THE ROWE VALLEY SITE (41WM437): A STUDY OF TOYAH PERIOD SUBSISTENCE STRATEGIES IN CENTRAL TEXAS

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THE ROWE VALLEY SITE (41WM437): A STUDY OF TOYAH PERIOD

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Gratitude is when memory is stored in the heart and not in the mind. -Lionel Hampton

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figures **Page**

CHAPTER I

INTRODUCTION

In the latter half of the Late Prehistoric Period in Central Texas, the Toyah period, a drastic cultural change occurred. This is marked by the appearance of a unique artifact assemblage often recovered in association with bison remains. Bison remains are virtually unknown in the period that precedes the Toyah period. This thesis examines the reappearance of the American bison (*Bison bison)* during the Toyah period, and how and to what extent this could have influenced the economic strategies of hunter-gatherers living between AD 1300 and AD 1700. For clarity, although, the Toyah period has alternately been termed horizon, phase, and interval, throughout the term period will be used.

There are two main explanations for how this material culture arose in a relatively short time across a wide geographic area (Arnn 2012). One model, in simplistic terms, suggests people already present in Central Texas rapidly adopted, a new set of tools to take advantage of the shift in the territorial range of the bison. The alternative to that is the model that a migration of a people from the northern plains followed bison south into Central Texas and brought with them a unique material culture. These explanations for the Toyah period were being developed, in response to site excavations Toyah in age that were found to contain bison remains. This led to explicit and implicit links being made between the change in Toyah cultural markers and bison; meaning Toyah were thought to be specialized bison hunters with cultural materials that reflect that change. The Toyah as specialized bison hunters, however, has been called into question (Arnn 2012, Black 1986, Dering 2008, Johnson 1994, and Mauldin et al. 2012). As analytical methods have improved and more sites have been investigated, understanding of Toyah hunter-gatherers has emerged to be less simplistic, although, a shift in economic choices from the preceding Austin period undoubtedly occurred (Prewitt 1981).

The Rowe Valley site (41WM437) is a Toyah site located in Central Texas, both archaeological analyses and experimental analyses were conducted and are presented here. The examination of the faunal remains along with the application of middle range theory, evaluates the level of dependence on bison by people at Rowe Valley specifically, as well as adding to the knowledge of the Toyah period as a whole.

This thesis demonstrates, that the while the presence of bison both across time and space for the Toyah, when compared with the Austin period has not been overstated, however it has at times been overemphasized. The presence of bison bones at many Toyah sites cannot be extrapolated to indicate that bison is the primary resource being exploited during this time for all Toyah hunter-gatherers. The results of the analyses here, as well as a brief site review demonstrate that relationship between Toyah hunter-gatherers and bison is to be more specific to the local environments that surrounded the formation of each campsite.

Economic theories on hunter-gatherer food choices are discussed in Chapter 2 to establish a framework to understand how Rowe Valley inhabitants related to and utilized the animal resources in their surrounding environment. The optimal foraging theory, and two of its models are discussed to identify the choice of certain resources over others and reasons why that would occur. Supporting the presentation of hunter-gatherer behavioral theories is ethnographic evidence that provides a more comprehensive context for the archeological features and artifacts that were discovered at Rowe Valley.

Chapter 3 will focus on research that is relevant to the temporal and geographic location of Rowe Valley. The location of Rowe Valley is considered in terms of how the specific environment could influence how the inhabitants related to the greater Toyah culture that they would have identified with. The second half of the chapter examines the Toyah period in depth, as well as a review of relevant sites.

Specifics of excavation methods and the cultural materials recovered at Rowe Valley are presented in Chapter 4. Density maps of most artifact categories are shown along with patterns in the densities of the various categories and how those artifacts relate to the faunal assemblage.

Chapter 5 discusses the specific analysis methods that were used in this study. Much of the faunal assemblage recovered from Rowe Valley is highly fragmented, which hindered the identification of species and skeletal elements. The methods utilized were chosen to illuminate the subtle characteristics that any stage of food processing would have imprinted on the bone. Further, if in fact the characteristics that demonstrate a focus on large animal resources also demonstrate how intensively they were processed.

To assist with identifications of human modification on the bone recovered from the archaeological record two experiments were undertaken. Chapter 6 presents the methodology and results of both the bison butchery experiment and the subsequent bone grease rendering experiment.

The results of the faunal analysis are presented in Chapter 7. These include the taxonomy of the assemblage, the size of animals that make up the assemblage, the differential use of animals, the amount of bone processing that was occurring, and a comparison of feature and non-feature bones. These examinations show a focus on large mammals, but that economic strategies of hunter-gatherers at Rowe Valley were varied and likely suited to their specific needs and environment.

The final Chapter, combines the results of the analyses of the archaeological assemblage with the experimental archaeology and uses both to integrate Rowe Valley into the body of knowledge on Toyah hunter-gatherer subsistence.

CHAPTER II

DIET AND THEORY

Before the faunal remains from Rowe Valley can be interpreted, it is necessary to understand how hunter-gatherers choose resources, and the variables that influence those choices. Selection of one resource over another involves complex decision making with many variables to consider. This complexity can began to be understood with a consideration of optimal foraging theory and how it specifically relates to diet breadth. Two specific models of that theory, diet breadth model and patch model, provide further means for later interpretation of analyses of the archaeological faunal assemblage.

Optimal Foraging

There are many factors that dictate how food resources are chosen including, the labor needed to obtain the resource, nutrition, taste, and other cultural factors. Optimal foraging theory holds that human decisions are made to maximize the net rate of energy gained (Bettinger 1991:84). The most straightforward model of optimal foraging is the diet breadth model. In this model, foragers encounter resources that vary based on abundance, amount of energy the resource provides, the amount of time needed to access the energy, and the amount of time needed to access that energy. In this model, resources are ranked from high to low in terms of how desirable a resource is. In this model, the forager is thought to select a combination of food types that maximizes energy gained with respect to energy expended to obtain a resource. Available resources have fixed amounts of energy, both in terms of what can be gained and the amount that needs to be expended. As a resource was added to the choices of a hunter-gatherer, search costs (in terms of resource location would diminish) but processing costs (in terms of diversifying cooking methods) would rise. This model contends, a balance can be struck balance can be struck between the resources sought and the processing costs.

The patch model, progresses from the diet breadth model and is a slightly more advanced version of the diet breadth model and contends with the fact that not every resource exists uniformly across the landscape (Bettinger 1991:87-90). In this model, the patches themselves would be ranked as opposed to individual resources. Like individual resources, certain patches may be highly ranked but rare or have high-energy costs.

The breadth of human diet is restricted by resources available at any given time. This coupled with the unpredictability of the environment means that the wider the variety of food choices available for exploitation, the more options a hunter-gatherer has. Environmental factors can affect the species of animals that are available for exploitation, like the season or weather patterns. For most types of animal resources, a hunter is required to leave the campsite to obtain the resource. There is difficulty in determining the point at which and the degree to which humans would stray from the optimal return resources (Jochim 1981:87). In the diet breadth model, the hunter would chose the resource that balances the energy that can be obtained from the resource with the energy expended to obtain the resource. The animal that supplies the most amount of food energy for the least amount of effort would be pursued more often than others.

It is possible though, that the patches the highly desired resources occupy are located far away from the campsite and the animal cannot be transported in its entirety to camp for processing (Emerson 1993). A smaller animal may be less desirable in terms of energy it contains, however, it could be transported more easily and therefore would be more likely to have the entirety of its skeleton present at campsites. A large animal may not be wholly represented in the archaeological record at a campsite site, as only the elements returned to camp would be recovered, due to the high cost of transportation. If an animal is brought back to camp nearly complete it is expected that the axial skeleton (vertebra and ribs) would dominate the assemblage recovered for that species. If transport costs were high, an animal might be partially butchered and body parts with low meat yield would not be transported to camp. However, extreme care should be taken to note that the bones that are present at the site cannot always be equated with patterns of consumption (Bartram 1993). Simply because bones of a certain animal are not present at a site, does not mean the meat from that animal did not make up a significant portion of the diet.

Importance of Fat and Subsistence Stress

During times of environmental stress when few resources are available, hunter-gatherers turn to starvation foods. Starvation foods are resources that are often low ranked as they require labor-intensive activities to access the energy, however, these foods have the benefit of remaining extremely reliable under many environmental conditions also (Gilmore 2012:116). The starvation food considered here is animal fat, specifically the fat contained in the interior of bone. Even during lean times, there is fat is within animal bones further, it is the last source of fat to disappear from animals (Gilmore 2007). This fact makes animals bones a highly reliable source of fat (even when the amount of meat is low), especially during times of environmental stress, when other sources become scarce or unavailable.

The reliability of fat stores within animal bones is not the only reason it would be sought after by hunter-gatherers. Fat is a key nutrient and performs essential functions for the human body (Mead et al. 1986 and Wing et al. 1979). The consumption of fatty food enables fat-soluble vitamins to be absorbed. Fats are also carriers of fat-soluble vitamins: A, D, K, and E; and in addition include essential fatty acids that are necessary for normal nutrition, but cannot be produced by the human body (Jochim 1981: 82, Wing et al. 1979:49). Another added benefit of fat to the hunter-gatherers is fat can be stored in the human body in almost unlimited amounts (Wing et al. 1979:47).

It is also true that many high-protein foods have high fat contents; a diet that focused on resources with protein and fat, would ensure that the protein consumed in tandem with the fat would not be metabolized as energy and would be free to perform other key bodily functions (Jochim 1981:82-84 and Wing et al. 1979:50). In other words, a high ranked resource would be one that contained both fat and protein, for Toyah this would include bison, deer, and antelope which, during good times, would contain large portions of meat and fat.

Bone fat exists both as marrow and as fat within the structure of the bone itself. Bones must be cracked to access the marrow cavities which is most plentiful in long bones. However, to access the fat that is contained in the bone structure itself (bone grease), the task consumes decidedly more time and energy. Bone grease is extracted by first crushing the bone into small fragments and then boiling the bone fragments until the fat is released, when it can be skimmed off the top and collected, and possibility for storage for later consumption. It is this time-consuming activity which makes bone grease a low ranked resource, not its energy content. This activity is labor intensive when compared to marrow extraction; it should only be expected to occur in times of serious need. Bone grease rendering can be detected in the archaeological record by assessing how intensively the bones of animals were processed for their fat stores. Following the diet breadth theory, during 'normal' times, these inner bone fat stores would not need to be accessed as meat and marrow consumption provides enough fat.

If the focus turned to low ranked resources, specifically bone grease, it is more likely that the appendicular skeletal elements would be transported back to camp; though those elements have low meat yields (Emerson 1993:142). Further, different elements have different proportions of marrow fat to bone grease which may be reflected in the archaeological record by which elements are present. Meaning, if a portion of the animal is consumed prior to returning to camp, a choice might be made for elements that contain marrow fat rather than grease fat (like the metapodials) to be consumed before returning to camp. Conversely, if hunting takes place relatively near to the habitation site, perhaps no marrow would be consumed before returning to camp and the high marrow; low grease elements (metapodials, phalanges) would still be present archaeologically. Elements with both high marrow and high grease yields (tibia, humerus, femur) would likely be returned to camp. Most of what has been discussed thus far relates the choice of the hunter-gatherer mostly in terms of energy and nutrition obtained from the resource. But, fat has another critically important quality; fat tastes good (Jochim 1981:78).

Summary

Using optimal foraging theory and the diet breadth and patch models, there should be an expected balance reflected in the resources chosen and the extent to which those resources are processed. If Rowe Valley inhabitants, however, were living under times of subsistence stress or were focusing primarily on the high ranked bison, this should be visible archaeologically. It should be pointed out that only a fraction of the choices that hunter-gatherers make are visible in the archaeological record, specifically those visible by examining animal remains. There are immense decisions related to resource consumption that can occur and only the preserved ones can be interpreted.

CHAPTER III

ENVIRONMENTAL SETTING AND CULTURAL BACKGROUND

The reliance of hunter-gatherers on certain resources cannot be understood in terms of theory alone. Rowe Valley is located in the core area of the Toyah period both culturally and geographically. While the environment specific to Rowe Valley influenced the resources that would have been available, the cultural setting of Rowe Valley most certainly influenced the choices made.

Environmental Setting

Bedrock Geology

Rowe Valley is located in the eastern portion of Williamson County along the right (here south) bank of the San Gabriel River (Figure 1). Williamson County is situated at the boundary of two different geologic zones; the eastern portion of the county is distinguished by having mostly Pleistocene-age deposits while those to the west are Cretaceous in age (Fisher 1974). The soils, in the western portion of the county tend to be thin when present and are located within areas of thinly bedded exposed bedrock. Bedrock of the Georgetown Formation is noted east of Georgetown and is the one in which Rowe Valley is nearest, this formation has bedrock up to depths of around 90 feet (Housh 2007:14). Although, there are other formations that make up the same geologic zone, like the Glen Rose formation that is up to 400 feet thick and consists mainly of limestone, marly limestone, and dolomite and is characterized by stair-step topography (Werchan et al 1983:95). In locales with exposed bedrock, there is no soil formation and it is unlikely that well stratified intact archaeological deposits will be preserved.

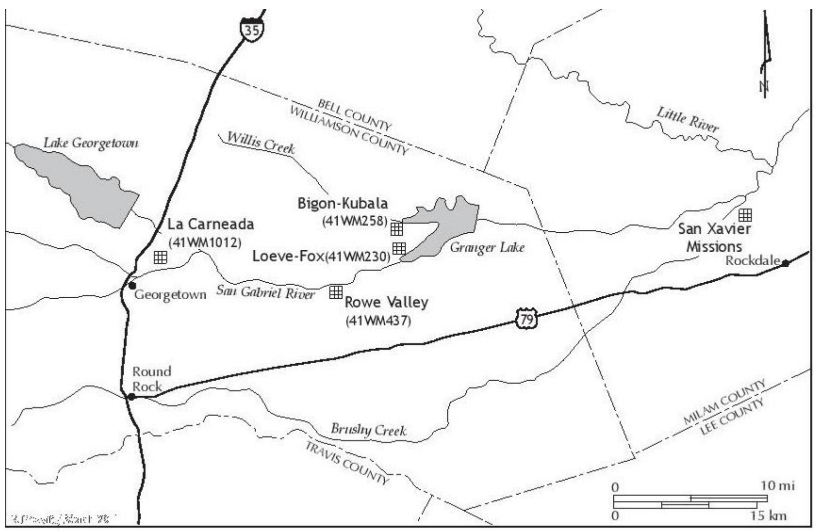

Figure 1: Location map of Rowe Valley south of the San Gabriel River

In contrast, the soils in the eastern part of the county are generally younger and often include thick upper Cretaceous and Pleistocene alluvial deposits along streams. North of the San Gabriel River, Holocene-age alluvial deposits can form, resulting in the formation of deep soils (Wercham 1983:96). Rowe Valley is located on a terrace of the San Gabriel River, where Holocene alluvial deposits are thought to have developed due to the low energy stream deposition during frequent flooding events (Prewitt 2012:136).

Oakalla soils are mapped at the site (Werchan 1983). These soils are frequently flooded, loamy calcarerous alluvium derived from Cretaceous limestone, and are restricted to river valleys.

Physiography

The dividing line that separates the two different geological zones also marks two different physiographic regions. The Balcones Escarpment is a large uplift that runs through Central Texas from the north-northeast then turn toward the Rio Grande in a westerly direction (Figure 2).

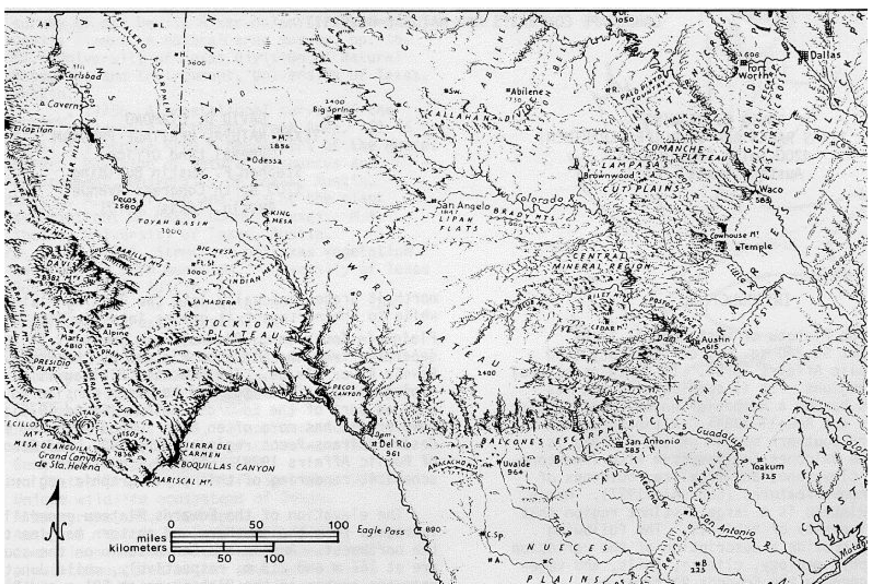

Figure 2: Landforms of Central Texas as portrayed by Erwin Raiz

The Escarpment marks the boundary between the Edwards Plateau and the Blackland Prairie, the divide between two distinct physiographic regions (Figure 3 and 4). The Blackland Prairie is a narrow band of relatively flat gently rolling prairie that follows the eastern boundary of the Escarpment (Bureau of Economic Geology: 1996). In contrast to the prairie, the karstic and heavily dissected Edwards Plateau has variable elevation and topography resulting in numerous canyons that contain countless springs and caves. The Plateau also contains plentiful sources of high quality chert, which is not readily available in the Blackland Prairie (Kenmostu et al. 2012:3-4), except as stream-rolled cobbles vailable in alluvial gravels.

Figure 3: Edwards Plateau vegetation

Figure 4: Rowe Valley site setting, Blackland Prairie

Williamson County's hydrology is dominated by the San Gabriel River which flows from west to east across the Plateau and then through the Black Prairie (Rogers et al. 2008:7-8). The San Gabriel flows into the Little River, before flowing into the Brazos River. The San Gabriel River is a low-energy stream where its infrequent flooding leads to thick floodplain deposits of fine-grained sediment.

Climate

Williamson County, like much of Central Texas is subject to variable weather patterns, is generally hot in the summer and cool in the winter, with occasional cold snaps (Werchan et al 1983: 2). In winter, the average temperature is 49 degrees F with the average daily minimum being 38 degrees F; and in summer, the average temperature is 89 degrees F, with the average daily maximum being 95 degrees F.

Rainfall occurs throughout the year, sometimes with a peak in the spring with another smaller peak occurring around October. Of the total annual precipitation, 19 inches (60 percent) falls between April and September (Werchan 1983:3). In every two out of ten years, however, the 19 inches that usually fall between April and September, drops to below 13 inches. Droughts of varying duration are common, with relatively short midsummer droughts being normal, although droughts of many months are also known to occur (Werchan 1983:57). Flash flooding is also common due to the vast expanses of bedrock across the Plateau.

<u>Vegetation</u>

Rowe Valley is located in the Texan Biotic Province. Prior to modern settlement, much of eastern Williamson County was an open prairie, with native trees mainly growing along streams (Riskind et al. 1986 and Werchan 1983:57). The trees most common along waterways would be elm, pecan, hackberry, and cottonwood. Away from water sources, the vegetation consists mainly of tall and mid-level grasses with occasional occurrences of trees. Presently much of Williamson County's Blackland Prairie vegetation has been replaced with modern croplands (McMahan et al 1984 and Bureau of Economic Geology Vegetation Cover 2000).

The nearby Balconian Province follows the edge of the Escarpment up to the Plateau. Variable rainfall, along with the flooding that occurs on the Plateau has created an environment for drought resistant vegetation (Riskind et al 1988:9). The Plateau also has an abundance of live oak, mesquite, and juniper, although the amount of juniper has increased dramatically due to overgrazing and modern development. This has led to a decided decrease in grass cover. Although, modern disturbances have led to a change in vegetation, Central Texas is still home to a great diversity of plants, which is especially evident on the Plateau (Kenmotsu et al. 2012:2).

<u>Zoology</u>

The Blackland Prairie historically supported the presence of other large ungulates; primarily pronghorn antelope (*Antilocapra Americana),* white-tailed deer (*Odocoileus virginianus),* and bison (*Bison bison)* (Werchan et al 1983:66). The movement of large mammals would be influenced by the season, and climatic changes which are highly variable in Central Texas.

Variable weather and climate would also affect the type and population densities of animals. Other wildlife species present include wild turkey (*Meleagris gallopavo),* fox squirrel (*Sciurus niger*), cottontail (*Sylvilagus floridanus),* Virginia opossum (*Didelphis virginiana),* cotton rat (*Sigmodon hispidus),* bobcat (*Lynx rufus),* raccoon (*Procyon lotor),* beaver (*Castor canadensis),* Guadalupe bass (*Micropterus treculi),* channel catfish (*Ictalurus puncuatus),* to name a few. Prehistorically, there are a wide variety of animals available at any given time (Wecrchan et al. 1983:66).

Although, bison remains are not common at archaeological sites throughout Texas they tend to have greater visibility during certain times, Toyah being one. It is hypothesized, that due to climatic changes just prior to the Toyah period, the Great Plains region would have extended into Texas would have expanded the grazing area of bison (Kenmotsu et al. 2012:2; Foster 2012:96). A recent study by Mauldin et al (2012) reconsidered the presence of bison in Central and South Texas during this Toyah period. Mauldin et al. (2012:105) concluded that the short-term variability of the climate would likely have "resulted in significant fluctuations in levels of bison mobility and herd size." They conclude that the number of bison in Central Texas was declining overall but patches of bison would have been available during certain years due to variability in rainfall that might have created locations with higher numbers of bison.

Summary

The location of Rowe Valley in the Blackland Prairie and its close proximity to the Edwards Plateua and that regions' wide variety of resources would have provided the inhabitants of Rowe Valley an expansive food resource list of both high and low ranked resources, this would be important in a region that has a variable environmental conditions. The presence of bison remains at Toyah sites has alternately been studied by many; these studies are summarized below in the Cultural Background, due to the inextricably link between the other cultural characteristics of the Toyah period.

Cultural Background

The Late Prehistoric Period is divided into the earlier Austin period and the later Toyah period. The Toyah period is distinguished from the earlier phase by a distinct set of distinct artifacts. This distinct artifact assemblage appears around AD 1300 and occurs until around AD 1700; these artifacts are contained geographically to Central and South Texas (Arnn 2012:1, Kenmostu et al. 2012:10, Johnson 1994) (Figure 5). This assemblage includes plain, often assumed to be utilitarian, pottery (most often bone tempered) known as Leon Plain, as well as a specific lithic tool kit which includes Perdiz arrow points, beveled bifacial knives, unifacial scrapers, and blade core technology used to produce blade flake tools (Arnn 2012: 52-56, Black 1986, Johnson 1994:241-242, Ricklis et al. 1994:9, Kenmostu et al. 2012: 10). These artifacts spread rapidly over the Central and South Texas geographic areas. Early research on Toyah focused on this rapid spread across the large geographic area (see Arnn 2012 and Kenmotsu et al. 2012 for a more in depth review).

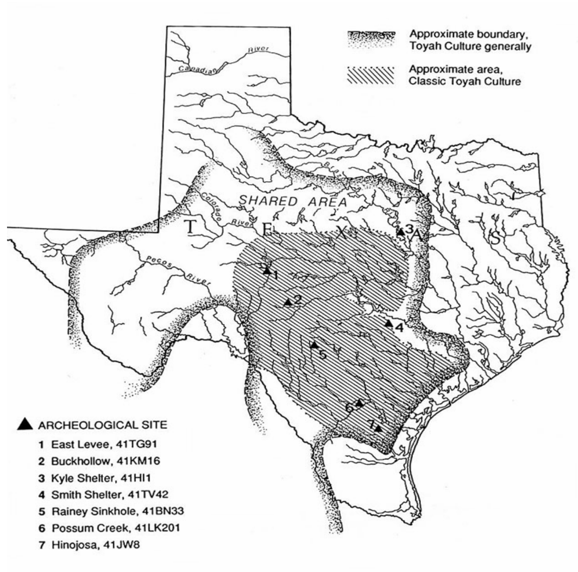

Figure 5: Toyah culture area (Johnson 1994)

This is the first time pottery appears in the archaeological record in Central Texas; it is occasionally of local creation but much has been sourced to East Texas as well as the Texas Coast (Perttula et al. 2003 and Prewitt 1981). Corn cobs remains also appear in the Toyah period, either due to maize horticulture or to trade (Kenmostu et al. 2012, Johnson 1994:262, and Prewitt 1981).

The lithic tool kit of Toyah suggests Toyah hunter-gatherers are more focused on hunting than Austin period hunter-gatherers (Prewitt 1981). Although, there is evidence that hunting was becoming more important in the Austin Period than in Periods preceding it (Prewitt 1981). During the Toyah period, hunting seems to have become as of equal importance as gathering. Coinciding with the beginning of the Toyah period, is the return of bison returned to Central and South Texas, after a period of rebound densities. This change was first noted by Dillehay (1974) who assessed the number of bison by cultural period. His study mapped presence and absence of bison over nearly 12,000 years. He attributed bison movement into Central and South Texas to climatic changes. Others (Baugh 1986 and Lynott 1979) found that bison were present during the Late Prehistoric period that Dillehay reported to be an absence period. Huebner's 1991 study, however, confirmed Dillehay's study, that there was no definitive evidence of bison during the Austin period. This has led to an uncertainty if the lithic tool kit of the Toyah was in response to bison or not (Mauldin et al. 2012). It has been hypothesized more recently that bison likely never left the Central Texas region, and simply had periods of greater densities in localized environments (Mauldin et al. 2012 and Prewitt 2012).

Mauldin et al. (2012:110) study, suggests that the number of bison in Central Texas was actually diminishing during the Toyah Phase and bison would have occupied patchier environments and could not likely have been a resource that was always counted on to be available. The conclusion being, that Toyah adaptations actually reflect a wide diet breadth as opposed to a narrow one with a bison focus.

The presence and influence of bison on the Toyah artifact assemblage, however, is often been stressed when examining Toyah sites and the Toyah period. There is little doubt when reviewing the literature on Toyah sites that bison are present at many sites. There are also many Toyah sites that do not contain bison bone and it has been argued that importance of bison has been overstated (Arnn 2012:57, Black 1986, Dering 2008, Gilmore 2007, Johnson 1994).

The lithic toolkit particular to Toyah, however, seems particularly well adapted for aspects of systematic hunting, butchery, and other activities associated with bison procurement (Ricklis et al. 1994:14). This toolkit's appearance coincides with what appears to be the expansion of the range of bison, back into Central Texas (Mauldin et al. 2012:106); some reaching the northern edges of the South Texas region. Although, bison were never likely completely absent from Central and South Texas, they have greater archaeological visibility, and thus a presumed greater population density, during the Toyah period than the previous Austin Phase (Prewitt 2012:188). However, the creation of a highly specialized lithic toolkit is hypothesized by Mauldin et al. (2012:106-107) to have been developed due to the unpredictable locations of bison during the Toyah period to maximize the productivity of bison attainment. Other research has suggested this toolkit did develop due to the hunting and processing of large game (Ricklis 1994:304).

Although, it is likely that people added bison to their diet when possible, irrespective of their cultural affiliation, Dering's study indicates that people continued to use flexible mobility strategies that focused on various resources in the unpredictable environment of Central and South Texas (2008:72-74). As mentioned, the Central Texas region is characterized by diverse environments, which leads some to hypothesize that it is unlikely that people could have relied on bison as a primary food source (Arnn 2012:75).

The significant importance placed on bison and the impact they had on the Toyah people and their material culture has made understanding Toyah economic strategies implicitly and explicitly tied to understanding them. This focus on bison by archaeologists has overshadowed the fact that, although many large Toyah sites contain bison remains, these sites also contain large amounts of deer and antelope remains. Clearly, bison were utilized at many Central Texas Toyah sites, however the extent to which bison served as a primary food resource is less certain. Alternatively, the fact remains that white-tailed deer remains are more common at Toyah sites than bison remains and it has been suggested this is the real animal focus of these hunters (Arnn 2012).

Five Toyah sites are reviewed here, each chosen due to the faunal assemblages recovered at each as well as the economic strategies the faunal assemblages suggest. The first four sites discussed were chosen primarily based on their interpretations on how intensively large mammal remains were utilized at those locales. The last sites is reviewed due to it location in the San Gabriel River Valley and for its clear presence of a bison focused kill site.

Mustang Branch (41HY209)

During investigations along the south side of the Onion Creek Valley in Hays County excavations at two sites (41HY202 and 41HY209), revealed Toyah components (Ricklis et al. 1994:8). A large Toyah site, 41HY209 was identified on a terrace, and is recognized by a discrete, thin, but dense layer of artifacts. Archaeological investigations at this portion of the site also revealed at the very least remains of 19 adult deer, 6 late-term / newborn deer, 8 antelope, and 2 bison.

The excavations at the terrace area and the features that contained faunal remains suggested to the investigators that 41HY209 represented a short-term occupation of the site by people that, to at least some extent, were processing large numbers of large and very large mammals (Ricklis et al. 1994:236). Like Rowe Valley, much of the bone recovered was highly fragmented; although the fragmented bone was recovered from across the site, there was one feature in which the density of bone fragments was quite high (Ricklis et al. 1994:240). This feature was thin, with only a 5cm thickness on average, but was densely packed

Site 41HY202, is near to 41HY209 and represents a much smaller site, but with some similarities to 41HY209. There are many fewer faunal remains at 41HY202, and they do not appear to be as intensively processed. This site has fewer number of individuals represented as the deposits at 41HY209.

These sites location in Central Texas, their proximity to each other, their abundance of large game remains, and unique quality of having two sites that demonstrate differential animal processing during the same period on virtually the same portion of the landscape make them interesting comparisons to Rowe Valley.

41SP220

Site 41SP220 is located on a flat terrace on the eastern bank of the Nueces River in South Texas (Gilmore 2007:30). Radiocarbon dates at the site indicate the site was occupied during the Late Prehistoric period through the Early Historic period. The majority of the faunal remains from the site were located in clusters and consist of primarily deer and bison remains. These clusters of bone appear to be where most butchery and processing activities took place (Gilmore 2007:31-32).

Conclusions reached by Gilmore suggest that although large mammals were very important to the people living at this locale the bones do not appear to be processed further than simple marrow extraction (2007:89). This is compelling since most Toyah sites with large amounts of fragmented bone are presumed to have had grease extraction take place. The large mammal resources make up the majority of the bone weight at 41SP220, but small mammals like opossum, cottontail, and fish remains are also present (Gilmore 2007:48-49).

This site is located outside the Central Texas region, but is still within the cultural boundaries of the Toyah area. The analysis methods used for the faunal material are similar to the methods used during the present study. The faunal analysis presently undertaken, therefore, has a recent direct comparison to reach conclusions relating to the human behaviors associated with the production of meat and fat from mammal bones.

Rush Site (41TG346)

The Rush site is located in the valley of the North Concho River in Tom Green County. Five distinct occupations were identified stratigraphically and radiocarbon dating puts occupations at the site spanning the last 700 years (Quigg et al. 1997:147). Occupation area 4 included Toyah artifacts as well as a large number of bison and deer remains. Interpretations made from the faunal remains suggest that pemmican production was interpreted to being undertaken to a great degree. The analyses methods utilized at the Rush Site do not follow the methods used in the present study, but the methods to determine freshness of fracture and modification of the bone along with the consideration of features supports the interpretations.

Bison remains dominate the faunal assemblage; at least seven individual bison were identified, along with at least two deer, and a variety of other small mammals and aquatic resources (Quigg 1997:157-158). Many of the bison long bones have evidence of being smashed open for marrow and then these remains were further smashed into tiny fragments, likely for grease production. The large number of bison remains at the site, which were based on estimates from limited excavations, further supports pemmican production; since the creation of pemmican includes the addition of dried meat, in this case bison.

La Carneda (41WM1012)

La Carneada (41WM1012) is an Early Historic period bison kill site that is located in Williamson County off the San Gabriel River (Roger et al. 2008). The site is interpreted to be a short term hunting camp with evidence of a bison kill site. Few artifacts were recovered from the site, however numerous bone features were present. The features are widely varied and include clusters of bones, small pits, hearths, and charcoal concentrations. The bone clusters are mostly deer and bison; one cluster is an almost completely articulated bison skeleton.

The faunal material at 41WM1012 is generally considered to have good preservation as there is minimal evidence of erosion, gnawing, and predepositional breakage (Rogers et al. 2008:75). Analyses were also done on hearth feature rocks to find fatty acids indicative of animal processing; five of the ten samples submitted were positive (Rogers et al. 2008:90). The presence of historic artifacts and cutmarks on the bison bones by a metal tool indicate that this site likely post dates Rowe Valley (which has no indication of historic artifacts), however, it demonstrates that within the San Gabriel River Valley, bison certainly existed in enough numbers at times to warrant a kill site.

Summary

The Toyah period can be characterized by a specific lithic tool-kit, the creation of the first pottery known in Central Texas, and the presence of bison. The economic strategies, however, seem to vary from site to site. The region of Central Texas is unified by its location in the center of the state, but the drastically different physiographic regions on either side of the Escarpment make unifying statements about hunter-gatherer economic strategies difficult at best. The review of Toyah cultural markers and four relevant sites reinforce the fact that large mammal hunting was among the possible economic strategies, but that the Toyah are not likely specialized bison hunters.

CHAPTER IV

SITE SPECIFIC SETTING AND BACKGROUND

Rowe Valley (41WM437) was recorded by Dan Prikyl in 1982 and subsequently excavated by a Texas Archeological Society (TAS) field school under the direction of Elton Prewitt in the summers of 1982 thru 1984. Rowe Valley was identified as being a multi-component Late Prehistoric site with both Toyah and Austin Period occupations (as well as earlier ones). These determinations were primarily based on the stratigraphy and the artifacts recovered. The majority of excavations focused on the upper Toyah deposits.

This chapter first discusses the field excavation methods and then the artifactual materials recovered from the site will be reviewed. The artifact review, in most cases, includes the total count and horizontal provenience of the artifact categories generated from field inventories. After each artifact type is discussed, a short summary of how each artifact category correlates with the others is presented. The artifact categories covered include both chipped and ground lithic tools, as well as non-tool lithics (debitage), ceramics, as well as faunal, and burned rock features. The counts and the proveniences were provided by Elton Prewitt.

This review of the fieldwork and artifacts recovered from Rowe Valley is in no way intended to be full and exhaustive analysis. Summary, and subsequent interpretations of the complexities of places the later, more detailed faunal analysis into a more comprehensive context.

Site Excavation Methods

Rowe Valley was divided into 11 different excavation areas (XA). Excavation Area 9 did not contain any Upper Toyah materials and does not appear in any figures. In general, these XA's were set up as 10-x-10m block units (Figure 6). These were then further subdivided into quadrants, and within those are 2-by-2 meter excavation units that were subdivided into 1-by-1 meter units. The 1-x-1m units were further labeled by their cardinal location (NE, NW, SE, and SW).

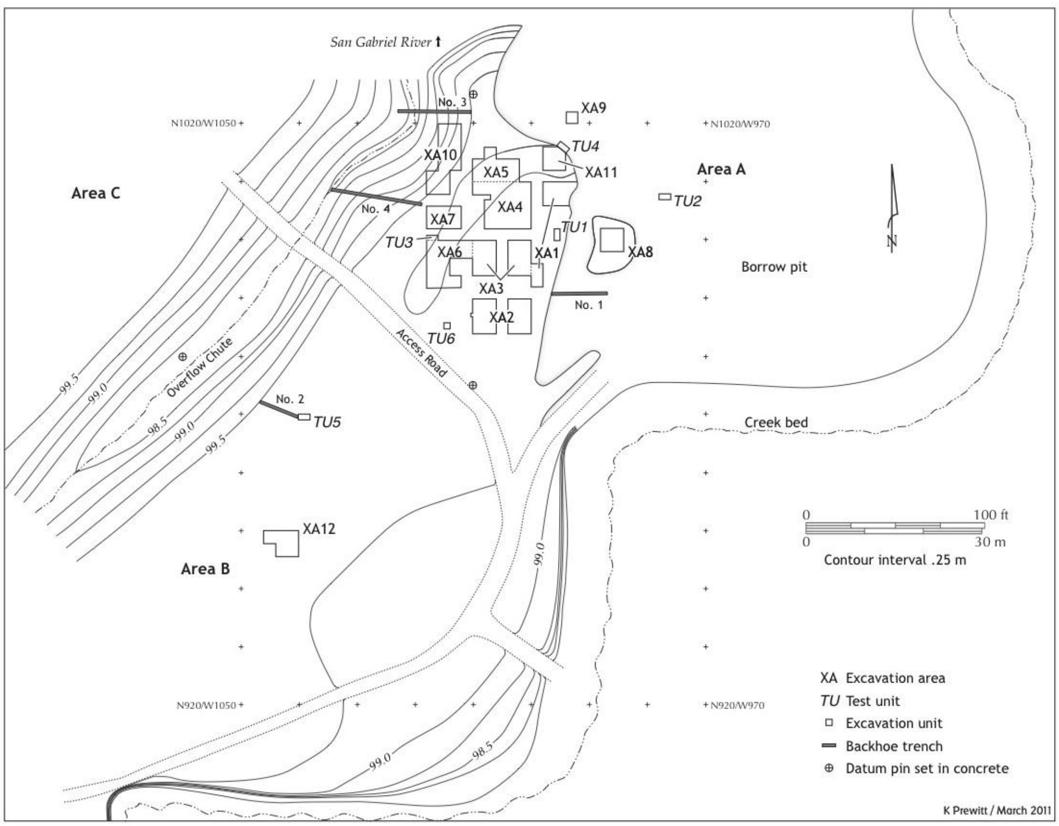

Figure 6: Site map with XAs Labeled

A total of 387 (1-x-1m) units were excavated that contained Upper Toyah material at Rowe Valley. XA 1 and 5 had 36 units each, XA 2, 3, 6, and 10 had 48 units each, XA 4 had 69 units, XA 7 had 26, XA 8 had 16, and XA 11 had 12 units. All the data presented and discussed below concerning the artifacts recovered and the features encountered that were from the Upper Toyah stratigraphic layer. The majority of the excavated matrix was screen with traditional ¼" screen. A portion of the artifacts recovered were piece plotted, including tools, large flakes, and cultural materials that were excavated in association with features.

Feature Excavations

The features encountered were divided into three main types: animal processing locations, tool manufacturing locations, and heating features (Prewitt 2012: 198). Animal processing features identified at areas of the site, which have the highest quantity of faunal remains; these tended to be located on the outskirts of the site and clustered together (Figure 7). The tool manufacturing features (chipping stations) consist of various sized concentrations of lithic debris; some with indications of different tool types being manufactured. The heating features include, hot-rock cooking areas, charcoal and ash filled pits, and burned clay pits.

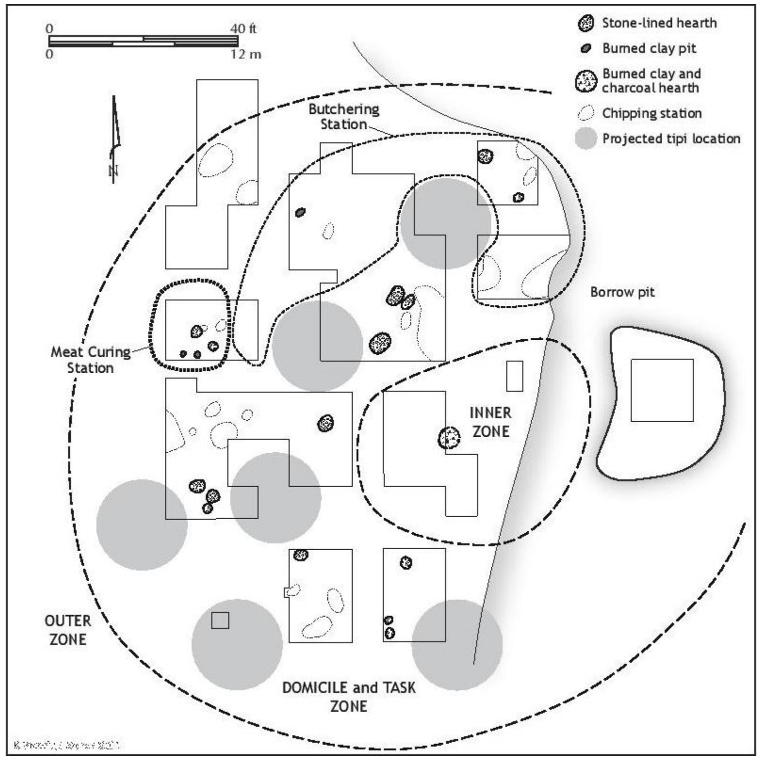

Figure 7: Prewitt's interpreted map with butchery area, thermal features, and chipping stations (after Prewitt 2012)

Cultural Material Present

Cultural material recovered includes lithics, ceramics, burned rock, and faunal remains. Much of the lithic material recovered from Rowe Valley is consistent with the artifacts that would be expected at a Toyah site; including Perdiz arrow points, beveled biface knives, endscrapers, and blade flake tools (Figures 8, 9, and 10). A tremendous amount of non-tool lithic debitage was also recovered from Rowe Valley.

Figure 8: Sample of Perdiz arrow points from Rowe Valley

Figure 9: Bifacial knife from Rowe Valley

Figure 10: Endscaper from Rowe Valley

The ceramic assemblage, seems to be consistent with Toyah aged assemblages, both in type and paucity of sherds. The sherds recovered from Rowe Valley; represent at least eight different vessels. The vessels are representative of three different cultural traditions known to surround the Toyah cultural area (Prewitt 2011:20). A portion of the sherds are classified as Leon Plain. Also present is a Patton Engraved jar and a Bullard Brushed jar; both types are generally associated with southern Caddo pottery tradition from East Texas (Figure 11). A burnished jar similar to Goliad Plain ware was also recorded, which is usually associated with pottery from the coastal region of Texas.

Figure 11: Rim of Bullard Brushed Jar

Artifact Densities

Excavations begin with 10-cm levels; when field observations led to two the distinction of two different Toyah components during the 1982 field season. After the distinction was made, excavations switched to 5-cm levels. The smaller vertical excavation unit was applied for the remainder of the excavations. Although, more specific vertical provenience were collected for each unit and level, all materials that were excavated and counted, in the field, as being part of the Upper Toyah stratigraphic level are presented here as one cultural stratigraphic level. The densities are presented by artifact category; large counts are demonstrated with red or orange colors, dark green indicating that no artifacts of that type were collected from those units. The various shades of yellow fall between the two extremes of red and green. In the interest of space, all density maps are placed at the end of the chapter.

Bone

The number of bone fragments recorded was 10,954. Fragmented bone was present in all XAs, although a few individual 1-by-1 units did not have any recorded bone. Areas with concentrations of bone and bone features are assumed to be the area of the site where butchery and other animal processing activities took place (Figure 12).

These areas of high bone counts are in the central to northernmost part of XA 11, the central portion to northernmost part of XA 5, central to western portions of XA 6, and with one high bone count unit in the unit N989 W1011 of XA 2. These sections identified correspond with the area marked in Figure 6 as the butchering area identified by Elton Prewitt.

The location of bone features in tandem the large bone counts support the interpretation of Prewitt that this is an animal processing area, with both primary and secondary butchery occurring. More specific interpretations related to the faunal assemblage will be covered in depth in Chapter 7.

Flakes

A total of 32,133 chert flakes were recovered from Rowe Valley, this is by far the largest artifact category .There are areas of extremely high concentrations of debitage, the western portion of XA 2 in 1 by 1 unit N985 W1011, has 6,000 pieces alone. Over 1,000 of those were large flakes that were piece-plotted. Two different density maps were created, one with the unit N985 W1011 count of 6,000 flakes counted (Figure 13), the other without to better reflect the overall flake density (Figure 14).

Excluding unit N985 W1011, most of the lithic debitage encountered from site excavations is from the central portion of the site in XAs 1, 4-6, 11, and the western portion of 2. Within these units are areas that were determined to be chipping stations due to high concentrations of lithic debitage. In general, these chipping stations are on the periphery of the area determined to be the main habitation areas.

Cores

The number of cores recovered is 105; the location of cores, seems to be congruent with the location of the identified chipping stations which supports the workshop interpretation of these areas (Figure 15).

Hammerstones

A total of 52 hammerstones and hammerstone fragments were recovered; at least one hammerstone or fragment was recovered from all XAs, except for XA 8 (Figure 16). The location of the hammerstones are within the designated butchery areas and within designated chipping station areas. The only area designated as a chipping station that does not have any hammerstones associated with it is the western portion of XA 2, which is notably the chipping station with the largest amount of documented debitage. Field observations, suggest that that some of the hammerstones were utilized as multi-purpose tools with regards to tool manufacture and to animal processing (Prewitt personal communication 2012).

Scrapers

A total of 51 scrapers were recovered from Rowe Valley (Figure 17). This includes both end and side scrapers. End scrapers make up the majority of the total number recovered (n=38). The scrapers are also located in the central areas of the site, although the eastern portion of XA 4 and XA 10 does not contain any scrapers and XA 7 and 11 only contain one.

Flake Tools

A total of 101 flake tools were recovered from the site, including both edge-trimmed (n=60) and edge-damaged (n=41) flake tools (Figure 18). Most of the XAs, have flake tools present, except for XA 10 and the excavated area that connects XAs 4and 1 which contain no flake tools. The concentrations of the flake tools seems to correspond with the butchery area and a portion of the chipping station areas.

Arrow Points

A total of 56 arrow points were recovered and consisted of 27 Perdiz, 9 corner notched, 5 triangular, 1 Cuney-like, and 14 fragments (Figure 19). Most of the arrow points seem to be consistently located within the main portion of the identified butchery areas. However, XA 2 has a substantially higher number of arrow points in the western units; this also is the location of the chipping station with the highest number of artifacts. There were no arrow points recovered from XA 8 or 10, with only one arrow point recovered from the excavated area that connects XA 3 and 1; the remaining excavated area of XA 1, also only contained one arrow point.

Bifaces

There were 20 bifaces recovered, 5 beveled, 1 untyped, and 14 miscellaneous (Figure 20). The bifaces seem to be concentrated in the central part of the site, also within the butchery area. XA 10, 7, and 8 did not have any bifaces recovered. XA 2, 11, and 3 only had one biface recovered from each.

Ceramics

The spatial distribution of the ceramic artifacts suggested to the site excavators that pottery was used for grease rendering. Pottery was recovered just south of the butchery area (Figure 21). There are some areas of concentrations, the highest numbers of sherds are in XA 1, the southwestern portion of XA4, and in the central portion of XA 6; the high count in the northern portion of XA 1 is due to a pot break.

Compared to the other cultural material categories ceramic sherds were the least represented, which is common at Toyah sites. A portion of the recovered ceramics from Rowe Valley were submitted during a previous study for a petrography study and for Instrumental Neutron Activation Analysis (INAA) (Perttula et al. 2003). Although the petrography study was inconclusive, the INAA study placed the ceramics into various source groups; a portion was sourced to the Titus group, an East Texas pottery tradition; only one sherd was sourced to Central Texas.

Drills

There were 10 drills recovered, unlike the other lithic artifacts categories are not in the area marked as the butchery area; the drills were recovered from XA 4, 1, 6, 7, and the eastern portion of 2, following more closely the location of the ceramic sherds (Figure 22).

Burned Rock

Although, there are not counts or weights available for the number and quantity of burned rock that was recovered from the site, the locations of the burned rock features were mapped during the field excavations. The majority of the burned rock features are outside of the area that contained the faunal features. However, this is excluding the burned clay pits, and a stone-lined hearth that is within the area that is presumed to be the meat-curing station. A portion of these burned features and their association with this faunal feature are discussed in detail in the following chapter.

Summary

It is clear from the individual examination of these selected artifact categories and the review of field excavations, Rowe Valley is a large multi-component archaeological site with a considerable Toyah component. The amount of cultural material suggests a large campsite that could have supported at least 150 persons (Prewitt 2012:202). A wide array of activities likely took place here, but as will be shown in the next chapter, a more detailed analysis of one artifactual category can elucidate not only the day-to-day activities but also add to understanding complexities of hunter gatherer behavior that occurred during the Toyah period.

Figure 12: Faunal counts by unit

Figure 13: Flake density by unit

Figure 14: Flake counts by unit, without unit N985 W1011

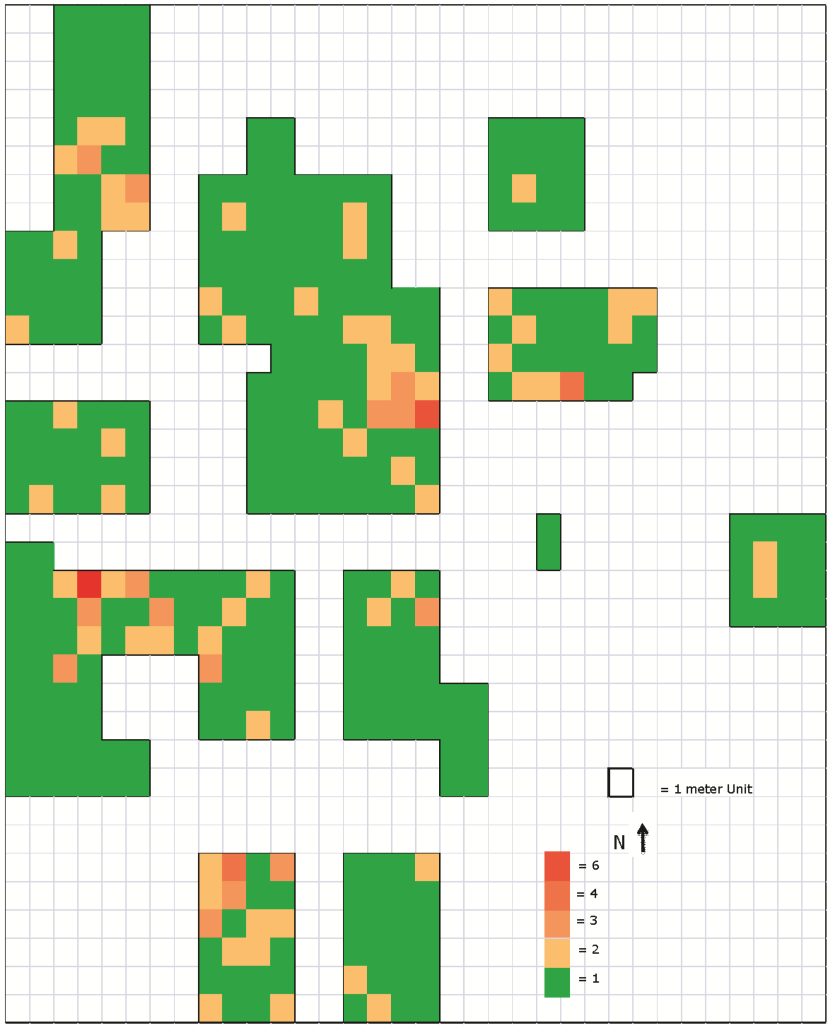

Figure 15: Core counts by unit

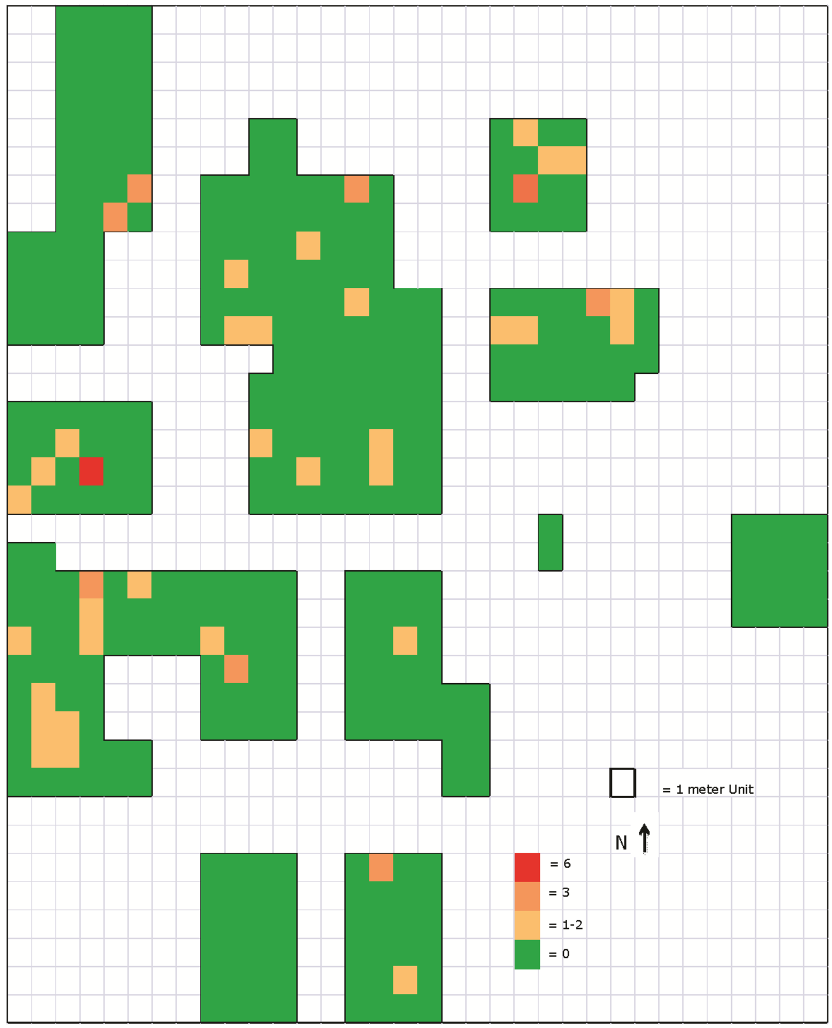

Figure 16: Hammerstone counts by unit

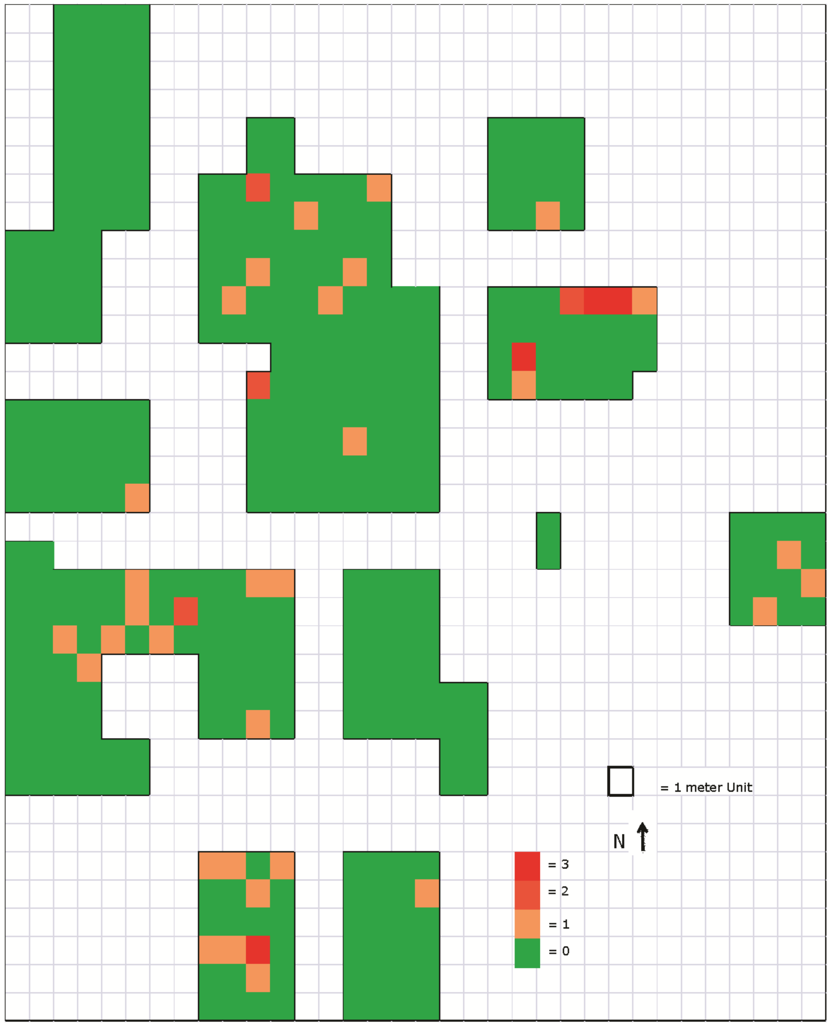

Figure 17: Count of scrapers by unit

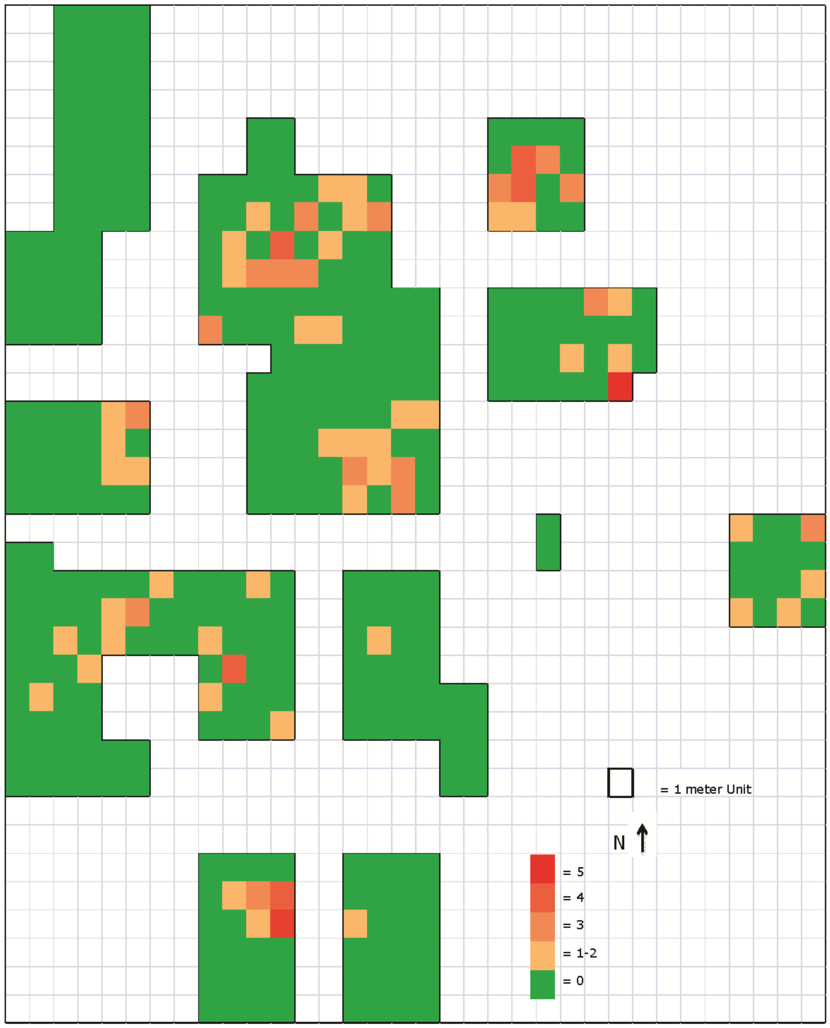

Figure 18: Flake tool counts by unit

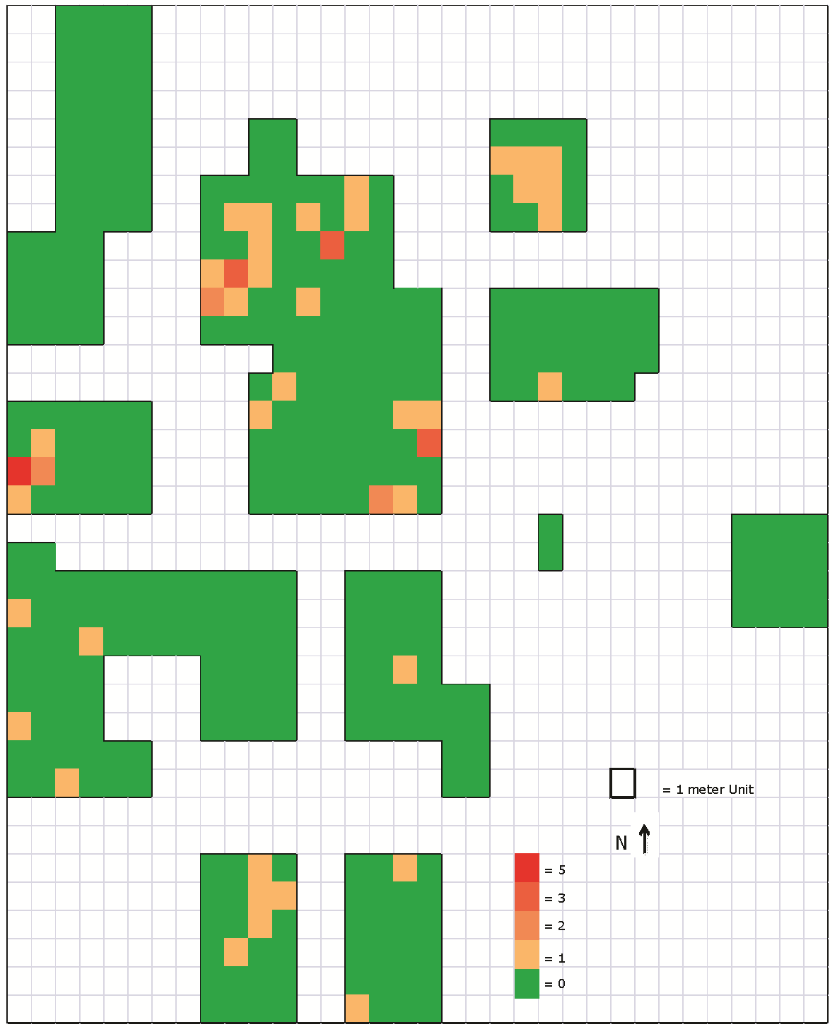

Figure 19: Arrow point counts by unit

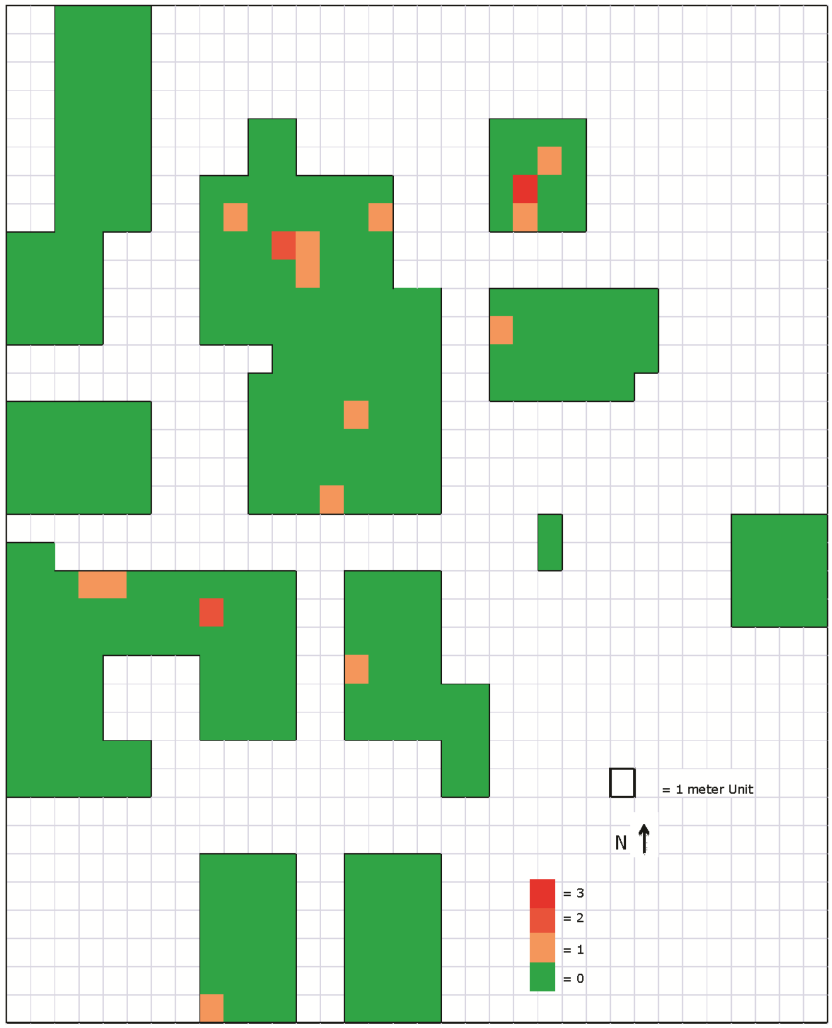

Figure 20: Biface count by unit

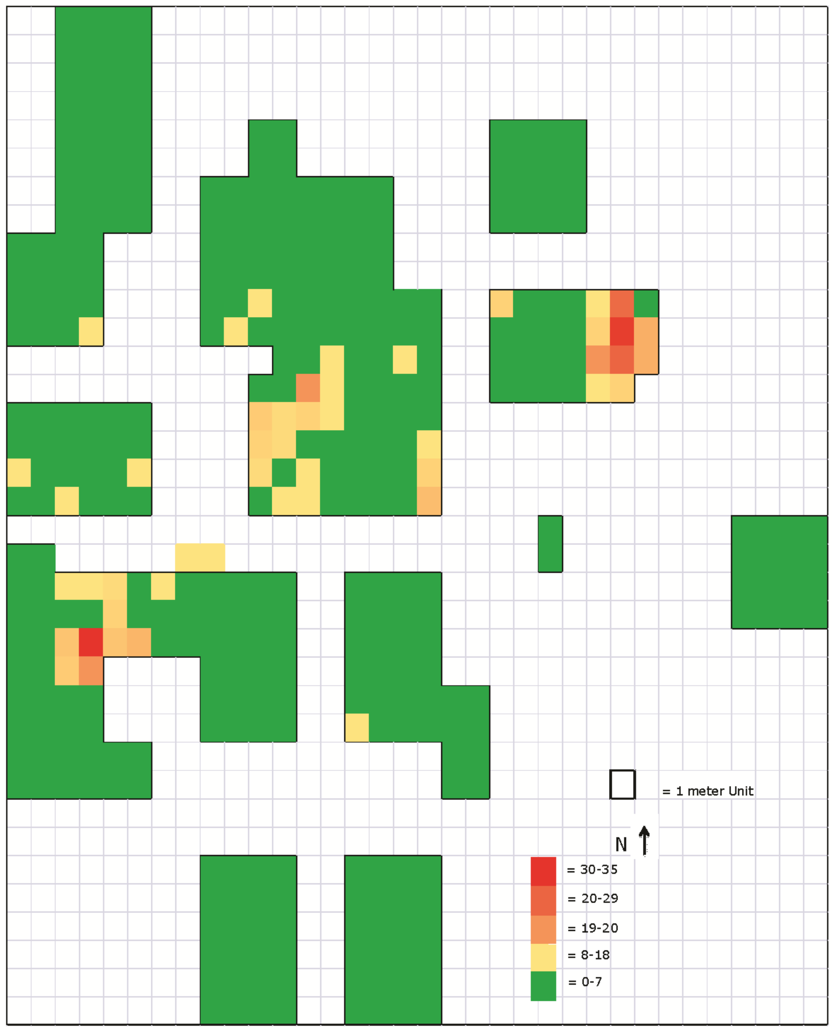

Figure 21: Ceramic sherd count by unit

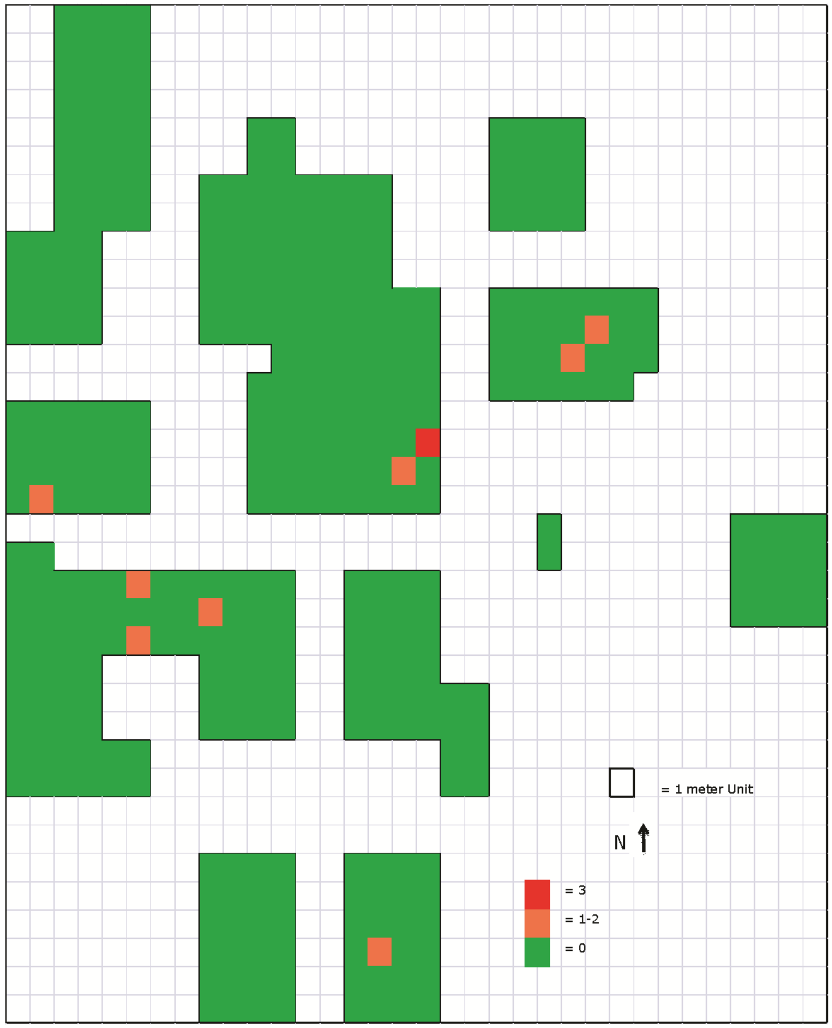

Figure 22: Drill counts by unit

CHAPTER V

METHODS

The recovery of animal bones can provide clues pertinent to prehistoric subsistence patterns, duration of occupations, and the season of occupation. The methods used to analyze the extensive faunal assemblage, are outlined below. Not all analytical procedures applied in all cases. The differential preservation level and fragmented nature of the collection made it necessary to analyze portions of the collection using different methods. The analytical methods allowed that both identifiable and unidentifiable fragments to be.

Basic Methodology

Faunal remains from Rowe Valley were first identified by using modern animal type collections from both Texas State University-San Marcos and the Vertebrate Pathology Laboratory at the J.J. Pickle research facility of the University of Texas at Austin. The invaluable assistance of Dr. Ernest Lundelius at the Vertebrate Pathology Lab was essential.

An attempt to identity all remains taxonomically was made. The analysis methods that are applied when a taxonomic identification could not be made are discussed below. After a taxonomic identification was attempted made the zooarchaeological remains were then identified to the element, side, and age of animal when possible. All complete bones and bone fragments were measured on a five-class size scale following methods used from various studies (Ricklis and Collins 1994:404; Gilmore 2007:43; Outram 2001:405). The five classes are: Class 1 measured less than 1.5cm, Class 2 measured between 1.5cm and 3cm, Class 3 measured between 3cm and 6cm, Class 4 measured between 6cm and 9cm, and Class 5 measured greater than 9cm. Bone size was determined by drawing graduated circles on a piece of paper and placing the bone within the circle and thus into the category in which it fit completely.

The specimens were also examined for evidence of modifications including; animal gnawing, cutmarks, and evidence of burning. Evidence of burning was determined to either be absent or present. If burning was determined to be present the color of the burned bone, and whether the burning was present on the entire specimen was recorded. The most common modification to the assemblage appears to be evidence of burning.

Mammal Utilization

Identification to the species level was not always possible; in those cases, a determination was still made as to the size and class of the animal. Majority of the remains from Rowe Valley are mammals, and were sorted accordingly: small mammals (size of rodents and similar sized animals), medium sized mammals (dog sized animals), large-sized mammals (deer and antelope sized animals) and very large sized mammals (bison sized animals). In most cases, size could be determined; in instances where it could not be, it was designated simply as unidentified mammal.

The specimens were further classified by element. In many cases, while an exact identification could not be made, the fragment could be broadly identified. In the cases of long bones, for instance, the diaphysis or epiphysis portion of the bone can be identified, even if the specific long bone cannot be identified. The diaphysis of a bone refers to the mid section of the long bone and the epiphysis is the rounded articular surface of the long bone.

Bone Fragments

Taxonomically unidentifiable fragments may still be useful when assessing cultural practices such as marrow extraction or bone grease rendering. Quantifications related to cultural practices followed the methods developed by Outram (1998:105-128, 2000:401). As previously mentioned, the majority of the faunal assemblage is fragmented but the analysis of these fragments is important in determining the extent to which people were purposely responsible for their fragmented condition

Interpretations from the determinations on the 'freshness' of bone fragment creation lies on the assumption that if humans utilized the animal bones for marrow or bone grease extraction, this would typically have occurred sooner rather than later and if fragments were intentionally broken (Gilmore 2007 and Outram 1998:105-155). Fragment analysis was done primarily by following Alan Outram's Freshness Fracture Index (FFI) (Outram 1998). In assessing the FFI, three separate criteria, fracture angle, fracture outline, and fracture texture are scored on a scale of 0 to 2, and the combined scores give the FFI score. The score achieved will be between 0 and 6, with a score of 0 to 2 signifying likelihood for the bone to be freshly fractured, with a score of 4 to 6 signifying the opposite; a score of 3 suggests characteristics of both fresh and un-fresh fragmentation (Outram 2001:407, Gilmore 2007:58). This method can be applied relatively quickly and allows for the inclusion of small, indeterminate bone fragments that might otherwise be excluded from consideration of past food resource exploitation (Outram 2001, 2005). This method is most effectively applied to long bone fragments.

The three criteria on which the bone fragments are measured are fracture angle, fracture outline, and fracture texture. Fracture angle is the angle at which the bone is broken in relation to the cortical bone (Figure 23). A score of 0 allows for up to 10 percent of the bone to be broken at a 90 degree angle, a score of 1 is between 10 and 50 percent of the bone is at a right angle than an acute or obtuse angle and a score of 2 is that more than 50 percent of the bone is at a right angle (Outram 1998:124-124).

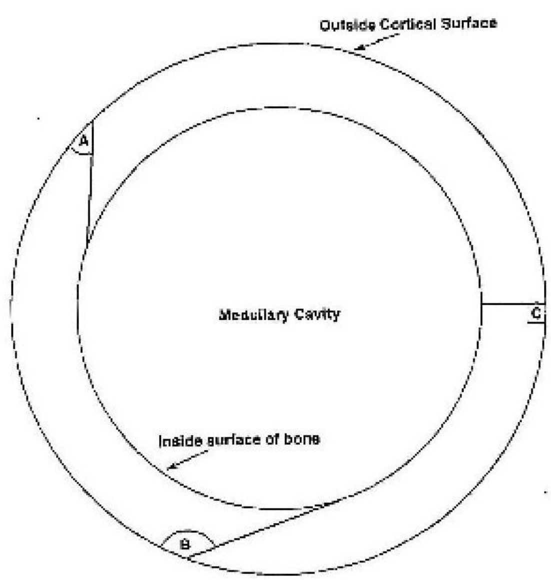

Figure 23: Fracture angles, a) acute, b) obtuse, c) perpendicular to cortical surface (from Outram 1998)

Second, the fracture outline is determined (Outram 1998:122). A score of 0 means only that the fracture outline is only helical in nature; a score of 1 means that that the bone has both helical and other fractures and a score of 2 means there is no helical fractures (Figure 24). Lastly, the fracture texture is assessed. A score of 0 means an absence of roughness, a score of 1 means that some roughness is present and a score of 2 means the fracture texture is mostly rough.

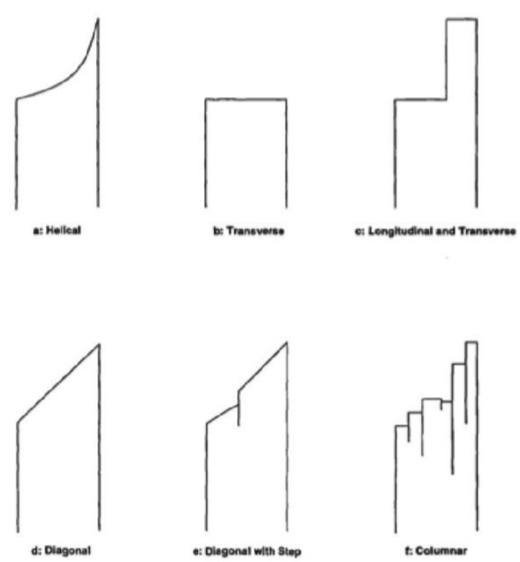

Figure 24: Bone fracture outlines (from Outram 1998)

The scores are then added and averaged to get an overall index for the assemblage (Outram 1998:122). A score of 0 means the assemblage has characteristics that are consistent with fresh fractures. A score of 6 would indicate that none of the assemblage has characteristics consistent with being freshly fractured. This numerical value should indicate how much human interaction with the bone accounts for the fragmented portion of the assemblage. It has been reported ethnographically that small fragments are the most efficient for producing grease (Church et al. 2002:1081), therefore a large amount of small, fresh fractured bone would support that bone grease rendering occurred at a site.

It should be noted that this method could not be used on all fragmented bone. Bone fragments that were smaller than size class 2 were not subject to the FFI; this was due to the difficulty in consistently assessing all three criteria to bones of this size. Also, bones that had evidence of burning were not subject to the FFI; heat treated bone fractures more easily and may not be reliable when determining if human activity was responsible for the fracturing (Gilmore 2007:54).

Bones that have fresh breaks are noted as well. This was determined based on color of the fractured edge when compared to the rest of the specimen. Often these bones appear to have been fragmented during their collection and subsequent storage. If the original fractured edge is still apparent that was analyzed for the FFI, if it is not then the FFI was not recorded due to its occurance after it was removed from its archaeological context.

Some of the specimens were determined to be "re-fits", although the majority of these were due to fresh breaks, there were occasions when there were re-fits that did not have indications of fresh breaks. This was noted in the analysis. As the analysis was conducted, each bone fragment was counted as one specimen; fresh breaks and re-fits were noted and the count adjusted to reflect the re-fits and fresh breaks.

Sampling Strategy

The faunal remains from Rowe Valley number over 10,000 specimens. Although, it would be ideal to have every analyzed every specimen, time limitations necessitated employing a sampling strategy for the immense faunal collection. The assumption being that reliable information could be obtained with a thorough analysis of a portion of the assemblage.

Of the total number of cultural features that were identified during excavations, a portion of these included large concentrations of faunal remains, three were chosen for analysis. The features analyzed are, Feature 5-1, Feature 5-3, and Feature 5-7. These features had a high quantity of taxonomically identifiable bone. This was important in taxonomic identifications as many of the bones from non-features were very difficult to identify to any taxonomic level. Further, this XA is included in the area of the site determined to be where the majority of the activities related to animal processing were occurring.

Remains chosen from non-feature contexts are from the excavation areas (XA) 1 through 9, with samples from the excavated profile cuts and test pits (Figure 6). Analysis of non-feature remains focused on XAs 4, 5, and 6. These were determined to be where much of the evidence for butchery and food processing was located. A comparative analysis from the feature and non-feature contexts in these XAs will demonstrate the differential treatment of animal remains.

CHAPTER VI

EXPERIMENTAL ARCHAEOLOGY

Introduction

A variety of factors limit the cultural materials that remain intact for discovery and subsequent interpretation at any given archeological site. Natural processes and cultural processes can limit preservation, as well as unintentional oversights perpetrated by the archaeologist her or himself. Experimental archaeology provides a means for archaeologists to augment their understanding of the past (Coles 1979:244). Experimental archaeology has a distinct advantage over excavated evidence as experiments can be replicated and repeated. This chapter will describe two experiments efforts undertaken to obtain a better understanding of the faunal assemblage recovered at Rowe Valley and to understand the processes that may have affected their condition in the archaeological record.

Bison Butchery Experiment

The author, along with archaeologists from the Center for Archaeological Studies (CAS) and the Texas State University Experimental Archaeology Club received the opportunity to butcher a bison. A plan was developed for the butchery to follow a strategy comparable to the Toyah period.

The severe drought of 2011 in Texas, led Hugh Fitzsimmons of Thunder Heart Bison to the plan to kill a bison for his personal consumption. Arrangements were made with Fitzsimmons for a bison to be humanely dispatched. Immediately following, archaeologists would be permitted to butcher the animal and the skeleton would be retained for further experimental work.

Bison Butchery Methodology

Fitzsimmons and Charles Koenig (M.A. student at Texas State) led the efforts in butchery planning. Koenig led meetings with the author and members from the Texas State Experimental Archaeology Club, on the process and what to expect. It was hoped that with cool weather and numerous workers, the bison could be completely butchered outdoors, however, it was arranged with the landowner that his refrigerated facility could be utilized, if needed, to ensure the meat would remains safe for consumption.

We designed the lithic tools after the Toyah toolkit; Chris Ringstaff, (Texas Department of Transportation) manufactured the tools. The desired toolkit consisted of; bifacial knives, unifacial scrapers, and blade flakes, all typical of Toyah tools. The bifacial knives were manufactured within the range of variation of knives that have been recovered from a variety of Toyah sites (Figure 25).

Figure 25: Bifacial knife knapped for butchery experiment

One biface that was broken into two halves was then hafted (Figure 26). Blade flakes were also manufactured from large chert cobbles. Two of these blade flakes were also hafted (Figure 27). The hafting materials used were wood and artificial sinew. The wood was split in half using a modern pocketknife, then carved using the knife to create a slot for that particular tool. Once the lithic tool was placed into the slot cut into one of the pieces, the other wood piece was placed back and artificial sinew was used to secure the lithic tool into place.

Figure 26: Hafted biface fragment

Figure 27: Hafted blade flake

The tools were then assigned a unique number by tool type and photographed before the experiment. Each tool's activity was documented and later microscopic use-wear was undertaken by another Texas State student.

Bison Butchery

On January 28th, 2012 of the butchery, Fitzsimmons and his ranch hand, began tracking a portion of the herd of bison. It took approximately two hours to locate a herd of bison on his 15,000-acre ranch. Once a group was located, a male bison with an estimated age of 4 months and a weight of approximately 400 pounds was selected and dispatched (Figure 28).

Figure 28: Bison herd

The bison was bled before being removed to the butchery location by having his hind limbs suspended from a tractor for approximately 15 minutes. Although, it was recognized that this action was perhaps not the most authentic way to treat the carcass, this was done in order that the butchery take place in a timely manner and that meat preservation level would not be compromised.

The animal then was transported to the butchery area, near the refrigerated building where it was placed on its back. Koening selected one of the bifaces to begin the skinning of the bison (Figure 29). The biface proved problematic, the serrated edge continually snagged on the hide; unaltered blade flakes were selected for the remainder of hide removal (Figure 30).

Figure 29: Start of hide removal with blade flake

Figure 30: Near completion of hide removal

After skinning, the entrails were removed solely by Koenig with unaltered blade flakes. After all the entrails were removed, the bison was moved indoors, to the refrigerated butchery area. The bison was suspended mechanically, the limbs removed and then taken to butchery tables where the meat was separated from the bones (Figure 31 and 32).

Figure 31: Beginning removal of meat from hind limbs

Figure 32: Meat separation from bone

It was recognized the mechanical suspension method used was not authentic; at this stage the butchery crew had been reduced to four individuals and there was a interest in the time the process took. A decision was also made to use a mechanical saw to sever portions of the rib bones from the spinal column.

Butchery Results

Approximately 90% of the bison was processed using these stone tools. Prior to the experiment there was an assumption that the bifacial tools would be the most useful, however in all cases were determined to not be very effective for butchery activities. For nearly all work done, unaltered blade flakes proved to be more effective for all tasks undertaken for this study. As they wore out and became less useful, another flake was simply employed and the activity continued. .

Subsequent to the butchery experiment, further research demonstrated that the bifacial knives would not have likely functioned as primary butchery tools. Use wear analysis on similar tools and tools from the Rush site showed patterns of wear that suggests thin meat cutting for later drying (Jodry 1999:204) and hide working (Quigg and Peck 1995:266).

Although, the majority of the people participating in the butchery experiment had never butchered an animal before, there were fewer cutmarks than the author expected left on the bones. Cutmarks were noted on two of the thoracic vertebra on the spinous process, seven rib fragments, and the right humerus. It is also noted that prehistoric hunters would be more proficient some ethnographic evidence suggest Blackfoot men could butcher up to ten bison in one day (Wheat 1972:109-110).

Stone Boiling Experiment

The purpose of the stone-boiling experiment was to use a cooking technique that was hypothesized to have been used during Toyah period to render the fat contained in animal bones. Interpretations of other similar aged sites with similar faunal assemblages have been interpreted to have had bone grease extracted.

There were four main goals of the stone boiling grease rendering experiment.

1. Determine if there are recordable patterns left on boiled bone fragments
2. Compare the boiled bone fragments to the archaeological assemblage
3. Quantify the amount of fat extracted during the boiling process
4. Determine the time needed to extract a worthwhile amount of fat

Stone Boiling Methodology

The stone boiling experiment took place at Freeman Ranch at Texas State University on March 31st, 2012. Dr. C. Britt Bousman arranged ahead of time for the cooking pits to be excavated and provided much of the firewood. Dr. Stephen Black provided guidance on obtaining rock resources. Both graduate students and members of the Experimental Archaeology Club provided invaluable assistance in both the planning and enacting stages of this second experiment.

The two areas were designated Areas 1 and 2. Area 1 was set up and intended to be the “control” location. It was not a true control station; but was rather set up to have the same set of bones boiled for the entire project day. Area 2 was set up to have varying skeletal elements boiled, at shorter time intervals than Area 1. Area 2 was used to account for the variable amount of grease that was assumed to be present in different skeletal elements; and to attempt to understand if certain elements would be more productive than others.

The bones were fractured using large limestone anvils with limestone or granite cobble hammers. The limestone collected for the anvils was gathered at the location of the experiment from a push-pile of naturally occurring limestone. The fracturing of the bones was achieved with some difficulty as the bones were still partially frozen (Figure 33 and 34). This was recognized to not be ideal. Especially since it seems unlikely that people inhabiting a Late Prehistoric site in Central Texas would not have had to deal with frozen bones.

Figure 33: Femur being fractured

Figure 34: Scapula being fractured

All bones used in this experiment came from the left side of the bison. They were split into four units; 1) femur and tibia, 2) humerus and scapula, 3) metapodials, and 4) ribs. Each bone “unit’ was well fractured and bundled together in fine window screen (Figure 35). This bundling was done to ensure that bone fragments from specific elements were kept together and would therefore be available for study later.

Figure 35: Scapula fractured and ready to be bundled

Once the bones were fragmented, they were assigned to either Area 1 or 2. Area 1 had the lower hind limb bones (excluding the metatarsal) boiled for approximately six hours total. Area 2 had the remaining bone units boiled for much shorter amounts of time, with two hours being the maximum time for those boiling episodes. It was hypothesized that the long boiling event at Area 1 would extract the maximum grease that could be obtained and the extraction rate could be calculated by comparison to the shorter boiling episodes at Area 2.

Grease collection took place every 20 minutes in most cases (Figure 35 and 36). There are pros and cons when hot or cold collection methods are considered. The cold collection method is done after the boiling process is complete and the water has cooled enough for the fat to congeal and then fat can be collected as one unit by skimming off. For this experiment, the hot collection method was chosen as we planned to quantify the amount of grease at intervals during the boiling process.

Figure 36: Grease rising to top of hot water

Figure 37: Grease being collected

This method produced difficulties when collecting the fat. When grease was collected from the still boiling water, the fat could not be separated from the water. Later each sample had to be reheated so that the excess water would evaporate (Figure 38).

After the water was determined to be sufficiently boiled from the sample, the remaining grease was measured for volume and then weighed and later densities were calculated.

Figure 38: Grease being reheated to facilitate evaporation of water

Prior to each boiling episode, the wood that was expected to be used and the rocks collected for boiling were weighed and split between the two stations. The rocks were divided by material type and photographed before and after each boiling episode (Figure 38). There were two main groupings of rocks; limestone cobbles gathered from the San Marcos river and from rock gardens located on the Texas State University campus. The rocks were carefully divided when heated to ensure that rocks were kept with their respective groups.

Figure 39: Rocks before burning

A fire was started and the amount of wood used was recorded with known measured wood held in reserve (Figure 39). After the wood had burned down sufficiently, one rock group would be placed into each respective fire (Figure 40).

Figure 40: Both firing areas started with measured wood

Figure 41: Rocks being heated in fire

The rocks were heated for approximately ten minutes, and then placed into a bucket of clean water to rinse the ashes off then placed into the rendering pot. The number of rocks added and the number of times this occurred were recorded. When the rocks in the pot could no longer keep the water boiling, they were removed and the remainder of that particular group of rocks added until there are none left (Figure 42).

Figure 42: Steam produced as hot rocks are added to water

The rocks were photographed after each boiling episode (Figure 43). The rocks that remain in large enough fragments were used again. Although, the documentation of the rocks and fuel needed for bone grease rendering was deemed important during the design phase of the experiment the methods that were used to record often seem to detract from the portion of the experiment more pertinent to the thesis research.

Figure 43: Rocks after first burning episode

Stone Boiling Results

Grease

The times were recorded the start of each boiling event and each grease collection event was recorded as well (Table: 1). The Femur and Tibia unit were boiled just over 3 hours, the ribs were boiled for 1 hour, and both the remaining units were boiled just over 2 hours.

Table 1: Time table for each bone unit and grease collection event

Grease Collection Event	Femur and Tibia Unit Time	Rib Unit Time	Scapula and Humerus Unit Time	Metapodial Unit Time
Start	10:24 AM	2:40 PM	10:31AM	1:08PM
1	10:44 AM	3:00 PM	10:51 AM	1:28 PM
2	11:04 AM	3:20 PM	11:10 AM	1:48 PM
3	11:24 AM	3:40 PM	11:30 AM	2:12 PM
4	11:45AM	n/a	11:54 AM	2:35 PM
5	12:05 PM	n/a	12:15PM	2:52 PM
6	12:25 PM	n/a	12:35 PM	3:11 PM
7	1:25 PM	n/a	n/a	n/a
8	2:20 PM	n/a	n/a	n/a
Total Time	3 hours 6 minutes	1 hour	2 hours 4 minutes	2 hours and 3 minutes

The ‘control’ bones used were the femur and the tibia/fibula unit. It was noted that at the 11:45 grease collection, that the amount of grease being produced had diminished substantially. The last grease collection event was one hour from the previous. This deviated from the 20 minute expected collection time but was done as the amount of grease that could effectively be collected had fallen off substantially. The weight of the grease collected from this experiment was 257.8g with a volume of 85ml and a density of 3.03 (Table 2).

Table 2: Weight, volume, and density of grease extracted from each bone unit

Element	Weight (g)	Volume (ml)	Density
Ribs	253.7	100	2.54
Femur/Tibia	257.8	85	3.03
Humerus/Scapula	198.7	20	9.94
Metapodials	222.4	30	7.41

Once the amount of grease from the 'control' bones had greatly diminished and the amount of grease being extracted became immeasurable, it was decided to improvise with another set of bones. Approximately six ribs were snapped in half and thrown into the pot. The ribs were boiled for forty minutes. They were brought to a violent boil half way through and it was at this point a large amount of grease was released from the rib bones. The final measurements of the rib grease were 253.7g, 85mL, with a density of 3.03 (Table 2).

At Area B the first set of bones boiled was the scapula and humerus unit; they were boiled for approximately an hour and a half. About a third of the way through a new set of hot rocks was added that increased the speed of the boiling; this was when most of the grease was released. The scapula and humerus grease weighed 198.7g, took up 20mL, and had a density of 9.94 (Table 2).

After the scapula and humerus were boiled, the metapodials were put in at Area B. They were boiled for just over two hours. They were hard boiled for approximately ten minutes mid way through. The metapodials grease weighed 222.4 g, took up 30mL, and had a density of 7.41 (Table 2).

Bone Fragmentation

A portion of the bones fragmented for this experiment were analyzed following methodology deemed pertinent that was laid out in Chapter IV. There are differences in the analysis of the experimental bones and the analysis of the archaeological materials. The experimental bones chosen to be analyzed were those from the tibia unit. The bones were still frozen when fragmented and the epiphyseal ends of the tibia were not as substantially crushed as they were determined to be in ethnographic accounts (Church et al. 2002:1077-1078). The bone fragments from the tibia were those chosen for FFI analysis for comparison. Other bones utilized for the experiment were examined for other alterations but were not subject to the FFI analysis.

The bones appear to have lost some of their freshness indicators when fractured during the experiment. A study by Karr et al (2011:557), demonstrated that experimentally frozen bones were documented to lose indications of being freshly fractured after just one week. The butchery experiment and the grease rendering took place nine weeks apart. The average score produced in the Karr experimental after 10 weeks was between .35 and .47. The fracture properties were shown to have characteristics less associated with fresh indicators if the bone was *still* frozen while it was fractured, versus being thawed before it was fractured. As mentioned above, the bones utilized during the grease experiment were still partially frozen when fractured. This may be the biggest concern when comparing the experimental results with the archaeological data.

There were 69 bone fragments from the tibia shaft that were good candidates for the FFI (Figure 44). There were at least 100 bone fragments that were in the smallest size category 1, and were not subject to the FFI (Figure 45). The majority of these size would have been lost to the traditional screening methods using ¼" screen, further there were numerous bone fragments that were simply uncountable as they were essential bone dust. Fragments of this size would most certainly be lost from the archaeological record using most conventional screening and collection methods. The total FFI score for the 69 bone fragments was 0.92; this is substantially smaller than the FFI score for the archaeological assemblage.

Figure 44: Selection of experimental bone fragments subject to the FFI analysis

Figure 45: Selection of experimental bone fragments in size class 1, not subject to FFI analysis

Summary

As shown in Table 2, 832.6 grams of bone fat was measured from the portion of the bison that was boiled. Fat is the most concentrated source of energy when compared with protein and carbohydrates, it also contains 9kcal per gram (Mead et al 1986:459). If the amount of experimental bone fat is assumed accurate, then half of the bones from a bison calf has approximately 7,493 kcal of bone fat, or nearly 15,000 kcal for the entire post-cranial skeleton.

Although, there are difficulties with estimating the direct number of calories a hunter-gatherer might expend in a day, it is estimated that women would burn about 2,400 kcal a day and men 3,016 kcal a day (Jenike 2001:218-220). For our experiment, the grease extraction process took the better part of a day. The number of individuals needed to perform this task by the Toyah is harder to estimate from the experiment. The preoccupation with measuring rocks, fuel, as well as collecting the grease while hot led to a large number of people being involved, if the focus was grease rendering of one animal, one to two individuals could probably handle the task in one day. Therefore, fat rendered from one bison could easily provide necessary daily dietary requirements for a few days for those two individuals. Rowe Valley, however, is a site that is estimated to have supported a population of at least 150 (Prewitt 2012:202). Bone grease rendering would have been a much larger affair at a site of this size, and using estimates of bison and deer present (minimum of two and minimum of five, respectively) this would have required a great deal of work.

Further, it is presumed the Central Texas winter would not likely be cold enough to keep the fat inside from going rancid for much longer than a couple weeks. Therefore, if that resource was going to be extracted it would have been done sooner rather than later (Karr et al 2011). Grease processing at Rowe Valley, however, is not completely out of the question because as shown by experimental work done by Karr et al. during cold weather, bones begin to lose the ability to exhibit characteristics that could be measured using the FFI score. This is supported by the present study's analysis of the experimental faunal fragments that although the bones were frozen; they began to lose indications of fresh fracturing. But as was shown with the analysis of a portion of the experimental bone fragments, the FFI score was still well within the range of fresh bone fracturing.

CHAPTER VII

RESULTS

The evidence for general subsistence strategies that were utilized at the site are discussed then followed by a more detailed examination for the focused use of large mammals by the inhabitants. The chapter will then explore the results of specialized analyses that were undertaken before concluding with a discussion of a selection of faunal features.

In general, the condition of the bone at Rowe Valley was quite poor. It was highly fragmented and generally the outer cortical surfaces of the bone was quite rough. Very few gnaw marks were noted on the bones and most of the bone fragments that could be re-fit to others were due to fresh breaks . A total of 3,459 bone specimens were analyzed. That count was adjusted to 2,580 specimens to reflect the fresh breaks and re-fits. This adjusted count is considered to be the total and is used throughout the chapter when referring to totals.

General Subsistence

The majority of the remains, 84 percent, were not identifiable to a taxonomic class (Table 3). Of the 16 percent identified, bison (*Bison bison)*, deer (*Odocoileus virginianus)*, and cotton rat (*Sigmodon hispidus)* make up a significant portion of the entire collection. The identifiable remains were used to determine the Minimum Number of Individual value (MNI) and the Number of Identified Specimen value (NISP) (Reitz et al. 2008). The MNI is the smallest number of individuals that would have to have been present to account for the skeletal elements of each species. The NISP value is simply a calculation of the percentage each identified species contributes to the entire assemblage.

Even though the MNI of the cotton rat is much higher than deer and bison, by count and NISP deer and bison dominate the taxonomically identifiable zoological remains from Rowe Valley.

Table 3: Identified mammals by count, percentage, NISP, and MNI of total assemblage

Identification	**Count**	**Percent**	**NISP**	**MNI**
Bison	93	4%	22.4%	1
Deer	284	11%	68.3%	5
Cotton Tail Rabbit	1	0%	0.2%	1
Rabbit	5	0%	1.2%	1
Fox Squirrel	2	0%	0.5%	1
Squirrel	4	0%	1.0%	1
Opossum	2	0%	0.5%	1
Wood Rat	2	0%	0.5%	1
Raccoon	6	0%	1.4%	1
Cotton Rat	17	1%	4.1%	10
Unidentified	2164	84%	n/a	n/a
Grand Total	**2580**	**100%**	**100%**	**24**

The MNIs for each animal was determined based on the number of certain types of elements present for each animal that was identified. The bison MNI from the current analysis places the number of bison individuals at one individuals based on the presence of two left metacarpals and the fact that it could not be determined if both fragments were from the same individual (Table 4). Further, the majority of the elements identified for the bison were either left side or ‘un-sided’ based on either the nature of the element (vertebra cannot be sided) or the remains did not have identifiable characteristics remaining.

Table 4: Selected identified elements for bison

Element	**Count**
Femur	1
Humerus	1
Radius	3
Left Tibia	1
Tibia	4
Left Metacarpal	2
Metacarpal	1
Metapodial	10
Left Metatarsal	1
Metatarsal	1
Long Bone	33
Left Phalange	1
Phalange	2

Observations during the fieldwork include the identification of the remains of at least one bison calf (Figure 46). The bison remains that were analyzed for the present study are from adult bison. Meaning, for the MNI for the site as a whole is at least two, although it could be higher.

Figure 46: Juvenile bison mandible in situ

The deer MNI is five based on the presence of five right radius fragments (Table 5). The actual number of deer remains is likely greater, as there was also a concentration of mature deer antlers at the site, hypothesized to be a meat curing station. Although, they were not included in the present analysis, the deer antlers were inspected and appear to represent at least three antler racks (Figure 47).

Table 5: Selected identified elements for deer

Element	Count
Femur	4
Left Humerus	3
Right Humerus	1
Humerus	6
Right Radius	5
Radius	4
Left Tibia	4
Tiba	5
Right Tibia	2
Right Ulna	1
Ulna	1
Right Metacarpal	1
Metacarpal	1
Metapodial	5
Right Metatarsal	1
Metatarsal	1
Long Bone	8
Phalange	32
Right Phalange	1
Patella	1

Figure 47: Adult deer rack in situ

Based on the presence of the bison calf mandible and the adult deer antler racks, Rowe Valley is presumed to be a late fall or early winter occupation site. Bison generally begin giving birth in early April or May, but are known to birth as late as October or November (Berger et al. 1999:113-118). This is further corroborated by the presence of the mature deer antlers still attached to the skull. Although, white-tail deer have highly variable mating seasons based on environmental factors, mating season is usually from December to January (De Young et al. 2011: 324-331).

The other identified animals were small mammals. These include Cottontail Rabbit (*Sylvilagus floridanus)*, rabbit (*Sylvilagus)*, opossum (*Didelphimorphia)*, raccoon (*Procyon lotor)*, fox squirrel (*Sciurus niger)*, squirrel (*Sciurus)*, wood rat (*Neotoma floridana)*, and cotton rat (*Sigmodon hispidus)*. The MNI of all the small identifiable animals was 1, excluding the cotton rat, which had an MNI of 10. The cotton rat MNI is based on the presence of ten mandibles; it is presumed that the high MNI of the cotton rat is based on intrusion of the cotton rat after the occupation period ended. This is based on the bones fresh appearance of the bones compared to the other specimens.

Although, not all the specimens were identifiable to the species level, all specimens were assigned to a size class of animal. The very large mammal category includes only bison-sized mammals, the large mammal category includes deer and antelope sized mammals, the medium-sized category include coyote sized animals, and the small-mammal category would include most rodents. Mammals dominated the collection (n=2,050), and in fact, of the analyzed collection, mammals were the only class of animal identified during the present investigation although, turtle remains were noted in the field. Remains that could not be identified to any taxonomic level comprise one fifth of the specimens analyzed (21 percent). The specimens determined to be from very large or large animals comprise nearly half of the total analyzed collection (n=1,174) at 45 percent.

Table 6: Counts and percentage of the total assemblage by animal size

Animal Size	**Count**	**Percent**	**Combined Percent**
Very Large Mammal	103	4%	
Very Large / Large Mammal	604	23%	46%
Large Mammal	467	18%	
Medium / Large Mammal	79	3%	5%
Medium Mammal	53	2%	
Small / Medium Mammal	29	1%	11%
Small Mammal	269	10%	
Unidentified Mammal	446	17%	38%
Unidentified	530	21%	
Grand Total	**2580**	**100%**	**100%**

Large Animal Use

The identified Rowe Valley faunal assemblage is dominated by large mammals, specifically deer and bison. It is important to note, that although pronghorn (*Antilocapra americana)* remains were not identified during the present analysis, they were noted to be present during the preliminary faunal inspection that took place during the fieldwork phase. There are difficulties in distinguishing between most of skeletal elements of deer and antelope, and it is likely that antelope remains contribute to a portion of the general large mammal category.

When the identified elements are compared between bison and deer, there are clear differences. More than half of the identifiable deer bones were from the axial skeleton (58 percent). This is much higher than the percentage of axial skeletal elements that were identified for bison (19 percent). The null hypothesis that each skeletal part (skull, axial, and limb) would be equally represented by deer, bison, and unidentified remains can be strongly rejected with a degree of confidence of <.01 (Table 7).

Table 7: Bison, deer, and unidentified element counts, percentages, and goodness of fit by skeletal part

	Skull	Axial	Limb	Unidentified Element	Total
Deer	27 (10%)	166 (58%)	91 (32 %)	0 (0 %)	284
Bison	10 (11%)	18 (19%)	62 (67%)	3 (3%)	93
Unidentified	6 (0%)	144 (7%)	1164 (54%)	850 (39%)	2164
Total	**43**	**328**	**1317**	**853**	**2541**
				$\chi 2$ =	866.97
				df=	6
				CV0.01=	16.812

When adjusted residuals are calculated, there is further indication that bison and deer skeletal elements are differentially represented in the archaeological assemblage. The axial elements are extremely overrepresented for the deer while deer limb bones are underrepresented. Axial elements for bison do not deviate from the expected values although the bison limb bones are overrepresented. Skull elements are overrepresented for both deer and bison (Table 8).

Table 8: Adjusted residuals of bison, deer, and unidentified elements by skeletal part

	Skull	Axial	Limb	Unidentified Element
Deer	10.83	24.29	-7.08	-12.71
Bison	6.90	1.89	2.92	-6.31
Unidentified	-13.25	-22.53	4.74	14.60

Further, if the limb skeletal parts are examined more closely, for the bison there are elements of both the fore limb (humerus, radius, and metacarpals) and hind limbs (femur, tibia, and metatarsals) as well as generally classified lower limb bones (metapodials and phalanges), and generally classified limb bone fragments that were not further identifiable (Table 9).

Table 9: Percentage of skeletal parts of deer and bison

	Bison	**Deer**
Skull	11%	10%
Axial	19%	58%
Fore Limb	4%	7%
Hind Limb	8%	7%
Lower Limb	19%	15%
Limb	35%	2%
Non-identifiable	3%	0%
	100%	100%

Bone Processing

Due to the high degree of fragmentation, much of the faunal collection was not identifiable to taxonomic levels (Figure 47). As discussed in the Chapter 5, the remains from Rowe Valley were subjected to various analyses to assess the degree to which human behavior was a factor in their fragmentation and modification.

Figure 48: Representation of highly fragmented faunal assemblage

Freshness Factor Index (FFI)

In assessing the FFI, three separate criteria, fracture angle, fracture outline, and fracture texture are scored on a scale of 0 to 2, and the combined scores equate with the FFI. The score achieved will be between 0 and 6, with a score of 0 to 2 signifying likelihood for the bone to be freshly fractured, with a score of 4 to 6 signifying the opposite; a score of 3 suggests characteristics of both fresh and un-fresh fragmentation (Outram 2001:407, Gilmore 2007:58).

Of the 2,580 bone fragments, 802 (31 percent) were suitable specimens for determination of the freshness fragmentation index (FFI) score. Of those fragments 611 were from taxonomically unidentified specimens; this is not surprising since the bone fragments most suitable to the FFI are long bone fragments, which are often hard to identify taxonomically. The remaining fragments that were taxonomically identified were mostly attributed to bison (64) and deer (120); the remainder was squirrel and rabbit (7) for a total of 191.

To determine the FFI for various portions of the assemblage, first the FFI is calculated for each fragment then multiplied by the count if it was higher than 1 and then divided by the entire count for that category. All of the FFI scores were above five. This suggests that these bones were not fragmented when fresh (Table 10). When the individual FFI score for each specimen is added up, the FFI is 4,237, when that is divided by 802, the FFI score for the entire collection is 5.28. This falls between a score of 'four' and 'six' and indicates that the specimens that qualified to be subjected to the FFI analysis do not exhibit characteristics of freshly fractured bone. Of the FFI scores, bison and deer, the very large and large mammals have scores, of 5.14 and 5.06 respectively, just below the average. Interestingly, excluding the fox squirrel specimen, other small mammal scores were generally lower than the average.

Table 10: Average FFI score with counts for each identified animal

Identification	**Count**	**FFI Total**	**FFI Score**
Bison	64	329	5.14
Deer	120	607	5.06
Cotton Tail Rabbit	1	4	4.00
Fox Squirrel	1	6	6.00
Rabbit	2	6	3.00
Squirrel	3	9	3.00
Unidentified	611	3276	5.36
Grand Total	**802**	**4237**	**5.28**

Since 76 percent (n=611) of the fragments analyzed using the FFI method were not identifiable to a specific animal identification, the FFI scores were broken out by the size class of the animal (Table 11). The high percentage of unidentified fragments is suggested to be because the act of fragmentation, whether by human or other processes, has a tendency to erase the characteristics used to identify the bone elements and taxonomy. Further, although it is not possible to distinguish animal size accurately in all cases, very large and large mammals are more distinguishable based on the large size of the bone before it is fragmented.

Table 11: Average FFI score with counts by animal size class

Animal Size	Count	FFI Total	FFI Score
Very Large Mammal	74	382	5.16
Very Large / Large Mammal	278	1510	5.43
Large Mammal	239	1244	5.21
Medium / Large Mammal	34	189	5.56
Medium Mammal	21	116	5.52
Small / Medium Mammal	6	30	5.00
Small Mammal	50	218	4.36
Unidentified Mammal	55	310	5.64
Unidentified	45	238	5.29
Grand Total	**802**	**4237**	**5.28**

Further, when the FFI scores are inspected at by the bone fragment size (all fragmented bone is discussed in the next section), 66 percent of the bones were in size class 2 (n=530). This was the smallest bone fragment size subject to the FFI analysis; size class 2 also has the highest FFI score of all bone size classes (Table 12).

Table 12: Average FFI score by bone fragment size

Bone Size	Count	Average FFI Score
2	530	5.40
3	180	5.03
4	62	5.00
5	30	5.07

The FFI score of 0.92 from the experimental bone further substantiates the bone from Rowe Valley was not fractured when fresh, as it scored 'five' and higher. Further, when comparing bone fragment sizes from the experimental analysis to the analysis of the archaeological record, there were many experimentally created bone fragments that were quite small and wouldn't have been subject to the FFI analysis with the methods utilized. Further, these even smaller fragments would not be collected from the archaeological record, as ¼" screen was used at Rowe Valley.

Fragmentation

The majority of the collection is not only fragmented, but is in the smallest size class that the analysis methods subjected it to (smaller than 1.5 cm) (Figure 13). The only animal size categories that contained bones in size category 4 and 5 were those that were deer/antelope sized or larger; their large nature makes them the only animals that have potential to be represented in those size classes (Table 13).

Table 13: Size of fragmentation and percentage

Size Category	1	2	3	4	5
Percentage of total fragments	54%	31%	10%	4%	1%

However, even when looking at the Very Large size the Large size classes, the majority of the fragments are still quite small. The bulk of which are in size classes 1, 2 and 3 (Table 14).

Table 14: Counts by size category with animal size identification

Animal Size	Size Category					
	1	2	3	4	5	Grand Total
Very Large Mammal		8	45	24	26	103
Very Large / Large Mammal	274	258	66	6		604
Large Mammal	37	238	118	61	12	467
Medium / Large Mammal	37	39	3			79
Medium Mammal	16	30	5	2		53
Small / Medium Mammal	15	14				29
Small Mammal	172	82	12	1		269
Unidentified Mammal	386	60				446
Unidentified	460	65	3			530
Grand Total	**1397**	**794**	**252**	**94**	**38**	**2580**

Burning

Only 15 percent of the entire analyzed assemblage shows evidence of being subject to burning. It is interesting to note that nearly half of the burned bone is from very large or large animal size class at 45 percent (Table15).

Table 15: Counts of specimens with evidence of burning by animal size category

Identification	No	Yes	Grand Total
Very Large Mammal	103		103
Very Large / Large Mammal	485	119	604
Large Mammal	413	54	467
Medium / Large Mammal	70	9	79
Medium Mammal	48	5	53
Small / Medium Mammal	23	6	29
Small Mammal	265	4	269
Unidentified Mammal	360	84	446
Unidentified	429	99	530
Grand Total	**2196 (85%)**	**380 (15%)**	**2580**

Of all the burned bone 91 fragments were calcined or partially calcined (24 percent), 126 were black or partially black (33 percent), and 165 were gray or partially gray (43 percent) (Table 16). Forty-five percent of the burned bone is from very large or large mammal, this is not in and of itself surprising, since that category makes up the majority of the collection, but does suggest these remains might be more likely to be roasted or subject to high heat. The exposure to high heat could be bones that are thrown into the fire after consumption of the meat from the bone, or the fatty bone fragments could be used as fuel for the fire.

Table 16: Burned bone specimens by color of burn

Burned Color	**Counts**	**Percentage**
Calcined	79	21 %
Part Calcined	12	3%
Black	31	8%
Part Black	95	25%
Gray	6	2%
Part Gray	159	42%
Total	**382**	**100 %**

Summary

Although the Rowe Valley faunal assemblage does not evidence of fresh fracture, it is highly fragmented. These qualities in tandem reveal that much of the bone at Rowe Valley was fragmented by processes not related to purposely human activities. Trampling by humans or animals or later site formation processes, are likely responsible.

Large and very large mammals make up almost half of the bone fragments that are burned, as they make up the majority of the remains this would be expected but also likely demonstrates large animal bones are being cooked more often on the bone by grilling or roasting.

There is an overwhelming presence of large animal bones at the site and yet few of the animal remains have characteristics that suggest they were processed for grease. This is also further supported by the type of heating features that were noted at Rowe Valley; they were shallow, basin shaped hearths. This shape and style of hearth is not noted ethnographically to be used for bone grease rendering (Collins 2011). Often, pit features would be excavated as deep pits that would be lined with a variety of perishable materials.

All animal size categories have approximately the same FFI, which is not what would be expected when looking for bone grease production. Grease extraction would be more likely to involve larger animals due to the larger fat stores contained within their bones. Grease extraction would not be worth the fat amount within small animal bones to process them. It is recognized that if bone was freshly fractured later formation processes at work could blur these markers.

Features

The analyzed features were all located in XA 5, Feature 5-1, 5-3, and 5-7. There are some commonalties among these three features. The features had more complete (and therefore) more easily identifiable bone than the other portions of the site. The location of these features along with the placement of bones within them, led to the conclusion that they are butchery features. In general the features contained fewer small bone fragments than the non-feature contexts (Table 17). There is a clear difference in the number of bone fragments from size class 1.

Table 17: Bone fragment size by feature and non-feature contexts

Bone Size	Feature	Percentage	Non Feature	Percentage	Total
1	108	31%	1294	57%	1402
2	95	27%	699	31%	794
3	60	17%	192	8%	252
4	47	14%	47	2%	94
5	38	11%	30	1%	38
Total	**348**	**100%**	**2262**	**100%**	**2580**

Feature 5-1

Feature 5-1 contained 57 bone specimens, of the identifiable bone present in this feature the most represented was axial skeletal elements, with 9 ribs and12 vertebra (four of which were nearly complete). The majority of these rib and vertebra fragments were determined to be from a deer. Unidentified long bone fragments number 30 and are the most plentiful specimen type, they are also in size category 1 or 2. None of the specimens recovered from this feature had any characteristics associated with having been burned. Further, the FFI for the specimens from this is 5.59 (Table 18).

Table 18: FFI score for feature and non-feature contexts

		Count	FFI Total	FFI Score
Context	Feature 5-1	27	151	5.59
	Feature 5-3	50	264	5.28
	Feature 5-7	40	200	5.00
	Non Feature	685	3622	5.29
	Grand Total	**802**	**4237**	**5.28**

This feature is hypothesized to be a deer butchery location where the majority of the appendicular skeleton was removed to another location (Figure 49). It is not determined if that was before or after butchery took place. When further looking at the breakdown of bone fragments recovered from this feature, 72 percent (n=103) were in size classes 3 and 4, bones in this size class are often easier to identify (Table 19). This feature was near Feature 5-2, which is one of the thermal features (Figure 50).

Table 19: Animal size class by bone fragment size in Feature 5-1

Fragment Size	Very Large/ Large Mammal	Large Mammal	Unidentified Mammal	Total
1			16	16
2	14	10		24
3		65		65
4		38		38
Grand Total	**14**	**113**	**16**	**143**

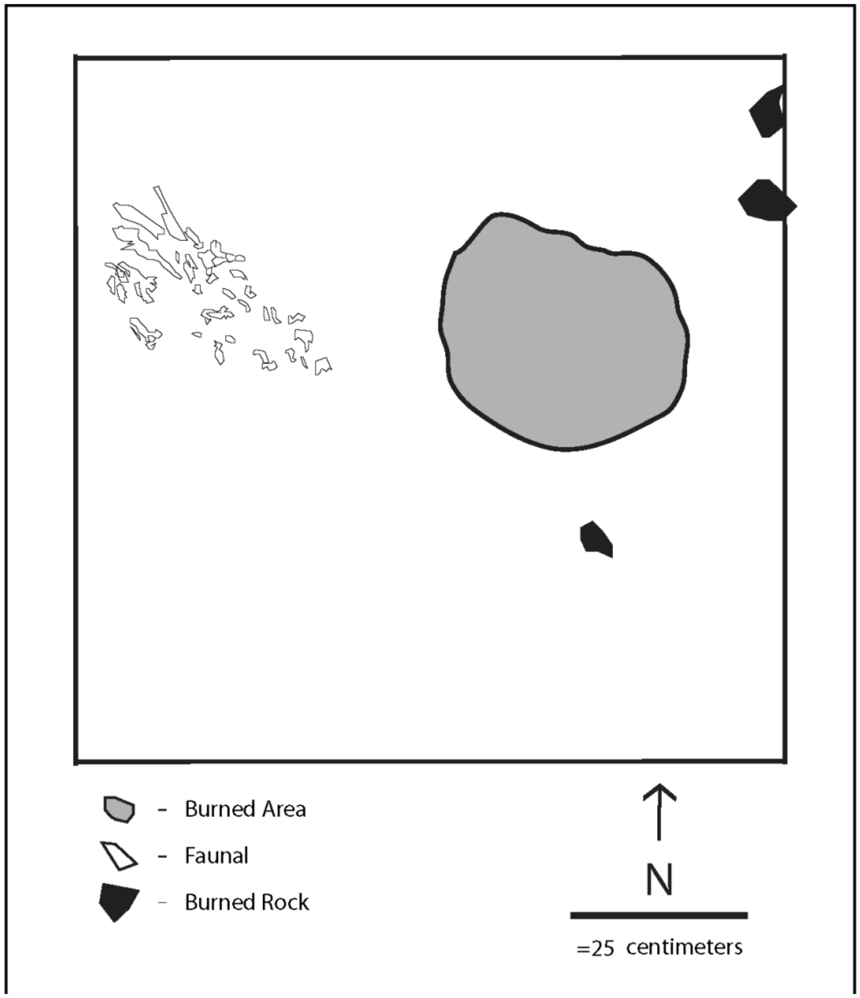

Figure 49: Feature 5-1 plan map

Figure 50: Feature excavation photograph, Feature 5-1

Feature 5-3

Feature 5-3 contained 181 bone specimens; in contrast to Feature 5-1, all portions of the axial and appendicular skeleton are represented. Most of the identifiable bone was determined to be deer and includes 36 vertebra fragments (9 of which are nearly complete), 14 rib fragments, 1 femur fragment, 1 humerus fragment, and 3 phalanges (2 are complete) (Figure 51). Further, the FFI for the specimens from this is 5.28 (Table 18).

Also present are 76 long bone fragments, only one long bone fragment is in size category 3, the rest are in categories 2 and 1 (Table 20). Two of the 181 fragments have evidence of burning and are partially blackened.

Table 20: Animal size class by bone fragment size in Feature 5-3

Fragment Size	**Very Large Mammal**	**Very Large / Large Mammal**	**Medium / Large Mammal**	**Unidentified Mammal**	**Unidentified**	**Total**
1			34	49		85
2	1	1	9		1	57
3						28
4						9
5						2
Total	**1**	**1**	**43**	**49**	**1**	**181**

Like Feature 5-1, this feature is inferred to represent the butchery of a deer, with the difference being that the feature still has the remains of axial and appendicular elements of the deer left at this location.

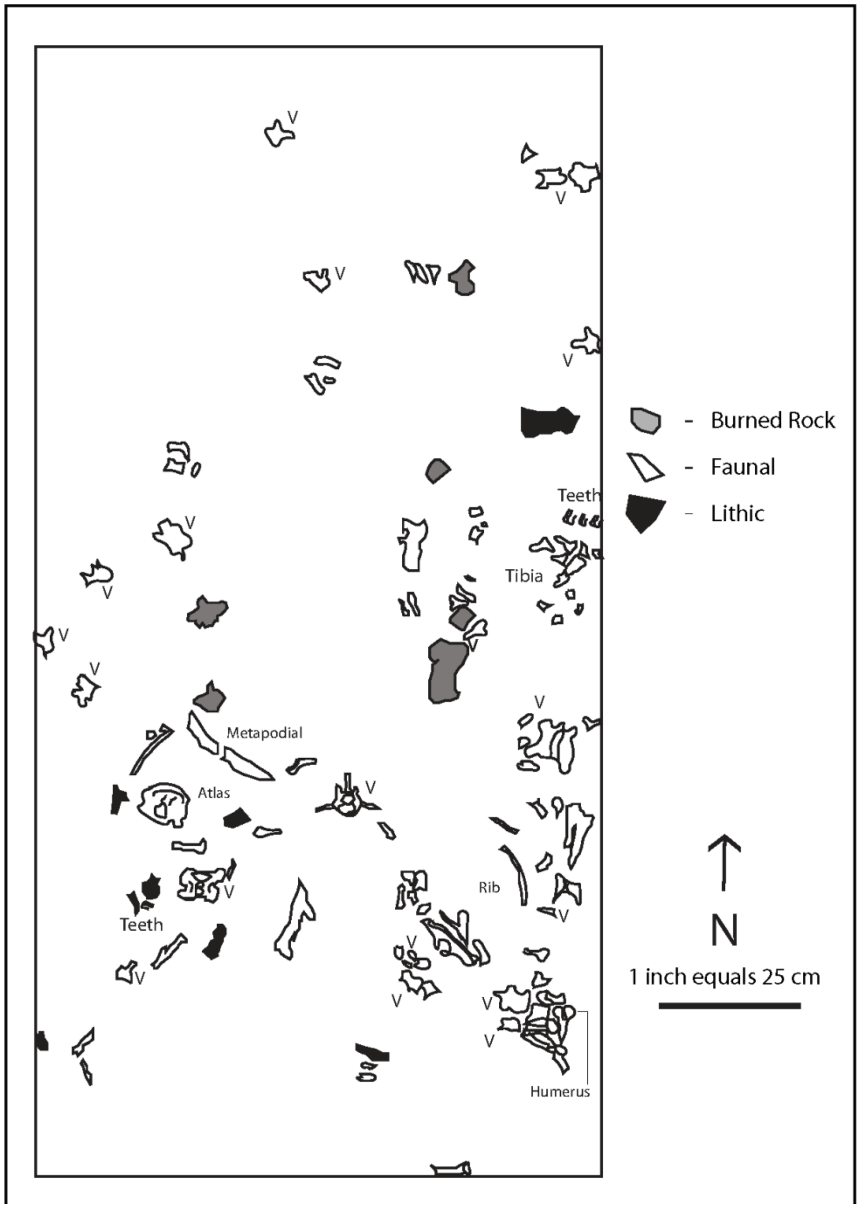

Figure 51: Feature 5-3 plan map

Feature 5-7

Feature 5-7 has 80 bone specimens, and, like Feature 5-3, has both axial and appendicular elements. Also, similar to Feature 5-3, the majority of the identifiable bone was determined to be deer. There were 20 vertebra (3 nearly complete), 17 rib fragments, 2 humerus fragments, 2 radius fragments (one identified as the right radi), 3 tibia fragments, 2 phalanges, and portions of what is likely 1 deer skull. The FFI for Feature 5-7 is 5.00 (Table 18).

There were also 20 unidentified long bone fragments. The majority of the long bone fragments, unlike Features 5-1 and 5-3, are in size categories 2, 3, and 4, with only 7 having a size less than 1.5cm (Table 21).

Table 21: Animal size class by bone fragment size in Feature 5-7

Fragment Size	**Very Large / Large Mammal**	**Large Mammal**	**Unidentified**	**Total**
1		3	4	7
2	7	9	3	19
3	2	17	2	21
4		27		27
5		6		6
Total	**9**	**62**	**9**	**80**

This feature, like the previously discussed two features seems to represent the butchery of a complete deer, with at least portions of the entire skeleton left in place (Figure 52 and 53).

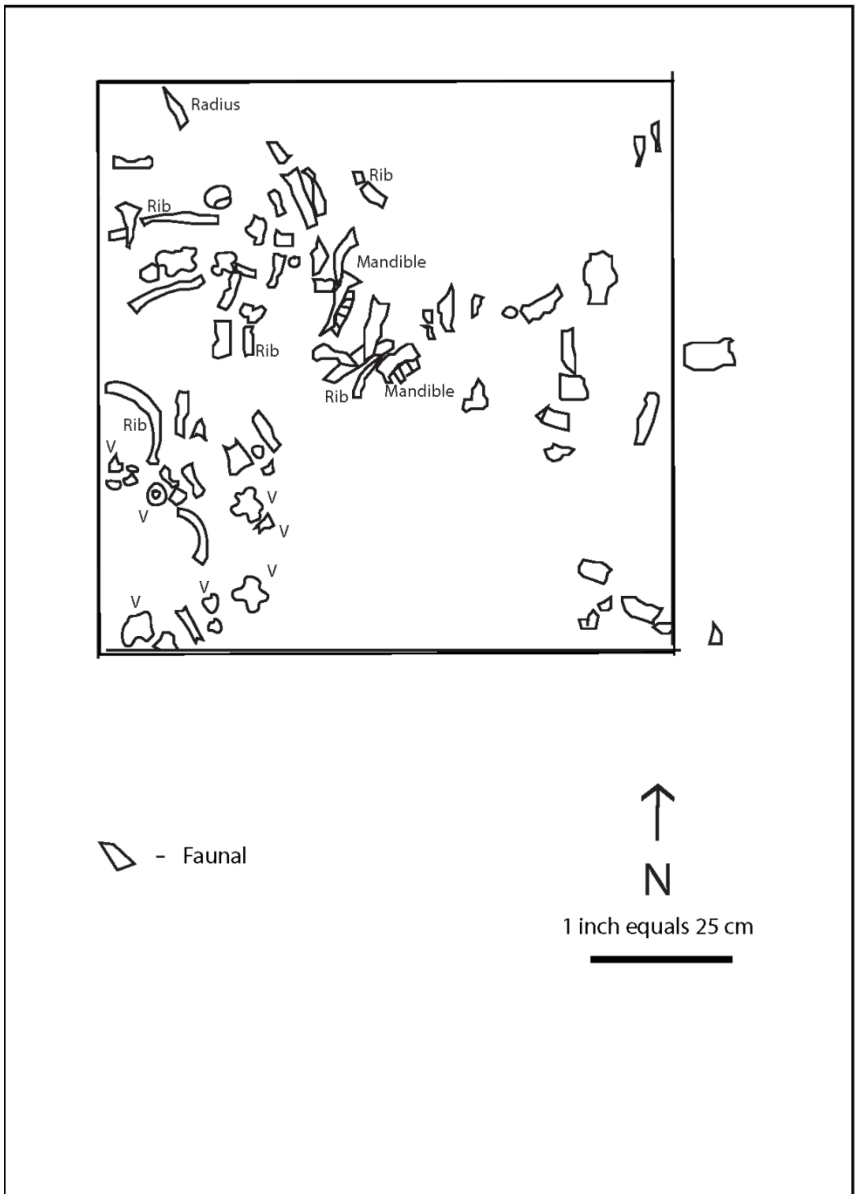

Figure 52: Feature 5-7 plan map

Figure 53: Feature excavation photo, Feature 5-7

Feature Summary

The faunal features seem to represent individual butchery events of at least three individual deer. Although, many portions of the appendicular skeleton are missing from Feature 5-1 and only fragments remain at the others, there are enough fragments to assume that entire deer carcasses were butchered at these locations at least one point during the occupation.

Summary

Analyses on a sample of faunal remains from Rowe Valley suggest that very large and large mammal resources were the focus of the inhabitants. However, much of the assemblage is highly fragmented and all butchery features discussed involve the butchery of entire deer carcasses and none had any bison bone. This suggests two separate butchery systems for the two different species, as well as a variety of co-existing subsistence strategies.

CHAPTER VIII

DISCUSSION AND CONCLUSION

Although, a complete analysis of the site is yet to be undertaken, the preliminary analysis of artifact densities and the analyses on the faunal assemblage, both here and in the field demonstrate that Rowe Valley (41WM437) is a large multi-component site, with a substantial Toyah occupation. This large campsite was likely occupied during the fall or winter. Its location in the Blackland Prairie and within a day's walk of the Edwards Plateau would differentially affect the bison, deer, and antelope that were available during that season. The high number of large mammal remains in conjunction with the assessment that those animals' bones were not used in bone grease rendering suggests resources were plentiful enough and that there was no need to rely on a low ranked resource.

Bison and deer make up the majority of the identifiable remains at Rowe Valley; however, both species are represented differently in the archaeological record. The high percentage of axial elements present for deer indicates that entire deer carcasses were being transported back to the campsite. This is further supported by the presence of primary butchery locations for at least three deer. This is in contrast to the bison remains; although there are elements present for the bison from the axial skeleton, it is not to the degree that is seen with the deer remains.

The experimental results support this; the analyses performed on the bone fragments demonstrated the appearance of fresh fracturing, which was not present archaeologically. Further, although, it is recognized that Toyah hunter-gatherers would be more adept at the butchery process, the movement of even a young bison in its entirety is a difficult feat. Bison are substantially larger than deer and would require much more effort and planning in order to transport the entire animal back to the campsite. The fact that bison fore and hind limbs were both being brought back along with the upper and lower portions of the limbs means that the bison metapodials and phalanges fragments are likely ‘riders’ and were transported brought to the campsite with the upper limb portions that contain more meat. The lower portions of the limbs do not seem to have been processed for their fat stores.

The overwhelming presence of large mammal remains (deer and antelope) versus very large mammal (bison) remains support the conclusion that deer and antelope made up the bulk of the animal diet, and would have the food choice that provided the most return energy for the least amount spent. Deer are and have been ubiquitous in Central Texas and would have been widely available, even during the lean fall and winter months. Whole deer carcasses can be transported with much less effort and deer is shown to be more a more utilized resource when compared to bison (Arnn 2012 and Black 1986). The presence of bison remains, however, does suggest that when possible bison were utilized and as suggested by Mauldin et al., bison were occupying specialty patches (2012). These ‘patches’ would likely have been further away from the campsite and have made transport of the entire carcass more difficult. Although, as mentioned, bones present in the archaeological context do not equate with meat use or how intensively a resource was relied upon. The presence of deer antler rack drying racks suggests jerky could have been produced. Meat from bison (or deer) could have been removed from the bones, thinly sliced, and then dried over thermal features.

Further studies on Rowe Valley could elucidate further the subsistence strategies of the inhabitants at Rowe Valley. There have been no studies on the botanical remains at Rowe Valley to date, hence a full evaluation of the plants that contributed to that breadth cannot be made. Studies on the plant present at the site might give more indications on the types of resources being exploited and if indeed Rowe Valley was a campsite focused on large mammal resources, or if resource exploitation was more evenly split between plants. A complete faunal analysis would assist in making these determinations; this thesis focused on large mammal use and it is known from some field records that turtle and other small mammals were present. Both further plant and animal research would shed light on the actual entirety of the breadth of diet Rowe Valley inhabitants really had.

Various studies on the lithic materials at Rowe Valley could further the interpretations, especially a use wear study on tools. Evidence for plant processing and butchery activities as well as hide processing would strengthen the interpretation that Rowe Valley evidences multiple economic strategies, reflecting a wide diet breadth. Further, if as is suspected, meat was being turned into jerky, a use wear study of the bifacial knives, might specifically lend evidence for this activity. If meat is being thinly cut and dried, this would suggest another manner of the inhabitants creating a food source that could be stored.

The change in lithic technology, appearance of pottery and occasionally of corn, suggests that a shift in economic strategies did take place during the Toyah period. The extent to which this was caused by, or related to bison, is not yet known, but it is clear bison was not the only economic strategy Toyah hunter-gatherers relied upon. Clearly, based on the large number of Toyah sites with large amounts of large mammal remains, there were locations where Toyah hunter-gatherers focused on hunting. The roots of an economic system with a heavier reliance on hunting and a lesser reliance on gathering were planted during the previous Austin Period. Although, an extensive review of other Toyah sites was not undertaken, evidence for a heavy reliance on large mammal hunting does not seem to occur at all Toyah sites. This study demonstrates that, although a new and distinctive artifact tool kit appears during Toyah, the economic strategies were still very much generalized and adapted to unique local environments.

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