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Food Processing and Cooking Technology of the Mimbres Mogollon (Early Pithouse Period through the Mimbres Classic A.D. 200-1130)

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FOOD PROCESSING AND COOKING TECHNOLOGY OF THE MIMBRES MOGOLLON (EARLY PITHOUSE PERIOD THROUGH THE MIMBRES CLASSIC A.D. 200-1130)

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ABSTRACT

This thesis examines food processing and cooking technology of the Mimbres Mogollon culture from A.D. 200-1130. Food processing and cooking technology includes any tool (chipped stone, ground stone, ceramics, basketry/perishables, etc.) or feature (fire-features, etc.) used to prepare, process, and cook food. Data on this technology as a whole is lacking in the region. The goal of this research is to document and explore the changes and developments in food-related technology over time and to investigate possible factors that influenced its development.

To document this technology over the course of approximately 1000 years, four case study sites were used: The McAnally site (Early Pithouse period, A.D. 200-550), the Harris Site (Late Pithouse period, A.D. 550-1000), and Galaz Ruin and NAN Ranch Ruin (Mimbres Classic period, A.D. 1000-1130). Ceramic, ground stone and fire-feature data from each site were gathered through a combination of personal analysis and published theses, dissertations, and site reports. Several changes occurred in material culture, architecture, and social organization during this time frame. Through documenting this technology, it was possible to further explore the relationship between larger organizational changes and those that occurred in food-related technology including tool types and location of features. By examining how various components of food processing and cooking technology changed over time within the region, more information may be understood regarding how the Mimbres people adapted to both changes in social organization and to their local environment.

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CHAPTER 1: INTRODUCTION

This thesis examines food processing and cooking technology of the Mimbres Mogollon culture, located in the Mimbres Valley of southwestern New Mexico, from the Early Pithouse through the Mimbres Classic periods (A.D. 200 – 1130). Food processing and cooking technology from domestic and extramural contexts from four sites are used to document the technology used by the Mimbres. These were the McAnally site (LA 12110), the Harris site (LA 1867), Galaz Ruin (LA 635), and NAN Ranch Ruin (LA 2465). The importance of studying this topic relates to the lack of available and accessible data on food-related technology in this area. Prior research on technology in the region has focused on decorated ceramics, architecture and agriculture, but little attention has been paid to food-related technology as a whole.

This research defines food processing and cooking technology (also referred to as food-related technology) as any tool or feature used to prepare, process, and cook food resources; these tools can be made from stone, clay, wood, and other organic materials. These include processing implements (ground stone and restricted chipped stone tools), cooking technology (pottery vessels and pottery cooking utensils), and cooking features (hearths and roasting pits). Chipped stone tools and basketry and other perishable materials are discussed when data are available.

The purpose of this thesis is to document food processing and cooking technology of the Mimbres Mogollon during specific time frames, discuss the changes that occurred, and investigate the various influences that may have affected this technology. In order to document and examine food processing and cooking technology two research questions are used to guide this thesis (Chapter 3).

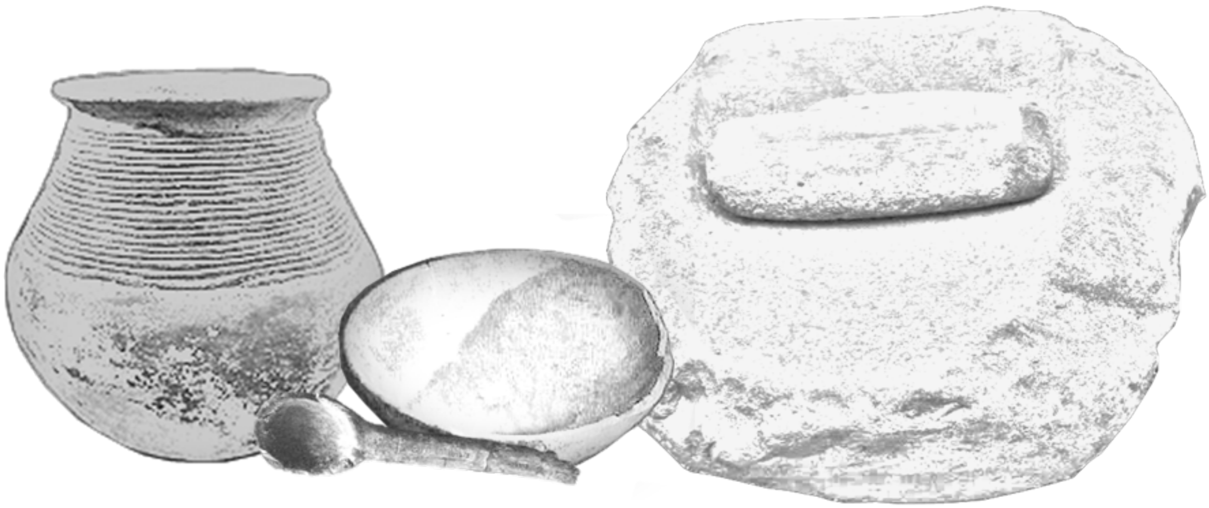

Figure 1.1 Examples of Food Processing and Cooking Technology.

(1) What types of food processing and cooking technology existed in the Mimbres Valley through the Early Pithouse, Late Pithouse, and Mimbres Classic Periods?

(2) Did any changes in food processing and cooking technology occur in the region over time?

The answers to these questions will provide a baseline of the food-related technology used by the Mimbres Mogollon and how it was changed over time.

Chapter 2 outlines the background information on the region, chronology, the case study sites, and previous research on food processing and cooking technology. The research questions and theoretical framework guiding this research are discussed in Chapter 3. Chapter 4 details the methodology used for artifact analysis and data gathering. Local food resource availability and potential food processing and cooking strategies are discussed in Chapter 5. Chapter 6 summarizes the results of the analysis by site. Chapter 7 addresses the research questions and overall conclusions.

Significance

This research examines food processing and cooking technology in the Mimbres region over the course of three time periods, A.D. 200-1130. Previous research on this form of technology as a whole is limited and tends to be focused on specific artifact types, i.e. decorated ceramics or ground stone. Furthermore, architectural features such as hearths and roasting pits have rarely been studied in the region. This research seeks to combine multiple forms of this technology that have sufficient evidence to provide a clearer understanding of the available food-related technology in the region.

While documenting food processing and cooking technology is important, studying changes and developments are significant when looking at the region as a whole. At this time there is little published research on changes in food-related technology in the area aside from various publications on pottery and ground stone that only hint at some of the developments. By examining how various components of food processing and cooking technology changed over time within the region, more information may be understood regarding how the Mimbres people adapted to their environment.

CHAPTER 2: BACKGROUND

The Mogollon culture encompasses portions of Arizona and New Mexico and extends into northern Mexico. Geographically, the Mogollon have been determined to have occupied a bounded area with the Little Colorado River to the north, the Verde River to the west, the Pecos River to the east, and the southern region extending into Mexico (Reid 2006). Due to both subtle and distinct differences, regional subgroups of the Mogollon have been identified. The Mimbres Mogollon are defined as a subgroup based on their geographic location and distinctive black-on-white decorated pottery (Wheat 1955). The Mimbres Mogollon are centered around and near the Mimbres and Gila Rivers in southwestern New Mexico and their riverine location makes the area prime for maize agriculture (Figure 2.1; Haury 1986).

Background

This chapter provides background information on the Mimbres Mogollon during the Early and Late Pithouse and Mimbres Classic periods (A.D. 200 -1130). The chronological framework and data on material culture, environment and subsistence, and social organization are discussed. Backgrounds of the archaeological sites to be used in this thesis also presented, along with previous research focusing on aspects of food processing and cooking technology.

Chronology and Material Culture

Around A.D. 200 archaic hunter gatherers in the region began to build permanent architectural features that are indicative of the transition from the Late Archaic period to the Early Pithouse period, A.D. 200-550 (Anyon et al. 1981; Diehl and LeBlanc 2001). This period is further marked by fundamental changes in material culture and settlement patterns. The Early Pithouse period is represented by oval and circular pithouses located on high knolls. Early

Pithouse villages tend to be isolated and found overlooking agricultural floodplains (Anyon et al. 1981; Hegmon 2002).

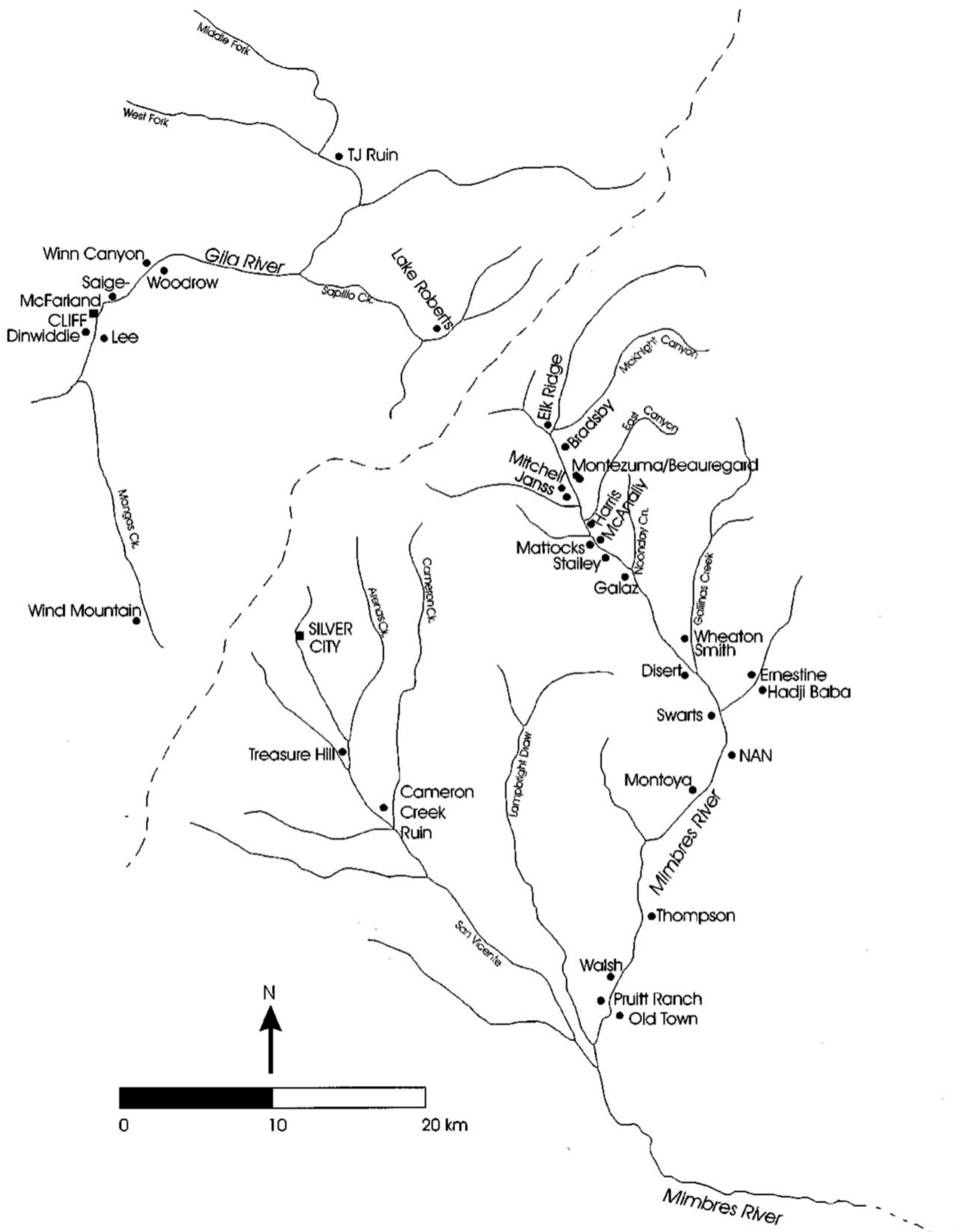

Figure 2.1 Map showing site locations along the Mimbres and Gila Rivers (Hegmon 2002:310).

Period	Dates (A.D.)	Architecture	Ceramics
Early Pithouse	200-550	Circular/oval pithouses located on high knolls and ridges	Plain or brown wares, fugitive red
Late Pithouse			
Georgetown	550-650	Circular and D-shaped pithouses; location change to river terraces	San Francisco Red
San Francisco	650-750	Rectangular pithouses with rounded corners	Mogollon red-on-brown
Three Circle	750-1000	Rectangular and square pithouses	Three Circle red-on-white, Style I and II black-on-white
Mimbres Classic	1000-1130	Cobble masonry pueblos	Mimbres Classic, Style III black-on-white

Table 2.1 Characteristics of Mimbres Mogollon Chronology (Anyon et al. 1981; Creel and Anyon 2003; Haury 1986; Reid 2006).

Communal structures, also referred to as kivas, are found during this period. While their exact function is speculative, they are referred to as communal structures because of the communal effort required in their construction and a public use suggested by their size (Anyon and LeBlanc 1980). Early communal structures are almost architecturally indistinguishable from domestic structures and may have functioned both in domestic and communal activities.

The transition to the Late Pithouse period is defined by a change in village location rather than a distinct change in material culture or architecture. The Late Pithouse period, A.D. 550-1000, saw a shift in settlement location from high knolls to first river terraces (Anyon et al. 1981; Haury 1986). This period is divided into three phases based on changes in decorated ceramics and architecture (Table 2.1). The first of these is the Georgetown phase, 550-650 A.D. During this phase plain wares continue and polished red-slipped wares appear; pithouses are either round or D-shaped and communal structures began to increase in size (Anyon and LeBlanc 1980; Anyon et al. 1981; Haury 1936a; 1986; LeBlanc 2006; Stokes and Roth 1999).

During the San Francisco phase, A.D. 650-750, the 'first' painted pottery is found, Mogollon red-on-brown; pithouses are square with rounded corners and communal structures remain round (Anyon et al. 1981; Haury 1986; LeBlanc 2006). During the Three Circle phase, A.D. 750-1000, pithouses are rectangular or square and in some instances are masonry lined (Stokes and Roth 1999). Three Circle red-on-white and Mimbres black-on-white Style I and II ceramic styles also appear (Anyon et al. 1981; Haury 1986). Communal structures continued to increase in size and some contain cobble masonry walling and distinct floor features (Anyon and LeBlanc 1980).

Around A.D. 1000 there is a sudden change in architecture from villages consisting of pithouse dwellings to cobble-walled masonry surface pueblos, marking the end of the Late Pithouse period and the beginning of the Mimbres Classic period, A.D. 1000-1130 (Anyon et al. 1981; Haury 1986). Changes in architecture are associated with an organizational shift and the introduction of Style III pottery has been associated with an ideological shift (Gilman et al 2014); little other significant changes have been noted in material culture between these time periods. Two forms of communal structures appear during this time frame: large surface rooms used by the village and semi-subterranean structures associated with separate room blocks (Anyon and LeBlanc 1980; Creel and Anyon 2003). Plazas increase in importance with similarities in functions of communal structures.

The time period after A.D. 1130/1150 has been referred to as a time of regional reorganization in which significant changes occurred and many sites were depopulated or abandoned (Hegmon et al. 1998, 1999). The Terminal Classic period in the Mimbres Valley refers to the time after A.D. 1130/1150 in which occupation occurred at some Mimbres Classic pueblos with changes in material culture. This is different than what occurs in the same time

frame in the Eastern Mimbres region, referred to as the Post-Classic period. Many of the large pueblo villages were depopulated; the location of settlements changed and there was an increase in residential mobility (Hegmon et al. 1998, 1999; Nelson 1999). The changes seen in the Eastern Mimbres region may have occurred later in the Mimbres Valley (Hegmon et al. 1999).

Environment and Subsistence

It is important to briefly introduce the different resources utilized by the Mimbres Mogollon, to be discussed further in a later chapter, that would have influenced the technology used to process them. The Mimbres Mogollon relied on hunted game, gathered plant resources, and cultivated crops. Some groups in the Mimbres were more mobile than others, with many sites occupied year-round and others seasonally, in part related to resource availability and agriculture (Swanson et al. 2012; Sanchez 1996). The river valleys in the Mimbres region were fertile and flooded annually keeping the soil rich in nutrients. The Mimbres took advantage of river terraces and used them as agricultural fields. This allowed for maize, in addition to beans and squash, to become staple resources in their diet. After A.D. 1000 the Mogollon not only practiced agriculture in floodplains, but also in the uplands (Minnis 1984). The moister and higher elevation environments are better suited for agriculture if soils are available, although frost would have been an element of concern.

Wild resources varied based on micro-environments in the Mimbres region. Petrean montane conifer forests, Great Basin conifer woodlands, and semi-desert grasslands make up the majority of this region (Diehl and LeBlanc 2001). Ponderosa pine, oak and juniper trees are found within the petrean montane conifer forests and ponderosa and piñon pine, juniper trees and a variety of cacti are located within the Great Basin conifer woodlands. The semi-desert grasslands are characterized by grasses, occasional juniper trees, and a large amount of shrubs

such as creosote, mormon tea, rabbit brush and saltbush (Diehl and LeBlanc 2001). Wolfberries, juniper berries, acorns, walnuts, and piñon nuts would have been gathered from local trees. Wild plant resources include box elder, buck wheat, buffalo gourd, cattails, chokecherry, duckweed, globe mallow, goosefoot, knotweed, mustard grasses, pigweed, piñon nuts, purslane, ragweed, sage, saltbush, sunflower, and thistle poppy. Cacti varieties found in this area include cholla, prickly pear, yucca, and in some cases agave (Diehl and LeBlanc 2001; Minnis 1984).

The Mimbres Mogollon hunted game in addition to what could be grown in agricultural fields or gathered nearby. Game found throughout the Mimbres region includes deer, elk, antelope, and rabbits. Coyotes, mountain sheep, rats and squirrels are also found in the northern Mimbres Valley (Diehl and LeBlanc 2001; Minnis 1984). The main animal resources relied upon by the Mimbres Mogollon were rabbit and deer. Jack and cottontail rabbit bones were amongst the most common fauna recovered along with mule and white-tail deer and pronghorn antelope (Cannon 2000; Diehl and LeBlanc 2001; Schollmeyer 2005). Bird and fish bones have also been recovered from deposits, but due to their fragility and decomposition rate, their availability and rate of consumption are not as clear. Over time the amount of large game recovered from faunal assemblages decreased. Cannon (2000) found evidence of this decrease over time and relates this to a decline in available resources due to human predation. Schollmeyer (2005) discusses a similar idea that suggests an increase in the consumption of small mammals and annual weeds over time.

Evidence suggests that by the Early Pithouse period the Mimbres population had already experimented with agriculture and these cultigens were a component of the diet (Crown 2000a; Minnis 1985a, 1985b). While their exact role in the diet is disputed, there is a general consensus for the cultivation of maize, beans and squash (Diehl and LeBlanc 2001; Hegmon 2002). Diehl

and LeBlanc (2001) argue for the use of two plant-based strategies. The first strategy involved agricultural plants including maize, beans and squash, and the second strategy targeted plants that provided large quantities of fruits, seeds and nuts.

LeBlanc (2006) argues that a change in settlement location at the beginning of the Early Pithouse period reflects a shift in subsistence strategies, where agriculture becomes more important in the diet, with a decrease in hunting and gathering. Over time the dependence on agriculture, and specifically maize, increases which is further marked by the introduction of a new maize variety, *maiz de ocho*, after 700 A.D. that produced easier to grind kernels for flour (Crown 2000a; Diehl 1996; Hegmon 2002). The movement of villages closer to farmable land at the beginning of the Late Pithouse period suggests an increasing reliance on agriculture, as well as an increase in population size (LeBlanc 2006; Stokes and Roth 1999). Indirect and direct evidence further indicates the increased consumption, and significant dietary contribution, of agricultural plants and domesticates during the Late Pithouse period (Diehl and LeBlanc 2001).

Social Organization

Early Pithouse villages were probably comprised of nuclear family groups represented by individual pithouses. Pithouse clusters, consisting of multiple pithouses facing each other or in close vicinity to one another and sharing similar architectural features and or material culture, appear during the Three Circle phase (Creel 2006; Roth 2015; Roth and Baustian 2015; Shafer 2003). These have been suggested to have been made up of family or kin-based corporate groups. Around this same time, 750/800 A.D., there was an increase in exchange and interaction between the Mimbres and Hohokam of southern Arizona as evidence by the increase in shell goods and appearance of stone palettes in the Mimbres region (Creel 2006; Shafer 2006).

Furthermore, the construction of irrigation networks occurs during this time frame and are considered to be a major influential factor in the formation of corporate groups and ties to land ownership (Creel 2006; Creel and Anyon 2003; Roth and Baustian 2015; Shafer 2006). The use of communal structures is seen as one way to integrate the village as a whole and create and solidify relationships outside of the family group. Courtyard corporate groups are established during the Mimbres Classic period where room blocks are contained within a walled compound with their own communal structure, separating them, to a degree, from the rest of the village (Creel and Anyon 2003). The purpose of village communal structures within an un-walled plaza functions to integrate the village community as a whole. Differentiation at the individual level also becomes apparent where specific burials are found in association with communal structures and contain abundant and rare offerings, such as those recovered at Old Town (Creel 2006; Shafer 2006).

Sites Used in this Study

The McAnally Site (LA 12110)

The McAnally site is located on the east side of the Mimbres River on a high knoll (Figure 2.2). A small portion of the site was excavated by the Mimbres Foundation in 1974. Excavations concentrated on locating cultural material in association with datable materials (Anyon et al. 2001). Very few Early Pithouse period sites have been excavated. The McAnally site is one of the only sites containing an Early Pithouse occupation in which recovered material was analyzed and reported (Diehl and LeBlanc 2001).

It has been estimated that the site contained approximately twelve pithouses, based on the observation of pithouse depressions. Mimbres Foundation excavations sampled four pithouses.

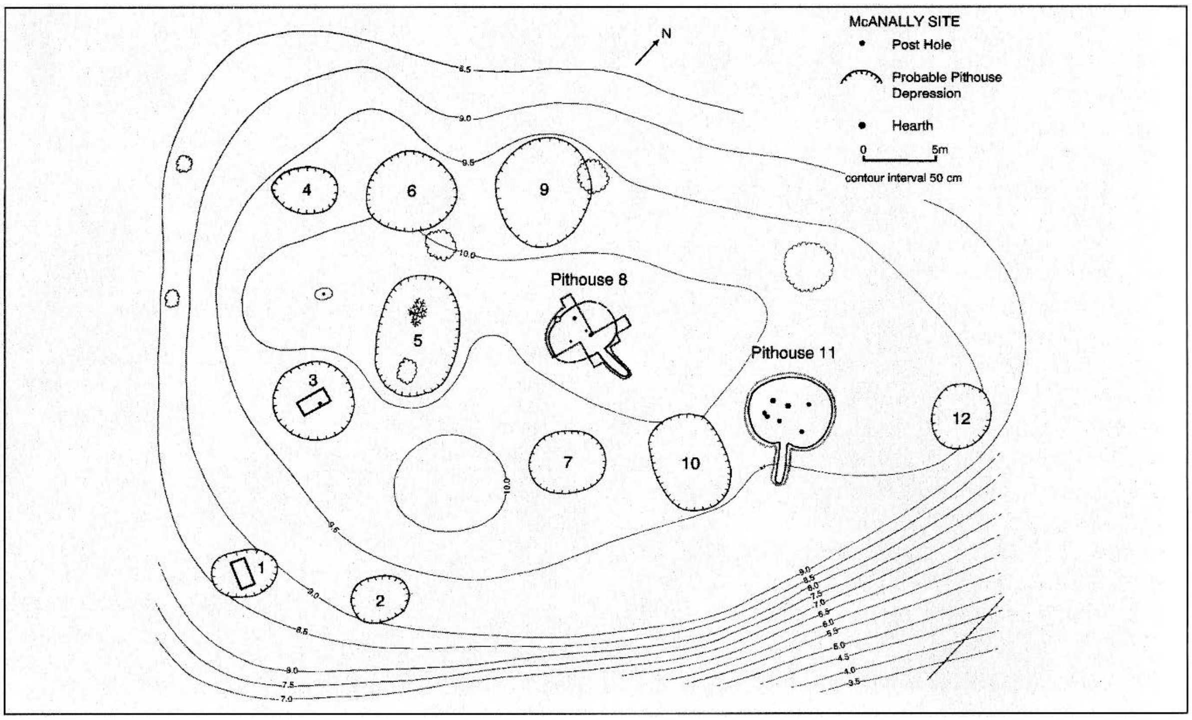

Figure 2.2 Site Plan for the McAnally Site, LA 12110 (Diehl and LeBlanc 2001).

Two pithouses, Units 1 and 3, were sampled with small test pits. One pithouse was partially excavated, Unit 8, and the other was completely excavated, Unit 11. Unit 8 was located in the approximate center of the site and Unit 11 was on the east side. Radiocarbon dates from the site indicate that it was occupied during the Early Pithouse period, during the sixth century A.D. (Anyon et al. 2001).

The Harris Site (LA 1867)

The first excavations at the Harris Site were conducted by Emil Haury in 1934. Haury excavated the southern portion of the site, totaling thirty-four structures, including three communal structures and several extramural areas (Haury 1936a, 1986). Information gathered from the Harris Site and Mogollon Village were used by Haury to define the Mogollon as a distinct culture group in the Southwest. The cultural material and data gathered from Haury's

excavation will not be used for this research, as information collected from later excavations will be the focus.

Further excavations at Harris began in 2005 and 2007, under the direction of Barbara Roth and UNLV, when test units were excavated in the northern portion of the site. Archaeological field schools were then conducted from 2008-2012; an additional short excavation season occurred in 2013 to complete unfinished structures (Roth 2015). Roth's excavations yielded twenty-one structures including five pairs of superimposed pithouses and part of a communal structure (Figure 2.3). Twenty burials and thirty-four extramural features were also excavated. The initial research questions guiding the project were in regard to household organization, specifically household organization during the Pithouse period and the relationship between household organization and subsistence and settlement strategies at the Harris Site (Roth 2015).

Pithouses from Roth's excavations were occupied during the Late Pithouse period from 550 to 1000 A.D. (Roth 2015). One pithouse was dated to the Georgetown phase, two to the San Francisco phase, and seventeen to the Three Circle phase, including a communal structure; one transitional structure was also excavated. Multiple plastered extramural activity surfaces and possible ramadas were also located in addition to three secondary occupation phases found in deposits above abandoned pithouses.

At Harris the household was the smallest component of social organization (Roth 2010a, 2015). The presence of five pithouse clusters indicated extended family corporate groups (Creel 2006; Roth and Baustian 2015; Shafer 2003, 2006). The pithouse clusters were defined from shared artifactual and architectural characteristics combined with their positioning around shared work surfaces. Other pithouses were considered autonomous households. Data from communal

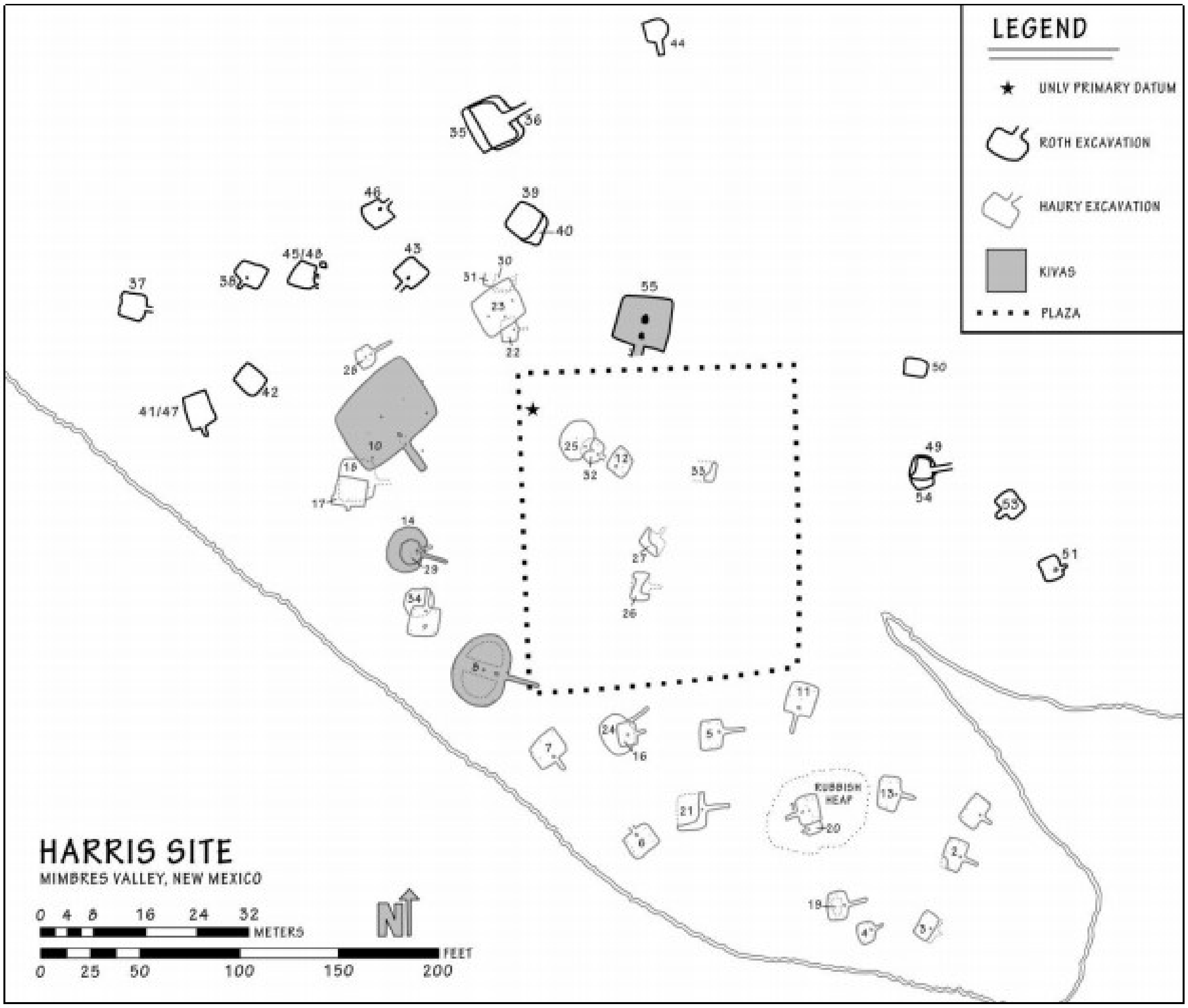

Figure 2.3 Plan Map of the Harris Site, LA 1867 (Roth 2015).

structures suggest that these structures and associated plazas played significant roles in village integration (Roth and Baustian 2015). Changes in social organization at Harris have been correlated with changes in sedentism and agricultural intensification (Roth 2015). Harris was abandoned at the end of the Late Pithouse period. This abandonment is further supported by the lack of Mimbres Classic surface rooms built above the underlying pithouse structures.

Galaz Ruin (LA 635)

Galaz Ruin is a large pueblo with several room blocks and an underlying pithouse component; it is located on the first river terrace, along the west side of the Mimbres River (Figure 2.4). Galaz has been excavated by multiple teams, each with different excavation and collection strategies and project goals. Therefore, some of the information regarding excavations has been lost. The first excavations conducted at Galaz Ruin were undertaken by the Southwest Museum in 1927. Detailed information was not available from these excavations, but it appeared that excavations took place in the northern portion of the pueblo. Fifteen surface rooms were uncovered, some of which revealed multiple lower floors; four pithouses were also uncovered beneath the surface rooms (Anyon and LeBlanc 1984).

Subsequent excavations occurred between 1929-1931 under Albert E. Jenks and the University of Minnesota. It appears that the goal of excavations was to assemble a large collection of ceramics, specifically Mimbres Classic Black-on-white bowls. Although this was the aim, it should not discredit the project or its excavations; detailed notes were taken on architectural and cultural materials, burials, and locations and types of vessels (Anyon and LeBlanc 1984). At the end of Jenks' excavations, the University of Minnesota had excavated 70 structures, including 2 ceremonial structures, over 500 ceramic vessels, and approximately 451 burials (Anyon and LeBlanc 1984). Part of the artifacts collected from the excavations were curated at the University of Minnesota; a portion of the collection, including numerous ceramic vessels are unaccounted for. It appears that data on ceramic vessels had been collected prior to the mysterious disappearance of part of the collection, which presumably had been promised to wealthy businessmen who had provided Jenk's funding for Galaz excavations (Dobbs 1999; King 2011). Some of the vessels have been located within numerous museums distributed throughout the Midwestern United States.

The last and most recent excavations at Galaz were conducted by the Mimbres Foundation from 1975-1976. Prior to Mimbres Foundation excavations the land owner had bulldozed the surface pueblo in response to violent pothunters who had been trespassing on private property (Anyon and LeBlanc 1984). Due to bulldozing, no indicators of surface structures could be located. As an alternative, excavators concentrated on uncovering pithouse structures within 18 backhoe trenches that were placed surrounding the edges of the bulldozed area. Sixteen pithouses and one ceremonial structure dating to the Late Pithouse period and one Mimbres Classic surface room were recovered by the Mimbres Foundation excavations (Anyon and LeBlanc 1984).

Five room clusters with Mimbres Classic occupations were explored by all of these

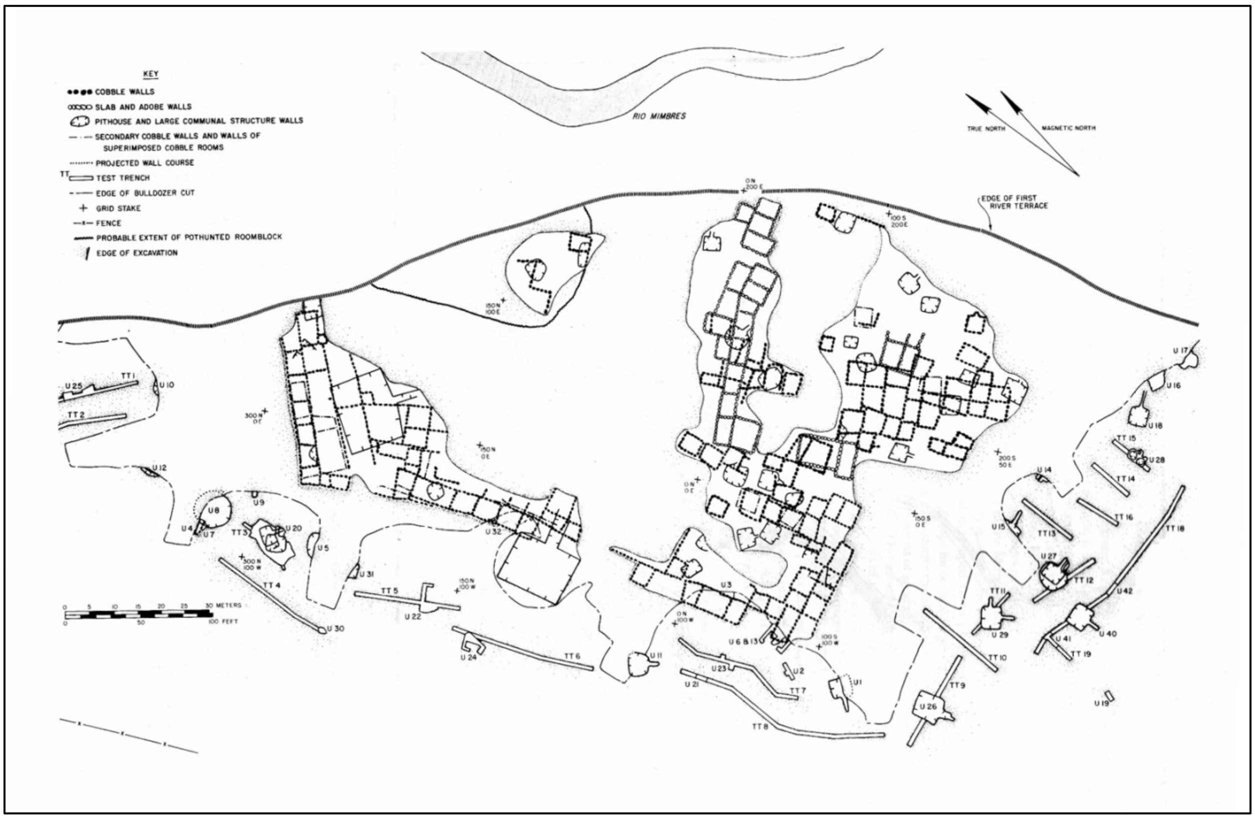

Figure 2.4 Site plan for Galaz Ruin, LA 635 (Anyon and LeBlanc 1984).

excavations: the south, west, north, northeast, and east room clusters. The South room cluster appears to be a large group of approximately 26 continuous rooms. One room was defined as isolated and two more as possibly isolated, but the area outside of the room walls had not been excavated (Anyon and LeBlanc 1984). One communal structure and a possible communal room were also found in the South room cluster. The West room cluster was made up of three room groups with four, thirteen, and fifteen rooms, respectively. Four other isolated rooms were found as well as extramural areas around the edge of the cluster (Anyon and LeBlanc 1984).

Excavations of the North room cluster were conducted by the Southwest Museum and the University of Minnesota and a lot of confusion was found in the notes pertaining to this cluster. Data indicates approximately 34 rooms in which a potential walled plaza area separated 15 rooms from another 19 (Anyon and LeBlanc 1984). The Northeast room cluster was heavily damaged by looters prior to the arrival of the University of Minnesota. Therefore, their excavations did not focus on this room cluster and only one complete and three partial Mimbres Classic rooms were excavated. The East room cluster contained 18 Mimbres Classic rooms that were superimposed by post-classic rooms and an associated activity surface (Anyon and LeBlanc 1984). Galaz Ruin will be used for data associated with the Mimbres Classic period. Architectural and cultural material data from University of Minnesota excavations contains the greatest amount of information regarding this time frame.

NAN Ranch Ruin (LA 2465)

NAN Ranch Ruin is located on the second terrace on the east side of the Mimbres River. Occupation at NAN Ranch spans from approximately A.D. 600 to 1140 (Shafer 2003). Harry Shafer (2003) has described the site as containing at least five Classic period room clusters within room blocks, situated above a pithouse village. The South room block, a portion of the

East and West room blocks, and the East and West plaza areas have been excavated at NAN Ranch (Figure 2.5).

Architectural and cultural material from the Mimbres Classic period occupation of NAN Ranch will be the focus of this research. More than 18 Mimbres Classic period surface and transitional rooms have been excavated at NAN. It is estimated that between 75 and 100

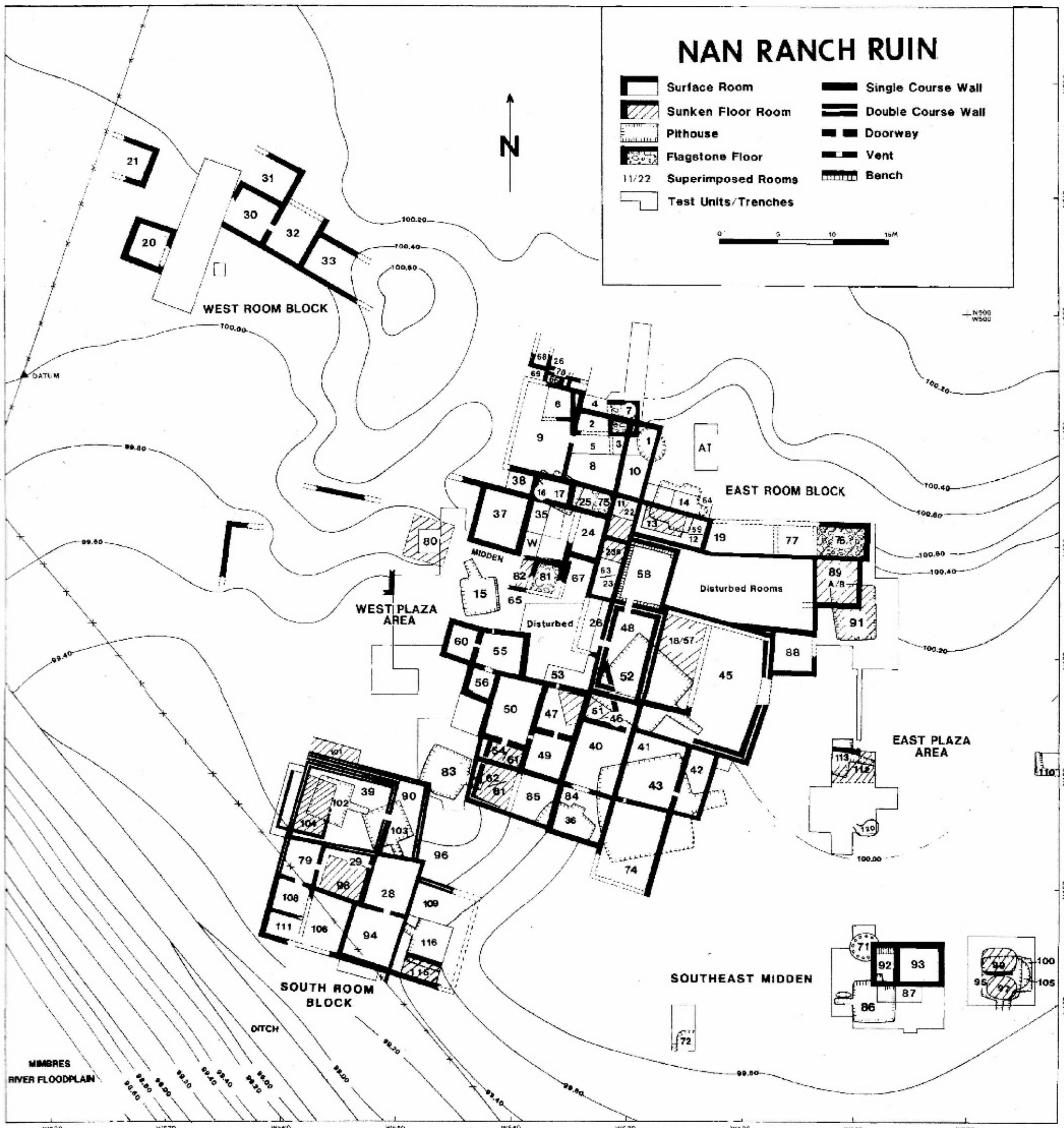

Figure 2.5 NAN Ranch Ruin Site Map, LA 2465 (Shafer 2003).

pithouses underlay the surface rooms. One Georgetown phase pithouse, four San Francisco phase pithouses, and 15 Three Circle phase structures, two of which were classified as ceremonial structures, were also excavated (Shafer 2003). An additional 24 transitional structures dated to Late Three Circle phase were also found.

Small excavation projects took place at NAN Ranch during the early 1900s. Two rooms in the east block were excavated by Virginia Wunder, an avocational archaeologist (Shafer 2003). In 1926, Harriet and C. B. Cosgrove excavated approximately nine rooms, 53 burials, and recovered an estimated 50 ceramic vessels. No maps were drawn by the Cosgroves' but it has been postulated that these rooms were located in the northeast part of the East room block. During the years prior to the Cosgroves' excavation and up until the 1970s, parts of the site have been looted (Shafer 2003).

Texas A&M University, under the direction of Harry Shafer, conducted field schools from 1978-1989, and additional volunteer seasons in 1990, 1991, and 1996. Shafer (2003) describes NAN Ranch architecture as comprised of four tiers of community structure. The first tier is defined as single households represented by one attached room and a suite of two unattached rooms. The second tier was defined as lineage households which were characteristic of the South room block. This room block was comprised of eleven rooms and is also considered the household of a corporate group. Building phases of superimposed structures indicate changes in the block are representative of the same lineage occupying the room block since the Three Circle phase (Shafer 2003).

The East and West room blocks represent the third tier, defined as aggregated multi-household units. These room blocks contain multiple corporate residential units. Within the East

room block domestic units, four corporate ceremonial structures, granaries, and civic-ceremonial rooms were located. These three tiers combined with extramural courtyard and plazas areas described by Shafer (2003) were part of a larger fourth tier representing the NAN Ranch site community.

Research Background

Little research has been published on food processing and cooking technology in the Southwest region that examines all forms of this technology. Several scholars have done research on specific forms of food-related technology such as pottery or grinding technology (Adams 1993, 1996, 1999; Crown and Wills 1995; Hard et al. 1996), but only a few have looked at other forms of this technology and even fewer have studied it in its entirety.

Ground Stone Technology

A number of scholars who have researched specific food technologies have equated some of the developments in this technology to environmental and societal changes. Diehl (1996) discusses the increase in the production of maize during the Early and Late Pithouse periods in the Upland Mogollon region as it relates to ground stone morphology. Diehl writes that the cultivation of maize directly relates to the type of technology produced for processing it. Changes are exhibited in ground stone by an increase in surface area of manos and an increase in the use of trough metates from basin metates over time due to an increased reliance on maize. This information indicated a correlation between agriculture and increased tool efficiency and production (Diehl 1996). Similarly, Mauldin (1993) and Hard et al. (1996) argue that mano size, the number of grinding surfaces, and the types of metates relate to agricultural intensification and dependence, and indicate that mano size reflects the amount of grain being processed. Mauldin

uses this information to suggest less dependence on agriculture in the Early Pithouse period in the Pine Lawn Valley and an increase during the Late Pithouse period. The authors mention that other factors may play a role in changes in ground stone technology, but argue that the degree of dependence on agriculture is the main factor influencing it.

Research by Adams (1993, 1996, 1999) challenges these theories, indicating that agriculture is not the only factor or even the primary factor influencing changes in grinding technology. Adams (1993) discusses the development of food processing tools and improvements in technology as related to several factors including grinding efficiency and intensity, and control of tool wear. These factors implemented as technological improvements in mano-metate sets can be beneficial to the user by providing less stress and lower energy. The importance of Adams' article to food processing technology is the relationship between efficiency and tool improvements. These changes also have important behavioral implications due to the effect they had on labor, time, scheduling, energy, and stress reduction to the body (Adams 1993, 1999). Adams (1989) also argues that changes in ground stone tool morphology can echo different processing techniques as experiments have determined that certain types of metates are better suited for specific types of corn. Therefore, depending on metate variation, there is cause to examine not only development and stress-related changes, but also design and food recipe-related changes.

Pottery

The reasons for the production and development of pottery vessels are discussed by Crown and Wills (1995). Cooking was originally performed using baskets, but over time with increased reliance on agriculture and the need for different processing techniques, new technology was needed for better heating and additional nutrition properties (Pierce 2005; Rice

1987; Schiffer 1990). The authors list several possible explanations for the development of ceramic technology including the introduction of new maize types and a method that enables long-term boiling of beans (Crown and Wills 1995:251).

Since their introduction to the Mogollon region after A.D. 200, changes in pottery form have suggested improvements for cooking and storage. The introduction of a coil method, the addition of corrugation to vessels, and smudging to reduce absorption and allow for better efficiency of heat transfer are proposed modifications (Crown 2000a:254). It is likely that the need to store more food was a factor in the development of different pottery sizes and that a more sedentary lifestyle required increased storage capacity (Crown 2000a). The majority of research on pottery in this region tends to focus on the development of decorated ceramic styles rather than on the vessels used for storing, processing and cooking food.

Cooking Features

Roasting pits and indoor and outdoor fire pits or hearths are the main features associated with cooking food. Typically roasting pits and outdoor pits are associated with roasting meat and some boiling, and indoor pits are used for boiling foods and providing heat (Lowell 1995). Cooking features, like ground stone and pottery, show an increase in the number of feature types and sizes over time, and fuel conservation has been promoted as one reason for this variability (Crown 2000a).

One of the few reports that discusses fire features in detail describes feature form and function. Lowell (1995) compares fire features from two sites in the Grasshopper region of Arizona, and defines four different fire feature types. Circular clay-lined and rectangular slab-lined hearths are defined as cooking features that are believed to have been used for different

food cooking techniques due to shape and the typical presence of associated food grinding tools near rectangular slab-lined hearths. Circular unlined hearths differ significantly in function and are believed to mainly serve as sources of heat and light. The last type was defined as roasting pits likely used for roasting meats or heating stones (Lowell 1995). These data reveal some of the first defined fire-features, providing a look at feature variability relating to cooking function.

During the Early Pithouse period the majority of hearths were ephemeral and informal; these consisted of ash deposits on the floor as a result of building fires directly on pithouse floors (Diehl 1997; Diehl and LeBlanc 2001; Shafer 2003). Simple basin hearths, which were dug into the floor, became the most common hearth form during the Late Pithouse period, where a trend towards the construction of more formal hearths has been noted (Anyon and LeBlanc 1984; Diehl 1997). Around 650 A.D., during the San Francisco phase, circular adobe-lined hearths became common (Anyon and LeBlanc 1984; Shafer 2003; Woosley and McIntyre 1996). Only after the onset of the Three Circle phase do we see the construction of rectangular slab and adobe-lined hearths (Anyon and LeBlanc 1984:94; Shafer 2003:59-62). Circular cobble-lined hearths appear late in the Mimbres Classic period as do rectangular slab-lined hearths adjacent to floor vaults (Shafer 2003).

Few arguments have been made in discussing why fire-features changed over time. It is plausible to suggest that fire-features may change in conjunction with changes in architecture, although these changes do not always coincide with one another. Diehl (1997) argues that the formality of hearth construction in combination with other changes in architecture was related to the intended use-lives of structures. The increase in more formal fire-features over time may indicate longer-term occupations of structures (Diehl 1997; Diehl and LeBlanc 2001).

Summary

The Mimbres Mogollon culture occupied the Mimbres Valley for almost a thousand years, during which time local resources dwindled and their population grew. This time frame also witnessed new technologies and changes in social organization that further affected the growing population. An important aspect of the daily lives of the Mimbres people would have involved planning and determining solutions in regard to how to supply their families and communities with food, especially in the harsher winter months. One of the ways the Mimbres coped with this problem, as local resources became scarce and their villages grew, was to invest more labor into agriculture and produce a higher yield of crops. Certain foods required different processing and cooking methods that may have been more labor intensive, such as maize, but became necessary in order to sustain the population when local wild resources alone were no longer capable of supporting them. Food processing and cooking technology were significant tools used by prehistoric peoples to make their food more nutritious and to process them in a way to provide surplus that could be stored.

Previous research on food processing and cooking technology as a whole is scarce, and tends to be focused on particular artifact types such as decorated ceramics or ground stone. Likewise, architectural features such as hearths and roasting pits have rarely been studied in the region. This research will be combining multiple forms of this technology to provide a clearer understanding of the available food-related technology in the region. Further, by examining how various components of food processing and cooking technology changed over time within the region, more information may be available regarding how the Mimbres people adapted to their environment.

CHAPTER 3: RESEARCH DESIGN

The purpose of this chapter is to discuss the questions that guided this research and the theoretical position undertaken to better comprehend how food processing and cooking technology were used in daily life and modified to meet changing demands.

Research Questions

Two research questions were developed with the goal of documenting food processing and cooking technology of the Mimbres Mogollon during specific time frames, the changes that occurred in these technologies overtime, and the various influences that may have affected these technologies. The questions addressed by this research are discussed below.

1) What types of food processing and cooking technology existed in the Mimbres Valley through the Early Pithouse, Late Pithouse, and Mimbres Classic Periods?

This question is meant to document food processing and cooking technology present in the Mimbres area during these time periods, both describing what forms of technology were present and how they may have changed over time, including the removal, addition and modification of specific technologies. Food processing, preparation and cooking technology were identified using four case studies with sufficient data, one from the Early and Late Pithouse periods and two from the Mimbres Classic period; these are McAnally, Harris, Galaz, and NAN Ranch.

In order to address this question site data were be collected from site reports and the facility where the site materials were curated. Other research was included from scholars who have discussed developments in various forms of food-related technology. The data needed to address this question include reports on ceramics including whole, partial, and reconstructed

vessels, and ceramics spoons and ladles, as well as ground stone used in food processing and cooking. The specific contexts that were focused on include roof assemblages, house floors, and extramural features where food processing occurred. Architectural information regarding food processing and cooking features were used, as well as any artifacts associated with these features. Macro-botanical and faunal data were incorporated for understanding of the exact foods being utilized.

Although chipped stone tools were part of food preparation technology, due to the variability of types and multi-purpose use of chipped stone tools, only specialized stone tools and ones in association with food processing and cooking features were used in this research. Furthermore, perishable materials such as wooden bowls and stirring implements, fiber baskets, trays and miscellaneous tools, rarely survive in the area of research due to environmental factors. Therefore, data regarding perishable materials was not included in this research project.

2) Did any changes in food processing and cooking technology occur in the region over time?

This question sought to examine if changes in food-related technology from the Early Pithouse Period through the Mimbres Classic Period occurred throughout the region. Once food-related technology was documented, it was possible to explore other sites in the region for similar technologies. This information was used to determine whether or not food processing and cooking technology remained stable over time.

In order to address this, the technology found at the sites used as case studies was compared with food-related technology at other sites occupied during the same time periods in the Mimbres region using site reports and other site publications. Similar environments and

access to the same resources should result in the use of similar food-related technology. Variances in the types of food-related technology between nearby sites may have been caused by other variables that affected technological development. The plausible factors to have been related to changes and differences in food-related technology were further investigated to examine their roles and significance.

Theoretical Framework

In order to understand the development of food processing and cooking technology, it is necessary to form a theoretical framework to address the research design. This research examines technology produced by people and therefore the role of individuals is instrumental in understanding how food processing and cooking technology were manufactured and used. Practice theory and technological style address the relationship between people and technology in a way that lays the foundation for which technologies can be further modified by individuals.

Practice Theory and Technological Style

Practice theory is important in this research because the questions posed examine human modifications in technology and can be used in understanding the relationship between individuals and changes in food processing and cooking technology. Practice theory seeks to understand the relationship between a human action and the system (Bourdieu 1977; Dobres and Hoffman 1994; Ortner 1984). Another way to view this is the relationship between daily activities and the social system, such as daily food production. This describes how individuals are able to affect and change aspects of their lives including the various technologies they use every day. When manufacturing food processing and cooking technology, individuals choose which material to use, what type of tool was going to be created, and how, if any, modifications

were going to be made. In this regard individuals are active participants (Johnson 2010). Those individuals who were manufacturing food-related technology and using it to process foods were part of a system in which a daily labor of food processing and cooking activities occurred.

This research utilizes technological style to address the manufacture and use of the tools defined as food processing and cooking technology. Technological style is concerned with how an object is made and refers to the sequence of steps carried out in its manufacture, also referred to as *chaîne opératoire* (Dietler and Herbich 1987; Sackett 1977). Technological style is learned through practice and interaction with others (Hegmon et al. 2000). This refers to what Bourdieu (1977) describes as *habitus*. *Habitus*, in relation to this research, refers to the structure or history behind how a technology is designed, which is taught to later generations. *Habitus* functions within a broader system of human action that interacts with daily processing and cooking activities.

The specific ways different manufacturing processes, such as pottery or stone tool manufacture, are taught become embedded and unconscious practices or rules for creating specific objects that are formed through *habitus* (Dietler and Herbich 1987; Schiffer and Skibo 1987; Stark 1998). Practice theory, technological style, and *habitus* are entwined within learning frameworks. Learning or teaching frameworks are the basis for how individuals learn specific behaviors and patterns for both technology and social spheres; these are typically learned at the family and community level as documented ethnographically (Adams 2010, 2014; Hegmon 1992, 1998; Schiffer and Skibo 1987).

This identifies what Adams (2010) refers to as technological identity. Technological identity is seen through certain practices and behaviors that create an object manufactured based

on a specific learning framework (Adams 2010; Hegmon 1998; Schiffer and Skibo 1987). The rules that underlie the manufacturing processes of different objects are unconscious practices that are formed through habitus and create the technological style of the tool. Different manufacturing processes demonstrate different ways of learning and potentially different cultures.

Objects that follow, but differ slightly from the identified learning framework may indicate that other factors were present that may have influenced these differences. A manufacturing process that diverges from the norm may also indicate another instrumental aspect of this process, the individual creating this tool. Trial and error, mistakes, experimentation, emulation, outside influence, changes in tools to meet new demands, and personal style and preference reflect choices made by actors demonstrating their individual agency (Adams 2010; Dietler and Herbich 1998; Schiffer and Skibo 1987).

Applications to Food Processing and Cooking Technology

Mimbres Mogollon food processing and cooking technology should reveal a shared learning framework based on the embedded and unconscious practices formed through *habitus*. Cooking and food processing strategies are composed of systems of behaviors and techniques that are taught (Stark 1998). The act, or practice, of creating and modifying food processing and cooking technology exists on a foundation of prior knowledge (Adams 2010; Bourdieu 1977).

The manufacturing process of each tool had to be learned individually; not only the specific steps to take, but how to correct for errors during manufacture and how to use the object once it was completed. Differences in raw material types, tool sizes, and tool function would also have to be taken into account. The use of poor and good quality raw materials and specific

manufacturing procedures are both taught and learned through trial and error. Therefore, learning frameworks can be used to understand the teaching processes involved in how ceramics, ground stone, and fire-feature technologies were learned and replicated. Similarities in the manufacture and use of ceramic vessels, ground stone, and fire-features over time may indicate a shared framework for making and using these technologies. Differences in manufacturing processes may reveal other factors, such as experimentation, external influences, or changes in labor demands, but also the agency of individuals during manufacture.

Part of this project involved investigating possible factors responsible for changes or developments in food processing and cooking technology. Scholars have suggested that some changes in technology may have been the result of making tools more efficient; new tool forms were created to save time and energy while putting more effort into processing food (Crown and Wills 1995; Crown 2000a). Adams (1993) discusses the role of individuals in the modification of food grinding tools in the selection of material, shape of the tool and the choice to modify the tool, such as the inclusion of finger grooves for better handling of tools. Further, food processing strategies and cooking techniques may also affect the tool type, the raw material, and size of the tool used (Adams 1999, 2010).

Summary

This thesis addressed the availability and use of food processing and cooking technology from the Early Pithouse through Mimbres Classic periods, what, if any, changes and/or modifications occurred overtime, and what factors may have influenced these changes. To understand why technology changes, it is necessary to understand the behavior of those creating the tools. These behaviors can be identified by examining how a tool was manufactured, or its

associated technological identity. Human behavior performed through individual actors can aid in understanding technology and technological change when examined through practice theory and technological style, which were important when discussing the changes in food-related technology over time.

CHAPTER 4: METHODS

This chapter describes the methods used to address the research questions. Site and data reports, museum collections, and research on food processing and cooking technology were used to document food-related technology and the changes that occurred over time. To address the question of food-related technology, a site from each time period was used as a case study (Table 4.1). The Early Pithouse Period was studied using the McAnally site (Diehl and LeBlanc 2001); this collection is curated at the Maxwell Museum of Anthropology at UNM. The Harris Site, located north of the McAnally site, was used for the Late Pithouse Period. This collection is currently held at UNLV. South of these sites is NAN Ranch (Shafer 2003) which was used as a case study for the Mimbres Classic period. This collection is curated at the WNMU museum. Due to the inaccessibility of the NAN Ranch collection at this time, material from NAN published in reports and theses was used in conjunction with data from a second Mimbres Classic site, Galaz Ruin, also curated in part at the Maxwell Museum; the rest of the collection is curated at the University of Minnesota. Other sites occupied during these time periods were used to provide supplemental data.

SITE	**PERIOD**	**CURATION LOCATION**
McAnally Site (LA 12110)	Early Pithouse	Maxwell Museum
The Harris Site (LA 1867)	Late Pithouse	UNLV To be curated at the Maxwell Museum
Galaz Ruin (LA 635)	Mimbres Classic	Maxwell Museum University of Minnestoa
NAN Ranch (LA 2465)	Mimbres Classic	Western New Mexico University Museum

Table 4.1 Table listing the sites used, the occupation span of focus for this research, and the location of the collections.

Sample Contexts

Several different strata were used to define contexts at each of the four sites as a result of varying excavation techniques and different primary investigators. Contexts were sampled in order to be able to associate artifacts and features with a specific room, feature, or activity area and thus be able to assign them to a specific occupation. Ground stone and ceramic vessels were sampled from roof contexts of pithouses and pueblos, pithouse fill, floor fill and floors of pithouses and pueblos, floor features, and extramural features. Cultural fill, also referred to as trash fill, was not studied as part of this research due to unknown contexts, as cultural fill is deposited after underlying structures are abandoned and used as trash middens; cultural material can also be deposited by flooding and other naturally-occurring processes.

The available contexts for study from each site varied slightly. Artifacts and features from strata at the McAnally site were roof fall/wall fall, pithouse fill, and floor. Strata from the Harris site were roof fall/wall fall, pithouse fill, floor fill, floor, floor features, and extramural features. Strata from floor, floor features, and extramural features were sampled from Galaz Ruin. Sampled strata from NAN Ranch were roof fall, room fill, floor, floor features, and extramural features.

Pithouse structures were intentionally dismantled and burned, or ritually retired, or they were abandoned and left to deteriorate and collapse on their own, as found at the Harris site (Lauzon and Roth 2014; Roth 2015). Roof fall/wall fall contexts are a result of the roof and walls of a structure collapsing and may include adobe and other building materials. Roofs of structures have been found to be significant contexts because evidence indicates roofs were used as work surfaces and for storage (Lauzon and Roth 2014; Roth 2010b). In cases where structures were abandoned and left open to the elements, an additional level of pithouse fill was present. This fill

represents a mixture of artifacts left at the time of abandonment, trash disposed of within the structure, and colluvial deposits that were washed in (Roth 2015). While this fill represents multiple contexts, some of the cultural material may have been associated with the structure and it was therefore included in this sample from the McAnally and Harris site excavations as well as at NAN Ranch, but as room fill rather than pithouse fill.

Floor fill, floor, and floor feature fill represent contexts directly associated with the occupation span of the household and typically only represent what items were left at the time of abandonment. At Harris, the material recovered from approximately 10 cm above the floor of a structure are defined as floor fill (Roth 2015); floor contexts indicate that artifacts were situated directly on the floor. Floor feature fill consists of the fill found within features located on the floors and include hearths, center post holes, post holes, and storage pits. Extramural feature fill is associated with work surfaces and activity areas found outside of the household and were typically shared by one or more households (Lauzon and Roth 2014; Roth 2015; Shafer 2003).

Analysis Methods

The data used to document ground stone, ceramics, and cooking features used in food processing and cooking were gathered from multiple sources. Since not all of the artifacts were curated and/or accessible, personal analysis of all of the artifact types was impossible. Data from the McAnally site, Harris site, Galaz Ruin, and NAN Ranch have been published in site reports and written as unpublished theses (Anyon and LeBlanc 1984; Diehl and LeBlanc 2001; Falvey 2014; Lyle 1996; McCollum 1992; Romero 2014; Rose 2004; Roth 2015; Shafer 2003). Many of these sources published data on their analyses of artifacts from the case study sites. These data were used as substitutes for attribute information on specific artifacts that were part of the sample assemblage.

A sample of the collections was analyzed from the McAnally and Galaz sites at the Maxwell Museum. Curated artifacts were sampled based on context and condition, as concluded based on a combination of museum records, site data, and personal analysis. A significant portion of the ground stone from Galaz Ruin was not curated. Artifacts from the Harris site were more accessible and were available for a longer period of study. This allowed for a more intensive analysis and personal examination of many artifacts in the sample assemblage.

Ground Stone Artifacts

The ground stone artifacts used in this study include those categorized as food-related tools, those with evidence of grinding and impact for crushing, and those with evidence of fire exposure. Evidence of grinding and crushing may correlate to the use of the tool for processing foods; fire-exposure may indicate the artifact was used during the cooking process. The types of food-related ground stone analyzed included manos, metates, mortars, and pestles. Ground stone that is whole and more than half complete was analyzed, as long as the function could be determined. The function of the ground stone in conjunction with form and amount of wear was important in establishing its role in food processing. Also of significance is context, because ground stone was sometimes reused and/or recycled for other purposes. Artifacts originally used and/or reused as food production tools were analyzed unless their current condition made attributes indeterminable.

Manos and metates are specialized grinding tools used in processing grain into flour, especially maize in the southwestern Unites States. Manos and metates were documented by these types, which develop through time and allow for different grinding efficiency and intensity (Adams 1996). There are three main design types of metates: Basin, flat/concave, and trough. Manos have been consistently classified as basin, flat/concave, or trough manos to associate their

use against a specific metate form, rather than by their own features. The surface use wear on one tool is reflected on the other because the mano is used against the metate and each retain particular use wear patterns (Adams 1996).

Basin metates are characterized by circular depressions, or basins, that were intentionally formed. Basin manos are used against a metate in circular and reciprocal strokes; these strokes leave unique wear facets on both the mano and metate surfaces. Wear facets should be present on some areas of the mano's ends and edges; multilinear striations should also be present on both the mano and metate surface (Adams 1996, 2002, 2014). Flat/Concave metates refer to metates that were originally flat, but because a mano with a shorter width than that of the metate was used against its surface, the flat metate becomes concave and the mano convex. These metates are differentiated from basin metates through the intentional shaping of basin metates and the use of smaller, rounder basin manos. Flat/concave use multiple strokes when worked against a metate. Wear facets form on the proximal and distal edges of the mano when it is used in a rocking, reciprocal motion against the metate so that pressure is exerted more heavily in one direction and the mano comes into direct contact with the metate, without grain between the two surfaces.

Trough metates have been intentionally chipped and pecked to exhibit borders and form a rectangular grinding surface. This creates a contained grinding area that restricts manos to reciprocal strokes and control grain spillage. Wear facets form on the ends of trough manos from grinding against the interior sides of the trough borders. As these borders wear down the grinding surface on the metate narrows and the mano surface shortens. Trough metates can be maintained by resharpening, or rewidening, the trough metate borders and replacing the mano with a longer one (Adams 2002, 2014). There are multiple styles classified as trough metates; these are the ¾

trough, Utah trough, and open or though-trough metate. ¾ trough metates are characterized by borders on both sides and on one end, whereas through-trough metates are open on both ends. Utah trough metates are ¾ trough metates with mano rests; these are defined as slight to deep depressions manufactured on the closed end of the metate which represent a specific holding area to place the mano associated with a particular metate (Adams 1996, 2002, 2014).

While manos and metates are classified as food processing tools, mortars and pestles are generally considered general processing tools that may include both food and non-food resources. Mortars may appear in multiple sizes that share an intentionally manufactured basin to be used with a pestle for crushing, stirring, and pounding. Boulder mortars are manufactured in large stones, that while are able to be moved short distances, were too large to transport. Pebble mortars are smaller in size and used to process smaller amounts of resources. Pestles are hand stones used to crush and grind items. Both mortars and pestles may have also been made of wood and although they rarely survive in the archaeological record, if a wood mortar is paired with a stone pestle, or vice versa, the stone object would have rounded grains from being worked against a softer material. Use wear in the basins of mortars reflects the types of processing carried out. Deep and jagged impact fractures are a result of pounding a pestle into the mortar basin in comparison to smaller impact fractures caused by crushing motions. Striations along the fractures and basin interior reflect stirring motions.

Ground Stone Attributes

Analysis attributes and morphological characteristics of ground stone tools used in this study followed Adams' (1996, 2002, 2014) methodology. A list of the attributes used in this analysis can be found in Table 4.2. The attributes recorded consisted of tool type (mano, metate, mortar, pestle), tool subtype, condition, texture, shape, design (expedient, strategic), use (single,

multiple, recycled, reused), number of surfaces, use level, and raw material type. Published ground stone data were incorporated using the attributes analyzed and documented by their authors with proper citations provided. Artifacts were identified as part of the assemblage using the context information provided by the authors, site documents, and site reports.

Texture of the tool, size, and re-sharpening are important aspects to be regarded in the choosing of the original material and determining use wear. Metric measurements of length, width, and thickness were recorded and artifacts were also weighed in grams for all of the artifacts personally analyzed, regardless of the condition of the artifact. Additional attributes were recorded for whole manos and metates. These attributes include the wear on the worked surface, surface configuration (concave, convex, flat, etc.) that relates to the strokes used with or against the mano or metate during use, and the addition of grips/grooves. Additional metric measurements (length and width) were also recorded for the mano and metate grinding surfaces, and the border width and depth for metates.

Additional attributes examined in this research were related to non-essential modifications made to the tool. Design refers to whether the artifact was expediently or strategically designed. Expedient designed items refer to those whose natural shape was not modified in any way other than the worked surface. In comparison, strategically designed items have been intentionally modified to make the tool easier to hold or use by grinding sides and creating finger grooves for better control of a tool, and grinding the bottom of a tool for more stability. Altering the shape of a tool for non-functional purposes and mano rests on metates are other examples of strategically designed tools. Expedient versus strategic design modifications have behavioral implications for the use-life of a tool and may reflect a more intensive use of strategically designed tools (Adams 2002, 2014).

Ground Stone Attributes	
Type and Subtype	
Condition	Whole, fragment, etc.
Texture	Fine, medium, coarse, etc.
Shape	General shape of artifact
Manufacture/Design	Expedient or strategic - intentionally altered for use
Grips/Grooves	Addition of grips or grooves for handling
Use/Secondary Use	Single or multiple; reused, recycled, multiple-use
# of Surfaces	# of used surfaces
Contact Type	Based on microscopic analysis; stone, wood/bone, etc.
Use Level	Light, moderate, heavy, nearly worn out, worn out
Raw Material	
Measurements	

Table 4.2 List of ground stone analysis attributes (Adams 2002, 2013).

A Dino-Lite AM3111T 10X-50X ~ 230X digital microscope was used to examine use wear on ground stone and to identify the presence of multilinear or unilinear striations, presence of wear facets, evidence of resharpening, and the angularity of grains on the worked surfaces. The artifact information gathered from the ground stone assemblages were also categorized quantitatively to look at the number of ground stone types and the occurrence of additional modifications by site and time period. These data were used to determine the use of new technology, a decline in certain tools, and modifications to existing technology.

Ceramic Artifacts

The ceramic materials needed for this part of the project were partial, reconstructed and whole vessels, ladles, spoons and other ceramics objects associated with food processing and cooking. The majority of this information came from site and analyst reports, and some personal analysis from museum collections. Food preparation and cooking vessels are represented by two ceramic types: Plainware and corrugated ware. Plainware consists of ceramics that have no additional slips, paints, or exterior or interior detailing. Corrugated ware consists of ceramics that

have additional exterior detailing formed during the manufacture of the vessel, rather than through paint; these include incising, punching, and banding of the vessel walls. The regional variants of these types were identified by Haury (1936b) based on his excavations at the Harris Site and Mogollon Village where he identified one plainware and five corrugated ware types.

Alma plain is a brownware consisting of unslipped vessels that occur in both bowl and jar form, although jars become more common during the Late Pithouse period. Interiors and exteriors of vessels may be polished and rarely smudging may occur in bowl interiors. The five corrugated ware types are Alma Neck Banded, Alma Scored, Alma Incised, Alma Punched, and Three Circle Neck Corrugated. Alma Neck Banded is a brownware mainly consisting of jar forms that began to appear during the early part of the Late Pithouse period. It is identifiable by the presence of between two to six flattened or obliterated coils, or bands, around the jar's neck. Alma Scored is a technique that uses a bundle of grass or similar tool to form a series of close lines on the neck of brownware jars and exterior body of bowls. The application of these lines appears to be random and no specific patterns have been identified.

In comparison, instead of forming multiple simultaneous lines, Alma Incised jars were incised using one tool to form individual lines. These lines were used to create crisscross like patterns on the neck of jars. Alma Incised bowls have also been recovered where the entire exterior was incised and the interior contained a red slip (Romero 2014). Alma Punched is a technique found on the neck of jars and pitchers that utilize tools such as fingernails, sticks, or reeds to impress designs on the exterior. Three Circle Neck Corrugated is identified as a brownware consisting of jar and pitcher forms that are a hallmark of the Three Circle phase. These vessels have coils that overlay each other, referred to as clapboard style. These coils may cover up to a third of the upper portion of the jar and the bottom coil is usually tooled.

Ladles are usually undecorated brownwares and considered utilitarian objects, but in some instances have been found to be decorated in serving and ritual contexts. No decorated ladles or spoons were used for this research. Ladles are defined as bowls with a single tubular or solid handle, extended outward. In most cases the handles of spoons and ladles are not recovered intact due to their fragility, but the base or basins of ladles and spoons are more commonly found intact. While ladles with broken handles may be misidentified as shallow bowls in some cases, using the shape of the bowl portion, location and type of use-wear, and handle attachment data, it is possible to classify some objects as ladles or spoons even though the handles are not intact.

Ceramic Attributes

Analysis attributes were assembled from several sources to accurately assess the vessel's function (Bennett 1974; Rice 1987, 2015; Shepard 1956). The variables used to analyze and document ceramic food technology are listed in Table 4.3. These attributes were documented for ceramics analyzed in-person. Published ceramic data were incorporated using the analysis variables and additional traits recorded by their analysts. Artifacts were identified as part of ceramic food-related technology based on the field numbers, context information, and ceramic attributes obtained from these sources, site data, and site records. Some attribute data was either not recorded or unpublished, and therefore not able to be obtained.

Metric measurements were recorded for height, body circumference and or diameter, if applicable, and body thickness. The length, width, and depth of ladle and spoon bases or basins were measured, and if present, dimensions of the handle were also recorded. Rim diameter, rim eversion, and rim thickness were also documented for vessels. Rim diameter, or the size of the vessel opening, was measured using a vessel diameter gauge in metric units. Rim eversion refers to the angle of the lip of the vessel's rim. Rims were grouped into four categories based on angle:

0°, 30°, 60°, and 90°. The volume of applicable vessels was also calculated using the equation for the volume of a sphere. Rim diameter and vessel volume are important attributes when examining the overall size of a vessel. Larger vessels may indicate a necessity for preparing larger meals and potentially can provide additional data on changes in family units and communal dining.

The paste and temper of ceramics were identified in the cross-section at a break and refers to the type of clay, its color, the type of temper, typically micaceous sand, and level of coarseness or fineness of the temper. The presence or absence of additional attributes were also noted; these were fire-clouding, oxidization, polishing, burnishing, smudging, sooting or blackening, pitting, and scraping. These attributed were recorded for vessels analyzed in-person, but could only be documented for other vessels if they were done so by other sources.

Fire-clouding and oxidization are a result of firing processes and provide data regarding firing techniques. Smudging occurs when the pottery surface becomes permanently blackened as a result of exposure to carbon from organic materials; this is an intentional finishing technique that occurred while a vessel was still hot from firing. Burnishing and polishing are finishing techniques that occur prior to firing. The presence of these techniques sheds light on investment in specific vessels and finishing practices and their abundance on certain vessel forms could indicate the benefits of using certain finishing techniques to alter the properties of ceramics.

Sooting or blackening, like smudging, is a result of burnt remnants of organic materials, except that sooting is a result of use typically associated with cooking vessels. Pitting and scraping are also a result of vessel use. Pitting is identified by thermal spalling, sometimes in association with sooting on the base of vessels, due to the high acidic contents of the foods being cooked and or stored in the vessels; specific patterning of pitting may also be indicative of

Ceramic Attributes	
Rim Diameter	Diameter of the opening of the vessel
Rim Thickness	Measured below, but close to the rim
Rim Eversion	Angle of the lip of the rim (A 0°, B 30°, C 60°, D 90°)
Body Thickness	Thickness of body near approximate center of vessel
Size	Includes height, body diameter, and volume, if applicable
Weight	Includes diameter and rim eversion
Temper/Paste	Clay type, color, coarse or fine, types of inclusions
Form and Type	Bowl or Jar; if corrugated, type is based off of those established by Haury (1936b)
Function	Cooking OR Food Preparation without Heat
Fire-cloud	Discoloration on the vessel exterior, usually from when the vessel comes into contact with fuel during open-pit firing
Oxidized	Orange in color as a result of an oxygen rich firing atmosphere
Polishing	Finishing technique indicated by a high luster on a surface
Burnishing	Finishing technique indicated by lustrous parallel, linear facets
Smudging	Burnt organic material remaining on the interior of the vessel as a result of the firing process
Sooting/Blackening	Burnt organic material remaining on the interior of the vessel from use
Pitting	Acidic wear on interior of vessels as a result of thermal spalling
Scraping/Use Wear	Wear from utensils on the interior of vessels

Table 4.3 List of ceramic analysis attributes (Rice 1987, 2015; Shepard 1956; Sinopoli 1991).

fermentation (Rice 1987, 2015; Skibo 2013). Scraping on vessel interiors is identified by striations along the neck, body, and base from contact with wood and ceramic stirring implements. Scraping on ladles and spoons are visible along the interior base of the basin and the exterior of the basin. Use-wear was identified using a Dino-Lite digital microscope.

Vessel Function

For this research, data on vessels that served two primary functions were needed, those used in preparation or processing and those used in cooking activities. Several variables were used to determine whether vessels were used as food preparation or cooking vessels. These

include presence of surface treatments, interior and exterior striations, and evidence of fire-related use.

Vessels used for preparing food without heat can be more difficult to identify because one vessel can be used for multiple food-related tasks (Sinopoli 1991). Food processing and cooking vessels typically have unrestricted openings to allow access to the contents and they typically lack slips and decoration. Cooking vessels should have larger volumes to accommodate cooking needs and are generally classified as plain or corrugated vessels. Processing vessels are more likely to have thick walls to create stronger vessels to withstand pounding and stirring (Rice 1987, 2015). Food preparation vessels can also be identified by the presence of specific use wear. Abrasions on the exterior base of a vessel are a result of being turned during processing (Sinopoli 1991). Interior use wear includes abrasions, areas with patches of abrasions, chipping, and pitting as a result of mixing, scraping, grinding, and pounding foods (Rice 1987, 2015).

Generally cooking vessels have been characterized as short, squat jars, and in some cases bowls, with a rounded base and thin walls to transfer heat more effectively and decrease thermal stress (Hally 1986; Henrickson and McDonald 1983; Rice 1987, 2015; Sinopoli 1991; Skibo 2013). To increase thermal shock resistance, cooking pots should also have coarse-textured temper and be porous (Rice 1987, 2015; Sinopoli 1991; Skibo 2013). Cooking vessels can also be identified through soot patterns and use wear. A vessel with soot located on the exterior sides and an oxidized base indicate that a vessel was placed directly into a fire, likely for boiling its contents (Rice 1987, 2015; Skibo 2013). In contrast, vessels lacking an oxidized base with soot deposits located on the base and lower sides were likely to have been suspended over a fire to simmer or fry the contents. Interior use wear present on cooking vessels include striations from

scraping and stirring the vessel's contents, and pitting, resulting from spalling associated with cooking and possibly fermentation.

Cooking Features

Cooking features are defined here as culturally built features that emitted heat and were used to cook food. Cooking features include roasting pits and fire-pits or hearths; these were located inside pithouses or pueblos, or extramural features. Cooking features were examined using site and data reports. These reports helped to determine the different types, variability in size and locations, and frequency of different cooking feature types.

There are several different forms of hearths that can be classified into two primary groups: informal and formal hearths. Informal versus formal refers to the effort invested into the feature's construction such as the time taken to build the feature, the required materials, and maintenance. Maintenance or the ease of cleaning and longevity potentially inform on the intended function of the hearth and may correlate to intensive hearth use (Diehl 1997). Hearth types identified in this region, see Figure 4.1, include fires built directly on the floor, unlined pits and circular plastered or collared hearths with or without a hearth stone, cobble-lined, and rectangular slab-lined hearths that may have an adjacent 'fire box' or floor vault, potentially used for containing ash (Anyon and LeBlanc 1984; Diehl 1997; Diehl and LeBlanc 2001; Roth 2015; Shafer 2003).

Roasting pits, also referred to at NAN Ranch as earth ovens, were identified due to a formally constructed circular subterranean pit with plastered walls and base (Shafer 2003:85). A layer of organic material was found at the bottom of the pit below a layer of burnt rocks. Informal roasting pits can be identified by a large amount of burnt and fragmented rocks within a

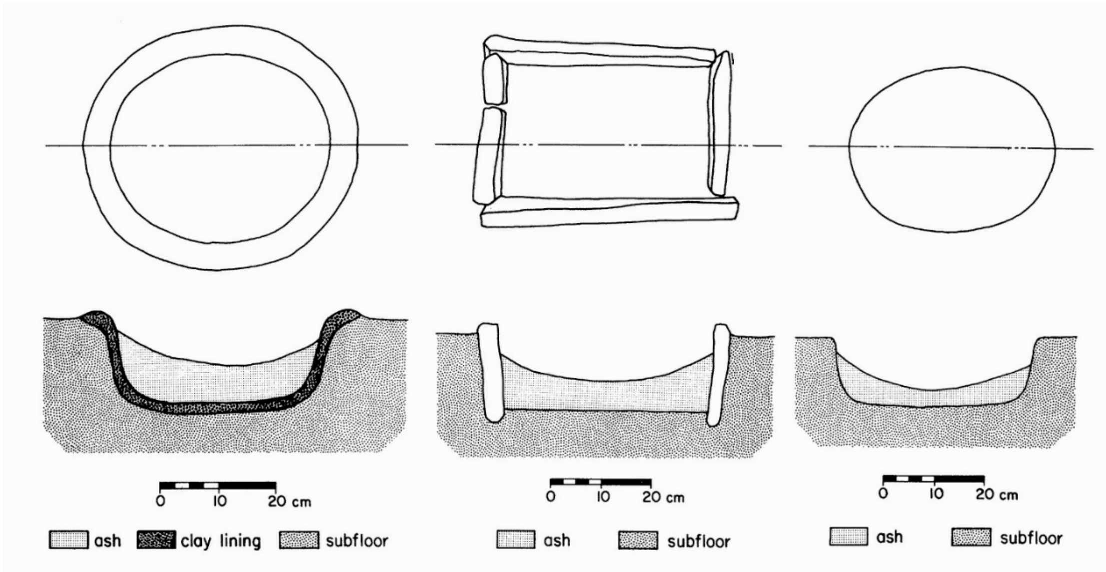

Figure 4.1 Hearth types, left to right, circular clay-lined, rectangular slab-lined, and circular unlined (Lowell 1995).

contained area and a high density of organic material (see Figure 4.2 for an example).

Attributes

The analysis traits for fire-features were adapted from work by Lowell (1995, 1999) and are listed in Table 4.4. If needed, the fire-feature function was determined based on the description of the fire-feature and associated cultural materials published in site reports or listed on feature forms. Context is significant when determining changes in the form and density of specific types of fire-features. Therefore, the location of these features, within pithouses, surface rooms, or extramural features, were recorded in addition to their dimensions.

Cooking features were first identified by type, roasting pit or hearth, and then by subtype. The features were defined by shape and then the presence or absence of a hearth stone was recorded. If the feature was lined, the lining material, plaster, cobbles, or slabs, were noted. If the feature had any additional traits including the addition of an adjacent ‘fire box,’ it was

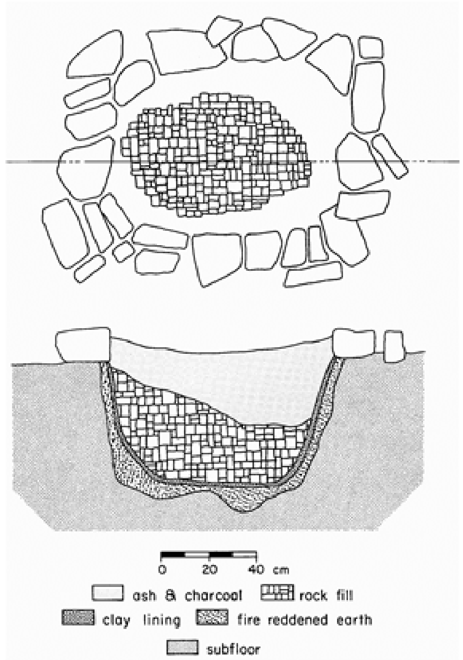

Figure 4.2 Roasting Pit (Lowell 1999).

documented. It was also important to include data on artifacts recovered in or near these features when available, as they may have been used in food-related activities.

Macrobotanical and Faunal Remains

Macrobotanical and faunal data were used to supplement the artifact and feature data by providing information on what type of food resources were being processed and cooked. These

Cooking Feature Attributes	
Type	Roasting Pit or Hearth
Subtype	Rectangular, circular, irregular, slab-lined, plaster-lined, cobble-lined, un-lined, 'fire-box'
Hearth Stone	Presence or absence of stone (sometimes referred to as a deflector)
Measurements	Length, Width, Depth
Location/Context	Intramural, Extramural/Associated Features
Associated Materials	Artifacts found in association with feature

Table 4.4 List of cooking feature analysis attributes (Lowell 1995, 1999).

data came from residue washes, pollen samples, and plant and faunal remains already analyzed from each site. Data was also collected from recovered organic materials from artifacts associated with food-related technology and from features associated with the processing and cooking of food. These data are combined and discussed as a whole in order to document the food resources being utilized by the Mimbres Mogollon and how the density of these food resources changed over time.

CHAPTER 5: FOOD RESOURCES AND PROCESSING STRATEGIES

The Mimbres people subsisted on both wild resources and cultivated crops. Data indicates that between the Early Pithouse period and the Mimbres Classic period reliance on these resources changed as a result of multiple environmental and human-related factors. This chapter examines the available wild plant and animal resources, and agricultural crops in order to document the subsistence practices of the Mimbres Mogollon. Food processing and cooking technology are directly related to the resources being consumed because of their role in transforming resources into consumable products. Therefore, alterations in subsistence strategies affect these forms of technologies. It is important to discuss the food resources being utilized through time to understand changes in food processing and cooking technology.

Wild Plants

Direct evidence from macrobotanical remains and pollen samples have indicated the substantial use of wild plants during the Early Pithouse through Mimbres Classic periods (Anyon and LeBlanc 1984; Diehl and LeBlanc 2001; Shafer 2003; Woosley and McIntyre 1996). Table 5.1 lists commonly found cultivars and wild plants within the Mimbres Valley. Botanical remnants indicate that the fruits of prickly pear, cholla, and banana yucca cacti, and the seeds from wilds grasses including purslane, chokecherry and juniper were gathered and consumed as part of the diet; mesquite pods, wild garlic and onions, chia seeds, watercress, and tree saps were likely also resources (Ebeling 1986; Moerman 1998; Shafer 2003). Coprolite samples from the southwestern region have also identified wild taxa and quelites as important components of the diet (Minnis 1989; Shafer et al. 1989).

Wild plants and resources varied based on micro-environments in the Mimbres region, as

Common Name	Latin Name
Bean (Common)	*Phaseolus vulgaris*
Bean (Tepary)	*Phaseolus acutifolius*
Buckwheat	*Eriogonum* sp.
Buffalo Gourd	*Cucurbita foetidissima*
Cattail	*Typha* sp.
Chia or Mint Family	Labiatae
Globemallow	*Sphaeralcea* sp.
Indian Rice Grass	*Oryzopsis hymenoides*
Maize	*Zea Mays*
Mormon Tea	*Ephedra* sp.
Plantain	*Plantago* sp.
Sagebrush	*Artemisia* sp.
Saltbush	*Atriplex* sp.
Sunflower	*Helianthus* sp.
Tansy Mustard	*Descurainia* sp.
Cacti	
Agave	*Agave* sp.
Cholla	*Cylindropuntia* sp.
Hedgehog Cactus	*Echinocereus* sp.
Prickly Pear	*Platyopuntia* sp.
Yucca	*Yucca* sp.
Nuts, Berries	
Canyon Grape	*Vitis* sp.
Chokecherry	*Prunus virginiana*
Hackberry	*Celtis reticulata*
Juniper Berry	*Juniperus* sp.
Alligator Juniper	*Juniperus deppeana*
Piñon Nuts	*Pinus edulis*
Walnut	*Juglans* sp.
Wolfberry	*Lycium* sp.
"Quelites"	
Beeweed	*Cleome* sp.
Carpetweed	*Mollugo verticilata*
Goosefoot	*Chenopodium* sp.
Grass Family	Gramineae or Poaceae
Pigweed	*Amaranthus* sp.
Peppergrass	*Lepidium* sp.
Purslane	Po*rtulaca* sp.
Ragweed	*Ambrosia* sp.

Table 5.1 Table listing the standard and Latin names of commonly found plants from macrobotanical and pollen samples within the Mimbres Valley (Bohrer 1975; Bye 2000; Diehl and LeBlanc 2001; Diehl and Toney 2015; Kaplan 1963; Minnis 1984, 1985b, 2000; Phillips 2015; Rose 2004; Shafer 2003; Woosley and McIntyre 1996).

previously discussed. In addition to the numerous wild resources already mentioned, weedy greens also referred to as quelites, were commonly available edible greens. Bye's (2000) study of the Tarahumara of northern Mexico revealed the significant contribution that weeds played in their diet, especially in those months when food was scarce. Further, quelites also grow as a result of human disturbance and were likely commonly found growing in agricultural fields in the Mimbres Valley (Bye 2000; Diehl and Toney 2015; Minnis 2000). Goosefoot, pigweed, and purslane are the most commonly recovered of these so called quelites and are often found abundantly in archaeological macrobotanical samples (Bye 2000; Rose 2004; Woosley and McIntyre 1996). It would have been advantageous for people to gather these plants for consumption during the agricultural season, especially when other resources may not have been as readily available.

Rose's (2004) botanical analysis from NAN Ranch found that many of the taxa recovered decreased from the Late Pithouse to Mimbres Classic periods, although this could also be due to sampling; seeds were more likely to be found in soil samples because of their size and preservation rate. Interestingly, the only two taxa that did not decrease were maize and *Chenopodium*, also known as goosefoot, a weed plant. This may indicate a relationship between agriculture and weed consumption because of the increase in growth of quelites due to human disturbance from agricultural practices; although this may have also affected samples due to natural soil disturbances (Bye 2000). Similar ubiquities of *Portulaca* and *Amaranthus*, or purslane and pigweed, were also found between the Late Pithouse and Mimbres Classic periods (Rose 2004). At Galaz Ruin, macrobotanical analyses demonstrate an increase in the consumption of weedy plants during the Mimbres Classic period due to their ubiquities in macrobotanical and pollen samples (Anyon and LeBlanc 1984; Minnis 1984).

Insects were most likely also consumed by prehistoric populations and were reliable sources of protein. Ethnographic sources indicate that grasshoppers, crickets, and ants were consumed by many Native American tribes and in some instances were pit baked (Ebeling 1986). Different types of ants, such as honey ants, also provided sugar to those who accessed their nests and consumed the honey or nectar that the ants had gathered from nearby flowers and desert plants (Ebeling 1986).

Agriculture

Domesticated crops were first introduced into the southwestern United States from Mesoamerica during the latter part of the Middle Archaic period, around 2000 B.C., but were not an integral component of the subsistence practices of existing groups until later. Evidence indicates that maize was introduced into the southwest prior to 2000 B.C. (Minnis 1985a, 1992; Crown 2000a). Squash, gourd, and beans were other domesticates originating from Mesoamerica that may have been brought to the region around the same time as maize, but due to preservation challenges, their dates are more ambiguous. Squash and gourd were present by the Late Archaic period, around 1500 B.C. (Crown 2000a; Hegmon 2002; Minnis 1992). Evidence for the common bean in the Mogollon Highlands is approximately 100 B.C., but other data suggests its cultivation around 300 B.C. (Crown 2000a; Minnis 1992).

Evidence recovered from Archaic period sites in the Southwestern region indicate that hunter-gather populations experimented with and cultivated maize for at least a thousand years prior to becoming reliant on it for a more substantial part of their diet (Minnis 1985a, 1992; Vierra and Ford 2006). Minnis (1985a, 1985b, 1992) argues that the limited use of cultigens by hunter-gatherer groups did not affect their mobility patterns or social organization because maize cultivation would not have conflicted with other plant and resource collection. Furthermore, the

supply of maize and other cultivated crops provided by this limited cultivation could have provided additional resources in times of resource stress with little additional time and maintenance required in its production.

The first maize varieties were flint and pop corn which were present during the Middle Archaic period in the Mogollon Highlands and on the Colorado Plateau (Crown 2000a). Maize was spread throughout the southwest region by 1000 B.C. and by 700 B.C. there was evidence of morphological changes indication selection for more productive types (Vierra and Ford 2006). Varieties of maize more conducive to being prepared into flour appeared between A.D. 500 and 700 in the Mogollon Highlands, but were not introduced further north until around A.D. 900 (Crown 2000a). The rate of spread and time frame between morphological changes in maize suggest that maize became more important in the diet over time (Diehl 1996; Hegmon 2002; Minnis 1985b). Overtime the dependence on agriculture, and specifically maize, increased which was further marked by the introduction of a new maize variety, *maiz de ocho*, after A.D. 700 that produced easier to grind kernels for flour (Crown 2000a; Hegmon 2002). Indirect and direct evidence further indicates the increased consumption, and significant dietary contribution, of agricultural plants and domesticates during the Late Pithouse period (Diehl and LeBlanc 2001).

Several researchers have advocated for the increase dependence in maize in conjunction with the pithouse to pueblo transition, but evidence suggests that this increased reliance occurred several centuries prior to the Mimbres Classic period (Hegmon 2002; Minnis 1981, 1985a, 1992). Diehl (1996) argues that the increased dependence on maize began around A.D. 700 using a combination of data from direct sources from ethnobotanical analyses and indirect evidence from ground stone, and was associated with the use of *maize de ocho*. The transition to pueblos

may coincide with an even greater reliance on agriculture, although many researchers see it tied more to social than economic changes (Hegmon 2002; Whalen 1981).

NAN Ranch Ruin, occupied during the Late Pithouse period with main occupation occurring during the Mimbres Classic period, provides further direct and indirect evidence of the level of agricultural intensity in the Mimbres region. Excavations at NAN revealed a ubiquity of maize kernels and cobs that tripled from the Three Circle phase to the Mimbres Classic period (Shafer 2003). Furthermore, there was a decrease in the amount of maize cobs with 8 to 10 rows, found more commonly in Pithouse period sites, and an increase in cobs with 12 to 14 rows, indicating a selection for cobs with more rows (Shafer 2003).

Indirect evidence for agricultural intensification is demonstrated by the construction of granaries during the latter part of the Three Circle Phase (after A.D. 900) that are found at NAN Ranch and other sites in the Mimbres Valley. In one of these granaries at NAN Ranch seeds from two species of squash were found within a storage pit (Shafer 2003:122). Other indirect evidence comes from irrigation dams and ditches and agricultural terraces that are believed to have been constructed during the Three Circle phase and Mimbres Classic period (LeBlanc 1983; Minnis 1985b; Pool 2013; Sandor et al. 1990; Shafer 2003). Several theories have been proposed for what may have sparked these changes and some relate these to a change in maize variety and others consider population increases as a major influential factor (Diehl 1996; Hegmon 2002; Stokes and Roth 1999).

Game Resources

The Mimbres Mogollon hunted game in addition to what could be grown in agricultural fields or gathered nearby. Animal species consumed consisted of both large and small game. The

most common large game consumed were mule and white-tailed deer and pronghorn antelope; bison and elk have also been recovered from assemblages, but are rare. Smaller game recovered from faunal assemblages include jackrabbits, cottontail rabbits, rats, and squirrels (Anyon and LeBlanc 1984; Cannon 2000, 2001, 2003; Diehl and LeBlanc 2001; Minnis 1985b; Sanchez 1996; Shafer 2003; Woosley and McIntyre 1996). Rabbit bones were amongst the most common fauna recovered from archaeological assemblages along with deer and pronghorn antelope (Cannon 2000, 2001; Diehl and LeBlanc 2001; Schollmeyer 2005).

Coyotes and bighorn sheep are also found in the Mimbres Valley (Diehl and LeBlanc 2001; Minnis 1984). Other than those already mentioned, several other animal species were consumed and have been identified from faunal assemblages in the Mimbres Valley. Badgers, beavers, bob cats, foxes, dogs, gophers, prairie dogs, mice, muskrats, and bears are amongst those identified (Anyon and LeBlanc 1984; Diehl and LeBlanc 2001; Minnis 1985b; Shafer 2003; Woosley and McIntyre 1996). Turtles, tortoises, lizards, snakes, and frogs have also been recovered in faunal assemblages at Galaz ruin and Wind Mountain (Anyon and LeBlanc 1984; Woosley and McIntyre 1996). Bird and fish bones have also been recovered from deposits, but due to their fragility and decomposition rate, their availability and rate of consumption are not as clear.

A variety of bird species were found in assemblages. Most of these species have been determined to have been used for food, but evidence has been recovered in the Mimbres Valley for the ritual use of macaws for their feathers, and both the consumption of and ritual use of turkeys and hawks (Shafer 2003; Woosley and McIntyre 1996). Geese, ducks, quails, ravens, pigeons, and eagles have also been identified. Freshwater fish caught from the Mimbres River were also consumed. Minnis (1985b) suggests that they may not have been a major resource due

to their low ubiquity in faunal assemblages, but these results were likely skewed by screening and collection methods. Unlike many of the Mimbres Valley sites, excavations at NAN Ranch yielded a high ubiquity of fish bones from Three Circle phase and Mimbres Classic period occupations as a result of consistent screening methods and flotation sampling. Analysis of the faunal assemblage indicates a high rate of consumption of fish during the Mimbres Classic period in relation to the preceding Three Circle phase (Shafer 2003).

Due to the lack of Early Pithouse site excavations and sampling biases towards excavating pithouse dwellings versus extramural areas, there is little data on faunal remains dating to this period (Diehl and LeBlanc 2001). Current evidence suggests that over time the amount of large game recovered from faunal assemblages decreased. The decrease in large mammal fauna recovered from sites have some researchers suggesting resource depression as the likely culprit; others propose that the decrease is related to an increased reliance on agriculture, or potentially a combination of the two (Anyon and LeBlanc 1984; Cannon 2000, 2001). During the Early Pithouse period the faunal assemblage suggests a mixed assemblage of both large mammals and smaller game, mostly rabbits, but by the Mimbres Classic period the faunal assemblages were dominated by rabbits (Anyon and LeBlanc 1984). Schollmeyer (2005) discusses a similar idea that suggests an increase in the consumption of small mammals and annual weeds over time. Cannon (2000, 2001) finds a significant decline in the proportions of artiodactyls between the Pithouse and Pueblo periods, and notes that there were higher proportions of artiodactyls in moister, wooded climates of the Mimbres region.

Analysis of faunal remains from Galaz Ruin and other Mimbres sites further support these trends. In the middle Mimbres Valley, during the Late Pithouse period, 58 percent of the identified rabbit bones recovered were classified as jack rabbits; during the Mimbres Classic

period 57 percent of rabbit bones were identified as jackrabbits (Anyon and LeBlanc 1984:221). Furthermore, faunal analysis illustrated a substantial decrease in the overall percentage of big game in this region over time. In the Georgetown phase of the Late Pithouse period approximately 71 percent of the total faunal assemblage were big game compared to 16 percent during the Mimbres Classic period (Anyon and LeBlanc 1984:220). Additionally, at Galaz Ruin alone 88 percent of the identified Mimbres Classic faunal assemblage were identified as rabbit.

Evidence for a higher abundance of large game during the Early Pithouse period and the succeeding Cliff Phase (post A.D. 1150) suggests multiple theories for this decline in the periods in between. With an increase in population during the Late Pithouse and Mimbres Classic periods there is increased stress on the environment to produce enough wild resources for the population. With the abundance of large game hunted during the Early Pithouse period in combination with the clearing of floodplains for agriculture the larger animals were overexploited and forced to relocate due to human impacts on the environment. The agricultural fields also provided an area for rabbits, especially jackrabbits, which may have increased the amount of small game available (Anyon and LeBlanc 1984; Cannon 2000). Cannon (2000, 2001) also poses an important potential relationship between wild game resources and agriculture, where due to the overexploitation of large game, occupants were 'forced' into increasing agricultural production.

Recent studies question the validity of earlier faunal analyses and the appropriate use of site comparisons that resulted in these findings (Sanchez 1992, 1996; Schollmeyer and Driver 2013; Shaffer and Schick 1995). The microenvironment of the Mimbres Valley varies depending on the location within the valley and along the Mimbres river, which affects the availability of fauna. The upper portion of the Mimbres Valley is more mesic, containing more moisture, while

the middle and lower valley are classified as lower Sonoran life zones with drier environments (Shaffer and Schick 1995). While evidence has suggested the decline in artiodactyls towards the end of the Late Pithouse and Mimbres Classic periods, the Wind Mountain site had an increase in artiodactyls likely relating to the moister environment that was more hospitable to larger game (Sanchez 1992). Therefore, while a decline was found in the consumption of large game and an increase in small game, other factors, such as differences in microenvironment, also need to be considered.

Food Processing and Cooking Strategies

The purpose of this is to discuss the potential processing and cooking methods that may have been practiced prehistorically, using ethnographic data, to gain a better understanding of how prehistoric groups used technology to transform their food. As noted previously, due to preservation, sufficient data on perishable containers like basketry are not available, and the multi-purpose use of chipped stone tools make associating tool forms with specific activities difficult; these technologies will be discussed only as part of the processing and cooking strategies found in the ethnographic record.

Just as there are specific ways to process and cook food today, there were also certain ways that women, who were likely the primary food processors and cookers, learned to process and cook foods in prehistory. These strategies may have focused on attaining specific food qualities, such as taste, digestibility, nutritive value, storability, ease of processing and cooking, as well as making foods more palatable. Other techniques involved removing toxins from foods in their raw state and developing new techniques and recipes for foods to introduce new varieties and to create more transportable foods. Using ethnographic data on cooking strategies of Native American groups, it is possible to identify prehistoric food processing and cooking techniques.

Prior to discussing strategies of the Zuñi and the Hopi, recent research on maize processing methods that were likely practiced prehistorically are presented.

Alkaline Treatment of Maize

Corn prepared in its raw state is nutrient deficient and can cause malnutrition and lead to health problems, especially in young children during weaning when they are the most vulnerable (Katz et al. 1974). Alkaline processing, also referred to as nixtamalization, is a way to add nutrients to maize, which occurs when foods are cooked with alkali at high temperatures (Trejo-Gonzalez et al. 1982; Wisseman 2010). Alkaline processing can be done with lye, lime, or wood ashes which are incorporated into the early stages of food processing (Katz et al. 1974; Kavena 1980; Trejo-Gonzalez et al. 1982; Wisseman 2010). Processing corn by intense grinding also enables specific nutrients to be released, making the food more nutritious and ground flour is better processed by the digestive system (Katz et al. 1974).

Heat is another important aspect in adding more nutrition to corn. Alkaline treated corn that is boiled will soften and remove the hard cap covering the maize kernel, which can be eaten as hominy or potentially re-dried and ground significantly easier, due to the absence of the corn's hull (Katz et al. 1974; Kavena 1980). Evidence of alkaline treatment may be present in rooms at several Mimbres Classic pueblos such as NAN Ranch where two slab-lined bins were present on some of the floors; only one was used as a hearth (Shafer 2003). The second bin may represent receptacles to hold ashes from the hearth which could then be used in food preparation.

Ethnographic Data on Processing Techniques

The Zuñi

The Zuñi make several meals from corn, seeds, and grains. Wild sunflower seeds, purslane seeds, pigweed and goosefoot seeds, wild rice, and corn were dried by toasting or parching using either ceramic vessels or baskets plastered with tempered clay (Cushing 1920). These grains were used in stews or ground and combined to form mushes or gruels, breads, and cakes. Mush was made by combining coarse corn meal and boiling water; various greens, spices, fruits, nuts, and meats could be added to the mush (Cushing 1920). Griddle cakes were formed by combining coarse and fine corn meal with water and cooking the batter on slab-like stones near a fire.

Leftover mush could be rolled into balls, flattened, and dried or baked in hot embers to make a form of bread. In addition, mush was also wrapped into leaves and placed into a basket containing water that had been boiled using stones. By wrapping the mush in leaves, the resulting dumplings would avoid contact with any grit from the rocks and fire (Cushing 1920). Wicker spoons made from the leaves of plants were used to remove the mush dumplings and the stones used to heat the water.

Squash, pumpkin, and beans were also cultivated by the Zuñi. Squash and pumpkin were boiled, fried, roasted, and baked; squash was also boiled into a paste and mixed with rancid suet (animal fat), which was then fried on heated stone slabs (Cushing 1920). Squash and pumpkin flowers (blossoms) were also consumed; these could also be dried and stored in ceramic jars for use during the winter. Beans were eaten raw, boiled, and stewed and were typically added to stews (Cushing 1920).

Acorns and piñon nuts were gathered by the Zuñi and were removed from their shells by toasting them and rolling them over a stone to break the shells. These nuts were eaten raw and when ground were used as thickeners in stews and soups (Cushing 1920). Wild onions,

watercress, milkweed, wild squash, bark pulp, and roots were eaten raw, boiled, or dried. Wild potatoes could only be eaten if they were boiled first because some are poisonous in their raw state (Cushing 1920).

Similarly, the datila, the fruit of the soapweed plant, and yucca pods could also be poisonous if they were not boiled or roasted in ashes before consuming. Agave hearts were boiled in water or in a mixture of water and ashes, or pit roasted. Chokecherries, wild plums, and other types of berries and fruits, including some fruit-bearing cacti, could be eaten raw, stewed, boiled, dried, or roasted. When agave hearts, datila, and other fruits are boiled into a paste, they can be dried and rehydrated at a later date (Cushing 1920). When dried these pastes, sometimes referred to as cakes, can also be ground and added to other meals. The Zuñi removed the spines found on some cacti and cacti fruits by using two flat sticks and stirring the fruit or cactus leaf or pad in sand (Cushing 1920).

Meat was prepared in several ways; it was boiled, roasted, and dried. The ears, hooves, and tails of antelope, deer, and cattle were singed and then boiled for 1-2 days, forming a thick gelatinous soup. Dried meat, or jerky, could be added to stews and soups when fresh meat was not available. Jerky was eaten by chewing to rehydrate the stringy meat fibers; when consumed with sauces or soups, the chewed jerky was used as brushes to sop up, or spoon, the meal (Cushing 1920).

The Zuñi used a variety of basketry, ceramic, and stone tools to process and cook their food. Stone slabs were used to grind corn, seeds, and other grains into flour. Tightly woven baskets were used as containers for stone boiling; flat pokers and cedar-bark holders were used to remove and add the hot stones. Ceramic vessels, shallow baskets plastered with clay, and flat mats were also used. Utensils tended to be made from perishable materials and many food items

doubled as eating utensils. After the seeds were removed and eaten, pepper-pods were used as spoons in the consumption of soups, stews, and sauces; as the meal progressed the pod was also consumed, similar to that of jerky. When eating squash, a piece of the rind is removed and the meat is consumed; the piece of rind is used as a spoon to remove the rest of the squash from the shell (Cushing 1920).

The Hopi

The Hopi also have specific techniques for processing and cooking food. Many Hopi recipes require culinary ashes from specific plants for color and seasoning, and also for important minerals including calcium, magnesium, phosphorous, and potassium (Kavena 1980). The four-winged saltbush (*Atriplex canescens*), also referred to as chamisa and suwvi, is favored because its ash is rich in minerals and its blue color is sacred to the Hopi. Other green plants are also used for culinary ashes; once the plants have been burned the ashes are stored in containers, so they are on hand when needed (Kavena 1980).

Culinary ashes are required in making hominy. Dried shelled corn, water, and ashes are combined and boiled; the hulls on the corn become loose due to the mineral content of the ashes combined with the high temperature; this allows the hulls to be removed by hand (Kavena 1980). The Hopi dry corn while it is still on the cob to better protect from insects; corn is laid out to dry, typically on roofs and turned frequently (Kavena 1980). Fresh corn is also baked in deep pits before drying as a preservation technique that allows the corn to retain more minerals than drying alone. A fire is lit within a pit and when the coals are hot enough a layer of corn stalks are placed on top of the coals, followed by the corn still within its husks; water is then sprinkled on top of the corn and then the pit is covered with metal, or prehistorically by stone slabs, and sealed with mud plaster and baked overnight (Kavena 1980). After the corn is finished and the

husks removed, the corn stems are pierced with an awl and strung using yucca thread and hung outside to dry.

Beans are another important food source for the Hopi; varieties of tepary beans and green beans are most common, and tepary beans grow wild in parts of Arizona (Kavena 1980). Except for green beans, beans are left to mature and dry on their vines and bushes before women remove the plants from the ground to bring back to their village. The beans are shelled and the pods are winnowed to remove debris. Then the pods and vines are burned and used for culinary ashes (Kavena 1980). Green beans are dried within their pods and strung together using yucca fiber. Hopis on the reservation also create a bean paste, not for food, but rather as a pitch for inlaying jewelry (Kavena 1980). The Hopi also parch beans and corn (popped corn) as treats; dried corn and beans are parched in a container with sand to keep the food from burning (Kavena 1980).

Squash, pumpkin, and gourds were sliced and dried, boiled, or baked. Yucca fruit and other fruit and berries could be dried, boiled, or baked. Prickly pear pads were boiled down into a thick juice, or dried and ground to use as a sweetener. The thorns on the pads were removed using a knife or by singeing them (Kavena 1980). Other greens were dried in the shade after they were washed to be added into later dishes. Greens, such as tansy mustard greens, were also baked in a pit similar to that of corn, but at a smaller scale and for only about 30 minutes (Kavena 1980). Leaves and stems dried from the wild Hohoise and Thelesperma plants were boiled in water for teas. To preserve meats, the Hopi sliced it into thin slices and salted it to make jerky. The meat was left in the sun for 3-4 days and turned twice a day. The jerky could be rehydrated by boiling it in water and by adding it to stews and soups (Kavena 1980).

The food tools used by the Hopi varied with a mixture of Hopi-manufactured technology similar to the tools used in prehistory and store-bought modern technology. Eating utensils and

tools were made from wood, natural straw, gourds and pottery. Spoons were also made from baked corn husks that were soft and flexible. Corn husks and leaves were also used for wrapping foods and as cooking containers. Cooking utensils included stirring sticks, gourd dippers, and peach twig bundles and broom straw for stirring liquids. Baskets were used for winnowing and sifting (Kavena 1980).

Summary

Wild plants and game were important resources for the Mimbres people. Plant foods were especially significant as they composed a large part of the diet and data further indicates the substantial consumption of quelites. Due to preservation it is unclear if there were significant alterations in specific plant consumption, but current macrobotanical and pollen data indicate that wild plant consumption remained relatively stable over time. As already discussed, changes occurred in Mimbres faunal assemblages between the Early Pithouse and Mimbres Classic periods. With the addition of agriculture, more food resources were available. Although agriculture provided additional resources, wild plants and game were still necessary not only for food consumption, but for the secondary products they provided.

In order to process and cook food both the wild resources and those cultivated in agricultural fields, new techniques and processing methods would have been required. Increasing dependence on agriculture would have also involved a surplus of resources to be saved for a later date, indicating that preservation methods would also have been practiced and the necessary technology developed. Alterations in resources should be echoed in food processing and cooking technology that demonstrates changes occurred in processing and cooking strategies.

Food processing and cooking implements were likely made of wood and plant materials in addition to ceramic and stone. Several shapes and sizes of basketry were used in food processing and cooking techniques from storage, winnowing, and parching to holding water and cooking foods by stone boiling. This accumulation of information has indicated that there are a plethora of tools and food processing strategies that were likely used prehistorically to process and cook food. Although chipped stone and perishable tools cannot be included in the following research due to the constraints already discussed, available data indicate their presence or availability and use in the region. Further, the data on food processing and cooking techniques establishes the intricacy and complexity involved in these processes that were more difficult in prehistory and likely included many more techniques and recipes than what can be discerned today.

CHAPTER 6: RESULTS

This chapter provides data on the artifacts and features from the McAnally Site, Harris Site, Galaz Ruin, and NAN Ranch Ruin that are components of food processing and cooking technology. These artifacts were recovered from roof, floor, and feature-related contexts. Using a combination of site reports, analyses records, and personal analysis, food processing and cooking technology was documented by site and time period. Ceramics, ground stone, and features are discussed independently except for such cases when relevant artifacts are associated with food processing and cooking features.

The Early Pithouse Period: The McAnally Site (LA 12110)

Only two pithouses were partially or completely excavated at the McAnally site, and therefore the relevant artifact assemblage is small. Radiocarbon dates place the occupation of Unit 8 between 200-300 A.D. and Unit 11 between 500-550 A.D. (Anyon et al. 2001). Unit 11 was completely excavated and contained a significant *in situ* floor assemblage, in comparison to Unit 8 which was partially excavated with a smaller floor assemblage, as mapped in Figures 6.1 and 6.2 (Diehl and LeBlanc 2001).

McAnally Site Ground Stone

Fourteen ground stone artifacts associated with food processing and cooking tasks were recovered from roof fall/wall fall and floor contexts of Units 8 and 11 (Appendix A). Only eight of the fourteen ground stone artifacts from the McAnally site were curated at the Maxwell Museum. Attribute data from the other six ground stone artifacts were found in the published site report (Diehl 2001). Most (50 percent) of the ground stone was from the floor of Unit 11 (n=7), followed by 29 percent from the floor of Unit 8 (n=4), and 21 percent from the roof fall/wall fall

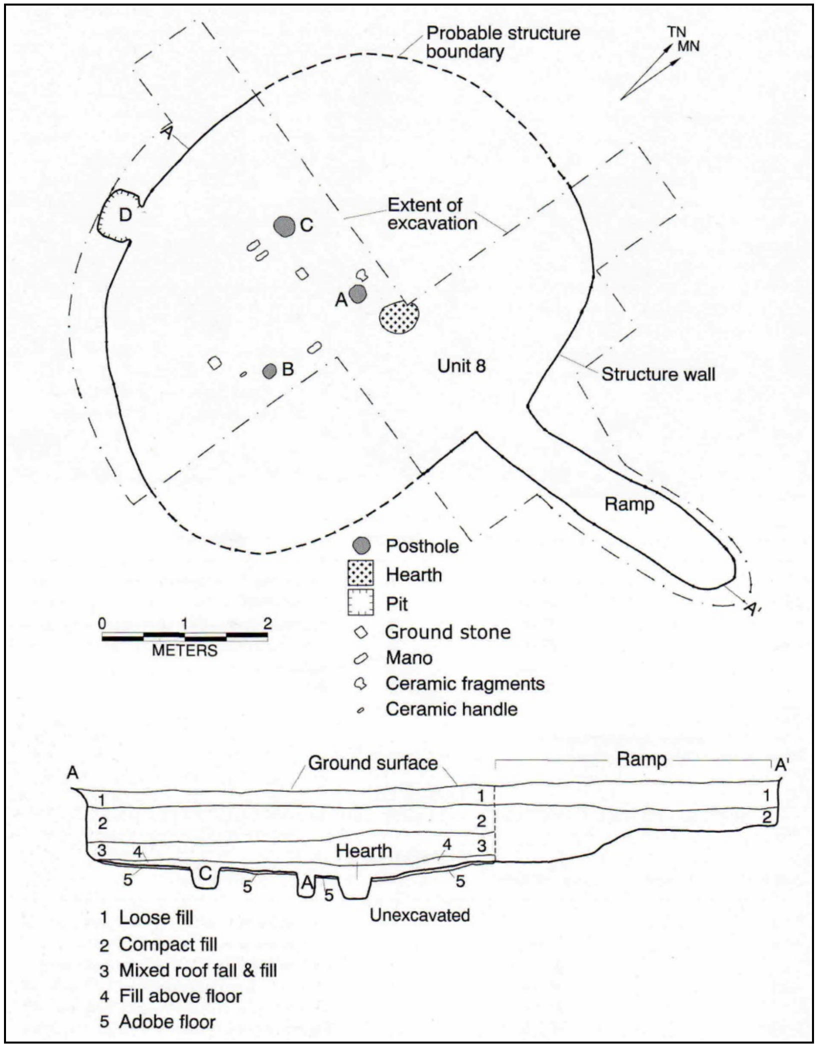

Figure 6.1 Plan view and profile of Unit 8 at the McAnally Site (Anyon et al. 2001:96).

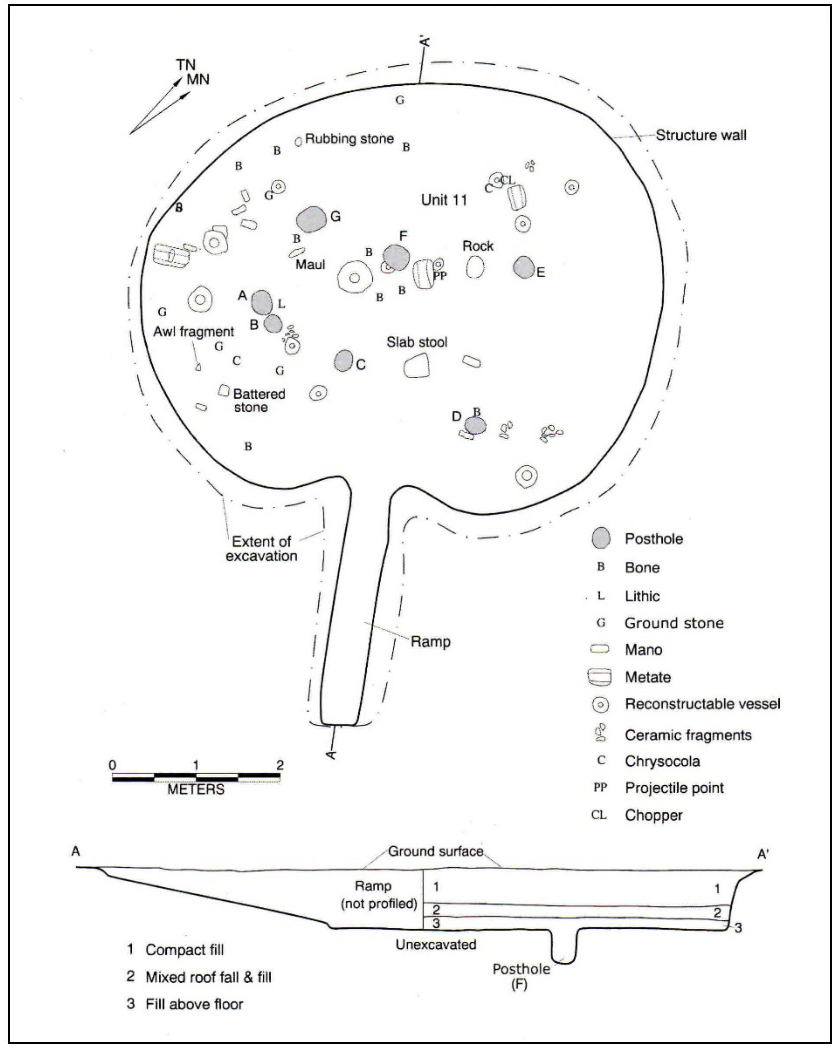

Figure 6.2 Plan view and profile of Unit 11 at the McAnally Site (Anyon et al. 2001:100).

of Unit 11 (n=3).

Several of the manos recovered from the McAnally site had modifications to one or more surfaces not associated with use. Visible alterations to ground stone surfaces/sides/ends, in the forms of grips, may suggest modification to the sides of manos for better handling and the addition of mano rests to metates creates a place holder for manos. These alterations are not necessarily related to increasing efficiency of tools, but rather personal choices made by women using these tools to make them easier to use. Pecking and grinding the sides of manos created tools that could fit in one's hand, making them easier for the user to hold during use. Further, the addition of mano rests may indicate a women's preference to have a set area to place a mano with its associated metate. The significance of these alterations are that they represent the agency of women in modifying their technology to better suit their needs.

All four of the ground stone artifacts from the floor of Unit 8 were manos. Two were identified as flat and two as trough manos. Three of the manos were strategically designed. Both flat manos were ground to hold and pecked to shape, creating a grip on one side. One of the trough manos (Figure 6.3) was pecked in a rectangular shape and ground to hold. It had two grips, one on each side, and had striations on both surfaces from use.

Two flat/concave manos and a trough metate were recovered from the roof fall/wall of Unit 11. The metate was made from sandstone and was not modified. The manos had striations on both surfaces from use. One of the manos, made of rhyolite, was strategically designed by pecking it into an oval shape, forming grips on both sides.

Four manos, one metate, and two slabs were found on the floor of Unit 11. Two of the manos were identified as trough manos, one a basin mano (Figure 6.4), and the fourth as a likely

Figure 6.3 (left) Mano (8-4-4/1) from the floor of Unit 8.

Figure 6.4 (right) Mano (11-3F-6/8) from the floor of Unit 11.

basin mano. One of the trough manos and the basin mano were both strategically designed and were ground on their sides for ease of handling during use. The trough mano had two grips on both sides and the grips on the basin mano encircled the artifact. All four manos had evidence of use wear on only one surface.

A fragment of a basalt trough metate was analyzed by Diehl (2001), but aside from artifact type and measurements, no other data on this metate were published. Two broken sandstone slabs were also found on the floor and both were fire-blackened. One was ground on one surface and the other was pecked and ground on both surfaces. While the functions of the slabs are not definite, it is plausible that they may have been used as cooking stones and placed near fire-features or used as trivets for holding ceramic vessels.

Examining the surface area of the nine manos from the McAnally site provided additional information. Basin manos typically have smaller surface areas than flat and trough manos. Therefore, when looking at average surface area, basin manos were separated from other mano types. The surface area for basin manos was between 61 and 71.76 cm^2 (n=2). The average surface area for flat and flat/concave manos was 254.44 cm^2 (n=3); there was an additional flat mano with a surface area of 74.88 cm^2. The average surface area for trough manos was 208.04

cm^2 (n=3). This demonstrates the relative similarity between the surface sizes of trough and flat manos and may also indicate that both mano types were used with the same frequency for food processing.

McAnally Site Ceramics

Eleven partially reconstructable ceramic vessels were recovered from the McAnally site. All were jars from Unit 11. Several of the reconstructable vessels could not be located in the curated collection. Six were personally analyzed and data on the remaining 5 vessels were documented in work by Arthur (1994, 2001). One was located in roof fall/pithouse fill and ten were found on the floor.

The jars were all identified as Alma plainware and all exhibited exterior and/or interior surface treatments (see Appendix B) as further discussed by Arthur (1994, 2001). Of the 6 vessels analyzed, 4 were burnished on the exterior, one was polished, and one exhibited no exterior surface treatments. Two of the 6 vessels were burnished on the interior, one was burnished and smoothed, one was smoothed, and two were polished and smoothed on the interior. Arthur's (1994, 2001) analysis indicates that the other 5 vessels exhibited surface treatments, but did not indicate which types.

All 11 jars exhibited interior scraping as a result of use. Nine of the jars contained soot on one or more areas including the interior and exterior, as well as localized areas on both surfaces. Data, including previous analysis by Arthur (1994:83, 2001), indicates that these jars, excluding C and E, were used in cooking activities. Vessel C and E were likely used for food processing. Only 4 of the jars were reconstructed enough to attain volume measurements. Vessel B held 8.3 liters; Vessel F held the smallest amount at 1.46 liters (Figure 6.5), Vessel H held 1.99 liters

Figure 6.5 Vessel F from the McAnally site.

Figure 6.6 Vessel H from the McAnally site.

(Figure 6.6), and Vessel L was found to hold the largest amount at approximately 10.44 liters, indicating the use of multiple jar sizes in food processing and cooking activities (Arthur 1994). Arthur's analysis of jar rims from the McAnally site found that a large number had rim diameters around 10 cm; Arthur (1994:82) found that the manufacture and use of jars with small rim diameters for cooking was likely related to the need for smaller heat effective jars.

McAnally Site Fire-Features

Unit 8 contained the only clearly defined fire-feature at the McAnally site. An unlined basin pit hearth was located west of the pithouse entry. The hearth contained ash and measured 40 x 38 cm and was 25 cm deep (Anyon et al. 2001; Arthur 1994). No obvious hearth was discerned on the floor of Unit 11. It is plausible, because the pithouse burned, that an ephemeral fire-feature (including a fire placed directly on the floor) may have been masked by the burning of the pithouse. Further, the soil matrix was very compact, making the detection of an ephemeral feature more difficult (Arthur 1994). Anyon et al. (2001:99) suggest that posthole G, located northeast of the entry approximately one meter from the east wall may have been the hearth.

Posthole G was large and shallow in comparison to the other postholes, measuring 40 x 30 cm and was 21 cm deep, but the soil type and artifacts from the feature were not recorded.

McAnally Site Summary

While the artifact assemblage from the McAnally site was small, the ceramic and ground stone artifacts provided a large amount of data on food processing and cooking activities, especially in regard to Unit 11. The significant *in situ* floor assemblage demonstrates the use of and storage of jars, manos, and metates within the domestic structure. The absence of reconstructable bowls may indicate that they were removed before the structure burned, that they were used less often than jars and therefore a smaller quantity was needed, or that they were used in other contexts including extramural areas, amongst other theories.

The Late Pithouse Period: The Harris Site (LA 1867)

Twenty pithouse habitation structures were partially or completely excavated at the Harris Site. Artifact assemblages were recovered from roofs, floors, and extramural surfaces. Structures were dated using architectural styles, ceramics, radiocarbon, dendrochronology, and archaeomagnetic dating, and place the occupation of the structures during the Late Pithouse period (Roth 2015).

Harris Site Ground Stone

Ninety-nine ground stone artifacts from the Harris Site were used in this study based on context and condition; this included ground stone from roof, floor fill, floor, and feature fill contexts that were more than half intact. This sample includes 72 manos, 10 metates, 13 pestles, and 4 mortars from pithouse and extramural features.

Mano Type	Pithouse				Extramural	Total
	RF/WF	RFWF/FF	PHF	FF/F		
Fragment						
Basin	1					1
Trough	2	1		2	2	7
Indeterminate				1		1
Total	3	1	0	3	2	9
Whole						
Basin	2		1	2	1	6
Trough	14	1	1	18	7	41
Flat	1					1
Flat/Concave	7		1	3	3	14
Indeterminate				1		1
Total	24	1	3	24	11	63

Table 6.1 Manos from the Harris site categorized by mano type, condition of artifact, and context.

Manos

Sixty-three of the manos were whole or contained minor fractures near the edges or sides (Appendix A) and nine were fragments that were more than half intact. Seven fragments were from pithouse contexts and included 5 trough manos, one basin mano, and one indeterminate mano; two trough mano fragments were also recovered from extramural features (Table 6.1 and 6.2).

Twenty-four manos were found in roof fall/wall fall contexts (Table 6.1 and 6.2). Six pithouses had roof top assemblages containing one or more whole manos (Roth 2015). A flat/concave mano with modified grips and a trough mano were recovered from pithouse 35; these manos were associated with other tools as part of a roof assemblage. Five manos were recovered from pithouse 41; two were identified as flat/concave with modified grips, and three as trough, two of which had grips (Figure 6.8). Four trough manos, three with grips, were recovered from pithouse 42. Six manos were found in pithouse 43; three were classified as flat/concave manos, two with grips. Two were identified as basin manos with grips, and one as a trough mano

Mano Type	Pithouse				Extramural	Total
	RF/WF	RFWF/FF	PHF	FF/F		
Basin	2		1		1	4
Trough	7	1	1	11	5	25
Flat	1					1
Flat/Concave	5		1	2	2	10
Total	15	1	3	13	8	40

Table 6.2 Number of manos from the Harris site with modified edges and/or sides by mano type and context.

(Figure 6.7). Two trough manos were located in pithouse 46, one with modified grips. Three manos were recovered from pithouse 53; one was a flat mano with grips and two were trough manos, one with grips (Figure 6.8). Many of the roof fall/wall fall manos were made of undifferentiated intermediate volcanic stone and vesicular basalt (Table 6.1-6.3). Three of the manos were made from sandstone, all with modified grips, two from pithouse 41 and one from pithouse 53. One trough mano with grips was recovered from the roof fall/wall fall/floor fill of pithouse 54. It is unknown if this mano was part of the roof or floor assemblage due to evidence indicating the roof fell directly onto the floor.

Twenty-four manos were from floor-related contexts (Table 6.1 and 6.2). One mano with an indeterminate design made from scoriaceous basalt was found in pithouse 35. Two unmodifed basin manos were found in floor-related contexts, one in pithouse 37 and one in pithouse 39. Both basin manos were manufactured from raw materials not typically used for food processing at the Harris site, granite and quartzite. Raw materials such as granite and quartzite have a finer texture compared to a volcanic stone with vesicles, which are much coarser. A coarser stone can be used to grind maize into a coarse flour much easier and faster than a fine-grained stone, but once in a coarse state, a fine-grained mano can be used to process coarse flour into a finer flour. These basin manos may represent manos used in a later stage of food processing.

Additionally, one trough mano each was recovered from five pithouses. The trough manos from pithouses 41 and 44 did not exhibit grips, but those from pithouses 36, 42, and 43 did have grips. The trough manos from pithouses 36 and 43 were located within the center posthole of the structures; other manos were recovered from this context and Falvey (2014, 2015) links the ritual retirement of the structure to the placement of manos in the center postholes of pithouses after the beam is removed. One trough and one flat/concave mano were also found in pithouse 38, both with modified grips.

Four trough manos were recovered from pithouse 45, and only one exhibited grip modifications. One of the unmodified trough manos was located within the center posthole. Pollen analysis was done on the trough mano exhibiting grip modifications and the sediment collected from beneath it. Pollen grains found in 100- and 200- grain counts included maize, cholla, prickly pear, cattail, cheno-am, low- and high-spine asteraceae, globemallow, wild grasses, wild buckwheat, wild mustard, and wild pea (Phillips 2015). These data indicate that the

Mano Type	**Basin**	**Trough**	**Flat**	**Flat/Concave**	**Indet.**	**Total**
Raw Material						
Basalt - Scoriaceous					1	1
Dacite		2				2
Diorite				1		1
Granite	1	1				2
Granodiorite				1		1
Limestone		2				2
Quartzite	1			1		2
Rhyolite		3				3
Sandstone		2		2		4
Undiff. Inter. Volc.	3	10	1	6		20
Undiff. Felsic Volc.		6		2		8
Undiff. Mafic Volc.		2				2
Vesicular Basalt	1	12		2		15
Total	6	40	1	15	1	63

Table 6.3 Number of manos from the Harris site by raw material and mano type.

Figure 6.7 Basin manos recovered from Pithouse 43 (left) and Pithouse 45 (right).

Figure 6.8 Trough manos recovered from Pithouse 53 (left) and Pithouse 41 (right).

mano was used to process a variety of plant species, not only agricultural crops like maize, but several wild plant species as well.

Two trough manos were found in pithouse 49, superimposed above pithouse 54, and both exhibited modified grips. Pithouse 54 contained three trough manos, two with grips. The last five manos were recovered from pithouse 53. Three were trough manos, two with grips, and two were flat/concave manos, one with grips. Raw materials mainly consisted of undifferentiated volcanic stone and vesicular basalt, and also included two manos manufactured from dacite.

Seven extramural features also contained one mano each. Flat/concave manos, two with modified edges and or sides, were recovered from three features: Feature 7, an extramural surface, likely a ramada in association with a hearth; Feature 11, an extramural storage pit, likely part of a ramada; and Feature 27, an extramural surface. A basin mano with grips was found in feature 24, an extramural surface with multiple storage pits. Trough manos, two with modified grips, were each recovered from features 28 and 32-34, both extramural surfaces with storage pits, and feature 35, a ramada. The presence of manos in both pithouse and extramural features indicate that both locations were used for food processing and storage of food processing tools.

Only one feature had more than one mano. Feature 30 represents a secondary occupation of superimposed pithouses 48/45 (Figure 6.9). It was identified from a concentration of stacked ground stone; this included four trough manos, three with modified grips. This ground stone feature may represent a storage area for different ground stone tools, including those used for food processing. The raw material of the manos found in extramural features were comprised mainly of vesicular basalt and undifferentiated volcanic stone. Two manos were made from diorite and granodiorite and are rarely used at the site for food processing. Like the manos from pithouses 37 and 39, these raw materials are finer-grained compared to the raw materials of the other manos, and may represent manos used in a later stage of food processing.

Metates

Metates were recovered from roof fall/wall fall and floor contexts (Appendix A). Five were in roof fall/wall fall and were found in association with four pithouses. Two broken metates were found in pithouse 39. One was a basin metate with heavy wear that was made of vesicular basalt. The other was a ¾ basin metate, also with heavy wear, made of undifferentiated intermediate volcanic stone. A broken trough metate, made of vesicular basalt, was also found in pithouse 53. It had a moderately worn surface and was ground on the base for stability. An indeterminately designed metate was recovered from the roof fall/wall fall of pithouse 46. It was whole, rectangular, and made of vesicular basalt. The minimal wear on the surface made classifying metate type difficult. A whole metate was also located in pithouse 38, likely left on the roof of the structure as a ritual item, as it was painted with red ochre prior to abandonment (Roth 2015). It had a surface area of 900 cm^2. It was a rectangular Utah trough metate with a pecked mano rest above the metate surface. This metate exhibited light wear and was made from undifferentiated felsic volcanic stone.

Figure 6.9 Feature 30 containing multiple ground stone artifacts (Photo credit: Barbara Roth).


Figure 6.10 Metate with mano rest from the floor of Pithouse 49.

Five whole metates were also recovered on the floors of three pithouses. A rectangular ¾ basin metate was found in pithouse 41. It exhibited light wear and was made of vesicular basalt; it had a surface area of 638 cm^2. Two metates were recovered from pithouse 46. One was a rectangular ¾ trough metate with heavy wear, and made of vesicular basalt, with a surface area of 882 cm^2. The other was a rectangular trough metate, also with heavy wear, made of undifferentiated intermediate volcanic stone.

Two Utah trough metates were also found on the floor of pithouse 49. One was ovoid in shape with heavy wear, and made of undifferentiated intermediate volcanic stone (Figure 6.10). It had a surface area of 636.5 cm^2. The other was irregular in shape, made from vesicular basalt, but was unused. This metate was likely being altered in preparation for use; the pecked surface area measured 910 cm^2. Both metates contained mano rests above the metate surface.

Pestles

Thirteen pestles were recovered from roof fall/wall fall and floor-related contexts, and extramural features (Appendix A). Pestles were used for crushing and grinding small amounts of

Figure 6.11 Pestle from Feature 21.

Figure 6.12 Ground stone assemblage from Pithouse 48 Floor (Photo credit: Barbara Roth).

food, including seeds and nuts; they were also used for processing non-food resources, such as minerals and pigment. The majority of the pestles were large, up to 27.3 cm in length. Several exhibited stone/resilient wear, likely due to a stone pestle being used in a wooden mortar.

Seven pestles were found in roof fall/wall fall as part of roof top assemblages. Two were found in the roof top assemblage of pithouse 35; one was also used as a netherstone. One triangular pestle was located in pithouse 54. This pestle was used on two opposite ends and was also used as a handstone. Two pestles were each found in pithouses 41 and 43. Two pestles from pithouse 41 exhibited wear to the ends of the tools from being worked as pestles as well as surface wear from being used as manos. Both pestles have stone-on-stone wear on the ends congruent with crushing and grinding use and functioned concomitantly with the mano surface. Likewise, the pestles from pithouse 43 shared similar patterns, but one of the pestles was broken. Use wear found on the whole pestle indicates that the tool did not function as a mano and a pestle concomitantly, but rather as a mano and then a pestle.

Four pestles were found in floor fill and floor contexts. A broken cylindrical pestle was located in pithouse 36 and another broken pestle in pithouse 38. This pestle was also used as a

mano. A whole cobble pestle was found in pithouse 39 and a whole conical pestle in pithouse 48. Two whole pestles were also found in extramural features. A pestle also used as a mano was recovered from feature 7; wear from being used as a pestle was present on one of the ends, at the corner. This tool likely functioned as a mano and pestle concomitantly. A cobble pestle with wear on both ends was found in feature 21 (Figure 6.11); both ends exhibit stone-on-stone wear from crushing and grinding. Wear is also present that may indicate stone-on-resilient wear, possibly a result of using the pestle in a wooden mortar.

Mortars

Four mortars recovered from the Harris site were included in this analysis. Two small mortars were recovered from roof assemblages in pithouses 35 and 42. Both exhibited light use wear and stone on resilient wear. The mortar from pithouse 35 was made of rhyolite. The mortar from pithouse 42 was made of pumice and contained two adjacent mortar basins.

Two mortars were also found in floor-related contexts, one in the floor fill of pithouse 46 and one on the floor of pithouse 48 (Figure 6.12); the mortar from pithouse 48 was found stored in the corner with other ground stone. Both were identified as large boulder mortars made of vesicular basalt. The mortar from pithouse 46 was broken and did not exhibit any use wear. It was whole and had moderate stone-on-stone use wear. The large size of the mortar and the unevenness of the mortar base was combatted by its users by placing several small stone fragments, or trivets, beneath it to stabilize it during use.

Harris Site Ceramics

Twenty-four ceramic artifacts were sampled from the Harris Site based on context and condition. This includes four ceramic tools, 19 reconstructed ceramic vessels, and one whole

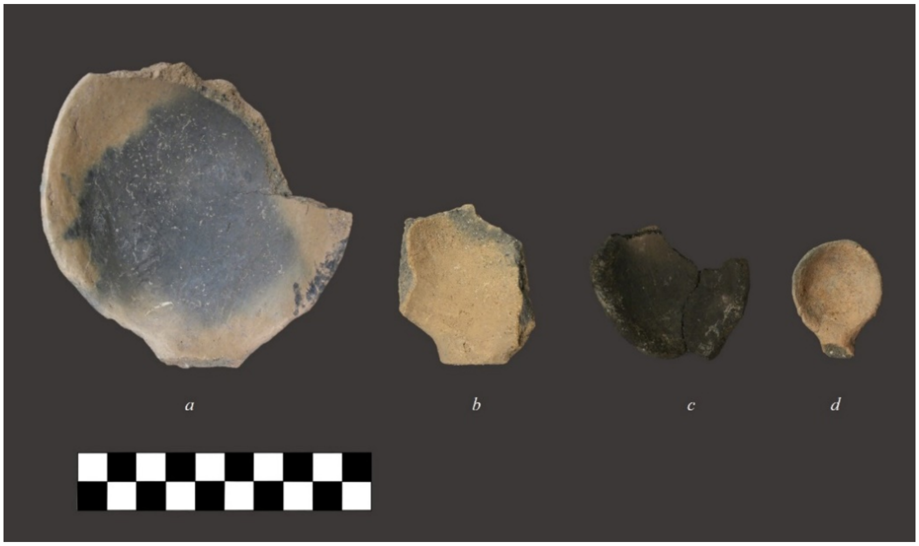

Figure 6.13 Ceramic Utensils, from left to right, *a*, ladle from Pithouse 53, *b*, ladle from cultural fill, *c*, spoon from Pithouse 41, *d*, spoon from cultural fill.

vessel.

Ceramic Tools

Two spoons/scoops/ladles were recovered from roof fall/wall fall and floor fill contexts. Two were also found in cultural fill. While cultural fill artifacts are not discussed in other sections, they are included here only to acknowledge that they were part of food processing and cooking processes. In many cases, when spoons/ladles are found they are broken at the handle, and only parts of the base are intact; this is true for those found at Harris.

Two of the ceramic tools were classified as scoops/ladles; one was from cultural fill and the other from the floor fill of pithouse 53 (Figure 6.13 *a*, *b*). The other two were classified as scoops/spoons and were found in cultural fill and the roof fall/wall fall of pithouse 41 (Figure 6.13 *c*, *d*). All four were plainware and only one was burnished, the ladle from pithouse 53.

Ceramic Vessels

Four ceramic vessels were recovered from roof fall/wall fall, one from roof fall/wall fall/floor fill, twelve from floor-related contexts, and three from extramural features (Appendix B). Two partial vessels were located in the roof fall/wall fall of pithouse 41. One was the neck of a Three Circle Neck Corrugated jar and the second was the base of an Alma plain jar. Soot was present on the interior and exterior of the jar neck and scraping was present on the interior of the neck. Evidence indicates the jar was used for cooking. The exterior of the jar base was burnished and contained soot. The interior of the vessel contained minor pitting and heavy soot, indicating it was also used as a cooking vessel.

Two partial jars were also recovered from pithouse 43. One was a small partial Alma Punched jar exhibiting exterior burnishing and polishing (Romero 2014). This jar had a rim diameter of 12 cm with an estimated volume of 0.95 L. The absence of soot and presence of light interior scraping indicate that this functioned as a serving vessel. The second vessel was the rim and neck of a Three Circle Neck Corrugated jar with a rim diameter of 19 cm. The exterior body of the vessel was heavily burnished/polished and slightly polished over the neck corrugation. Interior scraping was also present around the neck and rim. Available characteristics indicate that this jar was used for storage and/or processing.

A partial body and base of a plainware cooking vessel, likely a jar, was found in the roof fall/wall fall/floor fill of pithouse 54. The exterior body was burnished and contained soot, likely deposited from close proximity to fire. The interior had heavy soot, with pitting and scraping at the base. A reconstructed rim and neck of a Three Circle Neck Corrugated jar was found in the floor fill of pithouse 53. No evidence of burnishing or polishing was present on the intact portion of the jar and use wear was minimal; this jar was likely used for storage.

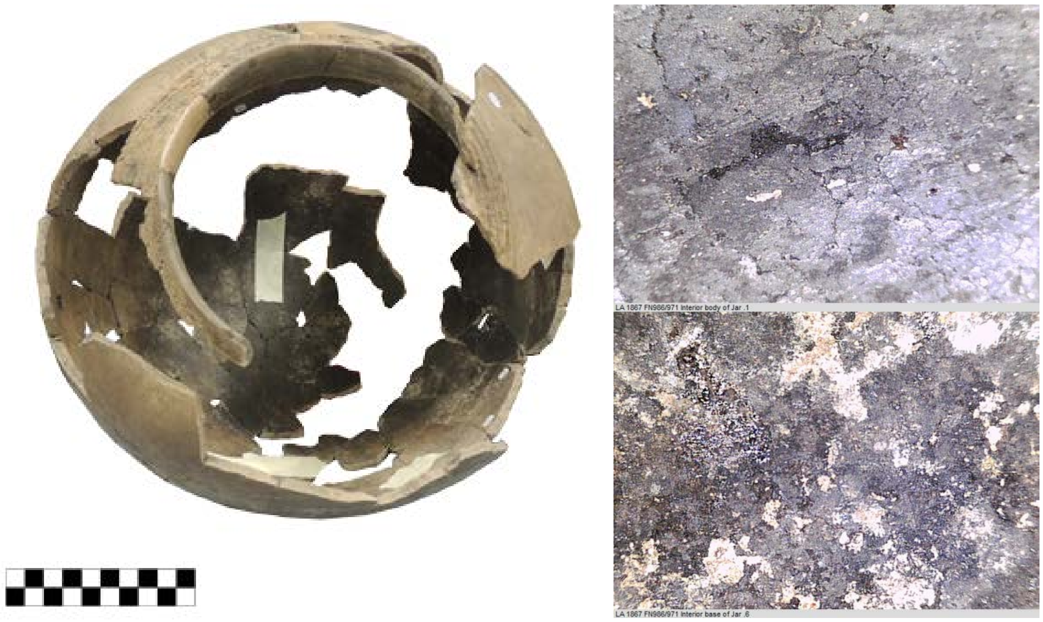

Figure 6.14 Jar found on the floor of Pithouse 36 (left) and close-up of use wear on the jar interior (right).

A large partially reconstructed Three Circle Neck Corrugated jar was found on the floor of pithouse 36 (Figure 6.14). The vessel had a rim diameter of 16 cm and an estimated volume of 9.4 L. Burnishing was present on portions of the base and body on both the interior and exterior of the jar. Scraping from use was visible on both the interior neck and body of the jar. Light soot was present on the lower body and base of the vessel, only on the interior. A small number of sherds exhibit minor pitting, located near the interior base of the jar. Evidence indicates that this jar likely served multiple functions, likely for processing and storage, but also as a cooking vessel based on the amount of interior use wear.

A partial fragment of a plainware bowl was found in the floor fill of pithouse 45, positioned below pithouse 48 (Figure 6.15). It had a rim diameter of 23 cm and an estimated volume of 3.2 L. The exterior of the bowl was burnished and the interior was polished. Interior scraping from use was present along the intact portion of the rim, body, and base. These characteristics indicate that the bowl was used for serving and processing. A plainware jar was

Figure 6.15 Bowl from the floor of Pithouse 45.

Figure 6.16 Jar from Feature 11.

also found on the floor of pithouse 45. The exterior of the jar was burnished and had a restricted neck and opening. Interior use wear was minimal and the jar had an estimated volume of 2.8 L. Vessel attributes indicate that the vessel was likely used for liquid storage and serving.

Four partial reconstructable Three Circle Neck Corrugated jars were found on the floor of pithouse 44, stored along the wall. One vessel had a rim diameter of 20 cm and two had rim diameters of 18 cm, one of which had an estimated volume of 11.5 L. The exteriors of the four jars were burnished. The jar interiors exhibited heavy sooting and pitting, beginning below the neck and extending to the base. The use wear on these vessels have been associated with fermentation, probably of corn beer, which has been documented at NAN Ranch Ruin (Romero 2014, 2015; Shafer 2003).

Four additional vessels were found plastered in the floors of four pithouses, positioned near the hearths. An almost complete Alma Plain jar was found plastered in the floor of pithouse 37. It had an estimated volume of 2.9 L. The exterior body was burnished and the base was flattened slightly and smoothed, so that the jar sat unevenly. The interior contained sooting,

pitting, and scraping from use. The jar functioned as a cooking vessel prior to being plastered in the floor. Afterwards, it was likely used as a storage bin for food storage, also consistent with its placement near the hearth. Results from a pollen wash on sherds from the jar found the presence of pollen grains from maize, pinyon pine, oak, maple, cheno-am, wild pea, wild buckwheat, and hackberry (Phillips 2015). Residue analysis also provided evidence for cooking both plant and animal species. This includes the processing of large herbivores and medium fatty acids such as maize, cholla, and mesquite (Woods and Roth 2013).

An Alma Plain jar, with an estimated volume of 5.4 L, was plastered in the floor of pithouse 38. The body and base were reconstructed, although the neck and rim were absent, the break likely occurring prior to its internment in the floor (Romero 2015). The exterior body was burnished and the base was flattened and smoothed. Pitting and sooting were present in the interior of the jar. Like the jar found in pithouse 37, this jar was also used as a cooking vessel and then reused as a food storage bin. Results from a pollen wash on sherds from the vessel found similar results to those of pithouse 37. Pollen grains of maize, cholla, prickly pear, juniper, cheno-am, and wild buckwheat were present (Phillips 2015). Residue analysis results found both animal and plant species, also with similar patterns to pithouse 37 (Woods and Roth 2013).

An intact Alma Punched jar was found plastered in the floor of pithouse 43, covered by a large rock (Figure 6.17). It had a rim diameter of 12.3 cm and an estimated volume of 5.6 L. The exterior body of the jar was burnished and the base was flattened and dimpled, and was not smoothed. Burnishing was also present on the interior body of the jar, but not extending to the base. The interior contained minimal pitting and sooting; interior use wear was also visible.

The last vessel recovered from floor contexts was a reconstructed Three Circle Neck Corrugated jar plastered in the floor of pithouse 48. The exterior of the jar was heavily burnished

Figure 6.17 Floor of Pithouse 43 with an arrow indicating the location of the vessel (left) and the jar after it was removed from the floor (right).

and the base flat and smoothed. The vessel interior contained pitting, soot, and scraping from use wear consistent with a cooking vessel. The estimated volume of the jar was 4.3 L. Like the other three vessels found plastered in the floors, this jar was also reused as a food storage bin. Pollen analysis was performed on both the sediment from inside the vessel and the vessel itself. Pollen grains found include maize, cholla, prickly pear, yucca, globemallow, wild pea, cheno-am, maple, and ponderosa and pinyon pine (Phillips 2015). Results of residue analysis were consistent with the pollen results finding high levels of fatty acids. The results suggest medium fat content plant foods such as maize, cholla, and mesquite were mainly cooked within the jar, but that large herbivores, likely deer, were also prepared (Woods and Roth 2013).

Three ceramic vessels were also recovered from extramural features. A partially reconstructed Alma Punched jar was found in feature 11, a storage pit that was dug into an extramural surface and possibly associated with a ramada (Figure 6.16). The rim diameter was 9 cm and the estimated volume was 0.312 L. The exterior was lightly burnished and the base was flattened and smoothed. The jar had minimal soot and the interior had slight pitting and scraping

from use. The small size of the jar suggests that it was likely not used as a cooking vessel, but is more consistent with a serving and or processing vessel.

The last two vessels were found in feature 12, a secondary occupation feature associated with pithouse 39. One was a portion of a reconstructed Alma Plain bowl with a rim diameter of 22 cm and an estimated volume of 2.8 L. The bowl was heavily burnished and contained interior scraping from use. The likely function of this vessel was processing and serving. The second vessel was part of the rim and a neck of a Three Circle Neck Corrugated jar with a rim diameter of 22 cm. The exterior body was burnished and the intact portion of the vessel had no evidence of cooking-related wear. Light scraping from use was present in the interior. The jar likely functioned as a storage and or processing vessel.

Harris Site Fire-Features

A total of 21 fire-features were excavated; eighteen were found on floors within habitation structures and three were located in extramural features, either secondary occupations of pithouses or ramadas (Appendix C). Basin hearths comprised the majority (16 of 18) of the intramural hearths. There were two forms of basin pit hearths; one is an informal unlined basin pit and the other is a formal basin pit lined with adobe or adobe and cobbles. Five were informal basin pit hearths ranging from between 40-73 cm by 20-53 cm and 5-20 cm in depth; two of these hearths contained a hearth stone. Ten hearths were formal lined basin hearths; nine were adobe-lined and one was adobe- and cobble-lined. Dimensions ranged from 34-62 cm by 25-47 cm and 8-23 cm in depth. Of the 10 formal lined hearths, 8 contained hearth stones.

The last of the 16 basin pit hearths, also accompanied by a hearth stone, was from pithouse 39 (Figure 6.18). The hearth measured 73 by 38 cm and was 34 cm deep; soil changes

Figure 6.18 Hearth from Pithouses 39 and 40.

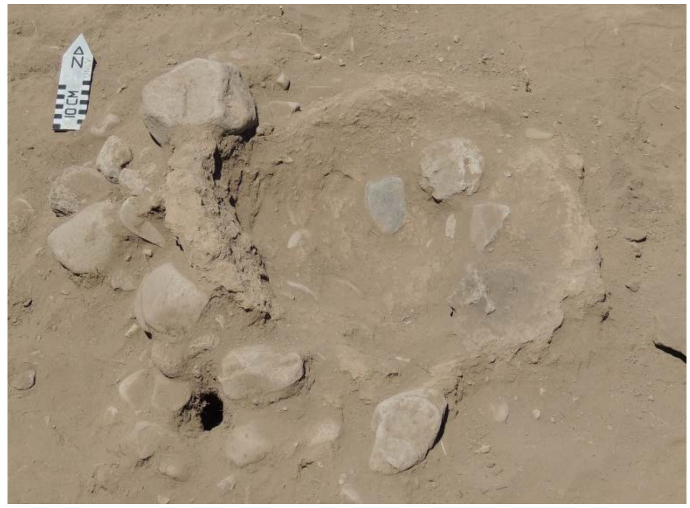

Figure 6.19 Hearth from Feature 31.

within the hearth indicate repeated use and this hearth was built directly on top of the hearth from the underlying structure, pithouse 40. Circular collared hearths were present in two of the pithouses. These hearths differed from the basin pit hearths by the presence of a ring, or collar, of adobe plaster around the top of the feature. These hearths measured 50 by 47 cm and 49 by 35 cm, respectively, and were 10 cm deep; the larger of the two also had evidence of multiple remodeling episodes.

The last three hearths were located in extramural areas. Two unlined basin pit hearths were located in the secondary occupation area associated with pithouse 39, feature 14, and in a ramada area, feature 1. They measured 35 by 31 cm and 55 by 50 cm, respectively, and were 13-15 cm deep. The last hearth, in feature 31, was located in the secondary occupation area associated with pithouses 49 and 54, and was collared and lined. It was lined with both adobe plaster and rocks, and measured 70 by 60 cm and was 20 cm deep (Figure 6.19).

Analysis of macrobotanical samples from the hearths revealed the presence and consumption of multiple plant species (Diehl and Toney 2015). A single domesticated common

bean (*Phaseolus vulgaris*) was found in the hearths of pithouses 35, 43, 46, 47, and 49. Maize was found in the hearths of pithouses 35, 36, 37, 39, 41, 42, 43, 44, 46, 48, 49 and 53. One ground cherry (*Physalis*) seed was found in pithouses 36, 39, and 53, and sunflower (*Helianthus*) seeds were recovered in pithouses 36 (n=2) and 43 (n=1). In several hearths, goosefoot (*Chenopodium*) seeds appeared in the largest quantities and were recovered from pithouses 36 (n=4), 42 (n=18), 43 (n=172), 48 (n=1), and 49 (n=24). Juniper (*Juniperus*) seeds were found in the hearths of pithouses 36, 37, 42, 44, 46, and 53. A piñon pine cone scale was found in pithouses 36 and 47. Wild grape (*Vitis*) seeds were also recovered from the hearths in pithouses 42 (n=2) and 49 (n=1).

Harris Site Summary

The Harris Site assemblage included in this study was composed of 99 ground stone and 24 ceramic artifacts and 21 fire-features. Manos made up the majority of the ground stone. Of the 63 whole manos, 41 were identified as trough, 14 as flat/concave, six as basin, and one as indeterminate. 63 percent (n=40) of the manos were modified to include some form of finger grips/grooves for improved handling of the tool during use. Further, 24 manos were found in both roof fall/wall fall and floor-related contexts indicating that both roof tops and floors were utilized in storing food processing tools.

Ceramic vessels in this study were composed of a large array of vessel types and sizes. The majority of the vessels applicable to this study were jars, likely influenced by the number of partial bowls that were decorated rather than corrugated or plainware. The presence of hearths within domestic structures reveals the importance of these features within households. Few hearths were located extramurally and many of the extramural features excavated had no evidence of fire-features, potentially indicating that cooking with ceramic containers may have

either occurred within pithouses or were limited extramurally to a few shared fire-features; the presence of extramural fire-features are also limited by the extents of excavations. Any form of roasting likely occurred outdoors (Whittlesey 2010).

Food processing and cooking may have functioned at the household level, in that each household was responsible for preparing and cooking their own meals. The processing of food likely occurred both indoors and outdoors, although the majority of food processing equipment was found in pithouse contexts. This may be related to the use of processing equipment in both pithouses and extramural areas with the storage of manos and metates concentrated on pithouse roofs and floors, indicating that each household had their own processing equipment.

The Mimbres Classic Period: Galaz Ruin (LA 635) and NAN Ranch Ruin (LA 15049)

A large number of habitation and non-habitation Mimbres Classic surface pueblo rooms were excavated at Galaz, mainly by the University of Minnesota from 1929 to 1931 (Jenks 1928a, 1928b; Anyon and LeBlanc 1984). Excavations at NAN Ranch also resulted in the excavation of numerous habitation, storage, and ceremonial surface rooms during the late 1970s and 1980s (Shafer 2003). A large amount of information was collected during these excavations that provides data on domestic activities. These data also yield important information on food processing and cooking activities.

Mimbres Classic Period Ground Stone

The ground stone recovered by the University of Minnesota at Galaz was not available for study, mainly due to the discard of ground stone prior to curation (Anyon and LeBlanc 1984). Specific attribute data on the ground stone from NAN Ranch Ruin were also not available for study. Therefore, as correlates for Classic period ground stone, attribute data on manos and

metates were obtained from Lancaster's (1983) thesis on the analysis of manos and metates from numerous sites in the Mimbres Valley. Only whole identified artifacts from the Mimbres Classic period sites in Lancaster's analysis were used for this study; this is composed of 135 manos and 21 metates. Lancaster (1983) analyzed ground stone from six Classic period sites: Wheaton-Smith (A:1:46), Mattocks (LA 676), Bradsby (Y:4:35), Montezuma (Z:1:30), Mitchell (LA 12976), and LA 12109. Lancaster's (1983:7) sampling strategy only comprised of artifacts from unambiguous contexts, including room fill, roofs, floors, trash, and a small number from extramural areas; ground stone from surface collections and mixed cultural fill levels were not included.

Fourteen of the 135 manos, or 10%, were identified as basin manos. One of these was made from vesicular basalt, one from basalt, two from unknown raw materials, five from rhyolite, and five from sandstone. The average length and width of the basin manos was 11.29 cm by 9.45 cm. The average surface area was 106.87 cm^2. Upon examination of raw materials, only slight differences in dimensions and surfaces areas of basin manos made from sandstone and rhyolite were noted (Table 6.4).

Twenty-seven manos (20%) were classified as flat manos based on the lateral shape and cross section characteristics recorded by Lancaster (1983). Two of the flat manos were made from basalt and one from an unknown raw material. Five manos were made from rhyolite, six from vesicular basalt, and 13 (48%) from sandstone. Average dimensions of flat manos were 20.7 cm in length by 10.24 cm in width, with an average surface area of 209.17 cm^2. Aside from the difference in quantities based on raw material type, no significant differences were found between the metric data and flat manos made from rhyolite, vesicular basalt, or sandstone (Table 6.5).

Raw Material	Average Dimensions	Average Surface Area
Rhyolite	11.46 x 9.62 cm	110.26 cm^2
Sandstone	10.64 x 9.08 cm	96.76 cm^2

Table 6.4 Average dimensions of basin manos.

Raw Material	Average Dimensions	Average Surface Area
Rhyolite	19.5 x 11.74 cm	225.54 cm^2
Sandstone	21.76 x 9.34 cm	202.06 cm^2
Vesicular Basalt	19.13 x 11.08 cm	211.27 cm^2

Table 6.5 Average dimensions of flat manos.

Raw Material	Average Dimensions	Average Surface Area
Basalt	19.39 x 10.28 cm	199.38 cm^2
Rhyolite	18.96 x 10.55 cm	200.18 cm^2
Sandstone	22 x 9.96 cm	217.56 cm^2
Vesicular Basalt	21.39 x 10.14 cm	215.95 cm^2

Table 6.6 Average dimensions of trough manos.

Metate Type	Dimensions Range	Surface Area Range
Basin	21.4 - 45 x 21.1 - 35 cm	200 - 1012 cm^2
Slab/Flat	30.3 - 42.5 x 16.8 - 23 cm	177 - 536 cm^2
Trough (3/4)	20 - 45 x 17.6 - 35 cm	141 - 952 cm^2
Through-trough	cm	cm^2

Table 6.7 Dimension ranges of metates by type.

Raw Material	Average Dimensions	Average Surface Area
Basalt	32.8 x 25.65 cm	714 cm^2
Sandstone	51.5 x 33.6 cm	1219.67 cm^2
Unidentified	44 x 33 cm	1056 cm^2
Vesicular Basalt	46 x 32.42 cm	1096.5 cm^2

Table 6.8 Average dimensions of through-trough metates.

The majority of the manos were identified as trough manos (n=94, 69%). Six of these were made from unknown raw materials, ten (11%) from basalt and 15 (16%) from rhyolite. Additionally, 19 (20%) were made from sandstone and 44 or (47%) from vesicular basalt. The average length and width of trough manos were 20.76 cm by 10.25 cm; the average surface area was 211.8 cm^2. The average dimensions by raw material type were calculated and indicate that sandstone and vesicular basalt manos were similar in size and slightly longer than trough manos made from rhyolite and basalt, but that the widths were relatively similar (Table 6.6).

Of the 21 metates, three were identified as basin, three as slab or flat, three as ¾ trough, and 12 as through-trough metates; dimension ranges are provided in Table 6.7. The three basin metates were made of basalt and two of the slab metates were manufactured from rhyolite and one from basalt. One of the ¾ trough metates was made from vesicular basalt and the other two from basalt. Of the 12 through-trough metates, one was made from an unknown raw material, two from basalt, three from sandstone, and six from vesicular basalt.

Average measurements for all 12 through-trough metates were 45 cm by 31.63 cm for the exterior dimensions, and 44.02 cm by 23.48 cm for the surface dimensions; the average surface area was 1060.17 cm^2 (Table 6.8). The two basalt metates had dissimilar dimensions, with one metate less than half the size of the other (Table 6.8). The drastic differences in metate sizes signifies that the larger metate was able to grind a significant amount more than the smaller metate. This may indicate that the smaller metate was used by a smaller household or potentially that the individual using the metate was smaller, such as a child.

As previously discussed, ground stone from NAN Ranch was not available, but limited contextual data regarding the locations of manos and metates was available. Single metates were found associated with three rooms. One was found upside down in the floor fill of room 85, in the northeast part of the room (Shafer 1991a). A metate was found in room 29, likely stored on the roof, positioned near the southwestern part of the room (Shafer 1991b). A through-trough metate was found on the floor of room 108, a small granary or utility room (Shafer 1992). Single manos were found on the floors in rooms 47 and 60 and a mortar was found on the floor in room 8.

At least four rooms contained multiple food processing tools. Five manos and one pestle were found in room 84 and one metate, one mortar, and three manos were found in room 50. A

large floor assemblage of manos was found on the floor of room 74, a shared storage room also containing numerous ceramic vessels (Shafer 1991b). A total of 25 manos were found of various types and raw materials. According to Shafer (2003) these manos were used for processing sprouted corn (WNMU Museum 2016). Three manos and a metate were found stored in the corner on the floor of room 94 (Shafer 1991c). All three manos were found to have been used with the associated metate. Each mano was made from a different raw material, with different levels of coarseness, potentially indicating the use of different manos to attain a specific level of coarseness or fineness of grain.

Galaz Ruin Ceramics

A number of ceramic vessels were recovered in floor contexts at Galaz (Appendix B). As previously mentioned, artifacts from the University of Minnesota excavations at Galaz were not available for study. Therefore, ceramic vessels could not be analyzed personally and the data relied on the traits recorded by University of Minnesota excavators; therefore information regarding interior and exterior use-related wear is unknown, aside from what could be determined based on published photographs and the attributes and vessel dimensions published in the appendices of the site report and excavation notes (Anyon and LeBlanc 1984). The majority of the vessels excavated and published from the University of Minnesota excavations were decorated and 10 of the vessels were considered to have been used in food processing and cooking activities based on vessel type, shape, and exterior decoration. The majority of these vessels were found complete or were able to reconstructed. Six vessels were found in the South room cluster, two in the West, and two in the North room cluster.

In the South room cluster, one vessel was found on the floor in room 70, three on the floor in room 70a, and one in the floor of rooms 94 and 52. A small jar with clapboard

Figure 6.20 Bowl found on the floor of Room 70a at Galaz Ruin (Anyon and LeBlanc 1984:603, Plate 139-D).

Figure 6.21 Jar found set into the floor of Room 52 at Galaz Ruin (Anyon and LeBlanc 1984:517, Plate 53-D).

corrugation covering half of the exterior was found in room 70. The jar had a plain handle and measured 11.5 cm high, with a rim diameter of 6 cm and a body diameter of 12 cm. The estimated volume was 0.434 L.

The three vessels from room 70a were found on the floor set on a layer of ash. Two vessels were corrugated bowls with obliterated tooled exteriors and flared rims and plain interiors. One bowl measured 19.5 cm high and had a diameter of 41-42.5 cm (Figure 6.20). It had an estimated volume of between 18.04 and 20.1 L. The second bowl was 20 cm in height and had a diameter of 41-44.5 cm. Its estimated volume was 18.71-23.07 L. The third vessel was a flare rim bowl with a plain interior and a red slipped and obliterated tooled exterior. It was 15.5 cm high and had a diameter of 31 cm; the estimated volume was 7.8 L.

A complete full bodied clapboard corrugated jar was found in room 94. It was in the northeast corner of the room standing upright, and set just below the floor. The area of the floor surrounding the jar had no evidence that adobe was applied around the top of the vessel after it was placed beneath the floor. When found, an approximate 30 by 30 cm flat limestone slab was on top of and covering the vessel. The jar was 32 cm high and had a body diameter of 33 cm. Based on its diameter, it had an estimated volume of 9.123 L.

The last vessel from the South room cluster was a small Style III black-on-white jar (Figure 6.21). While decorated vessels were not considered in this research due to their primary role as serving vessels, there are exceptions. This particular jar was set into the floor of room 52, so that the rim was at floor level. Therefore, while its original role was likely not for processing or cooking foods, its secondary role may have functioned as a food storage bin, similar to those found at the Harris site. The jar was almost complete and measured 9.5 cm high, with a rim diameter of 10 cm and a body diameter of 16 cm; it had an estimated volume of 0.637 L. A second vessel was also set into the floor of room 52, but no data was recorded by the University of Minnesota excavators and it was omitted from this sample.

The two vessels from the West room cluster were set in the floors of rooms 113 and 124a. These vessels had secondary roles as food storage containers, due to their permanent fixture as floor features, regardless of their original function. A broken olla or jar was set into the floor of room 113, in the southwest corner, and was found to have had been placed on a layer of ash. A ring of adobe, up to 7.6 cm thick, was applied over the rim of the vessel, causing the adobe to extend up to 7 cm above the floor. Additionally, once the ring of adobe was removed from the floor surface, a sherd not belonging to the vessel was worked and shaped so that it would fit into a break on the olla. Notes only indicate that the olla was a plainware, and no other vessel attributes were recorded (Anyon and LeBlanc 1984). The height of the olla was at minimum 36 cm. A diameter of 10 cm was noted, and likely references the rim diameter.

The last vessel in this cluster was found in the floor near the east wall of room 124a. This vessel was a corrugated bowl with an obliterated tooled exterior and a plain interior. It had a height of 15 cm, a diameter of 35 cm, and an estimated volume of 11.22 L. A ring of adobe was also plastered around the rim of the bowl up to 5 cm thick and extending up to 9 cm above the

floor. In addition, large broken sherds were found encircling the rim of the vessel, protecting it, beneath the adobe ring.

Two vessels, one jar and one bowl, were recovered from the North room cluster in rooms 41 and 85. A small broken olla was found on the floor of room 41; it was identified as a full bodied indented corrugated jar. It was 11 cm high and had a rim diameter of 7.5 cm and a body diameter of 12 cm. Its estimated volume was 0.415 L. A small bowl was recovered from the floor of room 85. It was a flare rim bowl with a corrugated obliterated tooled exterior and a plain interior. It measured 4.5 cm in height, had a diameter of 8 cm, and had an estimated volume of 0.134 L.

NAN Ranch Ruin Ceramics

The ceramic assemblage from NAN Ranch consisted of 16 vessels, all found within domestic contexts. Fourteen of the vessels were identified as jars and the other two as a pitcher and a mug (Appendix B). Vessels recovered from rooms that functioned as ritual or ceremonial rooms were excluded from this analysis. Of the vessels in the sample, only one was found in the South room block, while the remaining 15 were found within the East room block. This difference in location can likely be attributed to the number of rooms excavated within each room block. The East room block was the only one to be almost completely excavated at NAN Ranch.

Part of a fully corrugated pitcher was found on the floor of room 84, a habitation room. The height of the pitcher was 17.5 cm and the maximum diameter was 17.5 cm (Shafer 2003). Use wear was minimal except for the presence of heavy organic staining covering the exterior, associated with its use for liquid processing and serving (Lyle 1996; McCollum 1992). A fully

Figure 6.22 Jar found in the roof fall of Room 42 at NAN Ranch Ruin (Shafer 2003:253, Plate 30-H).

Figure 6.23 Jar found on the floor of Room 60 at NAN Ranch Ruin (Shafer 2003:249, Plate 26-F).

corrugated mug was also found on the floor of room 85, a habitation room, and was found associated with the hearth. The estimated volume of the mug was 0.53 L, the height was 10 cm and the maximum diameter was 10.7 cm (Lyle 1996; Shafer 2003). The majority of the wear consisted of light pitting on the exterior body and neck. The interior of the mug was smoothed and the exterior corrugation was polished obliterating the coils (McCollum 1992). Heavy sooting was also present on the interior and exterior as a result of burning and not use wear. This mug likely functioned as a single liquid serving vessel.

Three fully corrugated jars were found in the roof fall of room 42, in the room fill of room 47, and on the floor of room 94, associated with the hearth; all three were habitation rooms. The partial jar from room 42 had an estimated volume of 10.9 L, a height of 26.2 cm, and a maximum diameter of 29.5 cm (Lyle 1996; Shafer 2003). The interior of the jar was smoothed and had light sooting, pitting, and striations from use. Although the base of the vessel was not intact, based on the characteristics noted, this jar likely functioned as a cooking vessel (Figure 6.22).

The jar from room 47 had a height of 20 cm, a maximum diameter of 26 cm, and a volume of 4.58 L (Lyle 1996; Shafer 2003). This jar exhibited heavy sooting on the exterior rim and body and interior base. Light pitting was also present on the interior body. Heavy pitting was prominent on the interior body and base of the jar; oxidization was present on the interior body and exterior base of the jar. The heavy sooting and pitting indicates this jar functioned as a cooking vessel. The jar from room 94, the only vessel from the South room block, had an estimated volume of 16.36 L, a height of 32.8 cm, and a maximum diameter of 33.1 cm (Lyle 1996; Shafer 2003). The exterior of the jar contained heavy soot and oxidization. The interior body of the jar was smoothed and had light sooting; the interior body and base had moderate pitting. These characteristics in combination with the jar's association with the hearth indicate this vessel was used for cooking.

Two jars were found on the floor of room 60, a storage room. One was a plainware jar with suspension lugs (Figure 6.23). This was a small jar with an estimated volume of 0.274 L, and a height and maximum diameter of 10 cm (Lyle 1996; Shafer 2003). Light to moderate striations were present on the interior and exterior of the jar and no sooting was present, indicating this vessel likely functioned as a small processing and or serving vessel (McCollum 1992). The second vessel was a partially corrugated jar with a maximum diameter of 34.8 cm, a height of 32.3 cm, and an estimated volume of 18 L (Lyle 1996; McCollum 1992; Shafer 2003). The interior was smoothed and moderate pitting was present on the body and base; the interior base also had heavy soot. Light to moderate sooting was also present on the exterior base and body indicating this jar was used for cooking.

Two partially corrugated jars were found in a subfloor pit in room 22, a habitation room. The last band of corrugation on both vessels were punctated (McCollum 1992). The first jar had

Figure 6.24 Composite Jar from the floor of Room 74 at NAN Ranch Ruin (Shafer 2003:255, Plate 32-B).

Figure 6.25 Convento Indented Corrugated Jar from the floor of Room 74 at NAN Ranch Ruin (Shafer 2003:255, Plate 32-C).

a maximum diameter of 23 cm and a height of 22.2 cm (Shafer 2003). The jar was heavily sooted on the exterior and the interior body had light soot. The interior base was moderately pitted and very heavily sooted. The second jar had a maximum diameter of 24 cm, a height of 25 cm, and an estimated volume of 10.14 L (Lyle 1996; Shafer 2003). Light to moderate soot covered the exterior of the jar and light sooting was present on the interior rim, neck, and base. Light pitting was also present on the interior body and base. The presence of sooting and pitting on the vessels indicate both jars were used in cooking activities.

The remaining vessels were found in room 74, a shared storage room, which contained numerous large vessels. Shafer (2003) believes these vessels may have been used for large social gatherings and potentially for the fermentation and serving of corn beer. Although 15 vessels were found on the floor, only seven are included in the sample, all of which were jars. These vessels contained evidence of cooking and food processing activities. Three of these were unique because they are uncommon, either because of their form or because they are not from the Mimbres region; one was a composite jar and two were intrusive wares, discussed further below.

The composite vessel has a corrugated neck with the body of a plainware bowl, so that it almost appears as if the neck of a jar was placed directly onto a bowl (Figure 6.24). The neck of

Figure 6.26 Fully Corrugated Jar from the floor of Room 74 at NAN Ranch Ruin (Shafer 2003:253, Plate 30-B).

Figure 6.27 Partially Corrugated Jar from the floor of Room 74 at NAN Ranch Ruin (Shafer 2003:254, Plate 31-E).

this jar is short, with a gradual angle increase from the vessel body to the neck. Other jars from NAN Ranch with similar volumes have narrower bodies and a steeper body-to-neck angle. This vessel was 21.5 cm in height, had a maximum diameter of 29.7 cm, and an estimated volume of 9.22 L (Lyle 1996; Shafer 2003). The exterior body exhibited moderate pitting and oxidization and the interior body contained heavy pitting and moderate sooting.

The first of the intrusive jars was a very large Convento Indented corrugated jar (Figure 6.25) sourced to northern Chihuahua, Mexico (Shafer 2003). The jar measured 62 cm in height, with a maximum diameter of 68.6 cm, and an estimated volume of 147.316 L (Lyle 1996). The exterior of the jar contained very light pitting and the base was partially oxidized. Sooting was present on the interior and parts of the exterior body. The second intrusive vessel was identified as an El Paso red-on-brown jar sourced to El Paso (Shafer 2003). Like the previous vessel, this jar was also large with an estimated volume of 80.34 L; the jar was 51.6 cm in height and had a maximum diameter of 49.2 cm (Lyle 1996). The exterior body of the vessel exhibited moderate pitting and striations. The interior body contained moderate striations, light grinding, and light pitting associated with its use. These jars were used as cooking and processing vessels.

One fully corrugated and three partially corrugated jars were also found on the floor of room 74. The fully corrugated jar (Figure 6.26) was 52.6 cm in height, had a maximum diameter of 49.5 cm, and an estimated volume of 61.75 L (Lyle 1996; Shafer 2003). The interior of the jar was smoothed (McCollum 1992). The exterior body was slightly oxidized and the interior body and base exhibited moderate pitting. Evidence indicates this was a processing vessel. One of the partially corrugated jars was only partially reconstructed and had a maximum diameter of 45 cm and a height of 45 cm (Shafer 2003). The exterior body and neck exhibited light sooting as did the interior neck. The interior body and base had light to moderate pitting; evidence suggests this jar was used for processing and cooking.

The second partially corrugated jar (Figure 6.27) had an estimated volume of 88.8 L, a maximum diameter of 54 cm, and a height of 58.5 cm (Lyle 1996; Shafer 2003). The exterior body was slightly pitted and oxidized and the interior body was heavily pitted. The last partially corrugated jar was also very large with an estimated volume of 113.15 L, a height of 56.8 cm, and a maximum diameter of 60.8 cm (Lyle 1996; Shafer 2003). The exterior body exhibited both light pitting and oxidization. The interior base was lightly pitted, while the interior body had heavy pitting.

Galaz Ruin Fire-Features

Of the features excavated at Galaz Ruin dating to the Mimbres Classic period, only 18 fire-features were identified, 17 in rooms and one in an extramural area (Appendix C). Related to the time in which these rooms were excavated, around the 1930s, some of the data regarding architectural information was not recorded in detail. It is not known if other fire-features were present but not recorded. Five hearths were located in the South room cluster, eight in the West, one in the East, and four in the North room cluster.

In the South room cluster, slab-lined hearths were found in rooms 55, 70a, 105, and 139a. Three of these were square and measured 41 cm^2, 53 cm^2, and 81 cm^2, respectively. The hearth in room 139a was rectangular and measured 33 by 46 cm; this hearth was found containing a large amount of ash. Only the west side was slab-lined; the north, south, and east sides and the base were lined with 5 cm thick adobe plaster. The hearth in room 81 was large and circular, approximately 64 cm in diameter, and was described as a shallow basin pit.

Two of the eight hearths found in the West room cluster were rectangular, in rooms 39 and 43, but no information regarding the lining of the hearths was noted. They measured 56 by 61 cm and 48 by 38 cm, respectively. The six remaining hearths were slab-lined. The hearths in rooms 110 and 124a were square and the other four were rectangular, and found in rooms 113, 117, 118a, and 119. The hearth in room 113 was only slab-lined on the north side and base. Instead of all slabs, the hearth in room 117 was lined with a metate fragment on the south side, a mano on the east side, a slab on the north side, and adobe on the west side; all sides were reinforced with adobe. The hearth in room 118a was also lined with adobe and the hearth in room 124a had a concave adobe base.

Detailed information regarding the hearth in the East room cluster was absent from the excavation notes and aside from it being rectangular and measuring 51 x 46 cm, no other information was recorded.

Three of the four fire-features from the North room cluster were slab-lined. The hearth in room 84a was square and lined with both slabs and adobe; this hearth was 33 cm deep and was found with a significant amount of ash filled to floor level. The other slab-lined hearths were rectangular. The hearth in room 98 was lined with thin slabs on each side and had a slab base set in adobe. In room 99 the hearth was also lined with thin slabs on each side, but the base was

concave and plastered with adobe. The last fire-feature was found in an extramural area, plaza 42. This feature was a walled plaza with an adobe floor surface, surrounded by habitation rooms. This hearth was described as circular with an exterior diameter of 69 cm, an interior diameter of 43 cm, and a depth of 43 cm. It was also lined with small cobbles set in adobe plaster. Additionally, the hearth extended above the floor 15-20 cm and it was noted that some of the cobbles were carved.

NAN Ranch Ruin Fire-Features

A total of 55 fire-features were recorded from Mimbres Classic period domestic contexts at the NAN Ranch Ruin, including storage and habitation rooms and extramural activity surfaces (Appendix C). Fire-features located in ceremonial and ritual-related rooms were not included in this study. Thirty-six of the features were located in domestic contexts and the remaining 19 were from extramural areas. In addition to the 36 rooms containing fire-features, approximately 26 other rooms dating to this period either contained no fire-features or no data was available on this feature type due to disturbance or partial excavation.

Eight (22%) of the domestic fire-features were found in storage rooms; it is unusual to find fire-features in storage rooms and the multiple occurrences at NAN Ranch Ruin suggests some form of processing was occurring in these rooms. These fire-features occur in rooms 25b, 42, 46, 60, 63a, 74, 78(90), and 109. Four were in private store rooms (42, 46, 60, 78(90)) and two were in communal store rooms (74, 109) (Shafer 1983, 1991b, 1992, 2003).

The majority of the hearths were classified as rectangular slab-lined hearths sealed with adobe, comprising 25 of the 36 domestic features (69%). These types of hearths measured between 20 x 20 cm and 50 x 60 cm (Shafer 2003). All but one of these hearth types occurred in

habitation rooms; four were located in the South room block, three in the West room block, and 18 in the East room block, one of which was found in a storage room. Two additional rectangular adobe-lined hearths were also excavated. One was in a communal/public storage room in the East room block and the other was located in room 92, a habitation room in the 92/93 room suite.

Five rooms (14%) contained circular basin hearths that were adobe-lined. The adobe-lined basin hearths in rooms 60 and 47 measured 25 cm and 30 cm in diameter, respectively. Four of the five hearths were found in the East room block, one in a habitation room and three in storage rooms. The last hearth was located in a storage room in the South room block.

Two of the hearths were circular and cobble-lined. These were both located in habitation rooms in the East room block. The hearth in room 37 measured 60 x 65 cm and the hearth in room 84 measured 33 x 40 cm. The last two hearths associated with domestic contexts were located in storage rooms 42 and 78(90), one in the East and one in the South room block. These hearths were defined as ash deposits located on the floor surface and are likely the result of fires built directly on the floors.

More than 100 adobe-lined pits were excavated at NAN Ranch Ruin, the majority of which were located in extramural areas, outside of room blocks and in plazas (Shafer 2003). Shafer and Drollinger (1998) indicate that approximately 18 percent of these were fire-features; the remaining were adobe-mixing pits (Shafer 2003). Fire-features were differentiated based on the presence of burnt adobe lining, ash, and burned rocks. Due to construction similarities it was unclear if these fire-features and adobe mixing pits shared construction methods or if, prior to being used as cooking pits, they were adobe mixing pits.

Metric data could only be found for 17 of these adobe-lined fire-features (Shafer 1991c, 1992; Shafer and Drollinger 1998). Sobolik et al (1997) discussed 14 extramural fire-features from NAN Ranch, but it was unclear how many overlap with those already identified based on the unavailability of metric and descriptive data regarding the individual features. Fourteen adobe-lined basin pit fire-features were located in the East plaza. The smallest feature was 28 cm x 26 cm and the largest had a diameter of 110 cm; depths varied between 9 and 38 cm (Shafer 1991a; Shafer and Drollinger 1998).

Two adobe-lined basin pit fire-features were located in an extramural area below room 39, on the northwest side of the South room block. They measured 55 cm and 60 cm in diameter, and were 15 cm deep, respectively (Shafer 1991c). One adobe-lined basin pit fire-feature was located in an extramural area on the southeast side of the South room block, below room 109. This feature measured 70 cm in diameter and was 39 cm deep (Shafer 1992). A fire-feature was also found in an extramural ramada surface built onto the southern walls of room suite 92/93. It was defined as a shallow ash deposit (Shafer 1991a).

Three roasting pits, also referred to as earth ovens, were excavated at NAN Ranch, but only one was associated with the Mimbres Classic occupation of the site. This roasting pit was located in an extramural area on the northwest side of the East room block, below room 8. It was a circular pit measuring 1.15 m by 1.25 m and was 88 cm deep (Shafer 2003:85). The pit had an almost flat clay bottom that was burned orange and contained a layer of ash. Approximately 20 cm above the base of the pit were burned rocks atop a layer of burned organics, identified as various grasses and twigs. Midden-fill containing ceramics filled the upper portion of the pit, below river sand and gravel. The abundance of maize (*Zea mays*) pollen indicated that this roasting pit was used to roast green corn.

Paleobotanical data was available from flotation samples taken from fire-features in 9 rooms, two of which had additional subfloor fire-features on earlier floor surfaces, and four extramural adobe fire pits (Rose 2004). Maize (*Zea Mays*) was found in all of the fire-features. Goosefoot (*Chenopodium*) was present in all but one fire-feature, in room 25. Wild grape (Vitaceae) was only found in two of the extramural adobe fire pits. Cacti species were only found in two rooms; *Echinocactus* in the fire-feature in room 62 and *Opuntia* in the fire-feature in room 22. Seeds from the mustard family (*Descurainia*) were found in the fire-feature in room 29 and one extramural adobe fire pit. Juniper seeds (*Juniperus*) were only found in one extramural adobe fire pit.

Galaz Ruin Summary

The assemblage from Galaz Ruin contained 10 ceramic vessels and 18 fire-features. Although the assemblage was small, several trends and further questions became apparent from these data. Five of the vessels were jars, three of which were corrugated. Three of the jars were small and were estimated to have a volume under one liter. One other jar in which volume measurements could be calculated had an estimated volume of 9 L. The five remaining vessels were bowls, four of which had obliterated tooled exteriors. Only one had a volume less than one liter.

The three bowls found on the floor of room 70a were quite large, specifically two with rim diameters exceeding 40 cm. Both of these bowls had unslipped interiors and were likely food processing bowls and potentially also used for serving. The large size indicates food preparation and serving occurred on a larger scale. During the Late Pithouse period each household was likely responsible for their own food processing and cooking. An increase in vessel size during the Classic period potentially indicates that people were eating communally and/or serving

extended family groups. It is also possible that room clusters shared the tasks associated with food processing and cooking, indicating that there was a change in the organization of food-related tasks that involved multiple households sharing tasks.

Four (40%) of the ceramic vessels were found set in or just below the floors of four surface rooms. Excavation notes indicate that most of these vessels were located along walls or near corners of the rooms, and not centrally located. This may be related to the lack of hearths in some of these rooms, or may indicate storage.

Two of these were found in different rooms within the West room cluster. Both vessels set into the floor coincided with rooms also containing slab-lined hearths, in rooms 113 and 124a. Interestingly, both of the vessels in these floors had extensive remodeling to the floor area surrounding the vessels as well as modifications made to the vessel rims by adding unassociated broken ceramics, seemingly in attempts to repair the features for continued use. Architectural data from the West room cluster places room 113 in the first room group as a core room, and room 124a as an isolated room in close proximity. While a later room was built over room 124a, as part of the first room group, similar construction methods to room 113 dates their occupations contemporaneously (Anyon and LeBlanc 1984:106). This indicates a shared knowledge of the technology used in food processing and cooking activities between the people residing within these rooms.

Only 17 rooms containing fire-features were found out of 118 habitation-related surface rooms dating to the Mimbres Classic period, approximately 14 percent. With a large population and the need to process and cook food, it begs the question, where are the fire-features? Seventeen fire-features spread throughout Galaz, residing in rooms that were not simultaneously occupied, but rather built and abandoned unsystematically over a period of more than a hundred

years would not have been enough for the population, even after considering that not all of the surface rooms at Galaz were excavated. It is more likely that a portion of the fire-features were constructed in extramural areas, potentially implying that food processing and cooking activities moved outside of the household by the Classic period.

NAN Ranch Ruin Summary

The assemblage from NAN Ranch Ruin was comprised of 16 ceramic vessels and 55 fire-features. The ceramic assemblage, like those found at Galaz, also contained numerous large vessels, although several of these were larger than those usually recovered from Mimbres Classic pueblos (Shafer 2003). Further, two of these large vessels were trade-wares from the south, in now western Texas and northern Mexico.

The volumes of vessels range from 0.27 L to 147.3 L and fall into several volume ranges. Two vessels had volumes of 0.27-0.53 L and are the smallest in the sample. One jar, with a volume of 4.58 L, would be considered a medium vessel, which was used for cooking. Five jars, categorized as large cooking vessels, had volumes of 9.22-18 L. The last five vessels would be considered extremely large and were used for food processing/fermentation and cooking; three had volumes of 61.75-88.84 and two of 113.151-147.32 L. This indicates that there were more larger vessels used for cooking based on those recovered, not considering abandonment processes and excavation methods. It is also significant that extremely large vessels were manufactured for and traded-in for large scale processing and cooking. This may indicate that there was an increase in household size to include extended family groups, as proposed by Shafer (2006).

A large number of fire-features were excavated at NAN Ranch in both domestic and extramural contexts. The presence of these features in both of these contexts indicates their use at both the family group level and at the community level. Only one roasting pit was found to be in use during the Mimbres Classic period and based on its size and close proximity to the East room block, it was likely not limited to one family group, and was potentially accessed by the larger community, and minimally by those occupying the surrounding rooms.

Shafer (2003) theorizes that the increase in vessel size is not associated with an increase in family size, but is rather indicative of communal eating practices. Shafer (1982) also links the location of fire-features in domestic contexts with one room in each room cluster containing a hearth; this room functions as the primary room in which domestic activities take place, such as cooking for the entire room cluster. This is similar to what is seen at Galaz Ruin, in terms of the location of fire-features and the movement of food processing and cooking activities from the smaller scale single-household level, to a larger family group and community level.

Summary

The preceding results provided data on ground stone, ceramic, and fire-feature assemblages from the Early Pithouse through the Mimbres Classic periods, using four sites as case studies. Several trends became apparent from these data. All main types of manos and metates appear throughout these periods, but there is a trend towards an increase in the use of flat and trough manos and metates. Mortars and pestles were not recovered from all of the sites and is likely a result of abandonment processes, excavation methods, and the use of wooden technology that do not survive in the archaeological record.

There is an increase in the size of ceramic vessels used in food processing and cooking activities, that when paired with other data, can be linked to changes in how food was processed

and cooked. The majority of fire-features excavated at Harris were found in domestic contexts, at the household level. During the Mimbres Classic period there is a trend towards constructing fire-features in specific habitation rooms and in extramural areas, reinforcing the theory of a change in focus to family group or community level organization of food processing and cooking activities. These ideas will be explored further in the next chapter.

CHAPTER 7: DISCUSSION AND CONCLUSIONS

The purpose of this research project was to document food processing and cooking technology of the Mimbres Mogollon from A.D. 200-1130/1150 and to examine changes in this technology through time. In order to do this, four sites occupied within this time frame were used as case studies. Data from ground stone, ceramics, and fire-features were used to document the available technology, presented in the previous chapter. The aim of this chapter is to review the results and address the changes that occurred in food-related technology and the likely factors related to those changes.

1) What types of food processing and cooking technology existed in the Mimbres Valley through the Early Pithouse, Late Pithouse, and Mimbres Classic Periods?

A total of 425 artifacts and features were used to document food processing and cooking technology; this includes 61 ceramic artifacts, 269 pieces of ground stone, and 95 fire-features (Table 7.1). These data indicate the use of multiple forms of ceramic, ground stone, and fire-feature technology from the Early Pithouse through the Mimbres Classic periods.

Evidence from the McAnally site indicates that during the Early Pithouse period basin, flat, and ¾ trough mano-metate sets were in use. Modifications were made to manos to enable better handling and control of the tool during use. The quantity of reconstructable jars recovered that functioned as cooking vessels (82% of 11) suggests that jars functioned as the primary form of ceramic container used for cooking. None of these vessels were corrugated, but all exhibited exterior and interior surface treatments. Burnishing was the most common exterior surface treatment. Interiors were commonly smoothed, and burnishing and polishing also occurred. While only one fire-feature was excavated at McAnally, research on hearths during this period

Site	*Ceramics*		*Ground Stone*					*Fire-Features*	
	Vessels	**Tools**	**Manos**	**Metates**	**Mortars**	**Pestles**	**Possible cooking slabs**	**Intramural**	**Extramural**
McAnally	11	0	10	2	0	0	2	1	0
Harris	20	4	72	10	4	13	0	18	3
Galaz	10	0	0	0	0	0	0	17	1
NAN	16	0	0	0	0	0	0	36	19
MC Sites	0	0	135	21	0	0	0	0	0
Totals	57	4	217	33	4	13	2	72	23

Table 7.1 Table listing the artifact and feature assemblages from the case study sites.

indicates that fires built directly on the floor and in unlined basin pits were the most common (Diehl 1997; Diehl and LeBlanc 2001).

Data from the Late Pithouse period, represented by the Harris site, demonstrated that the same mano-metate designs were present in this period as in the preceding one. Basin, flat, and ¾ trough metates were found, in addition to the use of the Utah trough metate containing surface modifications for a mano rest. Crown's (2000a) research indicates an increase in the use of trough metates between the Georgetown and San Francisco phases (Diehl 1996). Diehl's (1996) research also found that the surface sizes of manos increased during this period, around the San Francisco phase, as well as the proportion of manos and metates made from vesicular basalt (Lancaster 1983). Of the whole manos in the Harris assemblage, 46% were made of volcanic stone. Modifications to the sides of manos for easier handling and tool control continue, as seen in the Harris assemblage, although this appears to be a likely result of individual preference rather than following any regional pattern.

Mortars and pestles were variable in size and shape. Mortars and pestles from Harris were the only kinds of these tool types with attribute data from the case study sites. At least two mortars and one pestle were present in the NAN Ranch assemblage, but the artifacts and/or

attribute data were not available. It is likely that both mortars and pestles were also made from perishable materials and are therefore not present in the archaeological record. Wooden mortars and pestles would have been lighter and likely smaller than stone mortars and therefore would have been less labor-intensive and easier to transport between intramural rooms and extramural contexts. Further, using stone materials to process by grinding and crushing cause fragments of stone to mix in with food, and wooden tools would not have had the same effect. The majority of the ground stone assemblage was found to have been stored on the roofs and floors of pithouses, suggesting that each household had their own set of food processing tools and that food processing was conducted at the household level.

Ceramic utensils recovered were variable in size and shape and were only available from the Harris site. This is likely related to excavation sampling and not the lack of ceramic utensils at other sites in other time periods; ceramic utensils would also have been made from perishable materials. Ceramic cooking vessels do not appear to increase in size over time between the Early and Late Pithouse periods, although more variation in exterior surface treatments does occur. The range of cooking jar volumes at McAnally were 1.46-10.44 L in comparison to 2.9-11.5 L at Harris. The mean of cooking jar volumes from the McAnally site was 5.47 L and the mean of cooking jar volumes from the Harris site was 6.52 L, see Figures 7.1 and 7.2 for standard deviations and boxplots. 67 percent (n=8) of the cooking jars at Harris were corrugated and the remaining were Alma plain or plainware (n=4); one of the corrugated vessels was an Alma Punched jar and the other seven were Three Circle Neck corrugated jars, representative of the Three Circle phase.

While previous research has addressed the utilitarian function of corrugation on jars for cooking, this does not appear to be the only explanation for the Harris assemblage; corrugation is

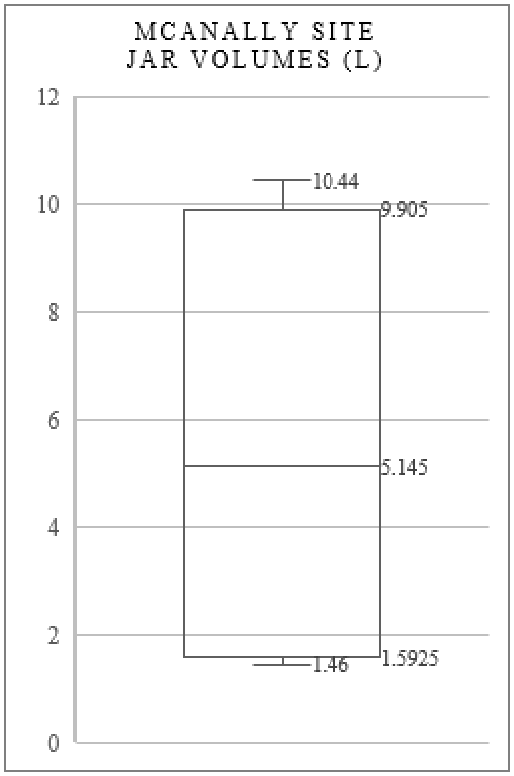

Figure 7.1 Boxplot of cooking jar volumes from the McAnally site (Sample Mean = 5.475, Sample Standard Deviation = 4.505, N=4).

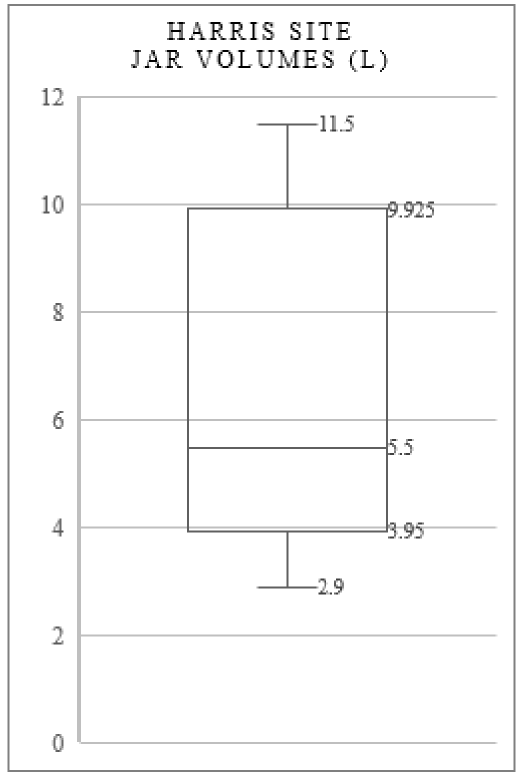

Figure 7.2 Boxplot of cooking jar volumes from the Harris site (Sample Mean = 6.517, Sample Standard Deviation = 3.263, N=6).

also representative of design styles (Pierce 1999; Romero 2014; Young and Stone 1990). All of the vessels, including cooking jars, exhibited some form of interior and exterior surface treatments including corrugation, smoothing, burnishing, and polishing. This indicates that there was an increase in the occurrence of exterior and interior surface treatments on vessels, probably for both functional and stylistic purposes. Experimental research on interior and exterior surface treatments has demonstrated that certain treatments can increase the heating effectiveness of vessels, although these experiments involved boiling water rather than food (Pierce 2005; Schiffer 1990). Other research has provided contrary results, indicating that vessels with differing surface treatments are only more effective when boiling water; when the same vessels were used to boil corn mush, similar rates of heating were attained due to food particles being absorbed by pores in the vessel walls (Pierce 1999). Young and Stone (1990) also found that

corrugated vessels were no more effective at heating food than plain vessels, but that corrugation causes heat to evaporate more rapidly than plain vessels (Pierce 1999; Schiffer et al. 1994).

Fire-features were primarily identified as adobe-lined hearths (56% of 18) in domestic contexts at Harris, while circular collared hearths (11% of 18) and unlined basin pits (28% of 18) were found less frequently. Many of these hearths were bordered by a hearth stone, positioned on the hearth edge closest to the pithouse entryway; hearth stones only appeared with fire-features within domestic structures, occurring in 61% of the pithouses (n=11). Fire-features in extramural contexts were not found in enough activity areas or work surfaces to draw conclusions on differences in feature types. The fact that only three were found out of all of the extramural areas excavated indicate that while several of these areas were used for food and general processing activities, few of them appear to have been involved in cooking processes near domestic structures. Food processing and cooking tasks would likely have occurred in both domestic and extramural contexts (Whittlesey 2010). Extramural fire-features may have been constructed farther from pithouses to avoid the smoke and accidental fires caused by cooking and roasting activities.

For the Classic period, evidence from Galaz and NAN Ranch, indicates that there was an increase in the size of both ceramic bowls and jars during the Mimbres Classic period. The largest bowl volume was estimated between 18.7-23.07 L. Two means were calculated based on the volume sizes of bowls from Galaz Ruin due to volume ranges assigned to the three largest bowls; the mean bowl volumes were 11.18 and 12.46 L, see Figures 7.3 and 7.4 for standard deviations and boxplots. Cooking jars from Galaz had measurements similar to those from the Harris site. Three of the five jars were found set into the floors and were not used for cooking once they became permanent floor features, suggesting that these jar volumes alone are not

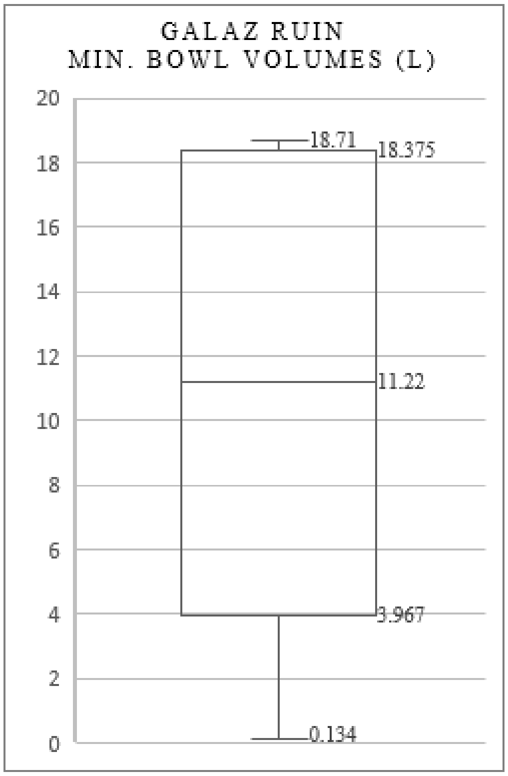

Figure 7.3 Boxplot of ceramic bowl volumes from Galaz Ruin based on the minimum volumes (Sample Mean = 11.1808, Sample Standard Deviation = 3.44384, N=5).

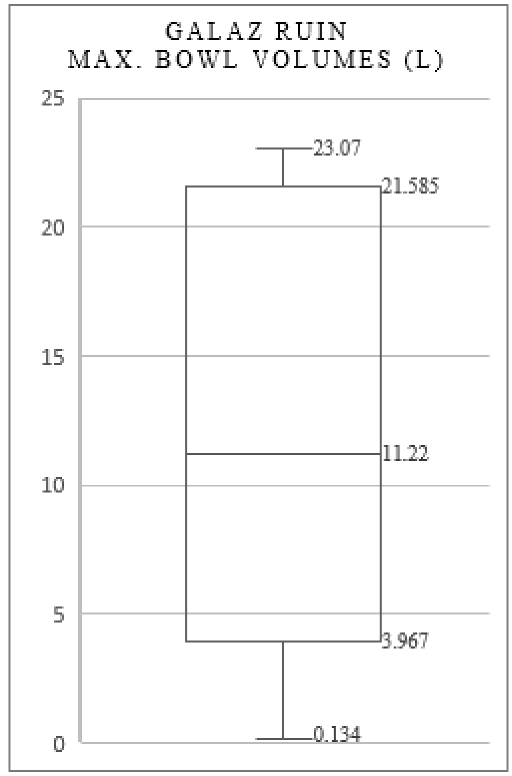

Figure 7.4 Boxplot of ceramic bowl volumes from Galaz Ruin based on the maximum volumes (Sample Mean = 12.4648, Sample Standard Deviation = 4.160078, N=5).

representative of the Classic period because they may have been manufactured prior to the construction of the rooms, so that they could be placed into the floors during construction.

In comparison, the jars from NAN Ranch varied greatly in volume. The mean volume of cooking jars from NAN Ranch was 50.97 L, see Figure 7.5 for the standard deviation and boxplot. Average cooking jars ranged between 4.58 L and 18 L (n=6), an approximate 6.5 L increase from the jars recovered from the Harris site. An increase in household size and/or shift to extended family room clusters may account for the increase in bowl and jar sizes. An independent-samples t-test was conducted to compare the volume of cooking jars at the Harris site and the volume of average cooking jars at Galaz (n=1) and NAN Ranch (n=6), see Table 7.2. There was a significant difference in the scores of the Harris site (M = 6.52, SD = 3.26) and

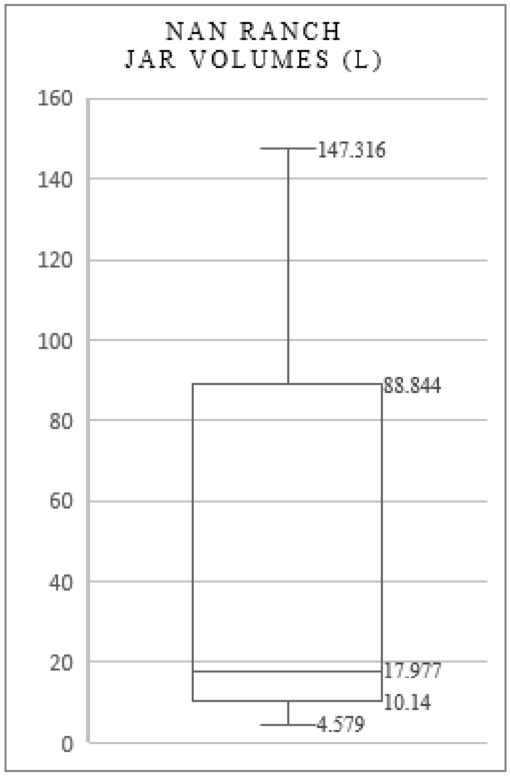

Figure 7.5 Boxplot of cooking jar volumes from NAN Ranch Ruin (Sample Mean = 50.97073, Sample Standard Deviation = 15.07847, N=11).

T Test: Two Independent Samples

SUMMARY			Hyp Mean Diff	0
Groups	*Count*	*Mean*	*Variance*	*Cohen d*
Harris	6	6.516666667	10.64566667	
Galaz & NAN	7	11.19857143	20.96662795	
Pooled			16.27528191	1.160535194

T TEST: Unequal Variances				Alpha	0.05		
	std err	*t-stat*	*df*	*p-value*	*t-crit*	*sig*	*effect r*
One Tail	2.183920865	2.143806966	10.70581126	0.027951823	1.795884819	yes	0.548044165

Table 7.2 Results of an independent-samples t-test conducted to compare the volumes of cooking jars at the Harris site and the volume of average cooking jars at Galaz and NAN Ranch.

Galaz and NAN Ranch (M = 11.2, SD = 4.58) cooking jars (t = 2.14, p = 0.028, df = 10.71). The largest jars at NAN Ranch ranged in volume from 61.76 L to 147.32 L (n=5) and were used for large-scale food processing, cooking, and fermentation. The drastic differences in jar volume may be related to communal events that involved the entire village or the room block; the largest

of these jars were stored in a shared storage room that cornered the East room block, not bordered by rooms on the East and South side, indicating that this room may have been more accessible than others.

Ground stone data on the Mimbres Classic period, obtained from Lancaster (1983), indicated that through-trough (57% of 21) and flat mano-metate sets were the most popular. ¾ trough metates were also present within assemblages and basin forms were still in use, although not as common. Although there are differences in surface size between metates this can be associated with the use of the through-trough metate, which has a larger surface area due to the absence of borders on the top and bottom ends. Sandstone and vesicular basalt were the most common raw materials used for manos (65% (n=88) of the 135 manos in the sample). No significant differences were found between the surface areas of manos from the Late Pithouse to the Mimbres Classic period. The location of metates on roofs and on habitation, storage, and granary room floors at NAN Ranch suggests that food processing activities were not restricted to specific areas. Further, the recovery of three manos made from different raw materials used on one metate, that produce different levels of coarse or fine meal, indicates that the grinding of corn occurred in multiple stages and that a specific texture of meal may have been desired.

Partial and full bodied corrugated vessels were produced during the Classic period; at NAN Ranch 75% (n=12) of the jars were partial or full bodied corrugated and only one was plainware. Three (60%) of the jars from Galaz were partial or full bodied corrugated. Many of the corrugated jars and tooled bowls and jars were burnished or polished on the exteriors over the coils, partially obliterating the corrugation. The interiors of the jars were commonly smoothed and burnished and in rare instances were also polished. Increases in ceramic vessel size and the amount of interior and exterior surface treatments suggests that ceramic production was more

time consuming as further evidenced by an inventive and complex form of composite jar unique to the NAN Ranch assemblage. This jar was formed of a bowl with a neck and orifice of a jar.

Fire-features mainly appeared in domestic contexts as rectangular slab-lined hearths reinforced with adobe (69% of 36 at NAN Ranch and 76% of 17 at Galaz). This differs from the circular adobe-lined hearths more commonly found during the Late Pithouse period. Further, unlike pithouse villages where almost all pithouses were found to contain a hearth, such as at the Harris site, not all surface rooms in pueblos contained fire-features. One room was found to contain a slab-lined hearth within a core room group, part of the larger room blocks, such as found at Galaz Ruin and NAN Ranch, possibly representing extended family groups. Additionally, a roasting pit and several adobe-lined pits were found in extramural contexts at NAN Ranch indicating that cooking activities also occurred outside of room groups. Although no roasting pits were excavated at the other case study sites, this type of fire-feature was likely in use at other sites prior to this period.

2) Did any changes in food processing and cooking technology occur in the region over time?

As previously documented, it is clear that several changes occurred in ground stone, ceramic, and fire-feature technology that were involved in food processing and cooking activities. As research by Diehl (1996), Mauldin (1993), and Hard et al. (1996) have shown, the surface areas of manos increased, as did the use of trough metates. Corrugation appeared on ceramic vessels with several variations; the size of ceramic vessels also increased. Fire-features became more formalized and complex architectural features within domestic structures and shifted from basin and circular to rectangular in shape.

In order to determine if these changes took place throughout the Mimbres Valley it was necessary to briefly examine other archaeological sites in the region for similar technologies. Artifact and feature assemblages from the Late Pithouse period occupation at Galaz Ruin and Swarts Ruin and the Mimbres Classic period occupation at Swarts Ruin and the Mattocks site indicated that similarities and differences occurred in technologies within each time period (Anyon and LeBlanc 1984; Cosgrove and Cosgrove 2011; LeBlanc 1975, 1976; Nesbitt 1931).

None of the hearths excavated at the Harris site were rectangular or square, although rectangular adobe-lined hearths were found in Late Pithouse period structures at Galaz, NAN Ranch, and Swarts Ruin (Anyon and LeBlanc 1984; Cosgrove and Cosgrove 2011; Shafer 2003). Anyon and LeBlanc (1984:94) have discussed the lack of rectangular fire-features prior to the Three Circle phase, although many of the pithouses from the most recent excavations at the Harris site were occupied during the Three Circle and late Three Circle phase, suggesting that rectangular fire-features may have appeared at the end of the Late Pithouse period or that, due to an increased investment in constructing these features, they may coincide with sites occupied during both the Late Pithouse and Mimbres Classic periods.

The ceramic and ground stone assemblages from Late Pithouse period occupations at both Swarts and Galaz Ruins are similar in the types and sizes of vessels and tools. Through-trough and ¾ trough metates were present at both Swarts and Galaz, but through-trough metates were not found at Harris. This may indicate that the metate types appeared earlier at Galaz and Swarts and that through-trough metates were not used at Harris. It is also possible that occupants of the Harris site transported some metates with them when the site was abandoned, although this would have been unlikely due to the size of metates. It is also possible that the Late Pithouse period structures at Galaz and Swarts were occupied longer than those at Harris; the Harris site

was abandoned prior to the Mimbres Classic period, unlike Galaz and Swarts which had continued occupation. The presence of Utah trough metates at Harris, but not at other sites, is also intriguing. Utah trough metates are typically representative of the Fremont culture, but the long distance between the Mimbres Mogollon and Fremont cultures makes this relationship doubtful (Barlow 2002). Additional research is necessary to further explore the presence of Utah trough metates at the Harris site.

Fewer differences were noted between Mimbres Classic period assemblages. Similar ceramic vessels and ladles as well as ground stone technology were present in the artifact assemblage at the Mattocks site and Swarts Ruin. Square and rectangular slab and adobe-lined hearths were still the most prominent fire-feature type (Cosgrove and Cosgrove 2011; LeBlanc 1975, 1976; Nesbitt 1931). The only noticeable difference was between the density of fire-features in rooms at Swarts Ruin versus NAN Ranch and Galaz Ruin. While those at the case study sites appeared to be relatively dispersed, those at Swarts Ruin occurred in more rooms and were more concentrated in room blocks. This may indicate that household size at Swarts Ruin was smaller and may have not included extended family groups, such as at NAN Ranch Ruin (Shafer 2003, 2006).

Based on the comparisons of sites, it appears that more differences in food-related technology were present during the Late Pithouse period and relatively few differences existed between sites during the Mimbres Classic period. Several factors are likely responsible for both the changes in technology over time and the differences in technology between sites during the same time periods including environmental, social, and organizational factors. Significant changes occurred between A.D. 200 and 1130, as previously discussed. Multiple external and internal factors could have played pivotal roles in affecting any change that could have led to a

domino-like affect. Therefore, my approach focused on a causal relationship between multiple factors. The catalysts, or influencing factors, that have been proposed for this region include climate and environmental change, change in the degree of agricultural dependence, resource depression, and population stress (Cannon 2000, 2001; Minnis 1981, 1985b; Sanchez 1992, 1996; Schollmeyer 2005; Schollmeyer and Driver 2013).

The data indicate that as the Mimbres people began to cultivate crops and become increasingly sedentary, their population began to grow. To combat the rising population, it was necessary to not only increase the exploitation of wild game, but also intensify agricultural production. As wild resources began to disappear the population was forced to further intensify agriculture and consume smaller game, as seen with the use of irrigation and the decrease in large game and increase in jackrabbit consumption (Cannon 2000, 2001). Changes in food-related technology may in part be seen as a way to combat the significant increase in population. During the Mimbres Classic period the population hit its peak at roughly 7½ -8 times larger than the population of the Early Pithouse period, estimated between 3500-4000 people (Anyon and LeBlanc 1984; Hegmon 2002).

The predominance of trough mano-metate sets in combination with the other data further supports the notion that the Mimbres Classic population was highly dependent on agriculture, specifically the cultivation of maize. The ceramic data shows a further increase in ceramic vessel size for both cooking and storage vessels (Anyon and LeBlanc 1984; Woosely and McIntyre 1996). This may suggest a need for larger vessels to feed more people associated with communal groups or extended family groups. An increase in the size of storage vessels as well as the evidence of storage rooms further supports the production of surplus.

The number of formal hearths began to increase during the Late Pithouse period and continued into the Mimbres Classic period. This increase in formality fits with the argument regarding longer-term occupation of structures due to a sedentary population heavily reliant on agriculture (Diehl 1997; Diehl and LeBlanc 2001). The increased formality of hearths may also be tied to other factors. Resource depression, including wood for fuel, may have affected hearth form if fuel conservation was an issue; heat efficiency may have also played a role depending on the material used to line the base and sides. Schollmeyer's (2005) research indicates that larger trees in the Mimbres Valley were used for construction and were cleared more heavily during the Mimbres Classic periods in comparison to other periods, but that smaller trees and bushes were left and available as fuel during all periods. This may suggest that wood was only available as smaller branches, bushes, and twigs. Limiting the fuel resources used by one family group may have affected the number of fire-features during the Mimbres Classic period.

The decrease, and in some cases absence, of fire-features within households at NAN Ranch and Galaz Ruin have also indicated that not all habitation rooms served the same purposes. Shafer (2003, 2006) suggests that one room in a cluster, which contained a hearth, served as the main room or focal point of activity. The change in density and distribution of fire-features during the Classic period in addition to the production and use of large processing vessels indicate that the processing and cooking of food occurred beyond the household level. Larger processing and cooking technology supports Shafer's (2006) research on the shift to extended family group living during the Classic period.

While these factors may explain changes in food-related technology over time in the Mimbres Valley, they do not necessarily explain the variation between sites. Causes relating to between-site variation of hearths may be a result of the agency of prehistoric builders rather than

larger cultural and environmental changes. Based on available data, increases in workloads can also be linked to changes in food processing and cooking technology in both those that occurred over time and in between-site variation. The changes and modifications in ground stone and ceramic technology may be seen as strategic actions to offset increasing labor demands related to an increased reliance on agricultural resources (Crown 2000a; Crown and Wills 1995). It seems plausible that modifications were made in technology to lessen the burden of these tasks on women.

Increases in ceramic size may have allowed for cooking of larger meals that offset the need to cook more than once a day. The addition of handles would have allowed for easier transport and handling of ceramic vessels. Crown (2000a) discusses changes in food preparation and cooking technology as a result of an increase in workloads and changes in labor division. The reasons suggested by Crown for changes in ground stone tools include changes in diet, changes in mobility, the need for energy preservation, and changes in the organization of food preparation. Modifications in ground stone technology represent more efficient tools over time. While trough metates were more efficient at grinding flour than other forms, they caused the user to exert more energy during use (Adams 2014; Crown 2000a, 2000b). This may indicate that women were willing to exert additional energy in exchange for lesser time spent grinding.

Conclusions

Food processing and cooking technology is composed of a number of different tools, of which only some were available for detailed study. Previous research has focused on ceramics, ground stone, and architecture, but food-related technology has received little interest. Ceramic, ground stone, and fire-feature data from four case study sites were used to document food-related technology in the Mimbres region. These data revealed that multiple forms of these tools were in

use at any given time and that new technologies and alterations to existing technologies were introduced over time. The developments in food-related technology appear to be geared towards increased efficiency in food processing and cooking strategies.

Between A.D. 200 and 1130 the subsistence strategies of the Mimbres Mogollon changed drastically from groups whose subsistence focused on hunting and gathering and seasonal agriculture and by A.D. 1000 had become highly dependent on maize agriculture. Food-related technology was developed and altered to match the changes in subsistence strategies and social organization that were affected by sedentism, population density, the environment, resource depression and overexploitation, and human agency.

This research project has also found that the way food processing and cooking activities were organized changed between the Late Pithouse and Mimbres Classic periods. During the Late Pithouse period each household was likely responsible for their own food processing and cooking. Pithouses each had a hearth and food processing equipment was stored on roofs and on floors of pithouses, and in adjacent extramural areas. During the Classic period, there was a shift to extended family groups occupying room clusters where one room contained a hearth. Food processing and cooking tasks appeared to be shared among the room cluster which is further supported by an increase in the sizes of cooking and serving vessels.

APPENDIX A: GROUND STONE DATA

APPENDIX A: TABLE 1

Ground Stone artifacts from the McAnally site and a sample of analysis attributes.
*Ground stone characteristics attained from published site report (Diehl 2001:60-61).

Artifact	Subtype	Context	Use Level	Design	Manufacture	Grip(s)	Raw Material	L x W (cm)	Surface L x W (cm)
Mano	Flat	8-4-3/1 Floor	Heavy	Strategic	Ground to hold	Grip-1 edge	Sandstone	17.6 x 13.9	16.7 x 13.5 or 225.45cm^2
Mano	Trough	8-4-4/1 Floor	Light	Strategic	Pecked/ground to shape and hold	Grip-2 edges	Vesicular Basalt	25.6 x 12.29	21.6 x 10.9 or 235.44cm^2
Mano	Flat	8-4-7/2 Floor	Heavy	Strategic	Pecked to shape and hold	Grip-1 edge	Vesicular Basalt	19 x 14.3	17.7 x 13.1 or 231.87cm^2
Mano	Trough	8-4-7/3 Floor	Light	Expedient	Natural	X	Basalt	20.9 x 14.7	16.9 x 11.9 or 201.11cm^2
Mano	Basin	11-3F-6/8 Floor	Moderate	Strategic	Ground to hold	Grip-encircling	Rhyolite	11.98 x 9.32	9.2 x 7.8 or 71.76cm^2
Mano	Trough	11-3-6/11 (mislabeled as 11-3F-6/10) Floor	Moderate	Strategic	Ground to hold	Grip-2 edges	Sandstone	20.5 x 11.9	16.9 x 11.1 or 187.59cm^2
Metate	Trough	11-3F-8/12 Floor	Moderate	Expedient	Natural	X	Basalt	25.9 x 20.4	25.7 x 18 or 462.6cm^2
Slab	Poss cooking slab / Fire-blackened	11-5F-F/18 Floor	Indeter-minate	Strategic	Pecked, ground on both surfaces	X	Sandstone	33 x 17.5	X
Metate*	Trough	11-2-6/12 RF/WF	X	Expedient	Natural	X	Sandstone	40 x 21.6	25.7 x 16 or 411.2cm^2
Mano*	Flat/ Concave	11-2-6/13 RF/WF	X	Strategic	Pecked to shape and hold	Grip-2 edges	Rhyolite	14.4 x 11.2	10.4 x 7.2 or 74.88cm^2
Mano*	Flat/ Concave	11-2-7/9 RF/WF	X	X	X	X	Sandstone	21 x 13.3	279cm^2
Mano*	Trough	11-3-6/9 Floor	X	X	X	X	Vesicular Basalt	X	X
Mano*	Basin?	11-3-8/11 Floor	X	X	X	X	Rhyolite	8.9 x 7.5	61cm^2
Slab*	Fire-blackened	11-5-1 Floor	X	Strategic	Pecked, ground on one surface	X	Sandstone	16 x ?	X

APPENDIX A: TABLE 2

Whole manos from the Harris site and a sample of analysis attributes.
Additional data collected from Falvey's (2014) thesis.

FN	Context	Subtype	Use Level	Design	Manufacture	Grip(s)	Raw Material	L x W (cm)	Surface L x W (cm)
126	RF/WF PH 35	Flat/Concave	Moderate	Strategic	Pecked to hold	Grip-encircling	Undiff. Intermed. Volcanic	8.6 x 8.2	5.4 x 5.3
130	RF/WF PH 35	Trough	Light	Strategic	Pecked to shape and hold	No	Vesicular Basalt	28.8 x 13.3	x
135	Floor Fill PH 35	Indeterminate	Indeter-minate	Indeter-minate	Indeterminate	Indeter-minate	Basalt – Scoriaceous	13.5 x 13	10.8 x 9.5
478	RF/WF PH 38	Trough	Light	Indeter-minate	Indeterminate	Indeter-minate	Undiff. Felsic Volcanic	19.7 x 16.8	17.4 x 12.5
926	Floor PH 38	Flat/Concave	Heavy	Strategic	Pecked to shape and hold	Grip-encircling	Vesicular Basalt	11.1 x 7.8	7.9 x 6.4
955	Entryway PH 38	Trough	Light	Strategic	Pecked to hold	Grip-2 edges	Undiff. Intermed. Volcanic	20.5 x 16.7	17.1 x 14.2
998	Feature Fill FEA 7	Flat/Concave	Moderate	Strategic	Pecked to hold	Grip-2 edges	Granodiorite	11.4 x 9.9	9.4 x 7.5
1060	Center Post PH 36	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Dacite	22.4 x 12	20.1 x 11.2
1317	Feature Fill FEA 11	Flat/Concave	Moderate	Strategic	Pecked to hold	No	Diorite	10.1 x 8.7	x
1628	RF/WF PH 37	Flat/Concave	Light	Expedient	Natural	No	Undiff. Intermed. Volcanic	21.4 x 12.7	x
1656	Floor PH 37	Basin	Light	Strategic	Pecked to hold	No	Granite	13.2 x 11.5	x
2252	Floor Fill PH 39	Basin	Moderate	Expedient	Natural	No	Quartzite	18.2 x 12.1	x
2823	RF/WF PH 43	Flat/Concave	Moderate	Strategic	Pecked to hold	No	Undiff. Felsic Volcanic	14.7 x 8.1	10.1 x 5.7
3091	Floor PH 44	Trough	Light	Expedient	Natural	No	Undiff. Intermed. Volcanic	18.6 x 14	13.1 x 9.8
3371	RF/WF PH 42	Trough	Moderate	Strategic	Pecked to shape and hold	No	Rhyolite	19.4 x 15.2	16.8 x 13.9
3555	RF/WF PH 43	Flat/Concave	Moderate	Strategic	Pecked to shape and hold	Grip-encircling	Undiff. Intermed. Volcanic	11.6 x 10	9.1 x 8.4
3827	RF/WF PH 43	Flat/Concave	Moderate	Strategic	Pecked to hold	Grip-2 edges	Vesicular Basalt	13.5 x 10.9	11.9 x 9.8
3853	Floor Fill PH 42	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Dacite	15 x 13.6	11.9 x 10.5

FN	Context	Subtype	Use Level	Design	Manufacture	Grip(s)	Raw Material	L x W (cm)	Surface L x W (cm)
3899	RF/WF PH 42	Trough	Moderate	Strategic	Pecked to hold	Grip-2 edges	Vesicular Basalt	20.2 x 14	16.3 x 13.3
3948	RF/WF PH 43	Basin	Moderate	Strategic	Pecked to hold	Grip-encircling	Undiff. Intermed. Volcanic	10.8 x 9.6	6.6 x 6.2
3976	RF/WF PH 42	Trough	Light	Strategic	Pecked to hold	Grip-2 edges	Undiff. Intermed. Volcanic	16.5 x 11	11.2 x 7.4
3983	RF/WF PH 42	Trough	Heavy	Strategic	Pecked to shape and hold	Grip-1 edge	Rhyolite	14.7 x 13.3	11.7 x 11.6
3986/ 2903	RF/WF PH 43	Trough	Moderate	Expedient	Natural	No	Granite	27.4 x 15.5	25.2 x 12.9
4109	RF/WF PH 43	Basin	Heavy	Strategic	Pecked to hold	Grip-encircling	Undiff. Intermed. Volcanic	10.3 x 9.6	9.7 x 9.2
4141	Feature Fill FEA 24	Basin	Moderate	Strategic	Pecked to hold	Grip-encircling	Undiff. Intermed. Volcanic	8.1 x 7.7	6.1 x 5.9
4345	Center Post PH 43	Trough	Moderate	Strategic	Pecked to hold	Grip-1 edge	Undiff. Felsic Volcanic	24.7 x 17.6	19.9 x 14.2
4589	Feature Fill FEA 27	Flat/Concave	Light	Strategic	Pecked to hold	Grip-encircling	Undiff. Felsic Volcanic	13.7 x 9.6	10.3 x 7.4
4852	RF/WF PH 41	Trough	Moderate	Expedient	Natural	No	Undiff. Felsic Volcanic	19.9 x 11	15.5 x 10
4873	RF/WF PH 41	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Sandstone	23.7 x 14	21 x 12.5
4890	Feature Fill FEA 28	Trough	Moderate	Strategic	Pecked to hold	Grip-1 edge	Undiff. Felsic Volcanic	17.7 x 14.5	14.5 x 13
4947	RF/WF PH 41	Flat/Concave	Moderate	Strategic	Pecked to hold	Grip-encircling	Quartzite	10.9 x 10.9	8.5 x 8.4
4969	RF/WF PH 41	Trough	Heavy	Strategic	Pecked to shape and hold	Grip-2 edges	Vesicular Basalt	18.8 x 10.4	13.5 x 9.8
5003	RF/WF PH 41	Flat/Concave	Moderate	Strategic	Pecked to shape and hold	Grip-encircling	Sandstone	14 x 10	11 x 8.5
5133	Floor PH 41	Trough	Light	Expedient	Natural	No	Limestone	16.6 x 14.3	11.8 x 10.2
5409	Pithouse Fill PH 47	Flat/Concave	Heavy	Strategic	Pecked to shape and hold	Grip-encircling	Sandstone	10.4 x 10	6.1 x 7.5
5454	Feature Fill FEA 30	Trough	Nearly worn out	Strategic	Pecked to shape and hold	Grip-1 edge	Undiff. Mafic Volcanic	18.5 x 12.7	16.5 x 11.5

FN	Context	Subtype	Use Level	Design	Manufacture	Grip(s)	Raw Material	L x W (cm)	Surface L x W (cm)
5465	Feature Fill FEA 30	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-1 edge	Vesicular Basalt	15.1 x 13.4	10.2 x 9.5
5466	Feature Fill FEA 30	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Vesicular Basalt	19.9 x 15.6	15.9 x 13.7
5470	Feature Fill FEA 30	Trough	Moderate	Strategic	Pecked to shape and hold	No	Undiff. Intermed. Volcanic	18.3 x 15.2	15.5 x 12.4
5494	RF/WF PH 46	Trough	Light	Strategic	Pecked to hold	No	Undiff. Intermed. Volcanic	19.9 x 14.1	15.1 x 9.3
5687	RF/WF PH 46	Trough	Moderate	Strategic	Pecked to hold	Grip-1 edge	Undiff. Intermed. Volcanic	21.6 x 14.4	17.8 x 12.7
5855	Pithouse Fill PH 45	Basin	Moderate	Strategic	Pecked to shape and hold	Grip-encircling	Vesicular Basalt	10.3 x 9.9	9.8 x 9.4
5856	Pithouse Fill PH 45	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Undiff. Felsic Volcanic	15.4 x 12.9	12.7 x 12.1
5900	Floor PH 45	Trough	Moderate	Strategic	Pecked to shape and hold	No	Vesicular Basalt	25.4 x 16.5	23 x 13.5
5905	Center Post PH 45	Trough	Moderate	Expedient	Natural	No	Undiff. Intermed. Volcanic	18.2 x 15.5	14.1 x 11.8
5912	Floor Fill PH 45	Trough	Nearly worn out	Strategic	Pecked to hold	No	Vesicular Basalt	16.2 x 11.4	13.3 x 8.9
5964	Entryway PH 45	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Undiff. Mafic Volcanic	20.5 x 11.6	15.5 x 11.5
6674	Floor PH 49	Trough	Moderate	Strategic	Pecked to shape and hold	Groove-1 edge, Grip-1 edge	Vesicular Basalt	20.9 x 12.4	17.9 x 11.4
6675	Floor PH 49	Trough	Heavy	Strategic	Pecked to hold	Grip-2 edges	Rhyolite	21.8 x 14.3	16.6 x 12.5
6757	Feature Fill FEA 32-34	Trough	Moderate	Expedient	Natural	No	Undiff. Intermed. Volcanic	17.1 x 10.6	14.1 x 9.2
6851	RFWF/FF PH 54	Trough	Moderate	Strategic	Pecked to hold	Grip-1 edge	Undiff. Intermed. Volcanic	15.6 x 13.5	13.1 x 11.9
6970	Floor Fill PH 53	Flat/Concave	Moderate	Strategic	Pecked to hold	No	Undiff. Intermed. Volcanic	12.4 x 10.6	9.9 x 7.6
7018	Floor Fill PH 54	Trough	Moderate	Strategic	Pecked to shape and hold	Grip-2 edges	Undiff. Intermed. Volcanic	18.6 x 14.8	14.4 x 13.9
7029	RF/WF PH 53	Trough	Nearly worn out	Strategic	Pecked to hold	Grip-1 edge	Sandstone	18 x 11	16.4 x 10.3

FN	Context	Subtype	Use Level	Design	Manufacture	Grip(s)	Raw Material	L x W (cm)	Surface L x W (cm)
7031	Floor Fill PH 54	Trough	Light	Strategic	Pecked to shape and hold	Grip-2 edges	Vesicular Basalt	18.3 x 16.4	15.9 x 14
7033	Floor Fill PH 54	Trough	Heavy	Strategic	Pecked to hold	No	Vesicular Basalt	18.4 x 11.2	15.3 x 9.9
7097	Floor Fill PH 53	Flat/Concave	Heavy	Strategic	Ground to hold	Ground to fit hand	Undiff. Intermed. Volcanic	13.39 x 10.26	11.5 x 8.72
7113	RF/WF PH 53	Trough	Heavy	Expedient	Natural	No	Limestone	19.7 x 12.93	18.7 x 10.78
7136	RF/WF PH 53	Flat	Light	Strategic	Ground to hold	Grip-2 edges	Undiff. Intermed. Volcanic	10.5 x 9.06	8.65 x 7.99
7160	Floor Fill PH 53	Trough	Light	Strategic	Pecked to hold	Grip-2 edges	Undiff. Intermed. Volcanic	22.7 x 13.3	17.4 x 9.75
7161	Floor Fill PH 53	Trough	Moderate	Strategic	Ground edges, ends	Grip-encircling	Vesicular Basalt	20.5 x 14.32	17.6 x 13.7
7162	Floor Fill PH 53	Trough	Moderate	Expedient	Natural	No	Undiff. Felsic Volcanic	20.1 x 14.9	16.6 x 13.1
7344	Ramada Fill FEA 35	Trough	Heavy	Strategic	Ground edges, ends	Grip-2 edges	Vesicular Basalt	15.5 x 13.5	13.26 x 12.2

APPENDIX A: TABLE 3

Metates from the Harris site and a sample of analysis attributes.
Additional data collected from Falvey’s (2014) thesis.

FN	Context	Subtype	Condition	Shape	Use Level	Design	Manufacture	Raw Material	L x W (cm)	Surface L x W (cm)
475	Roof PH 38	Utah Trough	Whole	Rectang.	Light	Strategic	Pecked surface feature - mano rest	Undiff. Felsic Volcanic	51 x 30	36 x 25
1611	RF/WF PH 39	Basin	>1/2	Broken	Heavy	Expedient	Natural	Vesicular Basalt	x	x
1678	RF/WF PH 39	3/4 Basin	>1/2	Irregular	Heavy	Expedient	Surface Pecked	Undiff. Intermed. Volcanic	65 x 47.5	x
4968	RF/WF PH 46	Indeterm .	Whole	Rectang.	Light	Expedient	Natural	Vesicular Basalt	38 x 33	x
4974	Floor PH 41	3/4 Basin	Whole	Rectang.	Light	Indeterm.	Indeterminate	Vesicular Basalt	40 x 36.2	29 x 22
5794	Floor PH 46	Trough	Whole	Rectang.	Heavy	Expedient	Surface Pecked	Undiff. Intermed. Volcanic	52 x 41	42 x 21
5795	Floor PH 46	3/4 Trough	Whole	Rectang.	Heavy	Expedient	Surface Pecked	Vesicular Basalt	46 x 36	x
6607	Floor PH 49	Utah Trough	Whole	Ovoid	Heavy	Strategic	Pecked surface feature - mano rest	Undiff. Intermed. Volcanic	51 x 43	33.5 x 19
6608	Floor PH 49	Utah Trough	Whole	Irregular	Unused	Strategic	Pecked surface feature - mano rest	Vesicular Basalt	51 x 32	35 x 26
Field	RF/WF PH 53	Trough	>1/2	Broken	Moderate	Strategic	Ground for stability	Vesicular Basalt	43 x 27	32 x 21

APPENDIX A: TABLE 4

Pestles from the Harris site and a sample of analysis attributes.
Additional data collected from Falvey's (2014) thesis.

FN	Context	Type	Subtype	Condition	Secondary Use	Sequence	# of Pestle Surfaces	Raw Material	L (cm)	W (cm)	TH (cm)
124	RF/WF PH 35	Pestle	Natural	Whole	Netherstone	Concomitant	1	Dacite	27.3	11.6	8.4
667	RF/WF PH 35	Pestle	Natural	Broken/ Measurable	x	x	1	Undiff. Intermed. Volcanic	26.8	12.7	10.5
919	Floor Fill PH 38	Mano	Indeterm-inate	>1/2	Pestle	Concomitant	1	Undiff. Intermed. Volcanic	11.2	10.6	7.3
960	Floor Fill PH 36	Pestle	Cylindrical	>1/2	x	x	1	Vesicular Basalt	19.3	10.6	10.3
998	Feature Fill FEA 7	Mano	Flat/Concave	Whole	Pestle	Concomitant	1	Granodiorite	11.4	9.9	4.5
2272	Floor Fill PH 39	Pestle	Cobble	Whole	x	x	1	Undiff. Intermed. Volcanic	14.5	10.8	8.3
2810	RF/WF PH 43	Mano	Basin	>1/2	Pestle	Concomitant	1	Granatic grading to Schist	x	12.4	6.4
2823	RF/WF PH 43	Mano	Flat/Concave	Whole	Pestle	Sequential	1	Undiff. Felsic Volcanic	14.7	8.1	4.7
3188	Feature Fill FEA 21	Pestle	Cobble	Whole	x	x	2 - opposite	Undiff. Felsic Volcanic	10.73	5.51	4.64
4852	RF/WF PH 41	Mano	Trough	Whole	Pestle	Concomitant	1	Undiff. Felsic Volcanic	19.9	11	4.1
4947	RF/WF PH 41	Mano	Flat/Concave	Whole	Pestle	Concomitant	1	Quartzite	10.9	10.9	4.5
5793	Floor PH 48	Pestle	Conical	Whole	x	x	1	Vesicular Basalt	23.3	11.6	9.5
6723	RF/WF PH 54	Pestle	Triangular	Whole	Handstone	Concomitant	2 - opposite	Dacite	12.9	8.1	7.1

APPENDIX B: CERAMIC DATA

APPENDIX B: TABLE 1

Ceramic artifacts from the McAnally site and a sample of analysis attributes.
*Ceramic characteristics attained from thesis and published site report (Arthur 1994, 2001).

Vessel	Context	Exterior		Interior			Blackening/ Soot	Oxidized Patch	Use Wear	Rim Diameter	Volume (L)
		Burnish	Polish	Burnish	Polish	Smoothing					
B	Roof Fall/ Pithouse Fill	Yes	No	No	No	Yes	Yes	No	Yes	8-10	8.3*
C	Floor	Yes	No	Yes	No	Yes	No	No	Yes	-	-
D	Floor	No	No	Yes	No	No	Yes	Yes	Yes	12	-
E*	Floor	-	-	-	-	-	No	No	Yes	-	-
F	Floor	Yes	No	No	Yes	Yes	Yes	Yes	Yes	8*	1.46*
G*	Floor	-	-	-	-	-	Yes	No	Yes	-	-
H	Floor	Yes	No	Yes	No	No	Yes	No	Yes	8	1.99*
I*	Floor	-	-	-	-	-	Yes	No	Yes	-	-
J*	Floor	-	-	-	-	-	Yes	No	Yes	-	-
K*	Floor	-	-	-	-	-	Yes	No	Yes	-	-
L	Floor	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	16*	ca. 10.44*

APPENDIX B: TABLE 2

Ceramic Vessels recovered from the Harris Site.
Additional data collected from Romero's (2014, 2015) analysis.

FN	Stratum	Feature	Phase	Type	Subtype	Rim Diam. (cm)	Volume (L)	Function
4714	RF/WF	PH 41	Three Circle	Three Circle Neck Corrugated Jar	Neck	N/A	N/A	Cooking
4902	RF/WF	PH 41	Three Circle	Alma Plain Jar	Base	N/A	N/A	Cooking
3689	RF/WF	PH 43	San Francisco	Alma Punched Jar	Partial	12	0.95	Serving
3690	RF/WF	PH 43	San Francisco	Three Circle Neck Corrugated Jar	Rim/Neck	19	N/A	Storage/Processing
6881	RF/WF/FF	PH 54	Three Circle	Plainware (possible jar)	Body/Base	N/A	N/A	Cooking
7195	Floor Fill	PH 53	Three Circle	Three Circle Neck Corrugated Jar	Rim/Neck	N/A	N/A	Storage
986/971	FF/Floor	PH 36	Three Circle	Three Circle Neck Corrugated Jar	60-70%	16	9.4	Cooking/Processing
5940	Floor Fill	PH 45	San Francisco	Plainware Bowl	Partial	23	3.2	Processing/Serving
5932	Floor	PH 45	San Francisco	Alma Plain Jar	Partial	N/A	2.8	Liquid Storage/ Serving
2906	Floor	PH 44	Three Circle	Three Circle Neck Corrugated Jar	Partial	18	11.5	Cooking/ Fermentation
2916	Floor	PH 44	Three Circle	Three Circle Neck Corrugated Jar	Partial	18	N/A	Cooking/ Fermentation
2996	Floor	PH 44	Three Circle	Three Circle Neck Corrugated Jar	Body/Base	N/A	N/A	Cooking/ Fermentation
3348	Floor	PH 44	Three Circle	Three Circle Neck Corrugated Jar	Partial	20	N/A	Cooking/ Fermentation
1704	Feature Fill	PH 37	Three Circle	Alma Plain Jar	80-90%	N/A	2.9	Cooking/Food Storage
1005	Feature Fill	PH 38	Three Circle	Alma Plain Jar	Partial	N/A	5.4	Cooking/Food Storage
7449	Feature Fill	PH 43	San Francisco	Alma Punched Jar	Complete	12.3	5.6	Cooking/Food Storage
5897	Feature Fill	PH 48	Early Three Circle	Three Circle Neck Corrugated Jar	80-90%	N/A	4.3	Cooking/Food Storage
1314	Feature Fill	Feat. 11	Three Circle	Alma Punched Jar	Partial	9	0.312	Processing/Serving
1540	Feature Fill	Feat. 12	Late Three Circle	Alma Plain Bowl	Partial	22	2.8	Processing/Serving
1946	Feature Fill	Feat. 12	Late Three Circle	Three Circle Neck Corrugated Jar	Rim/Neck	22	N/A	Storage/Processing

APPENDIX B: TABLE 3

Ceramics from Galaz Ruin (Anyon and LeBlanc 1984:97-114, 445-461).
[1]For vessels where more than one diameter is listed, *r* refers to the rim diameter, and *m* refers to the maximum diameter. For bowls, diameter refers to the rim. [2]This vessel was not complete and notes did not indicate which part the diameter represented.

FN	Room Block	Room	Context	Type	Subtype	Height (cm)	Diameter (cm)[1]	Estimated Volume (L)	Possible Function(s)
15B-13	South	70	Floor	Jar	Half corrugated with handle	11.5	6r 12m	0.434	Processing/Serving
15B-12	South	70a	Floor	Bowl	Flare rim, obliterated tooled exterior	19.5	41-42.5	18.04-20.1	Processing/Serving
15B-14	South	70a	Floor	Bowl	Flare rim, obliterated tooled exterior	20	41-44.5	18.71-23.07	Processing/Serving
15B-15	South	70a	Floor	Bowl	Flare rim, red slipped and obliterated tooled exterior	15.5	31	7.8	Processing/Serving
11B-480	South	52	Set in Floor	Jar	Style III	9.5	10r 16m	0.637	Serving/ Food Storage
15B-227	South	94	Set in Floor	Jar	Full body corrugated	32	33m	9.123	Cooking/Food Storage
15B-364	West	113	Set in Floor	Jar	Plain	36 frag	10 unk[2]	x	Cooking/Food Storage
15B-399	West	124a	Set in Floor	Bowl	Obliterated tooled exterior	15	35	11.22	Serving/Food Storage
2B-292	North	41	Floor	Jar	Full body indented corrugated	11	7.5r 12m	0.415	Processing/Serving
15B-112	North	85	Floor	Bowl	Flare rim, obliterated tooled exterior	4.5	8	0.134	Processing/Serving

APPENDIX B: TABLE 4

Ceramic Vessels from NAN Ranch Ruin (Lyle 1996; McCollum 1992; Shafer 2003).

Artifact I.D.	Room	Room Type	Context	Type	Subtype	Volume (L)	Function
D2F2SF-1	42	Habitation	Roof Fall (ceiling)	Jar	Fully Corrugated	10.989	Cooking
3-1146	47	Habitation	Room Fill	Jar	Fully Corrugated	4.579	Cooking
4-486(1)	60	Storage	Floor (SF1)	Jar	Fully Corrugated	17.977	Cooking
4-486(3)	60	Storage	Floor (SF)	Jar	Plainware with Lugs	0.274	Processing/Serving
5-1025	22	Habitation	Floor Pit (SF5)	Jar	Partially Corrugated	10.14	Cooking
5-1025	22	Habitation	Floor Pit (SF5)	Jar	Partially Corrugated	0	Cooking
7-282	84	Habitation	Floor	Pitcher	Fully Corrugated	0	Liquid Serving/ Processing
7-782	85	Habitation	Hearth (SF10)	Mug	Fully Corrugated	0.531	Liquid Serving
8-818	74	Shared Storage	Floor (SF12)	Jar	Partially Corrugated	88.844	Processing/Fermentation
8-953	74	Shared Storage	Floor (SF2)	Jar	El Paso red-on-brown	80.344	Processing/Fermentation
8-954	74	Shared Storage	Floor (SF3)	Jar	Fully Corrugated	61.756	Processing/Fermentation
8-957	74	Shared Storage	Floor (SF5)	Jar	Convento Indented	147.316	Cooking
8-986 (8-1310)	74	Shared Storage	Floor (SF20/58)	Jar	Partially Corrugated	0	Cooking
8-988	74	Shared Storage	Floor (SF19)	Jar	Composite	9.221	Cooking
8-1172	74	Shared Storage	Floor (SF49)	Jar	Partially Corrugated	113.151	Processing/Fermentation
9-872	94	Habitation	Hearth (SF43)	Jar	Fully Corrugated	16.361	Cooking

APPENDIX C: FIRE-FEATURE DATA

APPENDIX C: TABLE 1

Fire-Features from the Harris site and a sample of analysis attributes.

Feature	Phase	Type	Subtype	Lined (Y/N)	Lining Material	Hearth Stone (Y/N)	Dimensions L x W (cm)	Depth (cm)	Comments
Pithouse 35	Three Circle	Hearth	Basin	N		N	50 x 40	8	Amorphous; dug to touch PH 36 hearth
Pithouse 36	Three Circle	Hearth	Lined	Y	Plaster	N	indet. x 25	x	
Pithouse 37	Three Circle	Hearth	Lined	Y	Plaster	Y	57 x 39	23	
Pithouse 38	Three Circle	Hearth	Lined	Y	Plaster	Y	50 x 40	15	
Pithouse 39/40	Three Circle Georgetown	Hearth	Lined/ Basin	Y	Plaster	Y	73 x 68	34	PH 39 hearth (plastered) built into/ reused PH 40 hearth (not plastered)
Pithouse 41	Three Circle	Hearth	Basin	N		N	40 x 20	5	
Pithouse 42	Three Circle	Hearth	Lined	Y	Plaster	Y	62 x 40	23	
Pithouse 43	San Francisco	Hearth	Lined	Y	Plaster	Y	52 x 40	8	
Pithouse 44	Three Circle	Hearth	Basin	N		N	45 x 30	16	
Pithouse 45	San Francisco	Hearth	Collared	Y	Plaster	N	50 x 47	10	
Pithouse 46	Three Circle	Hearth	Lined	Y	Plaster	Y	55 x 45	17-21	
Pithouse 47	Three Circle	Hearth	Lined	Y	Plaster	Y	51 x 47	20	
Pithouse 48	Early Three Circle	Hearth	Basin	N		Y	73 x 53	20	
Pithouse 49	Late Three Circle	Hearth	Basin	N		Y	52 x 50	7	
Pithouse 51	Three Circle	Hearth	Lined	Y	Plaster	Y	40 x 30	13	
Pithouse 52	Transitional	Hearth	Collared	Y	Plaster	N	49 x 35	10	
Pithouse 53	Three Circle	Hearth	Lined	Y	Plaster and rock	Y	35 in diameter	11	
Pithouse 54	Three Circle	Hearth	Lined	Y	Plaster	N	34 x 28	15-20	
Feature 1	Three Circle	Hearth	Unlined	N		N	55 x 50	15	Ramada assoc. with PH 37 and 38
Feature 14	Late Three Circle	Hearth	Basin	N		N	35 x 31	13	Secondary Occupation of PH 39
Feature 31	Late Three Circle	Hearth	Collared	Y	Rock and adobe	N	70 x 60	20	Secondary Occupation of PH 49/54

APPENDIX C: TABLE 2

Fire-Features from Galaz Ruin (Anyon and LeBlanc 1984:334-376).

Room Block	Feature	Type	Subtype	Shape	Lining	Dimensions (cm)	Depth (cm)	Comments
South	Room 55	Hearth	Slab-Lined	Square	Flat slabs	53 x 53	28	
South	Room 70a	Hearth	Slab-Lined	Square	Fine flat slabs	81 x 81	nd	
South	Room 81	Hearth	Basin/Pit	Circular	No Data	64 diam.	13	Shallow
South	Room 105	Hearth	Slab-Lined	Square	3 cm thick slabs	41 x 38	13	
South	Room 139a	Hearth	Slab-Lined	Rectangular	W side - rock slab, N, S, E side & base - 5 cm thick adobe	33 x 46	18	Rounded corners
West	Room 39	Hearth	x	Rectangular	No Data	56 x 61	nd	
West	Room 43	Hearth	x	Rectangular	No Data	48 x 38	nd	
West	Room 110	Hearth	Slab-Lined	Square	No Data	30 x 30	nd	
West	Room 113	Hearth	Slab-Lined	Rectangular	N side and base - slabs	66 x 53	10	
West	Room 117	Hearth	Slab-Lined	Rectangular	S side - metate fragment, E side - mano, N side - slab, W side - adobe, adobe on all sides	30 x 38	nd	
West	Room 118a	Hearth	Slab-Lined	Rectangular	Slabs & adobe	41 x 36	15	
West	Room 119	Hearth	Slab-Lined	Rectangular	Thin slabs on edge, slab base	30 x 23	10	
West	Room 124a	Hearth	Slab-Lined	Square	Slabs on sides & adobe base	56 x 56	15	Concave base
East	Room 21a	Hearth	x	Rectangular	No Data	51 x 46	nd	
North	Room 84a	Hearth	Slab-Lined	Square	Flat slabs & adobe	51 x 51	33	
North	Room 98	Hearth	Slab-Lined	Rectangular	1 cm thick slabs on sides; slab base set in adobe	22 x 16	8	
North	Room 99	Hearth	Slab-Lined	Rectangular	1 cm thick slabs on sides & adobe base	33 x 24	10	Concave base
North	Plaza 42	Hearth	Lined	Circular	Cobbles in adobe	69 ext. diam. 43 int. diam.	43	

APPENDIX C: TABLE 3

Domestic Fire-Features from NAN Ranch Ruin (Shafer 1991a, 1991b, 1991c, 1992, 2003).
[1]Dimensions estimated based on plan maps.

Room	Room Block	Room Type	Type	Subtype	Shape	Comments	Dimensions (cm)
3	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	35 x 45[1]
4	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	30 x 38[1]
8	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
16B	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
18	East	Habitation	Hearth	Slab-lined/Pit	Rectangular/Undefined	Unknown, poss. slab-lined	
22	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	40 x 52[1]
23A	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
25A	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	20 x 20
25B	East	Storage	Hearth	Slab-lined	Rectangular	Adobe sealed	
28A	South	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	37 x 50[1]
28B	South	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
29B	South	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	30 x 30[1]
30	West	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
31	West	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
32	West	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
37	East	Habitation	Hearth	Cobble-lined	Circular		60 x 65
40	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
42	East	Storage	Pit	Ash Deposit	Undefined		
46	East	Storage	Hearth	Adobe-lined	Circular/Basin		
47	East	Habitation	Hearth	Adobe-lined	Basin		30 (diameter)
48	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
49	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	50 x 25frag[1]
50	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	45 x 50[1]
60	East	Storage	Hearth	Adobe-lined	Basin		25 (diameter)
63A	East	Storage	Hearth	Adobe-lined	Circular/Basin		
63B	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
74	East	Storage	Hearth	Adobe-lined	Rectangular		
78(90)	South	Storage	Pit	Ash Deposit	Undefined		
80	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
84	East	Habitation	Hearth	Cobble-lined	Circular		33 x 40
85	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	30 x 40[1]
89A	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
89B	East	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	
93	SE Rm Suite	Habitation	Hearth	Adobe-lined	Rectangular		60 x 60
94	South	Habitation	Hearth	Slab-lined	Rectangular	Adobe sealed	40 x 55[1]
109	South	Storage	Hearth	Adobe-lined	Circular/Basin		

APPENDIX C: TABLE 4

Extramural Fire-Features from NAN Ranch Ruin.
[1]Shafer 1991a, [2]Shafer 1991c, [3]Shafer 1992, [4]Shafer 2003, [5]Shafer and Drollinger 1998

Feature	Location	Type	Subtype	Shape	Lining	Dimensions (cm)	Depth (cm)
85-22[1,5]	East Plaza	Fire-pit	Basin	Circular	Adobe	62 x 55	13
85-25[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	70 x 65	26
86-9A[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	45 x 45	13
86-3[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	110 (diameter)	15
86-13[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	40 x 40	16
86-15[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	28 x 26	10
86-30[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	60 (diameter)	24
86-32[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	60 x 53	23
86-34[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	66 x 65	12.5
86-36[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	62 x 50	31
86-51[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	23 x 62	38
86-72[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	50 x 50	27
86-73[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	40 x 40	24
11-34[5]	East Plaza	Fire-pit	Basin	Circular	Adobe	80 (diameter)	9
10-25[3]	Extramural - NE side of South room block, below room 109	Fire-pit	Basin	Circular	Adobe	70 (diameter)	39
Subfloor feature 57[2]	Extramural - NW side of South room block, below room 39	Fire-pit	Basin	Circular	Adobe	55 (diameter)	15
Subfloor feature 58[2]	Extramural - NW side of South room block, below room 39	Fire-pit	Basin	Circular	Adobe	60 (diameter)	15
Ramada/ Room 87[1]	Extramural built on to the south walls of room suite 92/93	Pit	Ash Deposit	Circular	None	x	x / shallow
2-AFSF32[4]	Extramural - N side of East room block, below room 8	Roasting Pit	Straight sides, flat bottom	Circular	Adobe	115 x 125	88

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Wisseman, Sarah U.
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Woods, Aaron and Barbara Roth
2013 Preparation, Consumption, or Storage? Organic Residue Analysis of Archaeological Ceramics from the Harris Site, Southwestern New Mexico. Annual UNLV Graduate and Professional Student Association Forum. Las Vegas, NV.

Woosley, Anne I. and Allan J. McIntyre
1996 *Mimbres Mogollon Archaeology: Charles C. Di Peso's Excavations at Wind Mountain. An Amerind Foundation Publication*. University of New Mexico Press, Albuquerque.

Young, Lisa C. and Tammy Stone
1990 The Thermal Properties of Textured Ceramics: An Experimental Study. *Journal of Field Archaeology* 17(2):197-217.

CURRICULUM VITAE

Ashley M. Lauzon
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EDUCATION

2016	University of Nevada-Las Vegas **M.A. Anthropology** Thesis: *Food Processing and Cooking Technology of the Mimbres Mogollon (Early Pithouse Period through the Mimbres Classic A.D. 200-1130)*
2011	Hood College, Frederick, MD **B.A. Archaeology** **B.A. Art History** *Graduated Cum Laude*
2007-2009	College of Southern Nevada, Las Vegas, NV Completed through College of Southern Nevada High School No Degree (41 credits)

EMPLOYMENT HISTORY

2014 – Present	Southwest Archaeology Lab, University of Nevada-Las Vegas **Lab Manager** Responsibilities include processing flotation samples, washing, labeling, cataloging, and analyzing artifacts and keeping track of computer based versions of FN/SN book, catalog book, and other needed duties to maintain the lab including preparation of artifacts for curation.
2015 – 2016	University of Nevada-Las Vegas **Graduate Assistant** Department of Anthropology
Spring 2014	**Internship** at State Historic Preservation Office Las Vegas, NV
2012 – 2014	Southwest Archaeology Lab, University of Nevada-Las Vegas **Assistant Lab Manager** Responsibilities include processing flotation samples, washing, labeling, cataloging, and analyzing artifacts and keeping track of computer based versions of FN/SN book, catalog book,

	and other needed duties to maintain the lab including preparation of artifacts for curation.
Spring 2013	Far Western Anthropological Research Group, Inc. Henderson, NV Temporary part-time employee that aided in preparing collections for curation.

ARCHAEOLOGICAL PROJECTS

Summer 2016	Elk Ridge Field School, Mimbres, NM; PI- Barbara Roth University of Nevada-Las Vegas **Lab Director** Responsibilities included washing, labeling, cataloging artifacts and keeping track of computer based versions of FN/SN book, catalog book, and other needed duties to maintain the lab.
Summer 2015	Elk Ridge Site, Mimbres, NM; PI- Barbara Roth University of Nevada-Las Vegas (in coordination with USFS) **Volunteer** Excavation of pueblo along arroyo (2 weeks).
Summer 2013	Harris Site Project, Mimbres, NM; PI- Barbara Roth **Volunteer** Excavation of pithouse village from (18 days).
Summer 2012	Harris Site Field School, Mimbres, NM; PI- Barbara Roth University of Nevada-Las Vegas **Lab Director** Responsibilities included washing, labeling, cataloging artifacts and keeping track of computer based versions of FN/SN book, catalog book, and other needed duties to maintain the lab.
Summer 2011	Harris Site Field School, Mimbres, NM; PI- Barbara Roth University of Nevada-Las Vegas **Field Student** Excavation of pithouse village.

RELATED COURSE WORK

Spring 2014	ANTH 796 – CRM Internship
Fall 2013	ANTH 649A – Ceramic Analysis
Spring 2013	ANTH 649B – Lithic Analysis
Spring 2013	ANTH 755 – Archaeological and Historical Preservation

GRANTS/SCHOLARSHIPS

2016 UNLV Graduate and Professional Students Association, $525.
2015 Angela Peterson Memorial Scholarship, $830.
2015 UNLV Graduate and Professional Students Association, $550.
2014 UNLV Graduate and Professional Students Association, $425.
2014 UNLV Graduate and Professional Students Association, $350.
2013 Lambda Alpha Honor Society Scholarship, $150.

WORKSHOPS

Prehistoric Food Processing Techniques
March 2014 Nevada SHPO
Las Vegas Office, Nevada Site Stewardship Program
May 2014 Nevadans for Cultural Preservation (NVFCP)
Non-profit Organization

PRESENTATIONS

2014 18th Biennial Mogollon Conference, Las Cruces, NM
Paper Presentation, second author (with Danielle Romero)
Title: *The Art of Feasting: Style and Identity in a Ritual Area at the Harris Site*

2014 GPSA Forum, UNLV
Poster Presentation
Title: *The Function of Extramural Work Areas at the Harris Site*

2014 SAA Conference, Austin, TX
Paper Presentation, first author (with Barbara Roth)
Title: *From Architecture to Households: Pithouse Excavations at the Harris Site*

2014 2nd Annual Anthropology Research Forum, UNLV
Poster Presentation
Title: *The Function of Tabular Knives art the Harris Site, LA 1867*

2013 1st Annual Anthropology Research Forum, UNLV
Poster Presentation
Title: *Tool Differences in Relation to Activity Areas at the Harris Site LA 1867*

PUBLICATIONS AND REPORTS

Lauzon, Ashley
2016 Ground Stone Analysis. In *Report on 2015 Archaeological Excavations at the Elk Ridge Site (LA 79863), Mimbres Valley, Grant County, New Mexico,* edited by Barbara J. Roth and Darrell Creel, pp. 35-42. Submitted to the Gila National Forest, September 2016.

Romero, Danielle and Ashley Lauzon
2014 The Art of Feasting: Style and Identity in a Ritual Area at the Harris Site. *Proceedings of the 18th Biennial Mogollon Archaeology Conference.*

Roth, Barbara J., Aaron Woods, and Ashley Lauzon
2015 Chapter 5: Feature Descriptions. In *Archaeological Investigations at the Harris Site (LA 1867), Grant County, New Mexico*, edited by Barbara J. Roth, pp. 77-114. National Science Foundation Grant. Submitted to the National Science Foundation, Grant #1049434.

Roth, Barbara J., Danielle Romero, and Ashley Lauzon
2015 Chapter 11: Pithouse Rooftop and Floor Assemblages. In *Archaeological Investigations at the Harris Site (LA 1867), Grant County, New Mexico*, edited by Barbara J. Roth, pp. 319-333. National Science Foundation Grant. Submitted to the National Science Foundation, Grant #1049434.

Woods, Aaron, Ashley Lauzon, and Barbara J. Roth
2015 Chapter 4: Unit Descriptions. In *Archaeological Investigations at the Harris Site (LA 1867), Grant County, New Mexico*, edited by Barbara J. Roth, pp. 28-76. National Science Foundation Grant. Submitted to the National Science Foundation, Grant #1049434.

SOCIETIES AND PROFESSIONAL ORGANIZATIONS

- Lambda Alpha National Anthropology Honor Society
- Society for American Archaeology

PROFESSIONAL SKILLS

Archaeological Methods:
- Analytical: Primarily ground stone, but also plainware ceramic and debitage analysis
- Lab: Managing databases, artifact sorting and labeling, curation preparation

Computer Skills
- Microsoft Office Suite
- FileMaker
- AutoCAD - Architecture software used for site and plan maps