9	1.1
A006	3.1	12.9	10.4	1.2
A007	2.7	15.2	14.2	1.1
A008	2.4	13.8	11.6	1.2
A009	5.5	21.4	17.8	1.2
A010	1.6	16.2	14.8	1.1
A011	5.2	18.2	12.9	1.4
A012	3.3	15.3	12.7	1.2
A013	5.5	15.7	9.8	1.6
A014	2.7	17.8	13.6	1.3
A015	2.7	11.4	8.1	1.4
A016	1.9	22.9	9.8	2.3
A017	2.6	12.2	9.8	1.2
A018	3.0	19.0	11.9	1.6
A019	4.8	12.7	11.7	1.1
A020	1.2	9.6	6.1	1.6
A021	1.7	13.0	8.7	1.5
A022	4.5	11.1	10.5	1.1
A023	1.6	7.3	3.8	2.0
A024	2.7	13.1	10.8	1.2
A025	3.0	20.0	12.0	1.7
A026	3.4	33.5	10.3	3.2
A027	8.7	15.6	12.7	1.2
A028	2.5	11.5	9.7	1.2
A029	3.4	10.4	9.9	1.0
A030	10.9	15.3	12.2	1.3
A031	4.1	17.6	12.5	1.4
A032	1.3	11.3	9.3	1.2
A033	2.2	13.6	10.6	1.3
A034	3.6	23.0	13.9	1.7
A035	1.5	10.5	7.0	1.5
A036	1.1	17.4	8.3	2.1
A037	6.8	12.7	10.9	1.2
A038	1.2	11.5	7.3	1.6
A039	3.1	15.7	9.9	1.6
A040	4.0	13.4	7.7	1.7

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A041	13.8	14.4	12.4	1.2
A042	2.0	25.4	12.6	2.0
A043	4.6	16.0	11.0	1.4
A044	4.1	19.6	8.1	2.4
A045	13.3	17.4	12.9	1.4
A046	1.6	21.2	8.6	2.5
A047	2.0	11.9	7.7	1.5
A048	4.2	26.1	13.0	2.0
A049	1.9	12.1	6.2	2.0
A050	1.1	10.7	6.3	1.7
A051	2.0	8.2	4.9	1.7
A052	2.7	14.6	11.7	1.3
A053	1.3	11.5	7.4	1.5
A054	2.2	18.9	9.1	2.1
A055	10.7	17.1	13.3	1.3
A056	1.2	15.5	8.9	1.7
A057	2.5	8.1	4.5	1.8
A058	1.2	7.2	5.3	1.4
A059	2.1	9.2	9.2	1.0
A060	2.0	10.3	9.9	1.0
A061	3.2	12.8	11.3	1.1
A062	12.1	16.3	15.4	1.1
A063	0.9	10.1	9.9	1.0
A064	2.0	15.8	10.6	1.5
A065	2.2	14.2	7.7	1.8
A066	5.8	14.0	10.7	1.3
A067	3.2	23.8	11.9	2.0
A068	0.9	4.4	4.4	1.0
A069	0.9	7.2	4.2	1.7
A070	1.4	16.0	8.5	1.9
A071	1.7	13.6	10.5	1.3
A072	3.4	14.8	12.3	1.2
A073	1.7	10.4	10.3	1.0
A074	1.2	12.2	9.6	1.3
A075	7.9	16.4	12.4	1.3
A076	2.0	12.5	9.8	1.3
A077	4.9	19.6	10.1	1.9
A078	1.2	9.5	8.2	1.2
A079	4.5	17.5	11.5	1.5
A080	4.4	11.3	11.2	1.0

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A081	1.9	12.1	11.5	1.1
A082	3.6	17.0	13.7	1.2
A083	1.4	17.4	7.7	2.3
A084	2.5	14.8	6.9	2.1
A085	1.9	11.0	11.0	1.0
A086	2.8	13.4	8.5	1.6
A087	2.2	17.9	10.8	1.7
A088	2.3	12.1	11.0	1.1
A089	1.7	11.6	7.0	1.7
A090	11.8	16.1	13.8	1.2
A091	0.6	10.4	4.9	2.1
A092	1.0	8.9	6.5	1.4
A093	1.6	21.3	10.4	2.0
A094	6.7	11.0	9.1	1.2
A095	11.8	17.4	12.9	1.3
A096	7.9	18.6	11.9	1.6
A097	1.0	9.0	7.6	1.2
A098	0.9	10.1	5.9	1.7
A099	1.4	7.7	7.2	1.1
A100	4.4	12.5	12.2	1.0
A101	2.5	14.6	7.9	1.9
A102	0.7	8.3	8.0	1.0
A103	1.0	9.3	8.3	1.1
A104	3.1	16.6	11.1	1.5
A105	4.1	18.6	14.5	1.3
B001	1.7	11.5	9.3	1.2
B002	1.5	7.8	7.0	1.1
B003	5.3	14.5	10.9	1.3
B004	1.2	3.0	2.6	1.1
B005	2.7	9.2	6.9	1.3
B006	1.1	14.0	6.6	2.1
B007	2.2	9.2	7.0	1.3
B008	8.1	12.4	11.1	1.1
B009	2.7	4.2	3.7	1.1
B010	3.0	11.2	9.4	1.2
B011	1.9	14.8	12.3	1.2
B012	3.8	4.9	4.9	1.0
B013	1.9	5.2	5.0	1.0
B014	2.5	3.6	3.5	1.0
B015	1.5	3.9	3.5	1.1
B016	2.4	4.0	3.7	1.1

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
B017	2.9	9.5	8.8	1.1
B018	1.3	14.6	12.1	1.2
B019	3.3	12.8	7.3	1.8
B020	1.6	11.1	11.0	1.0
C001	2.9	15.4	10.9	1.4
C002	3.0	9.0	8.3	1.1
C003	1.4	5.9	4.5	1.3
C004	1.2	6.3	6.0	1.1
C005	Broken	14.2	14.0	1.0
C006	3.6	9.3	8.0	1.2
C007	1.0	7.7	7.0	1.1
C008	41.5	19.0	17.0	1.1
C009	3.7	11.8	10.8	1.1
C010	2.1	8.2	8.5	1.0
C011	1.9	8.5	7.7	1.1
C012	0.8	6.4	6.4	1.0
C013	3.7	10.9	10.7	1.0
D001	1.4	12.1	11.0	1.1
D002	1.5	17.7	8.9	2.0
D003	2.6	13.7	9.2	1.5
D004	0.6	9.7	9.1	1.1
D005	4.0	15.6	9.2	1.7
D006	1.1	12.5	11.1	1.1
D007	3.2	15.6	15.3	1.0
E001	5.3	26.8	12.0	2.2
E002	4.9	12.8	10.8	1.2
E003	2.9	17.8	12.7	1.4
E004	2.4	13.4	8.6	1.6
E005	1.6	7.9	7.2	1.1
E006	2.3	10.5	8.0	1.3
E007	1.5	10.7	6.8	1.6
E008	1.5	14.9	7.1	2.1
E009	5.1	12.0	10.6	1.1
E010	1.2	9.0	7.1	1.3
E011	4.0	Broken	Broken	Broken
E012	2.2	15.3	8.9	1.7
E013	2.1	13.3	7.5	1.8
E014	1.4	Broken	Broken	Broken
E015	1.3	8.9	7.0	1.3

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
E016	2.1	9.1	7.0	1.3
E017	1.8	11.9	6.4	1.9
E018	2.8	16.0	12.8	1.3
E019	1.8	11.3	11.0	1.0
E020	4.4	17.0	11.1	1.5
E021	1.2	9.1	8.3	1.1
E022	2.7	13.3	9.4	1.4
E023	1.8	11.3	11.2	1.0
E024	1.2	13.0	7.9	1.6
E025	57.5	20.9	20.7	1.0
E026	3.6	18.5	10.4	1.8
E027	1.8	13.7	6.2	2.2
E028	1.5	14.6	8.7	1.7
E029	1.4	11.7	9.1	1.3
E030	1.7	Broken	Broken	Broken
E031	1.5	8.0	7.4	1.1
E032	2.0	14.1	10.5	1.3
E033	2.3	10.2	8.3	1.2
E034	2.8	12.3	11.6	1.1
E035	1.2	12.5	7.8	1.6
E036	3.6	16.8	12.5	1.3
E037	2.0	16.1	9.2	1.8
E038	2.1	8.7	6.6	1.3
E039	2.2	12.7	10.4	1.2
E040	58.0	22.0	21.2	1.0
E041	1.5	11.4	11.2	1.0
E042	1.4	14.5	8.8	1.7
E043	1.9	14.9	9.8	1.5
E044	1.5	9.7	9.7	1.0
E045	2.3	13.3	8.5	1.6
E046	0.8	9.4	6.6	1.4
E047	2.8	14.2	11.9	1.2
E048	1.3	8.8	8.0	1.1
E049	1.4	13.9	9.5	1.5
E050	1.3	17.6	10.7	1.6
E051	41.0	22.4	20.1	1.1
E052	3.1	Broken	Broken	Broken
E053	0.8	Broken	Broken	Broken
E054	3.4	Broken	Broken	Broken
E055	1.7	16.2	9.1	1.8

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
E056	3.9	Broken	Broken	Broken
E057	1.7	Broken	Broken	Broken
E058	1.6	Broken	Broken	Broken
E059	2.0	15.6	10.7	1.5
E060	0.7	Broken	Broken	Broken
E061	3.0	12.5	11.9	1.0
E062	4.4	12.9	10.8	1.2
E063	1.7	12.2	7.5	1.6
E064	2.6	12.5	8.2	1.5
E065	1.2	11.0	9.7	1.1
E066	1.5	12.2	11.1	1.1
E067	0.9	8.9	8.5	1.0
E068	1.2	10.4	4.9	2.1
E069	2.4	11.0	10.3	1.1
E070	1.7	7.7	6.2	1.3
E071	1.4	6.8	6.6	1.0
E072	6.1	12.1	11.2	1.1
E073	1.1	8.0	5.2	1.5
E074	1.5	9.7	7.6	1.3
E075	1.5	12.8	9.0	1.4
E076	1.0	5.8	4.4	1.3
E077	1.2	6.5	5.0	1.3
E078	5.9	13.5	13.3	1.0
E079	2.0	11.1	10.3	1.1
E080	1.5	9.8	6.3	1.6
E081	1.4	9.8	7.2	1.4
E082	1.2	7.8	6.8	1.1
E083	1.3	6.0	5.1	1.2
E084	1.9	11.3	8.3	1.4
E085	6.9	13.3	12.2	1.1
E086	2.6	11.9	8.6	1.4
E087	2.1	14.5	11.1	1.3
E088	1.5	12.9	11.1	1.2
E089	4.0	17.0	12.1	1.4
E090	3.9	13.6	8.9	1.5
E091	1.1	9.1	8.5	1.1
E092	18.0	17.4	16.0	1.1
E093	7.2	11.0	10.9	1.0
E094	6.3	11.6	11.0	1.1
E095	3.5	10.4	9.5	1.1

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
E096	2.4	12.0	7.2	1.7
E097	7.3	13.5	12.5	1.1
E098	2.8	9.6	9.3	1.0
E099	2.0	9.5	9.3	1.0
E100	2.2	10.5	8.1	1.3
E101	3.1	13.1	10.9	1.2
E102	2.0	Broken	Broken	Broken
E103	2.7	Broken	Broken	Broken
E104	11.3	Broken	Broken	Broken
E105	5.0	18.8	10.6	1.8
E106	2.3	11.6	9.6	1.2
E107	3.6	10.8	7.8	1.4
E108	2.7	10.5	9.8	1.1
E109	2.8	13.8	10.2	1.4
E110	1.7	11.5	9.8	1.2
E111	3.1	10.7	8.3	1.3
E112	3.5	Broken	Broken	Broken
E113	5.7	Broken	Broken	Broken
E114	2.0	7.9	7.8	1.0
E115	3.3	12.8	8.9	1.4
E116	1.6	12.5	8.3	1.5
E117	1.9	8.7	8.3	1.1
E118	6.8	14.5	12.3	1.2
E119	1.4	12.3	9.3	1.3
E120	0.7	6.6	6.4	1.0
E121	2.4	9.8	7.5	1.3
E122	2.6	14.0	8.0	1.7
E123	2.0	10.3	9.8	1.0
E124	26	Broken	Broken	Broken
E125	53	Broken	Broken	Broken
E126	--	Broken	Broken	Broken
E127	Broken	Broken	Broken	Broken
E128	Broken	Broken	Broken	Broken
F001	3.3	7.5	5.8	1.3
F002	4.0	9.3	8.8	1.0
F003	3.7	9.4	7.4	1.3
F004	3.0	7.9	7.0	1.1
F005	3.7	9.3	6.9	1.3

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
G001	2.2	12.3	11.8	1.0
G002	2.2	12.5	12.4	1.0
G003	1.3	9.5	7.3	1.3
G004	0.4	5.6	2.9	1.9
G005	1.3	9.2	8.1	1.1
G006	2.1	20.9	11.2	1.9
G007	2.4	12.0	10.9	1.1
G008	58.0	Broken	Broken	Broken
G009	1.7	9.2	8.7	1.1
G010	3.4	8.6	8.4	1.0
G011	1.7	13.8	9.7	1.4
G012	4.9	15.6	10.7	1.5
G013	1.2	8.3	7.5	1.1
G014	2.1	14.6	14.1	1.0
H001	4.5	20.3	14.6	1.4
H002	1.3	13.4	8.3	1.6
H003	2.3	14.2	9.0	1.6
H004	1.2	11.3	10.8	1.0
H005	1.1	12.4	6.4	2.0
H006	0.8	6.7	6.1	1.1
H007	2.2	15.1	8.6	1.8
H008	57.0	25.0	23.4	1.1
H009	1.7	13.7	7.8	1.7
H010	1.7	8.4	8.3	1.0
H011	2.9	15.0	9.9	1.5
H012	2.6	17.4	10.8	1.6
H013	2.0	14.4	10.2	1.4
H014	1.8	17.1	11.0	1.6
H015	2.9	20.8	12.9	1.6
H016	1.1	8.3	6.9	1.2
H017	1.8	19.4	12.2	1.6
I001	3.2	13.4	11.1	1.2
I002	1.1	20.1	7.9	2.5
I003	2.6	18.9	8.8	2.2
I004	3.5	14.1	12.7	1.1
J001	14.5	Broken	Broken	Broken
J002	25	15.3	14.0	1.1
J003	2.0	14.1	9.8	1.4
J004	8.1	17.4	11.3	1.5
J005	5.9	Broken	Broken	Broken

Table App B.12. 41VV75 Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
J006	4.1	Broken	Broken	Broken
J007	2.0	Broken	Broken	Broken
J008	5.1	10.8	10.7	1.0
J009	4.3	9.3	8.6	1.1
J010	3.8	9.7	9.1	1.1
J011	3.9	7.9	7.8	1.0
J012	29.5	14.6	14.2	1.0
J013	1.8	Broken	Broken	Broken
J014	Broken	Broken	Broken	Broken
J015	8.2	Broken	Broken	Broken
K001	3.7	21.3	12.5	1.7
K002	1.3	14.1	9.7	1.5
K003	1.7	11.8	9.0	1.3
K004	1.8	9.0	8.9	1.0
K005	2.0	11.9	10.8	1.1
K006	1.7	14.9	10.7	1.4
K007	2.8	14.1	7.4	1.9
K008	6.5	19.5	15.5	1.3
K009	1.0	12.5	8.1	1.5
K010	2.2	16.5	9.5	1.7
K011	1.6	9.2	8.2	1.1
K012	2.7	15.0	7.8	1.9
K013	1.9	10.6	9.9	1.1
K014	2.6	19.8	9.7	2.0
K015	2.3	15.0	12.3	1.2
M1001	1.9	22.4	12.7	1.8
M2001	1.1	19.7	11.1	1.8
M3001	3.8	Broken	Broken	Broken
M4001	2.7	29.2	12.3	2.4
M5001	14.2	Broken	Broken	Broken
M6001	4.7	Broken	Broken	Broken
M7001	0.3	11.6	10.1	1.1
M8001	1.1	14.4	13.8	1.0
M8002	0.4	14.4	8.9	1.6
M9001	2.6	10.7	8.3	1.3

Table App B.13. Attribute Data and Use-wear Observations for Bedrock Features at Mountain Laurel.

	Qualitative Attribute Data					Use-Wear Data		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Cup	Round	Conical	Tapered	Gentle	Rounded	High point leveled	Same as walls
A002	Shallow	Round	Dished	Concave	Moderate	Rounded	Rugged with high points leveled	Same as walls
B001	Shallow	Ovoid	Dished	Concave	Gentle	Rounded	Some overall rounding on bumps	Rugged with high points leveled
C001	Shallow	Round	Dished	Concave	Horizontal	Rugged and uneven	N/A- weathered	N/A- weathered
D001	Cup	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
D002	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
D003	Shallow	Round	Conical	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
E001	Cup	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
E002	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
F001	Shallow	Round	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
F002	Pecked Area	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
G001	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged with high points leveled	Same as walls
G002	Shallow	Ovoid/Oblong	Dished	Concave	Horizontal	Rounded	Rugged, some high points rounded	Same as walls
G003	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged, some high points rounded	Rugged/pecked
G004	Shallow	Oblong/Lima Bean	Slightly Dished	Concave	Horizontal	Mostly rounded	Rugged with some high points leveled	Rugged
G005	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged, large pecks	Rugged
G006	Shallow	Round (almost diamond)	Dished	Concave	Horizontal	Rounded	Rugged, some high points rounded	Same as walls
G007	Shallow	Oblong	Dished	Concave	Horizontal	Rounded	Rugged	Rugged and irregular due to fossils
G008	Cup	Ovoid	Conical	Tapered	Horizontal	Rounded	Rugged with some high points leveled	Same as walls
G009	Flat	Irregular	Mostly Flat	Flat	Horizontal	Gradual	Rugged	Rugged
G010	Shallow	Round	Dished	Concave	Horizontal	Gradual	Highly rugged	Highly rugged
G011	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged with many peck marks and some high points rounded	Same as walls

Table App B.13. Mountain Laurel Continued.

	Qualitative Attribute Data					Use-Wear Data		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
G012	Flat	Irregular	Flat	Flat	Horizontal	Ephemeral	Rugged	Rugged
G013	Cup	Round	Dished, approaching Conical	Concave	Horizontal	Somewhat rounded	Rugged	Rugged with overall rounding
G014	Cup	Round	Conical	Tapered	Horizontal	Rounded	Rugged with overall rounding	Fairly leveled
G015	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged, some high points rounded	Same as walls
G016	Shallow	Oblong	Dished	Concave	Horizontal	Rounded	Very rugged with deep pecks	Same as walls
G017	Cup	Ovoid	Conical	Tapered	Horizontal	Rounded	Rugged	Rugged with some rounding
G018	Cup	Round	Conical	Tapered	Horizontal	Rounded	Moderately leveled with some high points rounded	Fairly leveled
G019	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged	Rugged
G020	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged	Rugged
G021	Cup	Ovoid	Dished/Conical	Concave	Horizontal	Rounded	Rugged	Rugged with significant leveling
G022	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rugged with some rounding	Same as walls
G023	Shallow	Round	Dished	Concave	Horizontal	Rounded	Most walls rugged, some leveling of high points	Very rugged
G024	Shallow	Ovoid, irregular	Dished	Concave	Horizontal	Rounded	Rugged with some sheen on high points	Rugged with leveled high points
G025	Cup	Ovoid	Conical	Tapered	Horizontal	Rounded	Rugged	Rugged
G026	Shallow	Round	Slightly Dished	Concave	Horizontal	Ephemeral	Rugged with some rounding	Same as walls, but obscured by bird poop
G027	Cup	Round	Conical	Tapered	Horizontal	Rounded	Rugged	Rugged with some rounding
H001	Cup	Ovoid	Conical	Concave-Wide	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H002	Shallow	Round	Conical	Central Divet	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H003	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H004	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered

Table App B.13. Mountain Laurel Continued.

	Qualitative Attribute Data					Use-Wear Data		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
H005	Cup	Round	Bowl	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H006	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H007	Cup	Round	Bowl	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H008	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H009	Cup	Ovoid	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H010	Cup	Round	Bowl	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H011	Cup	Round	Bowl	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
H012	Cup	Ovoid	Conical	Tapered	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
H013	Cup	Round	Bowl	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
I001	Shallow	Ovoid	Dished	Concave	Gentle	Mostly gradual	Mostly leveled with some remnant peck marks	Leveled
J001	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
J002	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Rugged with high points leveled	Same as walls
J003	Shallow	Round	Dished	Concave	Gentle	Mostly gradual	Rugged on downslope end, high points leveled on upslope end	High points leveled
J004	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
J005	Cup	Round	Conical	Concave	Horizontal	Rounded	N/A- weathered	N/A- weathered
J006	Cup	Round	Conical	Concave	Gentle	Mostly rounded	N/A- weathered	N/A- weathered
J007	Shallow	Round	Dished	Concave	Horizontal	Rounded	N/A- weathered	N/A- weathered
J008	Cup	Ovoid	Dished	Concave	Horizontal	Rounded	N/A- weathered	N/A- weathered
J009	Shallow	Round	Dished	Concave	Gentle	Mostly rounded	exfoliated, but where intact the surface is leveled	Same as walls
J010	Shallow	Round	Flat	Flat	Gentle	Slightly rounded	Completely leveled, smooth to the touch	Same as walls
J011	Cup	Ovoid	Conical	Concave	Horizontal	Slightly rounded	N/A- weathered	N/A- weathered
J012	Shallow	Ovoid	Dished	Concave	Gentle	Rounded	Rugged with some rounding	Some leveled high points
J013	Shallow	Ovoid	Dished	Concave	Gentle	Rounded	Slightly leveled	Same as walls

Table App B.13. Mountain Laurel Continued.

	Qualitative Attribute Data					Use-Wear Data		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
J014	Cup	Ovoid	Conical	Tapered	Horizontal	Somewhat abrupt	N/A- weathered	N/A- weathered
J015	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
J016	Mortar	Round	Conical	Tapered	Horizontal	N/A- weathered	Lower walls leveled	Rugged with leveled high points
J017	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K001	Shallow	Round	Dished	Concave	Horizontal	Rounded	Rugged with some parts leveled	High points leveled
K002	Shallow	Ovoid	Dished	Concave	Horizontal	Mostly rounded	Leveled	Leveled/smooth
K003	Shallow	Round	Dished	Concave	Gentle	Mostly gradual	Mostly leveled with some remnant peck marks	Small peck marks but leveled
K004	Shallow	Round	Dished	Concave	Gentle	Rounded	Some ruggedness	Bumps rounded
K005	Shallow	Round	Dished	Concave	Gentle	Mostly rounded	Mostly leveled	Mostly leveled
K006	Shallow	Round	Dished	Concave	Gentle	Ephemeral	High points leveled	High points leveled
K007	Shallow	Round	Dished	Concave	Gentle	Mostly rounded	Large areas leveled with some smal pecks	Same as walls
K008	Shallow	Ovoid	Dished	Concave	Horizontal	Mostly rounded	Some overall leveling	Same as walls
K009	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K010	Cup	Ovoid	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K011	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K012	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K013	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K014	Cup	Ovoid	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K015	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K016	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
K017	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
L001	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	High points leveled and some rounded	Same as walls
M001	Cup	Round	Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
P1001	Shallow	Ovoid	Dished	Concave	Horizontal	Gently rounded	Mostly completely leveled with some remnant peck marks, striations visible on long axis	More peck marks but leveling of high points present

Table App B.14. Metric Data for Mountain Laurel Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	6.3	13.5	11.6	1.2
A002	1.6	11.8	11.2	1.1
B001	3.1	15.4	11.6	1.3
C001	1.7	6.4	6.6	1.0
D001	3.1	10.8	10.8	1.0
D002	2.6	6.3	5.8	1.1
D003	0.6	9.6	8.4	1.1
E001	3.9	15.3	13.1	1.2
E002	1.9	21.9	11.4	1.9
F001	0.9	5.3	5.3	1.0
F002	0.5	3.9	3.7	1.0
G001	2.5	20.5	12.2	1.7
G002	3.1	21.4	18.1	1.2
G003	1.8	12.4	10.4	1.2
G004	1.1	18.4	9.7	1.9
G005	2.0	12.5	10.3	1.2
G006	1.9	11.5	9.6	1.2
G007	2.8	17.7	10.6	1.7
G008	4.4	11.6	9.1	1.3
G009	0.5	7.5	7.1	1.1
G010	1.4	10.2	10.1	1.0
G011	1.8	9.4	9.3	1.0
G012	1.1	23.6	11.6	2.0
G013	2.6	10.8	10.0	1.1
G014	7.0	14.8	12.0	1.2
G015	2.2	10.3	8.5	1.2
G016	1.2	18.6	8.2	2.3
G017	2.9	11.7	8.3	1.4
G018	7.5	18.4	17.9	1.0
G019	1.8	12.0	7.4	1.6
G020	1.3	6.8	6.4	1.1
G021	3.4	12.4	10.1	1.2
G022	1.0	10.1	7.6	1.3
G023	1.4	11.9	9.9	1.2
G024	1.4	9.7	6.5	1.5
G025	3.9	11.7	10.3	1.1
G026	0.8	7.1	5.3	1.4
G027	6.4	13.3	11.9	1.1
H001	2.5	11.2	6.7	1.7
H002	2.2	8.8	8.7	1.0
H003	3.9	9.5	9.4	1.0

Table App B.14. Mountain Laurel Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
H004	2.1	7.0	6.0	1.2
H005	5.6	11.6	9.6	1.2
H006	2.0	8.2	7.8	1.1
H007	3.1	9.7	9.5	1.0
H008	2.6	8.6	7.6	1.1
H009	3.2	9.4	7.9	1.2
H010	2.8	7.1	7.0	1.0
H011	4.1	9.1	8.4	1.1
H012	4.6	10.3	8.2	1.2
H013	4.9	7.7	7.2	1.1
I001	2.1	18.4	9.6	1.9
J001	7.0	31.3	24.3	1.2
J002	2.4	14.7	9.1	1.6
J003	2.4	15.9	12.8	1.2
J004	2.3	13.5	9.3	1.5
J005	5.2	10.0	9.4	1.1
J006	5.8	9.9	9.8	1.0
J007	3.1	12.5	11.2	1.1
J008	3.9	13.9	10.7	1.3
J009	1.7	6.4	6.3	1.0
J010	2.2	12.4	11.3	1.1
J011	3.6	23.0	12.2	1.9
J012	1.5	11.5	8.8	1.3
J013	2.7	12.1	10.3	1.2
J014	7.0	13.9	9.3	1.5
J015	2.3	9.1	7.5	1.2
J016	9.9	10.6	10.5	1.0
J017	6.3	10.9	10.8	1.0
K001	4.6	17.2	14.7	1.2
K002	4.2	19.4	9.7	2.0
K003	5.4	16.5	13.3	1.2
K004	6.5	11.3	10.8	1.0
K005	4.2	12.3	11.2	1.1
K006	5.2	11.7	10.6	1.1
K007	4.6	16.8	12.4	1.4
K008	2.3	14.9	8.2	1.8
K009	3.8	10.9	9.5	1.1
K010	3.4	10.1	7.3	1.4
K011	2.6	10.0	9.5	1.1
K012	5.2	11.2	10.8	1.0

Table App B.14. Mountain Laurel Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
K013	2.7	8.1	7.5	1.1
K014	7.0	13.3	10.9	1.2
K015	3.4	9.8	8.3	1.2
K016	1.9	9.9	8.6	1.1
K017	3.4	10.8	9.3	1.2
L001	1.6	11.2	7.1	1.6
M001	4.1	9.3	8.7	1.1
P1001	1.1	21.6	14.0	1.5

Table App B.15. Attribute Data and Use-wear Observations for Bedrock Features at White Shaman.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Mortar	Round	Straight Walled/Slanted	Broken Through	Moveable Boulder	Rounded	Extremely leveled, smooth to the touch, any bumps are rounded	Broken through
A002	Shallow	Round	Dished	Concave	Moveable Boulder	Rounded	High points leveled, light rounding	Fairly leveled with some rounding
A003	Shallow	Round	Dished	Concave	Moveable Boulder	Rounded	Fairly leveled, some rounding	Somewhat rugged with rounded edges
A004	Shallow	Round	Dished	Concave	Moveable Boulder	Rounded	Somewhat rugged with high points leveled	Central pecked depression is leveled, rim of peck is rounded
B001	Shallow	Irregular	Dished	Concave	Horizontal	Slightly Rounded	Rugged with some high points leveled	Fairly rugged, high points leveled
B002	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Slightly rugged, some high points leveled	High points somewhat leveled
B003	Mortar	Round	Straight Walled	Tapered	Horizontal	Abrupt	Very Rugged, some rounding	Obscured by sediment in the bottom
B004	Shallow	Oblong	Dished	Concave	Horizontal	Rounded	Rugged with some high points leveled	Same as walls
B005	Shallow	Irregular	Dished	Concave	Horizontal	Rounded	Rugged with some rounding	Same as walls
B006	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rugged with some high points leveled	Leveled and rounded
B007	Shallow	Irregular	Dished	Concave	Horizontal	Rounded	Rugged, high points leveled and rounded	Fairly leveled
B008	Shallow	Ovoid	Dished	Concave	Horizontal	Abrupt and rugged	Rugged, bumps are rounded	Same as walls
B009	Cup	Round	Conical	Concave	Horizontal	Rounded, very thick- almost a "collared" feature	Rugged but high points leveled and edges rounded	Completely leveled, any bumps are rounded
B010	Mortar	Round	Conical	Tapered	Horizontal	Abrupt	Fairly leveled, with some ruggedness	Same as walls
B011	Cup	Round	Bowlish/Conical	Concave	Horizontal	Mostly rounded	Rugged but high points leveled and some sheen	Rugged with leveling and rounding

Table App B.15. White Shaman Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
B012	Shallow	Ovoid	Dished	Concave	Gentle	Gradual and rugged	Rugged, all bumps are rounded	Rugged with large areas rounded and leveled
B013	Shallow	Irregular	Dished	Concave	Gentle	Rounded	Very leveled, all bumps are rounded	Rugged but rounded
B014	Mortar	Round	Conical	Tapered	Horizontal	Rounded	Rugged, but high points leveled and rounded	Same as walls
B015	Mortar	Round	Conical	Tapered	Gentle	Rounded	Rugged with rounded and leveled high points	Same as walls
B016	Cup	Ovoid	Bowlish	Concave	Gentle	Rounded but rugged	Hyper-rugged, bumps are rounded	Rugged, no leveling or rounding
B017	Cup	Ovoid	Bowlish	Concave	Gentle	Mostly rounded	Rugged, upper walls have some rounding	Rugged with some leveling and rounding
B018	Shallow	Round	Dished	Concave	Gentle	Rugged	Rugged, very little rounding	Same as walls
B019	Shallow	Round	Dished	Concave	Gentle	Rugged	Rugged with some overall rounding	Same as walls
B020	Shallow	Round	Dished	Concave	Gentle	Rugged, somewhat rounded	Rugged with some rounding	Same as walls
B021	Shallow	Round	Dished	Concave	Gentle	Ephemeral	Rugged, some high points leveled	Hyper rugged
B022	Shallow	Ovoid	Dished	Concave	Gentle	Rugged, somewhat rounded	Rugged with some high points leveled	Rugged
B023	Mortar	Round	Straight Walled	Unknown	Horizontal	Abrupt	Mostly rugged with rounding	Obscured by sediment in the bottom
B024	Mortar	Round	Conical	Tapered	Gentle	Rounded	Rugged, upper walls have some leveling	Fairly leveled
B025	Mortar	Round	Conical	Tapered	Gentle	Rounded	Very leveled, smooth to the touch, possible striations oriented vertically on wall	Leveled
B026	Cup	Round	Conical	Concave	Gentle	Abrupt	Rugged with some rounding	Same as walls

Table App B.15. White Shaman Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
B027	Shallow	Ovoid	Dished	Concave	Gentle	Not recorded	Not recorded	Not recorded
B028	Shallow	Ovoid	Dished	Concave	Gentle	Not recorded	Not recorded	Not recorded
B029	Shallow	Round	Dished	Concave	Gentle	Not recorded	Not recorded	Not recorded
B030	Shallow	Ovoid	Dished	Concave	Gentle	Not recorded	Not recorded	Not recorded
C001	Cup	Round	Conical	Tapered	Gentle	Abrupt	Rugged with leveling of high points and overall rounding	Same as walls
C002	Mortar	Round	Conical	Tapered	Gentle	Abrupt	Almost completely leveled	Completely leveled with some black coloration
C003	Mortar	Round	Conical	Tapered	Gentle	Rounded	Rugged but high points are leveled and rounded	Leveled and rounded
C004	Shallow	Irregular	Dished	Concave	Horizontal	Gradual	Lower walls are rugged with high points leveled and rounded, upper walls completely leveled	Completely leveled/smooth
C005	Mortar	Round	Conical	Tapered	Horizontal	Rounded	Leveled, any bumps are rounded	Same as walls
C006	Cup	Ovoid	Dished/Conical	Concave	Horizontal	Rounded	Rugged with high points leveled and some completely leveled	Large amounts leveled with rounded bumps
C007	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Totally leveled	Leveled with any bumps being rounded
C008	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Totally leveled	Same as walls
C009	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Mostly leveled	Leveled with a few rounded bumps

Table App B.15. White Shaman Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
C010	Shallow	Round	Dished	Concave	Horizontal	Rounded	Somewhat rugged with leveled areas	Rugged with high points leveled and rounded
C011	Cup	Ovoid	Conical	Tapered	Gentle	Rounded	Completely leveled	Same as walls
C012	Shallow	Round	Dished	Concave	Gentle	Rounded	Some ruggedness, but high points and other areas rounded	Almost all leveled
C013	Shallow	Ovoid	Dished	Concave	Gentle	Rounded	Somewhat rugged, lots of leveling and rounding	Same as walls
C014	Shallow	Round	Dished	Concave	Gentle	Rounded	Leveled, bump are rounded	Same as walls
C015	Shallow	Round	Dished	Concave	Gentle	Rugged	Leveled with pecks and rounding	Same as walls
C016	Shallow	Round	Dished	Concave	Gentle	Rounded	Rounded bumps, all leveled	Same as walls
C017	Broken	Broken	Broken	Broken	Broken	Not recorded	Not recorded	Not recorded
D001	Shallow	Ovoid	Dished	Concave	Gentle	Mostly gradual	Extremely leveled, peck marks are rounded	Same as walls
D002	Shallow	Irregular	Dished	Concave	Moderate	Gradual	Leveled and rounded	Same as walls
E001	Cup	Round?	Conical	Tapered	Gentle	Rounded and rugged	Rugged with some rounding	Somewhat rugged but more leveled overall

Table App B.16. Metric Data for White Shaman Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	48.0	15.0	15.0	1.0
A002	1.5	7.0	7.0	1.0
A003	3.0	10.0	9.0	1.1
A004	2	7.0	7.0	1.0
B001	1.5	15.2	13.9	1.1
B002	1.6	16.7	12.0	1.4
B003	56.0	12.0	11.5	1.0
B004	0.7	15.2	7.5	2.0
B005	2.3	14.8	9.8	1.5
B006	1.1	11.5	9.0	1.3
B007	1.7	11.7	10.0	1.2
B008	0.6	12.5	7.7	1.6
B009	7.2	13.6	12.9	1.1
B010	10.4	15.5	15.4	1.0
B011	7.1	10.4	9.4	1.1
B012	1.8	11.1	7.8	1.4
B013	1.5	16.7	16.0	1.0
B014	24.7	15.0	10.3	1.5
B015	11.7	16.9	16.1	1.1
B016	4.2	15.1	11.6	1.3
B017	4.1	11.3	9.7	1.2
B018	0.6	6.1	5.8	1.0
B019	1.6	6.7	6.7	1.0
B020	1.2	6.2	5.7	1.1
B021	1.2	6.5	4.9	1.3
B022	1.6	11.3	6.5	1.7
B023	51	15.0	14.0	1.1
B024	8.5	15.1	14.1	1.1
B025	12.9	15.7	14.5	1.1
B026	6.1	11.9	11.6	1.0
B027	2.0	11.2	8.2	1.4
B028	3.9	11.2	9.0	2.0
B029	1.0	7.9	5.3	1.5
B030	1.7	6.2	5.3	1.2
C001	5.7	10.1	9.3	1.1
C002	10.3	12.5	12.3	1.0
C003	7.5	14.2	13.2	1.1
C004	1.4	10.0	8.0	1.2
C005	16.4	15.3	15.1	1.0
C006	2.3	11.2	8.5	1.3

Table App B.16. White Shaman Continued.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
C007	1.4	11.1	9.8	1.1
C008	0.5	8.0	5.3	1.5
C009	0.8	6.7	6.0	1.1
C010	1.6	9.0	8.9	1.0
C011	3.1	13.9	10.7	1.3
C012	0.7	8.1	7.6	1.1
C013	1.5	11.5	8.3	1.4
C014	1.6	11.3	10.6	1.1
C015	0.8	8.2	8.0	1.0
C016	1.8	7.4	7.0	1.1
C017	broken	broken	broken	broken
D001	1.1	34.8	13.6	2.6
D002	0.7	12.4	12.4	1.0
E001	broken	broken	broken	broken

Table App B.17. Attribute Data and Use-wear Observations for Bedrock Features at Running Deer.

BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Cup	Round	Almost Straight-Walled/Slightly Conical	Concave	Horizontal	N/A- weathered	N/A- weathered	Mostly leveled with gentle rounding
A002	Shallow	Round	Dished	Concave	Horizontal	Gradual on upslope end, abrupt on downslope end	N/A- weathered	Visible peck marks, have been rounded and leveled
A003	Mortar	Ovoid	Likely Conical	Tapered	Horizontal	Obscured by mineral accretion	Lower wall is completely leveled, upper wall obscured by mineral accretion	Completely leveled with polish, striations visible staring in base and oriented vertically up lower wall.
A004	Shallow	Ovoid	Dished	Almost Flat	Gentle Incline	Gradual on upslope end, rounded on downslope end	Fairly rounded	Rounded with some leveling of high points
B001	Shallow	Ovoid	Dished	Concave/Flat	Gentle Incline	Gentle on N & E rim, Rounded on S & W rim	Wall is rugged with rounded high points	Same as walls, very broad base
C001	Cup	Ovoid	Dished/Conical	Concave	Horizontal	Somewhat rounded	Rugged	Some peck marks visible, mostly rounded
C002	Cup	Round	Conical	Concave	Horizontal	Mostly rounded	Fairly rugged with leveling of high points	Same as walls
D001	Shallow	Round	Dished	Concave	Horizontal	Gradual	Rugged with leveling of high points and sheen	Somewhat rugged but with more leveling than the walls
D002	Shallow	Round	Dished	Concave	Horizontal	Gradual	Rugged with leveling	Obscured
D003	Cup	Ovoid	Conical	Concave	Horizontal	Gradual	Rugged with some leveling of high points and sheen	Leveled and rounded
D004	Cup	Round (egg)	Conical	Concave	Horizontal	Fractured	Completely leveled, all bumps completely rounded	Same as walls

Table App B.17. Running Deer Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
D005	Cup	Ovoid	Conical	Obscured	Horizontal	Gradual	Leveled with gentle rounding	Obscured
D006	Cup	Ovoid	Conical	Tapered	Horizontal	Abrupt	Leveled	Leveled
E001	Flat	Irregular	Flat	Flat	Moderate Incline	Gradual	Completely leveled, smooth to the touch	Same as walls
E002	Flat	Ovoid	Flat with slight Dish	Flat	Gentle Incline	Rounded	Completely leveled, smooth to the touch	Some ruggedness, but mostly smooth
F001	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	N/A- weathered	Some pecks, but fairly leveled and rounded
F002	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	N/A- weathered	N/A- weathered
G001	Cup	Ovoid	Obscured	Concave	Horizontal	N/A- weathered	N/A- weathered	Leveled
G002	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	Mostly leveled	Mostly leveled
H001	Shallow	Ovoid	Dished	Concave/Flat	Gentle Incline	Gradual	Leveled	Somewhat rugged with high points leveled
H002	Shallow	Round	Dished	Irregular	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H003	Shallow	Ovoid	Dished	Irregular	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
H004	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Fairly leveled	Some ruggedness but high points leveled

Table App B.18. Metric Data for Running Deer Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	7.0	11.6	11.1	1.0
A002	3.5	10.1	9.1	1.1
A003	10.7	13.9	12.0	1.2
A004	1.3	11.6	10.8	1.1
B001	2.6	15.3	12.9	1.2
C001	2.7	11.9	9.1	1.3
C002	3.5	11.4	12.0	1.1
D001	2.0	14.9	12.1	1.2
D002	2.3	10.4	9.9	1.0
D003	4.4	15.3	10.7	1.4
D004	Broken	10.2	9.3	Broken
D005	2.9	13.0	10.8	1.2
D006	5.5	12.0	10.9	1.1
E001	0.3	16.5	14.1	1.2
E002	1.3	12.9	13.4	1.0
F001	2.5	9.1	7.1	1.3
F002	4.4	23.9	21.8	1.1
G001	3.5	10.2	8.3	1.2
G002	3.1	9.8	7.7	1.3
H001	1.0	21.8	17.8	1.2
H002	1.0	14.3	12.6	1.1
H003	1.0	23.3	21.3	1.1
H004	0.0	16.6	13.6	1.2

Table App B.19. Attribute Data and Use-wear Observations for Bedrock Features at Ryes 'N Sons Retreat.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A001	Cup	Ovoid	Dished/Conical	Concave	Gentle	Gradual and rugged	Rugged and pecked, high points leveled with some polish	Rugged, high points leveled and slighly rounded
A002	Flat-Slick	Irregular	Flat/Dished	Flat	Gentle	Mostly gradual	Rugged with extensive leveling of high points	Same as walls
A003	Shallow	Ovoid	Dished/Conical	Concave	Horizontal	Gradual and rugged	Rugged with some leveling	Pecked areas
A004	Shallow	Round	Dished/Conical	Concave	Horizontal	Irregular, gradual	Polished on leveled high points	Rugged
A005	Cup	Round	Conical	Tapered	Horizontal	Rounded	Mostly leveled with some rounding	Obscured by accretions
A006	Shallow	Round	Dished/Conical	Concave	Horizontal	Rounded	Mostly leveled and polished	Obscured by accretions
A007	Cup	Round	Conical	Tapered	Horizontal	Rounded	Mostly leveled	Obscured by accretions
A008	Shallow	Ovoid	Dished	Concave	Horizontal	Gradual	Leveling and rounding	Same as walls
A009	Shallow	Ovoid	Dished	Concave	Gentle	Gradual	Rugged with highest points leveled and polished	Obscured by accretions
A010	Cup	Ovoid	Conical	Concave	Horizontal	Gradual	Rugged with some leveling	Rugged with rounding
A011	Shallow	Ovoid	Dished	Flat/Concave	Moderate	Rounded	Rugged with some leveling and polishing on highest points	Same as walls
A012	Cup	Unknown/Fractured	Likely Conical	Unknown	Unknown	Rounded	Rugged	Not present
A013	Shallow	Round/Irregular	Dished	Concave	Moderate	Gradual	Rugged with some high points leveled	Rugged with some larger divets, somewhat rounded
A014	Shallow	Round/Irregular	Dished	Concave	Moderate	Gradual	Rugged with some leveling	Rugged with some larger divets, somewhat rounded
A015	Shallow	Round/Irregular	Dished	Concave	Moderate	Rounded	Rugged with some rounding and leveling	Same as walls

Table App B.19. Ryes 'N Sons Retreat Continued.

BRF#	Qualitative Attribute Data					Use-Wear Observations		
	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
A016	Shallow	Round	Dished	Concave	Gentle	Gradual	Rugged with high points leveled and rounded	Same as walls
B001	Shallow	Ovoid	Dished/Flat	Flat/Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B002	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B003	Cup	Ovoid	Conical/Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B004	Shallow	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B005	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B006	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B007	Cup	Round	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
B008	Irregular	Irregular	Dished	Irregular	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B009	Cup	Round	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B010	Shallow	Round	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B011	Shallow	Ovoid	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B012	Shallow	Semi-triangular	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B013	Shallow	Ovoid	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
B014	Shallow	Ovoid	Dished	Concave	Gentle	N/A- weathered	N/A- weathered	N/A- weathered
C001	Shallow	Ovoid	Dished	Concave	Horizontal	N/A- weathered	N/A- weathered	N/A- weathered
D001	Cup	Round	Conical	Tapered	Horizontal	Rugged	Rugged with rounded edges	Some large divets but leveling and bumps rounded
D002	Shallow	Round	Dished	Concave	Horizontal	Rugged	Rugged with rounded edges	Same as walls
D003	Shallow	Round	Conical	Irregular	Horizontal	Rugged	Rugged with rounded edges	Same as walls

Table App B.19. Ryes 'N Sons Retreat Continued.

	Qualitative Attribute Data					Use-Wear Observations		
BRF#	Type	Opening	Profile	Base	Inclination	Rim	Walls	Base
E001	Shallow	Ovoid	Conical	Tapered	Horizontal	Rounded	Rugged with some leveling of high points	Rugged, large pecks but they are rounded and somewhat leveled
E002	Flat-Slick	Irregular	Flat	Flat	Gentle	Gradual	Irregular with some leveling of high points	Same as walls
F001	Cup	Ovoid/Oblong	Conical	Concave	Horizontal	Rounded	Some rugged but many leveled parts	Rugged/pecked with rounding
F002	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rounded bumps and leveling	Some pecks, rounded and leveled
F003	Shallow	N/A	Conical	N/A	Horizontal	Not Recorded	Not Recorded	Not Recorded
G001	Cup	Round	Conical	Pointed,weathered	Horizontal	Rounded	Rugged with some rounding	Rugged, rounded central pit
G002	Shallow	Ovoid	Dished	Irregular, weathered	Gentle	Rounded	Rugged	Rugged with rounded pits
M1001	Cup	Round	Conical	Tapered	Horizontal	Rounded	Rugged with rounding	Rugged, rounded central peck
M1002	Cup	Ovoid	Conical	Concave	Horizontal	Rounded	Rugged with some rounding	More Leveled
M1003	Shallow	Ovoid	Dished	Concave	Horizontal	Rounded	Rugged with some rounding	Smoothed bumps, some leveled
M2001	Cup	Round	Conical	Concave	Horizontal	Rounded	Rugged, pecked with rounding	Same as walls

Table App B.20. Metric Data for Ryes 'N Sons Retreat Bedrock Features.

BRF#	Depth (cm)	Axis 1 (cm)	Axis 2 (cm)	L/W Ratio
A001	8.1	21.4	13.0	1.6
A002	2.8	8.4	8.3	1.0
A003	1.1	9.8	4.7	2.1
A004	1.0	10.0	9.2	1.1
A005	5.7	12.2	12.1	1.0
A006	2.6	8.9	8.2	1.1
A007	7.7	12.8	12.6	1.0
A008	3.6	19.5	11.2	1.7
A009	3.3	12.7	12.3	1.0
A010	5.1	15.7	12.2	1.3
A011	3.0	11.4	7.6	1.5
A012	4.4	Broken	Broken	Broken
A013	0.4	6.4	5.9	1.1
A014	0.9	6.7	6.1	1.1
A015	0.0	11.4	9.6	1.2
A016	2.2	10.5	8.7	1.2
B001	1.2	6.2	4.5	1.4
B002	2.1	11.2	6.1	1.8
B003	2.8	11.7	10.2	1.1
B004	2.3	14.7	11.3	1.3
B005	2.3	7.8	6.7	1.2
B006	0.9	9.9	8.5	1.2
B007	4.2	16.6	8.9	1.9
B008	2.4	17.4	9.2	1.9
B009	1.9	10.7	9.3	1.2
B010	2.1	11.2	9.0	1.2
B011	1.0	8.4	5.8	1.4
B012	2.9	12.5	10.5	1.2
B013	4.2	18.0	12.3	1.5
B014	2.0	13.0	8.5	1.5
C001	1.5	14.9	13.7	1.1
D001	2.9	12.7	10.8	1.2
D002	2.3	8.6	7.3	1.2
D003	2.5	10.8	9.0	1.2
E001	2.8	20.0	13.4	1.5
E002	2.7	8.8	8.8	1.0
F001	6.2	Broken	Broken	Broken
F002	3.2	18.1	10.2	1.8
F003	3.1	Broken	Broken	Broken
G001	2.9	11.7	10.7	1.1
G002	4.7	13.8	9.4	1.5
M1001	2.6	10.2	10.0	1.0
M1002	5.1	14.3	11.3	1.3
M1003	1.1	8.5	6.0	1.4
M2001	2.8	13.3	12.7	1.0

APPENDIX C: CLUSTER ANALYSIS TABLES

The cluster analysis in Chapter 6 resulted in a dendrogram consisting of four major groups. Since the data set is so large, the feature ID in each cluster is not visible on the left side of the chart. This appendix provides tables with all feature numbers in each of the clusters. The features are listed in the order presented on the dendrogram from SPSS. Further, any features that were misidentified by the discriminant function analysis in Chapter 6 are noted in the tables. Cluster 1 (Table App C.1) is made of four smaller groups that are presented in numerical order in the table. These groups are separated by a horizontal line and different background colors. Cluster 2 (Table App C.2) consists of one group. Cluster 3 (Table App C.3) consists of two small groups that are separated by different background colors and a horizontal line. Cluster 4 (Table App C.4) is made up of three small groups that are designated in the same way as described above.

Table App C.1. Cluster 1 Feature Identifications.

41VV0075_A001	41VV0075_A070	41VV0075_C009	41VV0075_E047
41VV0075_A002	41VV0075_A071	41VV0075_C010	41VV0075_E048
41VV0075_A003	41VV0075_A072	41VV0075_C011	41VV0075_E049
41VV0075_A004	41VV0075_A073	41VV0075_C012	41VV0075_E055
41VV0075_A005	41VV0075_A074	41VV0075_C013	41VV0075_E059
41VV0075_A006	41VV0075_A076	41VV0075_D001	41VV0075_E061
41VV0075_A007	41VV0075_A078	41VV0075_D003	41VV0075_E062
41VV0075_A008	41VV0075_A080	41VV0075_D004	41VV0075_E063
41VV0075_A012	41VV0075_A081	41VV0075_D005	41VV0075_E064
41VV0075_A013	41VV0075_A084	41VV0075_D006	41VV0075_E065
41VV0075_A015	41VV0075_A085	41VV0075_E002	41VV0075_E066
41VV0075_A017	41VV0075_A086	41VV0075_E004	41VV0075_E067
41VV0075_A019	41VV0075_A088	41VV0075_E005	41VV0075_E068
41VV0075_A020	41VV0075_A089	41VV0075_E006	41VV0075_E069
41VV0075_A021	41VV0075_A091	41VV0075_E007	41VV0075_E070
41VV0075_A022	41VV0075_A092	41VV0075_E008	41VV0075_E071
41VV0075_A023	41VV0075_A094	41VV0075_E009	41VV0075_E072
41VV0075_A024	41VV0075_A097	41VV0075_E010	41VV0075_E073
41VV0075_A028	41VV0075_A098	41VV0075_E012	41VV0075_E074
41VV0075_A029	41VV0075_A099	41VV0075_E013	41VV0075_E075
41VV0075_A030	41VV0075_A100	41VV0075_E015	41VV0075_E076
41VV0075_A032	41VV0075_A101	41VV0075_E016	41VV0075_E077
41VV0075_A033	41VV0075_A102	41VV0075_E017	41VV0075_E078
41VV0075_A035	41VV0075_A103	41VV0075_E018	41VV0075_E079
41VV0075_A037	41VV0075_A104	41VV0075_E019	41VV0075_E080
41VV0075_A038	41VV0075_B001	41VV0075_E021	41VV0075_E081
41VV0075_A039	41VV0075_B002	41VV0075_E022	41VV0075_E082
41VV0075_A040	41VV0075_B003	41VV0075_E023	41VV0075_E083
41VV0075_A043	41VV0075_B005	41VV0075_E024	41VV0075_E084
41VV0075_A047	41VV0075_B006	41VV0075_E027	41VV0075_E085
41VV0075_A049	41VV0075_B007	41VV0075_E028	41VV0075_E086
41VV0075_A050	41VV0075_B008	41VV0075_E029	41VV0075_E087
41VV0075_A051	41VV0075_B010	41VV0075_E031	41VV0075_E088
41VV0075_A052	41VV0075_B011	41VV0075_E032	41VV0075_E090
41VV0075_A053	41VV0075_B012	41VV0075_E033	41VV0075_E091
41VV0075_A056	41VV0075_B013	41VV0075_E034	41VV0075_E093
41VV0075_A057	41VV0075_B017	41VV0075_E035	41VV0075_E094
41VV0075_A058	41VV0075_B018	41VV0075_E037	41VV0075_E095
41VV0075_A059	41VV0075_B019	41VV0075_E038	41VV0075_E096
41VV0075_A060	41VV0075_B020	41VV0075_E039	41VV0075_E097
41VV0075_A061	41VV0075_C001	41VV0075_E041	41VV0075_E098
41VV0075_A063	41VV0075_C002	41VV0075_E042	41VV0075_E099
41VV0075_A064	41VV0075_C003	41VV0075_E043	41VV0075_E100
41VV0075_A065	41VV0075_C004	41VV0075_E044	41VV0075_E101
41VV0075_A066	41VV0075_C006	41VV0075_E045	41VV0075_E106
41VV0075_A069	41VV0075_C007	41VV0075_E046	41VV0075_E107

†Feature was misidentified as Cluster 2 by the discriminant function analysis.
*Feature was misidentified as Cluster 3 by the discriminant function analysis.

Table App C.1. Cluster 1 Continued.

41VV0075_E108	41VV0075_J010	41VV0124_C006	41VV0165_B015
41VV0075_E109	41VV0075_J011	41VV0124_C007	41VV0165_B016
41VV0075_E110	41VV0075_K002	41VV0124_C008	41VV0165_B018
41VV0075_E111	41VV0075_K003	41VV0124_C009	41VV0165_B019
41VV0075_E114	41VV0075_K004	41VV0124_C010	41VV0165_B020
41VV0075_E115	41VV0075_K005	41VV0124_C011	41VV0165_B021
41VV0075_E116	41VV0075_K006	41VV0124_C012	41VV0165_B022
41VV0075_E117	41VV0075_K007	41VV0124_C013	41VV0165_B023
41VV0075_E118	41VV0075_K009	41VV0124_C014	41VV0165_B025
41VV0075_E119	41VV0075_K010	41VV0124_C015	41VV0165_B026
41VV0075_E120	41VV0075_K011	41VV0124_C016	41VV0165_B027
41VV0075_E121	41VV0075_K012	41VV0124_D002	41VV0165_B028
41VV0075_E122	41VV0075_K013	41VV0164_A001	41VV0165_B029
41VV0075_E123	41VV0075_K015	41VV0164_A002	41VV0165_B030
41VV0075_F001	41VV0075_M7001	41VV0164_A006	41VV0165_B031
41VV0075_F002	41VV0075_M8001	41VV0164_B001	41VV0165_B033
41VV0075_F003	41VV0075_M8002	41VV0164_B002	41VV0165_B034
41VV0075_F004	41VV0075_M9001	41VV0164_B003	41VV0165_B036
41VV0075_F005	41VV0124_A002	41VV0164_B004	41VV0165_B038
41VV0075_G001	41VV0124_A003	41VV0164_C001	41VV0165_B039
41VV0075_G002	41VV0124_A004	41VV0164_D001	41VV0165_B040
41VV0075_G003	41VV0124_B001	41VV0164_D002	41VV0165_B041
41VV0075_G005	41VV0124_B004	41VV0164_D003	41VV0165_B042
41VV0075_G007	41VV0124_B005	41VV0164_D004	41VV0165_B043
41VV0075_G009	41VV0124_B006	41VV0164_D005	41VV0165_B044
41VV0075_G010	41VV0124_B007	41VV0164_D006	41VV0165_B045
41VV0075_G011	41VV0124_B008	41VV0164_D007	41VV0165_B046
41VV0075_G012	41VV0124_B009	41VV0164_E001	41VV0165_B047
41VV0075_G013	41VV0124_B011	41VV0164_E003	41VV0165_B048
41VV0075_G014	41VV0124_B012	41VV0164_E005	41VV0165_C004
41VV0075_H002	41VV0124_B016	41VV0164_E007	41VV0165_C007
41VV0075_H003	41VV0124_B017	41VV0164_P002	41VV0165_C012
41VV0075_H004	41VV0124_B018	41VV0165_A001	41VV0165_C015
41VV0075_H005	41VV0124_B019	41VV0165_B002	41VV0165_C016
41VV0075_H006	41VV0124_B020	41VV0165_B003	41VV0165_C019
41VV0075_H007	41VV0124_B021	41VV0165_B004	41VV0165_C021
41VV0075_H009	41VV0124_B022	41VV0165_B005	41VV0165_C022
41VV0075_H010	41VV0124_B026	41VV0165_B006	41VV0165_C023
41VV0075_H011	41VV0124_B027	41VV0165_B007	41VV0165_C024
41VV0075_H013	41VV0124_B028	41VV0165_B008	41VV0165_C025
41VV0075_H016	41VV0124_B029	41VV0165_B009	41VV0165_D002
41VV0075_I001	41VV0124_B030	41VV0165_B010	41VV0165_D003
41VV0075_I004	41VV0124_C001	41VV0165_B011	41VV0165_D005
41VV0075_J003	41VV0124_C002	41VV0165_B012	41VV0165_D010
41VV0075_J008	41VV0124_C003	41VV0165_B013	41VV0165_E002
41VV0075_J009	41VV0124_C004	41VV0165_B014	41VV0165_E003

†Feature was misidentified as Cluster 2 by the discriminant function analysis.
*Feature was misidentified as Cluster 3 by the discriminant function analysis.

Table App C.1. Cluster 1 Continued.

41VV0165_E004	41VV0166_C004	41VV0167_C008	41VV1342_B006
41VV0165_E005	41VV0166_C005	41VV0167_P1001	41VV1342_B007
41VV0165_E006	41VV0166_D001	41VV0167_P1005	41VV1342_B009
41VV0165_E008	41VV0166_D002	41VV0167_P1006	41VV1342_B010
41VV0165_E009	41VV0166_D003	41VV0167_P1007	41VV1342_B011
41VV0165_E010	41VV0166_D004	41VV0167_P1008	41VV1342_B012
41VV0165_E012	41VV0166_D005	41VV0167_P2001	41VV1342_B014
41VV0165_E013	41VV0166_D006	41VV0167_T002	41VV1342_C001
41VV0165_E016	41VV0166_D008	41VV0167_T003	41VV1342_D001
41VV0165_E017	41VV0166_D009	41VV0890_A003	41VV1342_D002
41VV0165_E019	41VV0166_D011	41VV0890_A004	41VV1342_D003
41VV0165_E020	41VV0166_D012	41VV1284_A001	41VV1342_E002
41VV0165_E021	41VV0166_D013	41VV1284_A002	41VV1342_G001
41VV0165_E022	41VV0166_D014	41VV1284_A003	41VV1342_G002
41VV0165_E023	41VV0166_D015	41VV1284_A004	41VV1342_M1001
41VV0165_E024	41VV0166_D016	41VV1284_B001	41VV1342_M1002
41VV0165_E025	41VV0166_D017	41VV1284_C001	41VV1342_M1003
41VV0165_F001	41VV0166_D018	41VV1284_C002	41VV1342_M2001
41VV0165_F003	41VV0166_D019	41VV1284_D001	41VV2010_A001
41VV0165_F004	41VV0166_D020	41VV1284_D002	41VV2010_A002
41VV0165_F005	41VV0166_D021	41VV1284_D003	41VV2010_B001
41VV0165_F007	41VV0166_D022	41VV1284_D004	41VV2010_C001
41VV0165_F008	41VV0166_D023	41VV1284_D005	41VV2010_D001
41VV0165_F009	41VV0166_E004	41VV1284_D006	41VV2010_D002
41VV0165_P001	41VV0166_E005	41VV1284_E002	41VV2010_D003
41VV0165_P002	41VV0166_E006	41VV1284_F001	41VV2010_E002
41VV0165_P003	41VV0166_E007	41VV1284_G001	41VV2010_F001
41VV0165_P004	41VV0166_E008	41VV1284_G002	41VV2010_G003
41VV0165_P005	41VV0166_E009	41VV1284_H002	41VV2010_G005
41VV0166_A001	41VV0166_E010	41VV1342_A002	41VV2010_G006
41VV0166_A002	41VV0167_A002	41VV1342_A003	41VV2010_G008
41VV0166_A003	41VV0167_B002	41VV1342_A004	41VV2010_G009
41VV0166_A004	41VV0167_B003	41VV1342_A005	41VV2010_G010
41VV0166_A005	41VV0167_B005	41VV1342_A006	41VV2010_G011
41VV0166_A006	41VV0167_B006	41VV1342_A007	41VV2010_G013
41VV0166_A008	41VV0167_B008	41VV1342_A009	41VV2010_G014
41VV0166_A011	41VV0167_B010	41VV1342_A010	41VV2010_G015
41VV0166_A012	41VV0167_B012	41VV1342_A011	41VV2010_G017
41VV0166_A013	41VV0167_B013	41VV1342_A013	41VV2010_G019
41VV0166_A015	41VV0167_B014	41VV1342_A014	41VV2010_G020
41VV0166_B002	41VV0167_C001	41VV1342_A015	41VV2010_G021
41VV0166_B003	41VV0167_C002	41VV1342_A016	41VV2010_G022
41VV0166_B004	41VV0167_C003	41VV1342_B001	41VV2010_G023
41VV0166_B005	41VV0167_C004	41VV1342_B002	41VV2010_G024
41VV0166_B006	41VV0167_C005	41VV1342_B003	41VV2010_G025
41VV0166_C002	41VV0167_C006	41VV1342_B004	41VV2010_G026
41VV0166_C003	41VV0167_C007	41VV1342_B005	41VV2010_G027

†Feature was misidentified as Cluster 2 by the discriminant function analysis.
*Feature was misidentified as Cluster 3 by the discriminant function analysis.

Table App C.1. Cluster 1 Continued.

41VV2010_H001	41VV0166_B007	41VV0165_C010	41VV0075_G006	41VV0075_A048*
41VV2010_H002	41VV0166_A017	41VV0075_A082	41VV0165_F006	41VV0165_C017*
41VV2010_H003	41VV0165_B035	41VV0165_E001	41VV0075_A025	41VV0165_C020*
41VV2010_H004	41VV0075_B009	41VV2010_K003	41VV2010_G001	41VV0075_A042*
41VV2010_H005	41VV0075_B016	41VV0075_A014	41VV0075_H015	41VV0890_A001
41VV2010_H006	41VV0075_B014	41VV0075_E003	41VV0167_P1002	41VV0890_A002*
41VV2010_H007	41VV0075_B015	41VV0165_B017	41VV0075_K001	41VV0165_C026
41VV2010_H008	41VV0075_G004	41VV0075_A079	41VV1342_E001	41VV0165_D007
41VV2010_H009	41VV0167_B004	41VV0075_E020	41VV0075_A046	41VV1284_F002
41VV2010_H010	41VV0166_D024	41VV0167_B009	41VV0075_I002	41VV1284_H003
41VV2010_H011	41VV0075_A068	41VV0165_D004	41VV0075_E026	41VV0165_B050
41VV2010_H012	41VV0165_B001	41VV1342_B013	41VV0165_B032	41VV2010_G002
41VV2010_H013	41VV2010_F002	41VV0075_E036	41VV1342_F002	41VV0164_E002
41VV2010_J002	41VV0166_E001†	41VV0165_C011	41VV0075_A077	41VV0167_B007
41VV2010_J003	41VV0166_E003†	41VV0075_A031	41VV2010_K002	41VV0075_A009
41VV2010_J004	41VV0075_A041	41VV0165_D001	41VV0075_E105	41VV1284_H001
41VV2010_J005	41VV0124_C005†	41VV0075_E089	41VV0075_A044	41VV0164_A004
41VV2010_J006	41VV0165_E007†	41VV2010_K007	41VV0167_P1004	41VV0165_C014
41VV2010_J007	41VV0075_E092†	41VV0075_A011	41VV0075_H012	41VV0167_A001
41VV2010_J008	41VV0167_P1003	41VV1284_E001	41VV2010_G007	41VV0075_A034*
41VV2010_J009	41VV2010_G018	41VV1284_H004	41VV0075_A087	41VV0075_H001
41VV2010_J010	41VV0165_C006	41VV0075_A010	41VV0075_E050	41VV0075_K008
41VV2010_J012	41VV0075_A096	41VV0167_T004	41VV0165_D009	41VV0165_C013*
41VV2010_J013	41VV0075_J004	41VV0124_B013	41VV0075_H014	41VV1342_A001
41VV2010_J014	41VV0075_A027	41VV0165_D006	41VV0165_D008	
41VV2010_J015	41VV0075_A075	41VV0075_D007	41VV0164_A005	
41VV2010_J016	41VV0124_B024	41VV0164_A003	41VV0165_C018	
41VV2010_J017	41VV0075_A062	41VV0167_T001	41VV0124_B002	
41VV2010_K004	41VV0124_B015	41VV0075_A016	41VV0075_A054	
41VV2010_K005	41VV0167_B011	41VV0075_A093	41VV0075_I003	
41VV2010_K006	41VV0124_B025	41VV0075_A067*	41VV2010_I001	
41VV2010_K008	41VV0165_E018	41VV2010_J011*	41VV0075_K014	
41VV2010_K009	41VV0075_A090	41VV0164_P001	41VV0167_B001	
41VV2010_K010	41VV0124_B010	41VV2010_E001	41VV2010_G004	
41VV2010_K011	41VV0075_A055	41VV0075_M1001	41VV0075_A036	
41VV2010_K012	41VV0075_A095	41VV2010_G012*	41VV0075_A083	
41VV2010_K013	41VV0165_E011	41VV0165_E014	41VV0165_F002	
41VV2010_K014	41VV0075_A045	41VV2010_M1001	41VV2010_G016	
41VV2010_K015	41VV0075_A105	41VV0166_D007	41VV0075_D002	
41VV2010_K016	41VV0165_B024	41VV0165_C001	41VV0166_D010	
41VV2010_K017	41VV0166_B001	41VV0075_H017	41VV1342_B008	
41VV2010_L001	41VV0164_E004	41VV0165_C005	41VV0075_M4001*	
41VV2010_M001	41VV0165_C008	41VV0075_M2001	41VV0164_E006*	
41VV0166_A016	41VV0165_B049	41VV0075_A018	41VV0165_C002*	
41VV0166_A018	41VV0165_C009	41VV0166_A010	41VV0075_E001*	
41VV0075_B004	41VV2010_K001	41VV1342_A008	41VV0165_E015*	

†Feature was misidentified as Cluster 2 by the discriminant function analysis.
*Feature was misidentified as Cluster 3 by the discriminant function analysis.

Table App C.2. Cluster 2 Feature Identifications.

41VV0075_J012
41VV0166_E002
41VV0166_A014
41VV0166_C001
41VV0166_A007
41VV0166_E011
41VV0075_J002
41VV0166_A009
41VV0124_B014

Table App C.3. Cluster 3 Feature Identifications.

41VV0165_B037
41VV0165_C003
41VV0075_A026
41VV0124_D001
41VV0167_D001*
41VV2010_J001

*Feature was misidentified as Cluster 1 by the discriminant function analysis.

Table App C.4. Cluster 4 Feature Identifications.

41VV0075_E051
41VV0075_C008
41VV0075_E025
41VV0075_E040
41VV0075_H008
41VV0124_A001
41VV0124_B023
41VV0124_B003

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