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Investigating Intra-Site Variability in the Use of Buildings During the Mississippian Period at the Ames Town Site (40FY7) in Western Tennesee

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INVESTIGATING INTRA-SITE VARIABILITY IN THE USE OF BUILDINGS DURING THE MISSISSIPPIAN PERIOD AT THE AMES TOWN SITE (40FY7) IN WESTERN TENNESSEE

By

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Abstract

This thesis investigates a series of overlapping structures in unit F1-U25 at Ames (40FY7), an Early to Middle Mississippian period (ca. AD 1050 – 1300) site in Fayette County, Tennessee. Ames is comprised of a town, plaza, and four mounds all surrounded by a palisade wall. Approximately 220 meters east of the palisade wall, unit F1-U25 revealed a series of superimposed structures. The two primary goals of this thesis include determining the temporal relationship between the superimposed structures and the town site; and determining the function of the structures. A multi-staged research design, including geophysical prospection, soil analyses, excavation, artifact analysis and radiometric dating, was undertaken to achieve the two goals. The results of the study will improve the understanding of Early to Middle Mississippian period variability in settlement patterns in the uplands of Western Tennessee.

Acknowledgements

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Finally, I would like to thank my family who without them completion of my thesis would not be possible. My grandmother, Barbara Menietto deserves more than words can say in a simple thank you as she cared for my son day in and day out while I was and undergraduate and graduate student. She spent countless nights with my son while I studied. I would also like to acknowledge my mother as she has always pushed me through school, and she became my role model. Finally, I would like to thank Scott Nuccio as he helped push me through the hardest part of my graduate career and stood by my side making sure to always encourage me to succeed. This research was funded in part by a Tennessee Council for Professional archaeology research award to Krista Menietto and the West Tennessee Archaeological project.

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1. Introduction

"Of all those aspects of man's prehistory which are available to the archaeologist, perhaps the most profitable for such an understanding are settlement patterns" (Willey 1953:1).

The Ames site (40 FY7) in Fayette County, Tennessee is an Early to Middle Mississippian (ca. AD 1050 -1300) town and mound complex with four mounds, a plaza, and is surrounded by a palisade wall (Figure 1). In a multi-staged research effort, a series of superimposed prehistoric structures were identified in unit F1-U25 (Figure2), 220 meters east of the town site at Ames. The goal of this thesis is to determine the age and use of these structures within unit F1-U25 and to understand connections with the town site. Settlement patterns at Ames can be investigated by establishing a temporal relationship, determining the function of the structures found within unit F1-U25 and comparing the F1-U25 buildings with previously excavated buildings at the site.

Settlement pattern studies in the southeastern United States have been a major focus of North American Archaeology for many years (Blitz 2010:2, Rafferty 1994:405, Schroeder 2004:313, Smith 1978:479, Steponaitis 1986: 364). Settlement pattern archaeology, according to Willey and Sabloff (1993: 172) became widely practiced after Willey's Viru Valley analysis. Settlement patterns studies can not only represent how humans used the landscape but also communicate aspects of daily human life including social structure and belief systems. The current study will investigate settlement patterns at Ames, since according to Willey (1953:1),

> The term 'settlement patterns' is defined here as the way in which man disposed himself over the landscape on which he lived. It

> refers to dwellings, to their arrangement, and to the nature and disposition of other buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated and various institutions of social interaction and control which the culture maintained.

Examination of settlement patterns is key to understanding how a past culture lived and interacted with the natural and social landscape. Settlement pattern studies can be carried-out at a variety of scales and range from the regional scale down to the configuration of a single community plan. The research at hand will focus on the smallest aspect of settlement pattern studies, individual structures comprising the Ames community plan. This study establishes how individual structures relate and play a role within a community through time. A series of superimposed structures within unit F1-U25 will be investigated to understand diachronic change of the community plan. Inferences can then be drawn about how these communities shaped the regional settlement pattern. Finally, I will place my analysis within regional context.

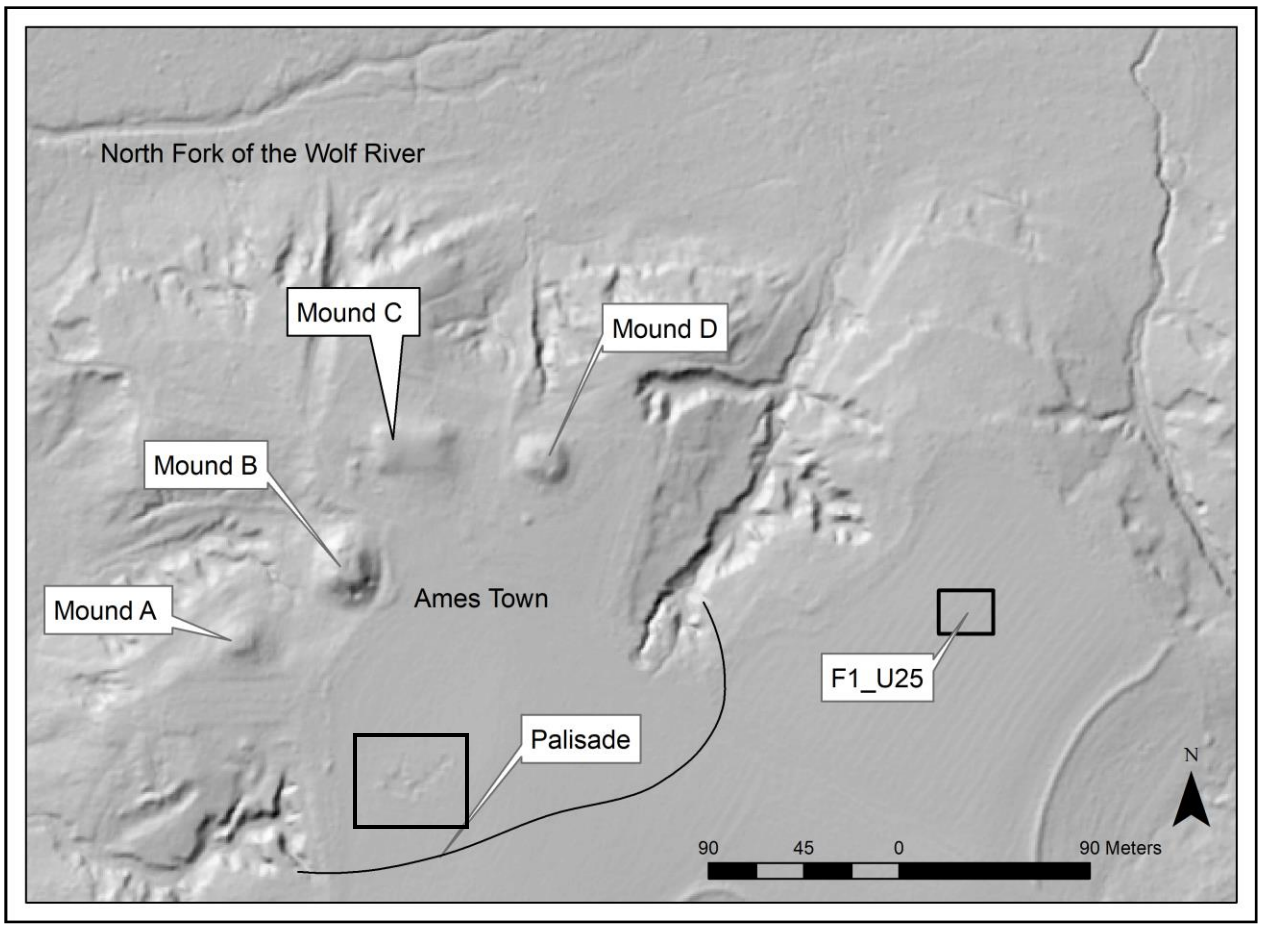

Figure 1: Lidar data of the Ames site. F1-U19 can be seen in lidar data south of Mound A (Indicated by the large square).

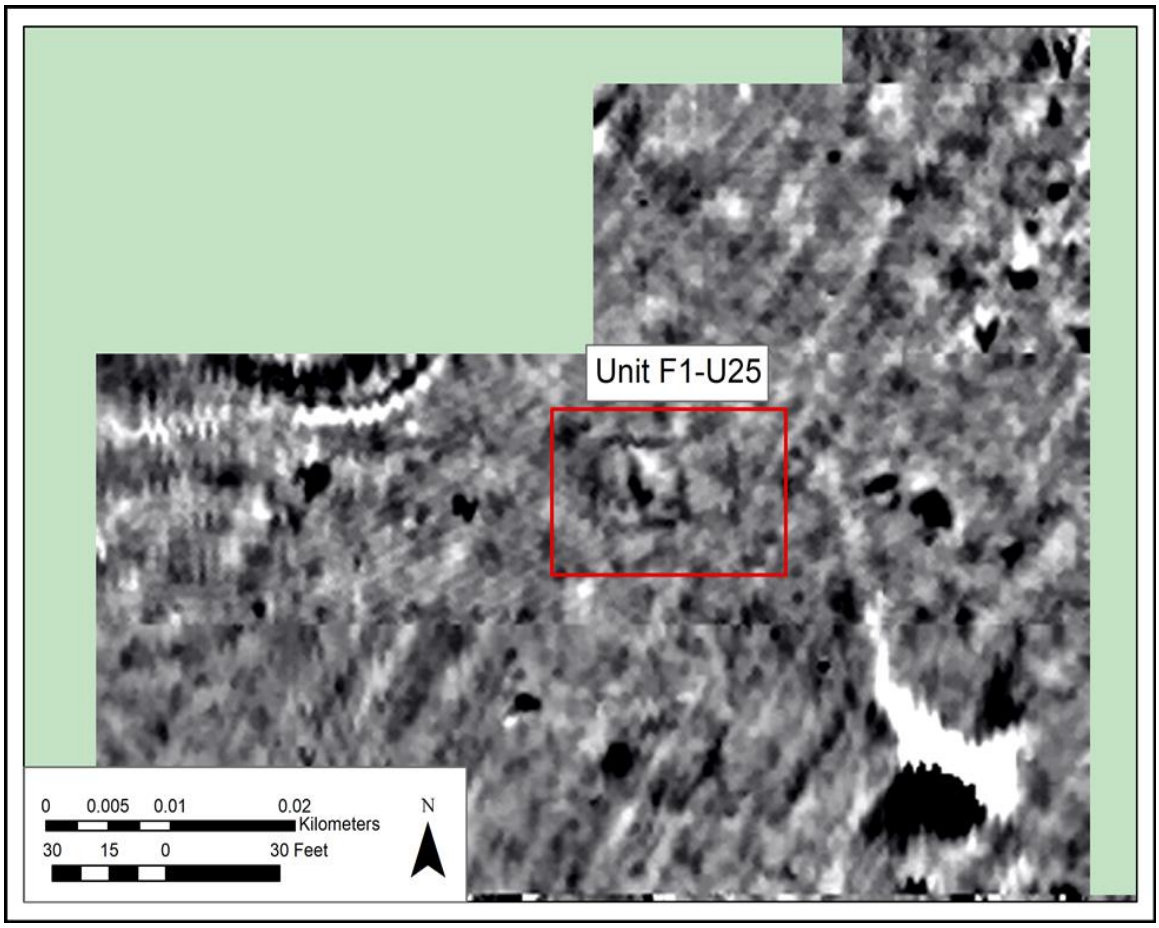

Figure 2: Magnetometry results from the 2018 geophysical survey revealed structures in unit F1-U25 (in red square).

Significance

The purpose of my research is to examine how the community plan at Ames changed throughout the Mississippian period. The structures within unit F1-U25 are explored to understand how people used the landscape through time. This thesis will add to a growing body of knowledge of Mississippian sites in the uplands of western Tennessee. A regional perspective can be achieved by comparing the results of this study to other Mississippian sites in western Tennessee to understand regional diachronic change.

Research Questions

This study involves two related research questions regarding temporal and functional aspects of the structures investigated in block F1-U25. The first research question is what is the temporal relationship between the structures in unit F1-U25 and the town site? The second research question is what is the function of the unit F1-U25 structures? By establishing a temporal relationship between the structures and town site I will be able to examine the function of these structures and attempt to understand how the community settlement pattern changed through time.

Hypotheses Formulation

Two sets of hypotheses frame my research. The first set of hypotheses addresses the temporal relationships between the structures and the town site. The second set of hypotheses relates to the function of the structures in unit F1-U25. These hypotheses are presented below.

1. Hypotheses regarding the temporal range and relationship to the town site.

The null hypotheses H_o, states that nothing can be said about the temporal relationship to the town site given the data available. Rejection of the null hypothesis would be supported by the architectural style of the structures and the artifacts collected. The first hypothesis, H_1, states that the structures are temporally related to the town site. Acceptance of H_1 requires a method such as radiocarbon dating combined with examining the super-positioning of the overlapping structure features to determine the age of the structures. The second hypothesis, H_2, considers if the structures are not temporally related to the town site and are evidence of an earlier or later occupation.

2. Hypotheses regarding the function of the structures.

The structures within unit F1-U25 may or may not have functioned differently over time. Determining the function of these structures is important in order to better understand how the use and organization of space at Ames may have changed over time. There are two distinct classes when discussing the function of the F1-U25 structures: domestic structures and non-domestic structures. According to Steere (2017:11-12), "Domestic structures are those that appear to have served primarily as residential dwellings in domestic contexts," while "nondomestic structures … include large public buildings and smaller special purpose buildings, like mound-top temples and sweat lodges." Non-domestic structures can vary in the way they function, some may be public centers while others may be related to ritual and religious institutions or storage.

My research analyzes the function of the structures within unit F1-U25. I developed a series of hypotheses which question if these structures are either domestic or non-domestic in use. As part of my analysis I will compare unit F1-U25 with previously investigated structures at Ames. These structures include unit F1-U2, a series of overlapping rebuilt domestic structures (Guidry 2013) and unit F1-U19, a non-domestic structure (Cross 2016). The hypotheses related to my second research question are presented below.

The null hypothesis, H_o, states the use of the structures could not be determined due to lack in the available data. There is a clear lack in artifactual remains which could suggest the rejection of this hypothesis, however, that could also be due to sampling bias, collection technique, or differential deposition.

The first hypothesis, H_1 states the structures are domestic structures. Domestic buildings are usually filled with domestic debris, have large artifact assemblages, and multiple storage

features. Though non-domestic structures often contain a multitude of artifacts as well, differences in the artifact type and style can differentiate the significance of the structure. The lack of artifacts could possibly provide the rejection of H_1 because domestic structures tend to have more numerous artifact collections. The second hypothesis, H_2, considers if the structure is non-domestic in use. To test this hypothesis, I will compare unit F1-U25 with units F1-U2 and F1-U19.

The remainder of the thesis consists of the following layout. Chapter two presents the environmental and cultural background of the area. Chapter three discusses the methods and results of this research. Chapter four provides the details on analysis and compares unit F1-U25 with unit F1-U2 and unit F1-U19 to determine the function of the structures. Finally, chapter five is the discussion of the future implications of this research.

2. Background

This chapter will review the environmental context of the Ames site, including its geographical and ecological setting as well as providing a cultural historical background. Following the review of Ames's environmental setting focusing on the Mississippian period (ca. 1000 -1500 AD). The cultural discussion reviews the origin of the term "Mississippian," settlement patterns, social organization, and ideological aspects. Finally, there will be discussion of the previous research of the Ames site.

Environmental Context and Resources

Ames, an Early to Middle Mississippian (ca. A.D. 1050-1290) town site is located along the interfluve between the Tennessee and Mississippi Rivers on the North Fork of the Wolf River, a tributary of the Mississippi River in southwestern Tennessee. Large Mississippian sites are generally located along major waterways (Griffin 1990:8), however, smaller towns are often located away from major river systems. In the uplands of western Tennessee and northern Mississippi, Early Mississippian town sites including Bolivar (40HM2), Denmark (40MD85), Obion (40HY14), and Owl Creek (22CS502) are also located at the headwaters of tributary streams and within the same environmental zone as Ames (Figure 3).

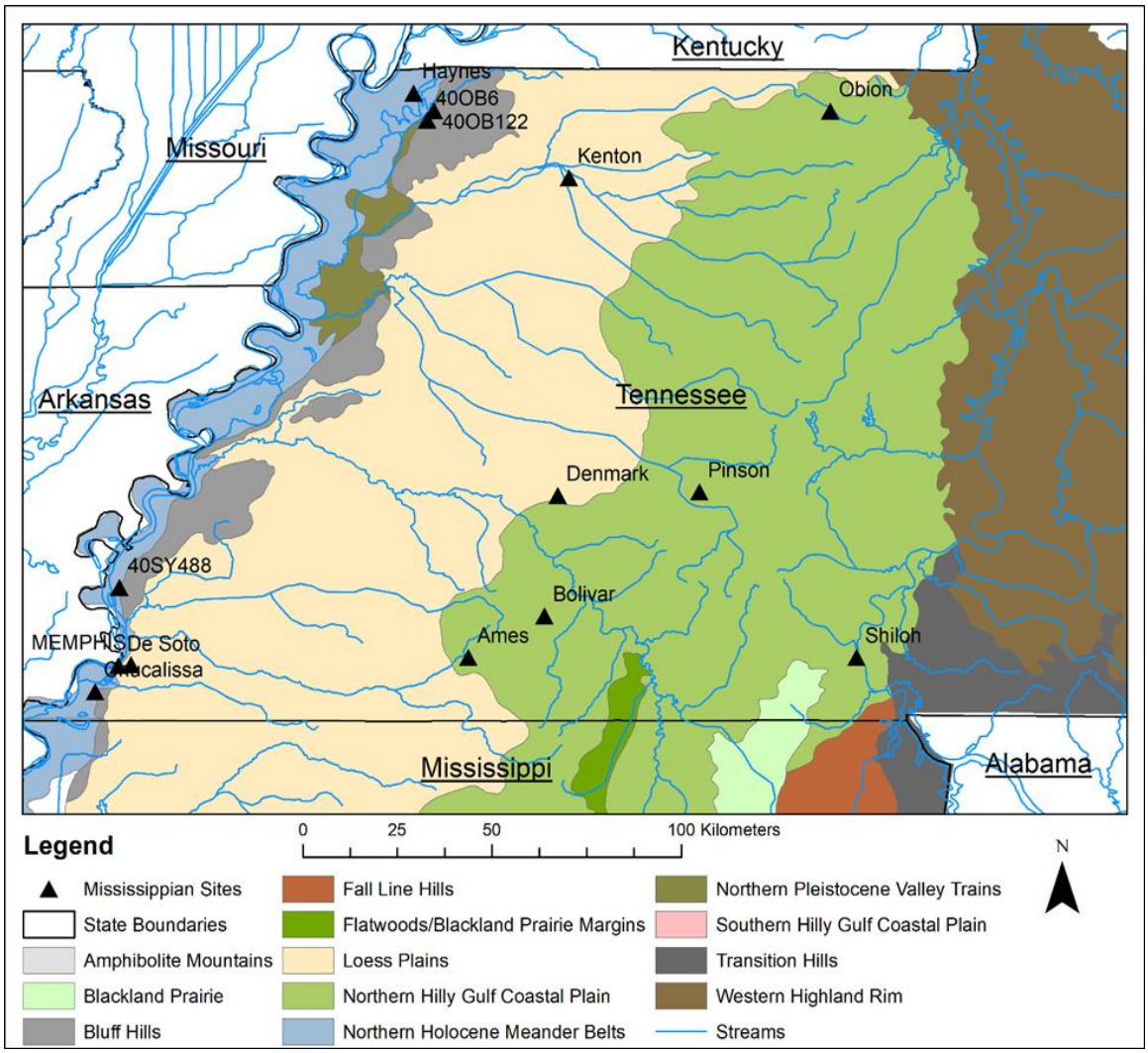

Figure 3: Location of the Ames site (40FY7) with other regional Mississippian period sites.

Ecologically the site lies along the interface between the Northern Hilly Gulf Coastal Plain and the Loess Plains, which dominate the western Tennessee landscape (Griffith et al. 1998). The Loess Plains are described as areas of "gently rolling, irregular plains, 250-500 feet (76-152 meters) in elevation with loess up to 50 feet (15 meters) thick" (Griffith et al. 1998). Loess deposited in Fayette county is between 6 and 12 feet (1.8 -3.6 meters) deep (Flowers 1964:1). Streams in the Loess Plains are "low gradient and murky with silt and sand bottoms" (Griffith et al. 1998). The Northern Hilly Gulf Coastal Plain is an area of "irregular plains" with elevations

upwards of 650 feet (198 meters) (Griffith et al. 1998). The streams in the area are mostly low gradient with sandy bottoms (Griffith et al. 1998). The five major streams of the area, Loosahatchie, Hatchie, Obion, Forked Deer, and Wolf River, are East to West flowing with their headwaters between the environmental zones and terminating in the Mississippi River. The soil series of Ames are the Memphis and Loring, which are both moderately well drained and acidic (Soil Survey Staff 2013, 2018). Average yearly temperature ranges from 27°F (-2.78°C) in the colder winter months to 90° F (32.2°C) in the warmer summer months. Average yearly rainfall in the area is between 50-52 inches or 127-132 cm (Griffith et el. 1998).

Abundant rainfall and equally agreeable yearly temperatures offer a variety of flora and fauna resources. The Loess Plains are characterized by oak-hickory forests with some "less disturbed bottomland forest and cypress-gum swamp habitat still remain" (Griffith et al. 1998). However, much of the Loess Plains has been cleared for modern agricultural practices. Modern crops of the area include corn, cotton, soybean, and sorghum (United States Department of Agriculture, Soil Conservation Service 1964). "Natural vegetation of the Northern Hilly Gulf Coastal Plain is oak-hickory forest grading into oak-hickory-pine to the south" (Griffith et al. 1998). Flora species other than those discussed above include pin oak, persimmon, cottonwood, and sycamore as well as a variety of understory species like vines, canes, shrubs, and herbs (Smith 1996:99). According to Smith (1996:99) "Shagbark and scalybark hickories tend to form groves on Grenada and Calloway soils on the terraces, whereas the upland species of hickory are predominantly those too high in tannic acid for human use without special processing." Fauna in the area include, but are not limited to, white-tailed deer, racoon, squirrel, turtles, turkey, and seasonally migratory birds (Smith 1996:99). Lithic resources were sparse in the area around Ames; however, areas of chert and quartzite gravels are available underneath the Pleistocene

Loess deposits along the Bluff Hills and in streambeds (Smith 1996:99). Ferruginous sandstone and siltstone could be accessed in central western Tennessee (Smith 1996:99-100). According to Smith (1996:100), "Ferruginous siltstone was widely used in the region for atlatl weights, gorgets, celts, and rough bifacial tools."

Cultural Background

The Mississippian period (1000-1500 AD) is defined by a series of traits including intensive maize cultivation, high degrees of sedentism, shell tempered pottery, and increasing social complexity. The Mississippian period is divided into three subperiods, Early (1000 – 1150 AD), Middle (1150 – 1300 AD), and Late (1300 – 1500 AD), within the Central Mississippi Valley (CMV) which stretches from the confluence of the Ohio River to the Arkansas River. (Cobb and Butler 2002:627). Throughout most of the period the people occupied floodplain areas and the adjacent uplands in much of the Southeastern United States.

The term "Mississippian" was first used by William Henry Holmes (1886:434) in reference to the common occurrence of shell tempered pottery found across much of the Midwest and Southeastern United States. Holmes identified the pottery as being "homogenous in character" and assigned it to a single period of culture (Holmes 1886:371). The concept of "Mississippian" has evolved over time in relation to changing paradigms, methodologies, and advances in technology within archaeology. Griffin (1967:189) stated "the term Mississippian is used here to refer to a wide variety of adaptations made by societies in which developed a dependence upon agriculture for their basic storable food supply." Almost ten years later Smith (1978:480) critiqued and refined the concept of "Mississippian as a cultural adaptation to a specific habitat situation and as a particular level of sociocultural integration." Further, Smith (1978:481) elaborated,

> It has been recognized for a number of years that the Mississippian cultural adaptation was largely restricted to meander-belt zones of the river valleys of the Eastern United States. What has not generally been recognized is the restriction of Mississippian populations to floodplain situations was not simply because of the availability of easily tilled alluvial soils. Rather this restriction was a function of the specific, complex adaptation by Mississippian populations to this habitat zone composed of linear bands of circumscribed agricultural land and concentrated biotic resources.

Smith determined the concept of "Mississippian" was a floodplain adaptation with varying degrees of social organization. However, his definition does not account for the numerous sites in the uplands especially in western Tennessee. The definition of the term "Mississippian" is still evolving, being adapted to best suit what archaeologists need as new methodologies and technologies are introduced. According to Anderson (2017:293-294), "We are still wrestling with questions like what Mississippian is and how it appeared and changed over time, and the role that variables like climate, intensive maize agriculture, population growth, religion, warfare or migration played in the observed changes."

This thesis is concerned with the time period from ca. AD 1050 – 1300, where societies often lived in aggregated towns with outlying hamlets and farmsteads. Towns had a stable residential population that experienced increased social and political complexity, and were sedentary agriculturalists who relied primarily on corn, beans, and squash. In the following

discussion, there will be a review of Mississippian settlement systems, subsistence practices, and ideology.

Settlement Systems. Mississippian settlements were most often located on the floodplains of river valleys where both the floodplain resources and upland resources can be accessed. However, Ames, like other sites in western Tennessee, such as Obion, Denmark, and Bolivar, is in the uplands, not on the floodplain. According to Alt (2018:51), there was a "highly variable upland cultural landscape" during the Mississippian period. The communities during the Mississippian period were "sedentary agriculturalists who lived in ranked societies scattered across, much but not all, of the Southeast and southern Midwest" (Milner and Schroeder 1999:96).

Mississippian towns often included earthen platform mounds, towns, plazas, and defensive features like palisade walls. A Mississippian town is a "habitation center with a public area such as a plaza or courtyard, that may be flanked by one or more mounds" while a mound center is a "planned site with earthworks but little or no archaeological evidence of habitation" (Lewis, Stout, and Wesson 1998:5).

Mississippian town sites, such as Obion, Ames, Bolivar, and Denmark, dot the western Tennessee uplands. Towns are described as being occupied throughout all or most of the year. Before the advent of new archaeological technology like magnetometry data, it was thought mound centers were typically void of yearly human occupation and were thought to represent vacant centers. However, since the technology revolution in geophysical surveys, this idea has been refuted in many cases. Hamlets, usually two to five residences, are areas where there is a clustering of houses which represent "a balance among labor demands, resource distributions, and defensive needs" (Milner 2004:145) while farmsteads usually are made of one residence.

The Ames site is a small Mississippian town with a stable residential population, which were responsible for building the mounds, central plaza, and defensive palisade feature.

Mississippian period residential structures typically have wall trenches, post molds, interior features, and occasionally interior partition walls. Regional variation in households occurs across the Southeast and is largely due to social organization. According to Steere (2017:179), "House construction is not an individual activity… Houses are … usually constructed by social groups larger than households, and it is the interaction between these large social groups that we need to consider in our explanations of architectural variability." Archaeologists should account for variability within households to better understand how Mississippian sites interacted across the region and how sites formed.

Subsistence. Mississippians participated in large-scale intensive maize agriculture which was supplemented with hunting, gathering, and fishing. Maize agriculture varied in development and timing across the Southeast. "Mississippians throughout southeastern and midwestern North America produced and consumed maize but varied significantly in their levels of production and consumption" (Vanderwarker et al. 2017:29). In general, Mississippians practiced some form of maize agriculture, which was usually coupled with squash and beans (which appear later in the time sequence).

Mississippians continued to hunt and gather a variety of plants and animal resources to supplement their dietary needs. Oily and starchy seeds like may grass, goosefoot, and sunflower were common dietary staples other than maize (Schroeder 2004:335). Faunal resources which were commonly exploited included white-tailed deer, turkey, racoon, and seasonal waterfowl (Smith 1978:483).

Social Organization. Mississippian society is classified as a hierarchical ranked system generally in the form of chiefdoms. Chiefdoms could be either paramount, complex, or simple chiefdom with paramount being the largest and exerting the most control and simplest being typical mound centers which controlled a set of distant hamlets and farming communities. "Simple chiefdoms were ranked sociopolitical formations with fixed, inherited leadership positions with limited authority" (Milner and Schroeder 1999:97). Complex chiefdoms were regional-scale, where "a series of districts made up of large and small settlements where only one principal site was preeminent" (Milner and Schroeder 1999:97) existed. Paramount chiefdoms exerted power over multiple smaller town and mound centers. Examples included "Cahokia, Moundville, Etowah, Spiro, Lake George, Lake Jackson, Winterville, Kincaid, Angel, and one or more sites in the Nashville Basin" (Cobb 2003:67). No evidence currently exists to suggest that there were paramount chiefdoms in the western Tennessee uplands.

Rank at these chiefdoms was often ascribed and members of the elite lineage often resided on top of the mounds or in special districts away from the rest of the population. According to Cobb (2003:69) "large platform mounds simultaneously manifested overt and covert powers of display." Status can be identified in the archaeological record by examining burials. Presently Ames lacks burial information because none have been excavated. Burials provide archaeologists with information about the differential access to exotic goods. Though rank was mostly ascribed warriors and ritual specialists often achieved higher status. The ability for certain groups to achieve higher status internally within a society and externally in the form of chiefdoms competition caused perpetual warfare during the Mississippian period.

Ideology. Ideology and iconography studies have become major research interests for archaeologists. "A tremendous growth of interest in the material expression of ideology and

symbolism, especially solar, warrior, fertility and animal iconography as depicted in ceramic, stone, shell, rock art, and even earthen mounds, has occurred in the past decade" (Schroeder 2004:338). Many studies of iconography look at pottery and effigy figurines. See (Dye 2020a, Dye 2020b, and Sharp et. al. 2020) for recent advances in iconographic studies and its contributions to better understand aspects of Mississippian ideology.

According to Griffin (1967:190), Mississippians practiced a belief system focuses on the "four world quarters, the wind, sun worship, and the sacred fire, and the sacrifice of captives. Mississippian beliefs can be interpreted by examining the town. According to Lewis and Stout (1998:227),

> If there can be said to be any physical representation of Mississippian views of the cosmos, it is the town. At the macro level, it reflects the political organization, economy, and religious beliefs of Mississippian peoples. At the micro level, its archaeology is the primary means by which we reconstruct Mississippian household organization, kinship, gender relations, technology, and subsistence.

The Mississippian world view spreads across the Southeastern and Midwestern United States. Mound and plaza are defining architectural features of what is meant by Mississippian, according to Lewis and Stout (1998:228). Larger Mississippian sites all have at least one mound and usually a plaza adjacent to it. Ames, like other large sites during the Mississippian period contains mounds and a plaza.

Mississippian towns are aligned with cardinal directions. “Many mound centers are … oriented to the cardinal directions, making it difficult to separate symbolic from practical siting influences” (Payne and Scarry 1998:40). Examining the town layout as well as identifying orientations with lunar and solar events, archaeologists can better understand Mississippian ideology (Hally 2008). According to Wesson (1998:96),

> All architecture can therefore be seen as a translation of a culturally defined cosmological order into a physical form. These acts of translation establish built environments and social spaces that serve as existential centers, producing a meaningful context for human action and social life.

In conclusion, what is meant by Mississippian has varied through time and continues to vary today. The process of becoming Mississippian was a complex progress which involved many facets and adaptations to the environment. “Becoming Mississippian involved more than the adoption of a few items of ritual or material culture, but rather changes in many aspects of daily life and practice, the creation of a new identity that required appreciable effort” (Anderson 2017:298). Becoming Mississippian was not a simple or quick process, instead it involved adapting to changing conditions through time which made the Mississippian population diverse and versatile.

Previous Research at Ames

Ames was first documented by Morse, Graham, and Polhemus in 1962 (Mickelson 2008:201). At that time, they identified looter trenches in the mounds and determined the site to

be Mississippian. In 1969, Smith visited Ames and collected radiocarbon samples from a looters trench. Preliminary investigations, though few and far between, did determine the site to be important for further investigations. In 1972, Guthe completed excavations over areas of the site, however, information relating to these excavations was lost (Mickelson 2008:201-202, Peterson 1979:28). Peterson's investigations through Memphis State University (now the University of Memphis) were part of the Wolf River Valley archaeological survey. Peterson excavated units across the site but turned up little material remains. "He reports finding little archaeological material, except a few sherds of Woodland period ceramics from Unit 3 near mound B" (Mickelson 2008:203).

Initial confusion surrounding the sites temporal association began during the 1980s to 1990s. During this period, the Ames site was initially classified as a Woodland period site by Mainfort (1992). However, later was able to place Ames in the Mississippian period by using Smith's 1969 samples to obtain a date and additional radiocarbon dates, confirming a Mississippian age for Ames.

Since 2007, Ames has been the subject of extensive archaeological investigation. Mickelson had three main goals when he visited the site. These goals include a (1) systematic topographic survey to determine the sites boundaries, (2) to accurately place Ames within temporal context, and (3) to determine if there was evidence of habitation (Mickelson 2008:206). The first two goals were completed by the end of the 2008 field season, with a completed topographic survey. However, the last goal was not reached until 2009, the town component of the site just south of the mounds was discovered through a large scale magnetometry survey (Figure 4) which located the palisade wall surrounding the town and the mounds (Guidry 2013, Mickelson and Goddard 2011). Research from 2009 and 2013 conceptually changed Ames from

a vacant mound center, which previously was a matter of debate, to a town and mound complex. In 2016, the identification of a possibly non-domestic structure in unit F1-U19 (Figure 5) supported the probability of a fifth mound which modern agricultural practices had been destroyed (Cross 2016). In the last few years inspection of archival documents and land deeds have confirmed that there were once five rather than four mounds at Ames (Mickelson, personal communication).

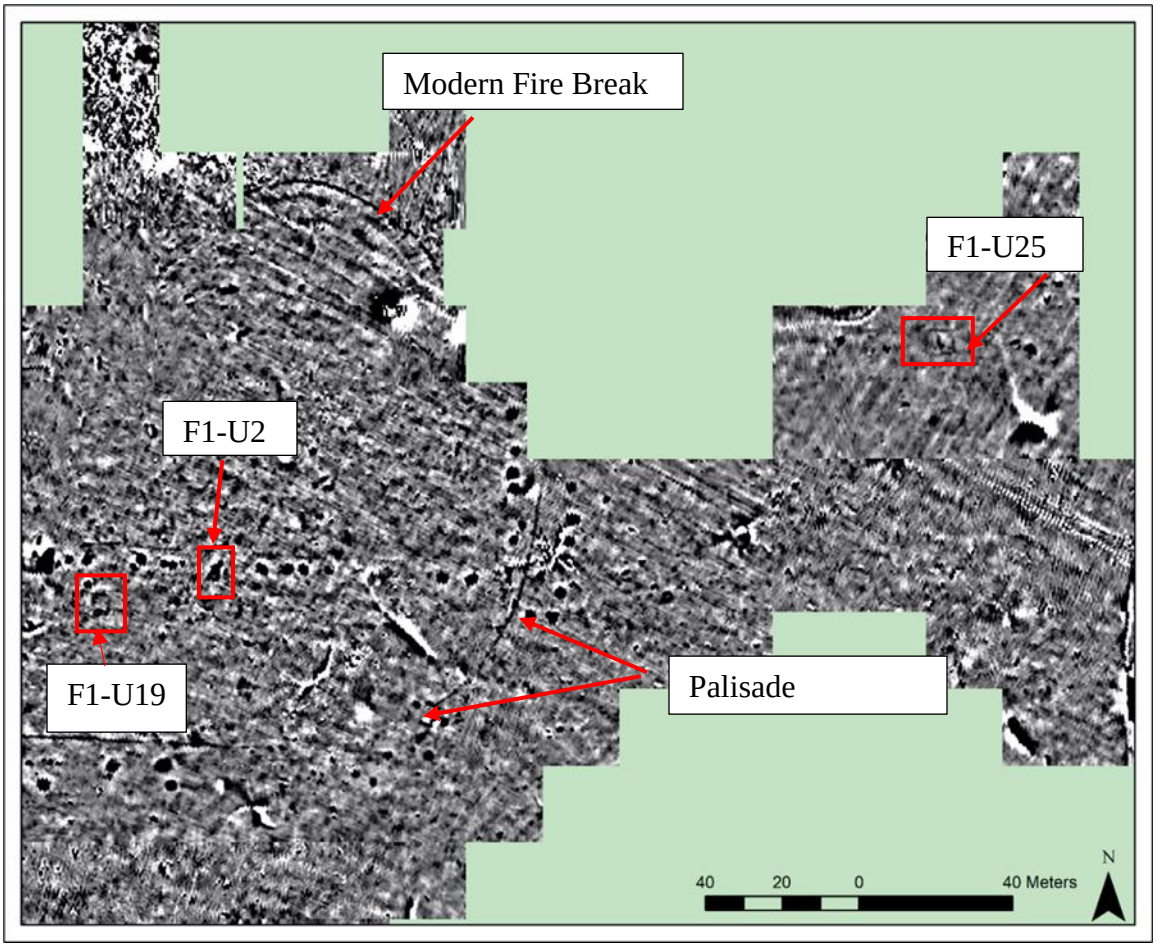

Figure 4: Magnetometry data collected at Ames from 2009-2019.

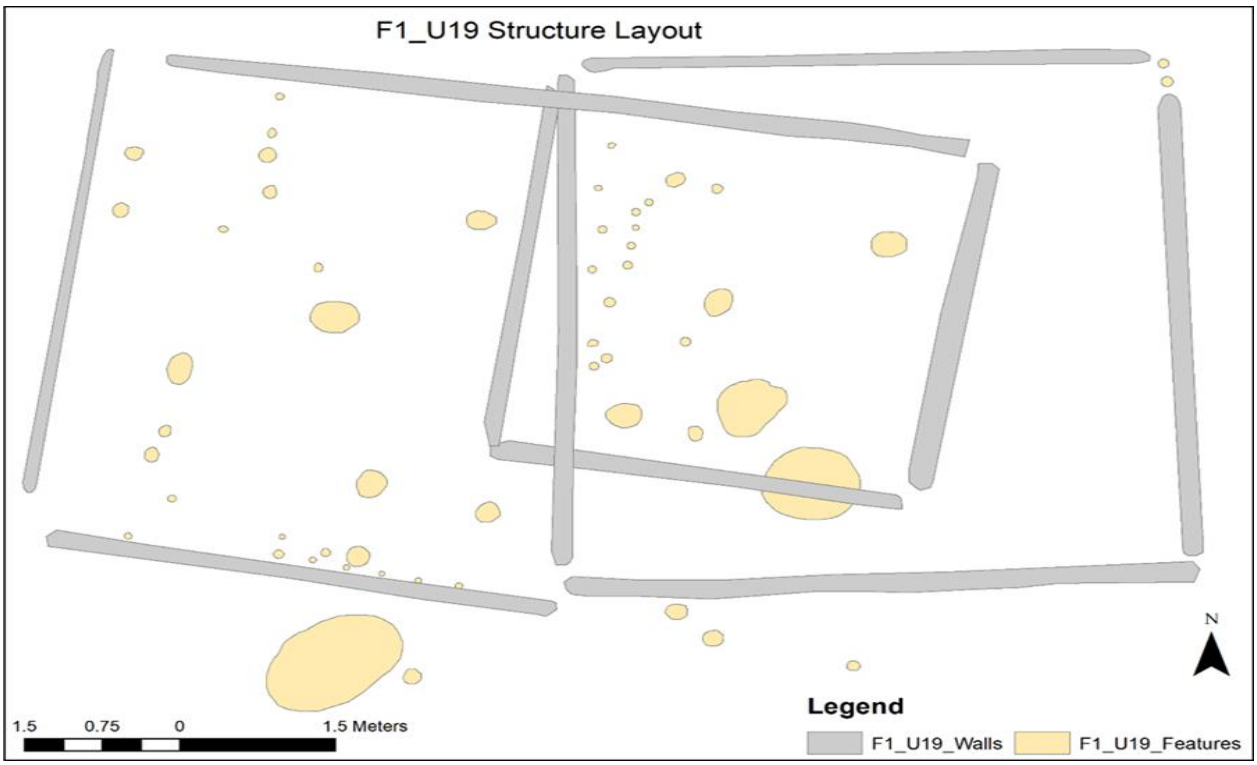

Figure 5: Planview of unit F1-U19.

Ames has four extant mounds A, B, C, and D (see Figure 1) with A, B, and D being flat topped or truncated pyramidal mounds and C being a ridge top mound (Mickelson 2020:265). Mound excavations at Ames have focused on two of the four mounds, mounds B and D, due to the presence of previous looter trenches. According to Mickelson (2020:266), "Mound B, the largest platform at the site, measures 25 m^2 and is 4 m tall." Mound D, also a platform mound, has been excavated to reveal stratigraphic sequences which include burned structural remains. Radiocarbon samples from both mounds have been collected and processed to determine mound chronology at the site. Table 1 below displays the chronology of the mounds. The radiocarbon samples revealed the mounds were most likely a Late Woodland/ Early Mississippian construction. Mounds A and C have had received little attention. Metal contamination from a

historic home prevents geophysical investigations of mound C. Mound A, has not received any subsurface investigations.

Table 1: Mound chronology from the Ames site. (Mickelson 2020)

Mound	Sample 1	Sample 2
Mound B	AD 1020 +/- 40	AD 620 +/- 40
Mound D	AD 1210	-

Note: a – indicates no data available.

The site continues to be subject to archaeological research. Large-scale geophysical surveys continue across several select locations within the 18,000-acre land base of Ames Plantation. Soil chemistry is being examined to determine prehistoric use and work is continuing to identify possibly related hamlets and farmsteads on the land base. This thesis is continuing that effort to connect the town site to outlying settlements that may represent farmsteads or hamlets across the landscape.

3. Methods and Results

In this chapter, the steps to completing the multi-staged research design will be discussed. The chapter will focus on the methods of excavation, material analyzed, and provide results of the investigations. First, there will be a brief explanation of the motivation for this study, followed by a discussion on excavation methodologies, and finally a summation of the results.

Motivation for this research came from Guidry's 2013 thesis where she studied the community plan at Ames. She stated "improving understanding of community development at Ames during the Mississippi period has implications for other mound sites in and around western Tennessee that have not been as thoroughly investigated in off-mound areas" (Guidry 2013:82) Understanding areas like off -mound sites will help piece together how the community was developed and changed through time. By examining the groups "living on the edges of Mississippian … will also help us understand more clearly the emergence and evolution of individual Mississippian societies and the Mississippian world" (King and Meyers 2002:115).

This thesis attempts to understand the temporal relationships between unit F1-U25 and the town site, and to determine the function of the structures within unit F1-U25. To complete this goal, I developed multiple hypotheses for testing the temporal relationships and function of the structures. In order to test my hypotheses, I employed a multi-staged research design. My research design parallels Cross (2016), where he analyzed the use of intra-structure space between and within a series of overlapping structures at Ames within units F1-U2 and F1-U19. I will employ the same type of analysis; however, I will be solely investigating intra-structure space by completing a comparison between units F1-U25, F1-U19, and F1-U2.

Methodology

Multi-staged research at Ames includes controlled surface surveys, geophysical surveys (principally magnetometry), test excavations, and large-scale block excavations. The goals of this multi-staged research effort are to collect a sample of archaeological remains to identify the temporal relationships and functions of unit F1-U25. Mickelson has employed a multi-staged research design in ongoing research at Ames (Mickelson and Goddard 2011). First a systematic surface survey takes place, then areas of interest are surveyed with a Bartington Gradiometer (magnetometer), next, 1 x1 m or 2 x 2 m test excavations are completed. Finally, large-scale excavations are conducted to examine structural remains and associated features. In this section I will explain each step of this system and the excavation of F1-U25.

Surface Surveys. Typical investigations begin with a systematic surface survey of available agricultural fields with good surface exposure, some of which contain locations of previously identified artifact clusters. The surface surveys take place when visibility is medium to high when fields are freshly plowed, and after rain has occurred. No-till agricultural practices hindered the ability to complete a surface collection of Field 1 during the 2019 field season, however, surface collections were completed in 2007, 2009, and 2013 (Mickelson personal communication). Figure 6 displays the current extent of surface surveys at Ames while Figure 7 shows the surface collection of Field 1.

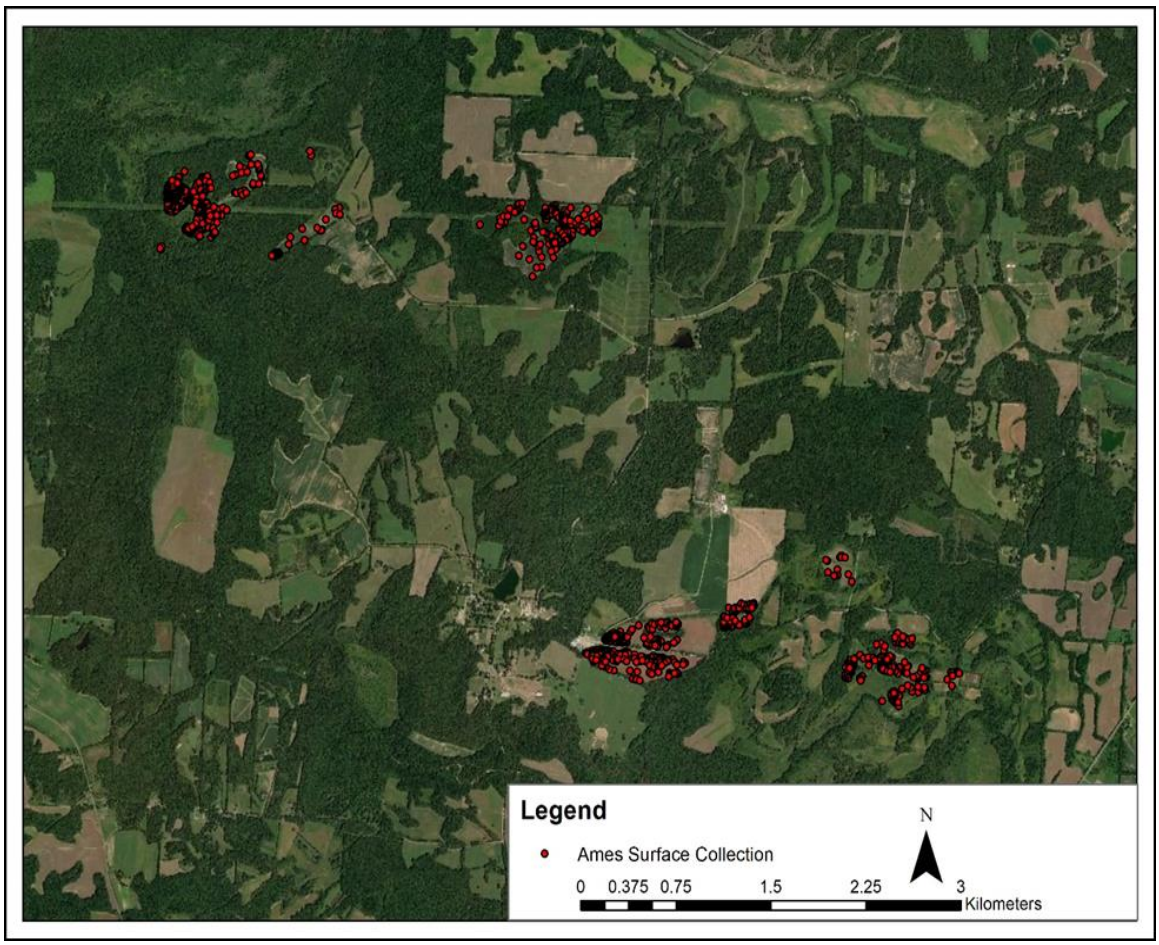

Figure 6: Current surface collections at Ames from 2007 – 2019.

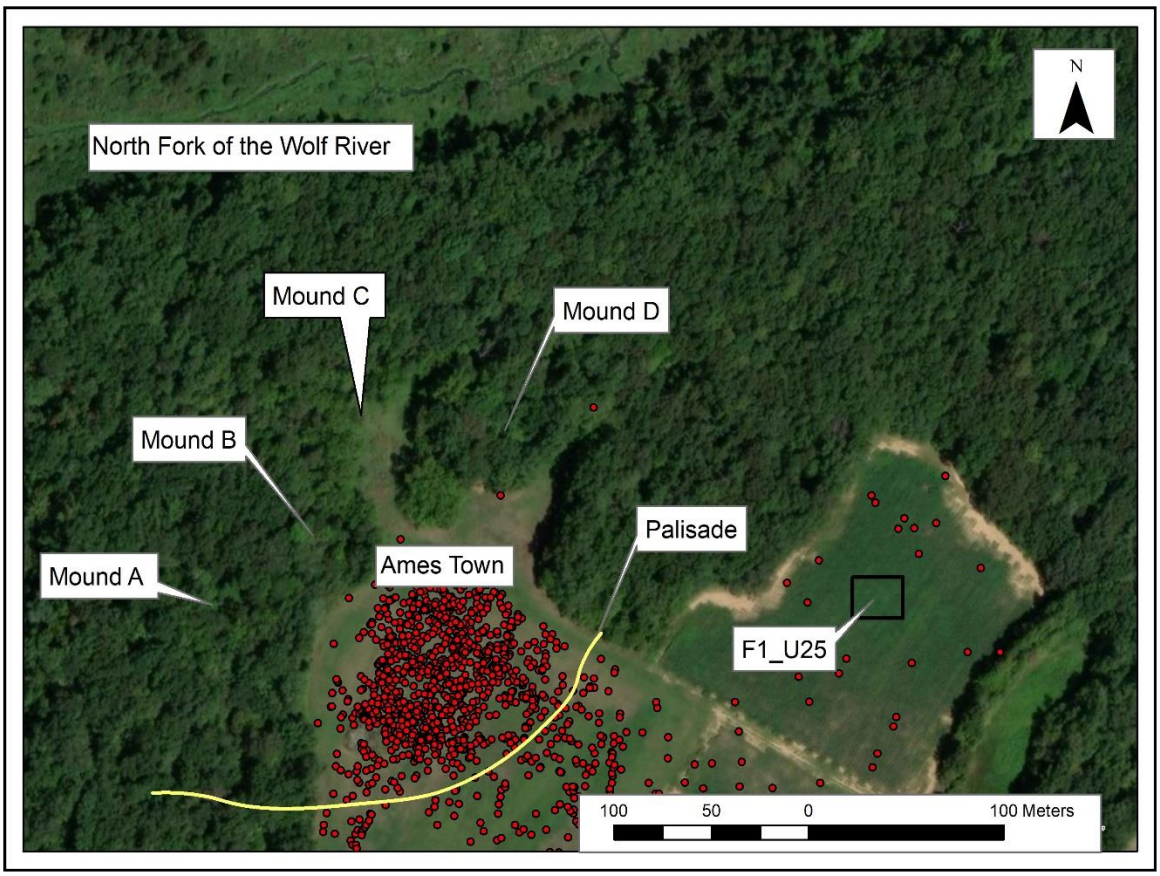

Figure 7: The distribution of surface-collected artifacts within Ames Field 1.

Magnetometry surveys. The next archaeological procedure consists of magnetometry surveys. "Magnetometry is a prospecting method that maps local variations of the Earth's magnetic field in the near surface, is cost effective and allows for more coverage of an area in less time, and magnetometry is one of the most productive prospecting methods employed in archaeology" (Kvamme 2006a:205-206).

Magnetometry investigations of Field 1 began in 2009 (Figure 4) and have continued in various areas across the field designated as F1, through 2018. Magnetometry surveys employ a Bartington 601-2 dual sensor fluxgate gradiometer which collects data at a .5 m transect interval with four reading per meter along each transect. Processing the magnetometry data requires removal of the noise, "noise refers to everything else that is measured and obscures the targeted

features" (Kvamme 2006b). In a survey completed in 2018, a rectangular anomaly with what appeared to be wall trenches was identified. The feature was burned to produce a clear reading in the magnetometry data. Figure 2, above, illustrates the magnetometry data once it was processed and highlights the rectangular wall trench structure which was in unit F1-U25.

Excavations. In 2019, excavations of unit F1-U25 began by placing a 6 x 12 m excavation block over the location where the magnetometry survey detected a series of wall trench structures. Interior features were systematically excavated with the southern half of the feature being fully excavated while leaving the northern portion intact. An example of this excavation technique can be seen in Figure 8. Doing so allowed for collection of soil profiles, was quicker, and cost effective. Fill from the southern portion of the features and from small post mold features were collected for flotation. Flotation of the feature fill allows for identification of small flora and possible faunal remains not seen during excavations. Flotation samples were not processed.

Figure 8: Feature 22 excavation with southern portion removed and northern portion left intact.

Within the excavated portions of the features, artifact provenience was recorded. Artifacts commonly found within these features included ceramics, sandstone, and burned clay pieces. Table 2 (Appendix A) presents the details of the feature excavations.

Wall trenches were sampled due to time constraints. Wall trench E was partially excavated to reveal a series of post molds (Figure 9). Time did not allow for the complete excavation of any wall trench however, to determine the construction sequence, excavations took place at the intersections of wall trenches I and J, and D and E. Investigations at the intersections allowed for the determination of construction sequences. See Table 3 (Appendix A) for a more in-depth analysis of each wall trench.

Figure 9: Wall Trench E with excavated wall trench posts. Wall Trench F is unexcavated.

Results

The utilization of a multi-staged research method proved effective for answering the research questions developed at the onset of investigations. To reiterate, the first research question is, does unit F1-U25 have a temporal relationship with the town site at Ames? The second research question is what is the function of the structures within unit F1-U25? These questions yielded a series of hypotheses which were able to be tested. The rest of this chapter will be dedicated to explaining the results from excavations.

Radiometric Dates. Multiple radiocarbon (^{14}C) samples were collected from unit F1-U25 to determine the temporal association of the structures within the unit and to investigate the super positioning of the structures. Samples for analysis were collected from numerous features and wall trenches in unit F1-U25. Radiocarbon samples selected for analysis were sent to Direct AMS. Samples were selected based on contextual confidence within the superimposed

structures. Two samples were selected for analysis; sample 1 from Feature 8 and sample 2 from Wall trench C. Wall trench C and Feature 8 overlapped (Figure 10), making the samples best suited for analysis because they could clarify the construction sequence of unit F1-U25. Table 4, below, presents the results of the radiocarbon analysis.

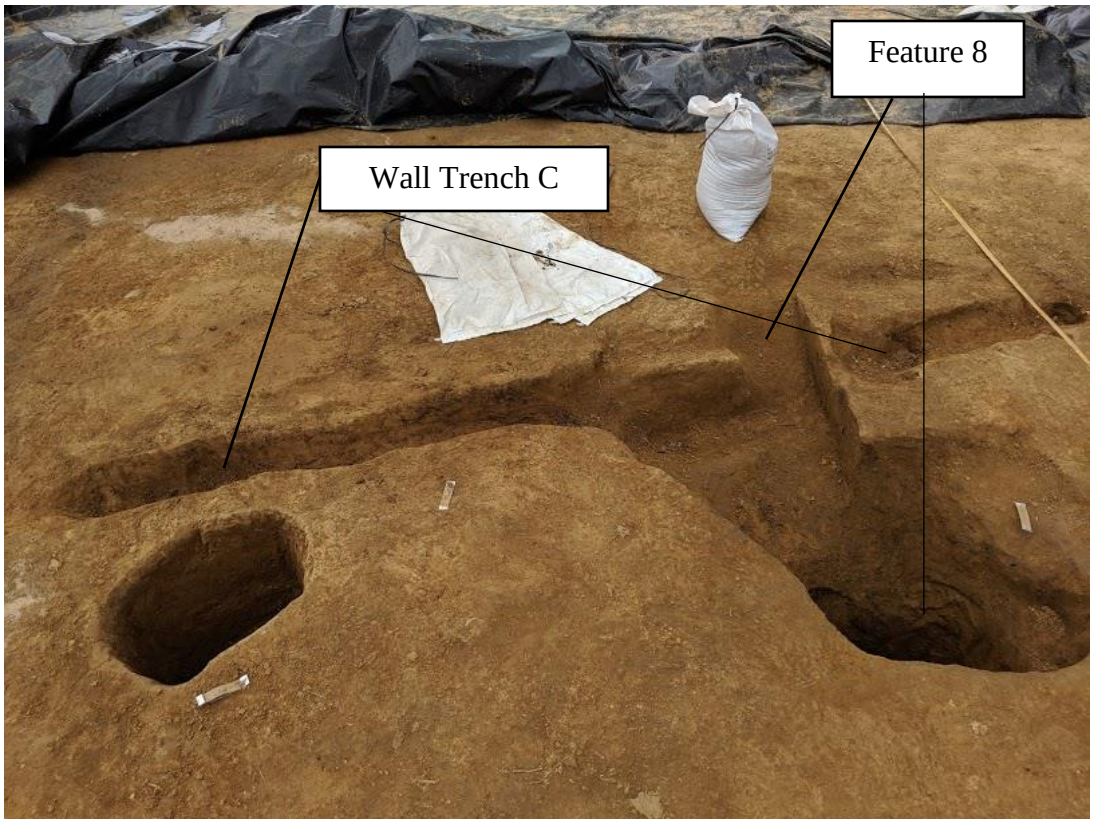

Figure 10: Wall Trench C and Feature 8 super positioning.

Table 4: Radiocarbon sample results from unit F1-U25.

Sample number	Provenience	Material	^{14}C Age (BP)	1 sigma Cal Age (AD)	2 sigma Cal Age (AD)	Intercept (Cal AD)
D-AMS 036642	Feature 8	Charcoal	776 +/- 27	1217 -1279		
D-AMS 036643	Wall Trench C	Charcoal	686 +/- 26	1270-1310	1360-1388	

Note: Calibrated with Oxcal V 4.3.2 Bronk Ramsey (2017): r.5: IntCal13 atmospheric curve.

Feature Excavations. In unit F1-U25 there were 39 features, with all but one sampled. Feature 16 was the only feature which was not sampled due to time constraints. Features varied in size, shape, and contents. Table 1 further explains the features' shape, width, depth, contents, and type in unit F1-U25.

Table 2 (Appendix A) shows that Feature 8 was unique compared to the other features within unit F1-U25. Feature 8 was the largest feature, at approximately 120 cm east to west and 110 cm north to south and a depth of 70 cm (Figure 11). Excavations of Feature 8 yielded a variety of material including a portion of cord-marked ceramic and numerous burned clay pieces. After examination of the entire feature, it is likely the Feature 8 was originally a central support post, which was later used as a storage pit or hearth, or possibly an area for ritual burning to have taken place.

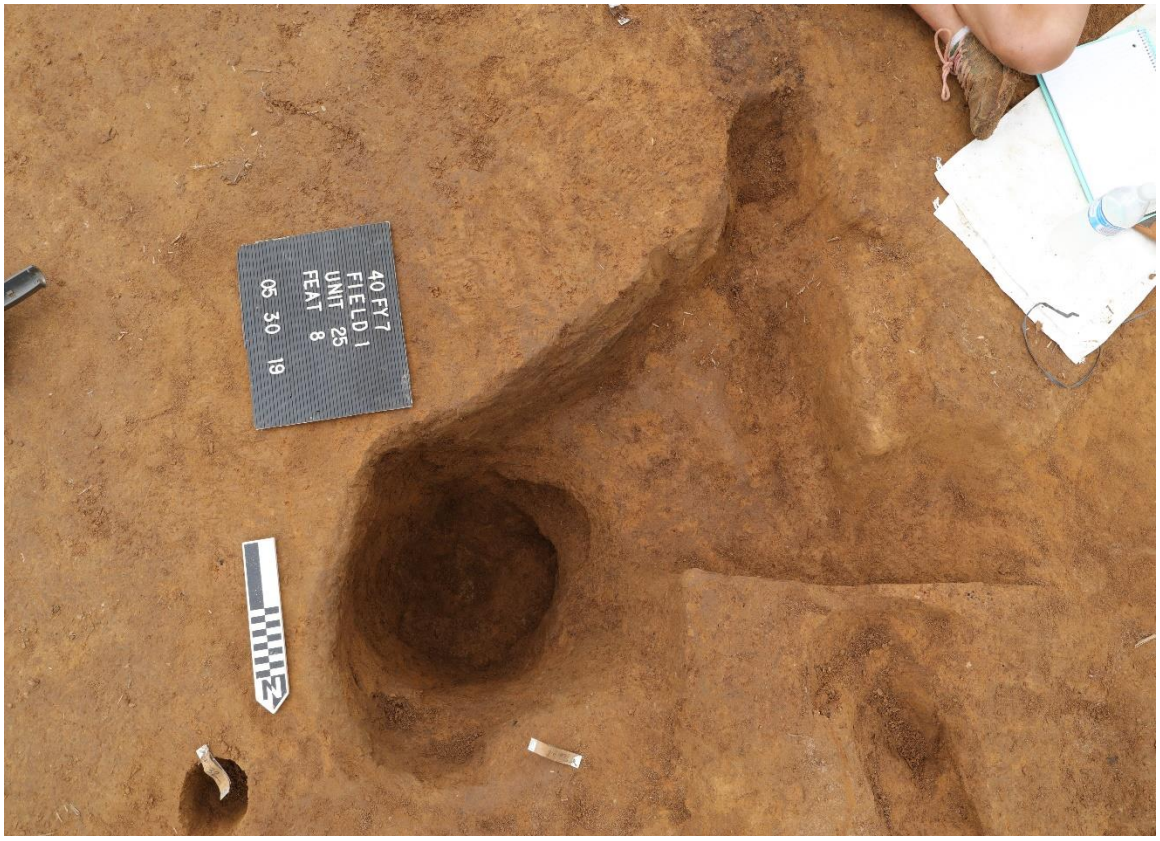

Figure 11: Feature 8 with eastern portion removed and northwest portion intact. Showing the super positioning of Wall Trench C.

Wall Trench Excavations. Wall trench excavations only focused on the sections critical to understanding the construction sequences and techniques used in unit F1-U25. Time limitations did not allow for the complete excavation of any wall trench. Walls, however, were measured and samples were taken from many of the walls. Samples which were collected included charcoal samples for radiocarbon dating, daub if there were large visible pieces at the surface, or any other artifact which was visible at the surface. Table 2 explains the width, length, and the collected samples of each wall. Wall trenches were labeled alphabetically "A" through "N" as they were mapped. Wall A is the western most wall with wall H being the easternmost wall

trench. The north side and south side of the structures were difficult to discern due to overlap and evidence of rebuilding.

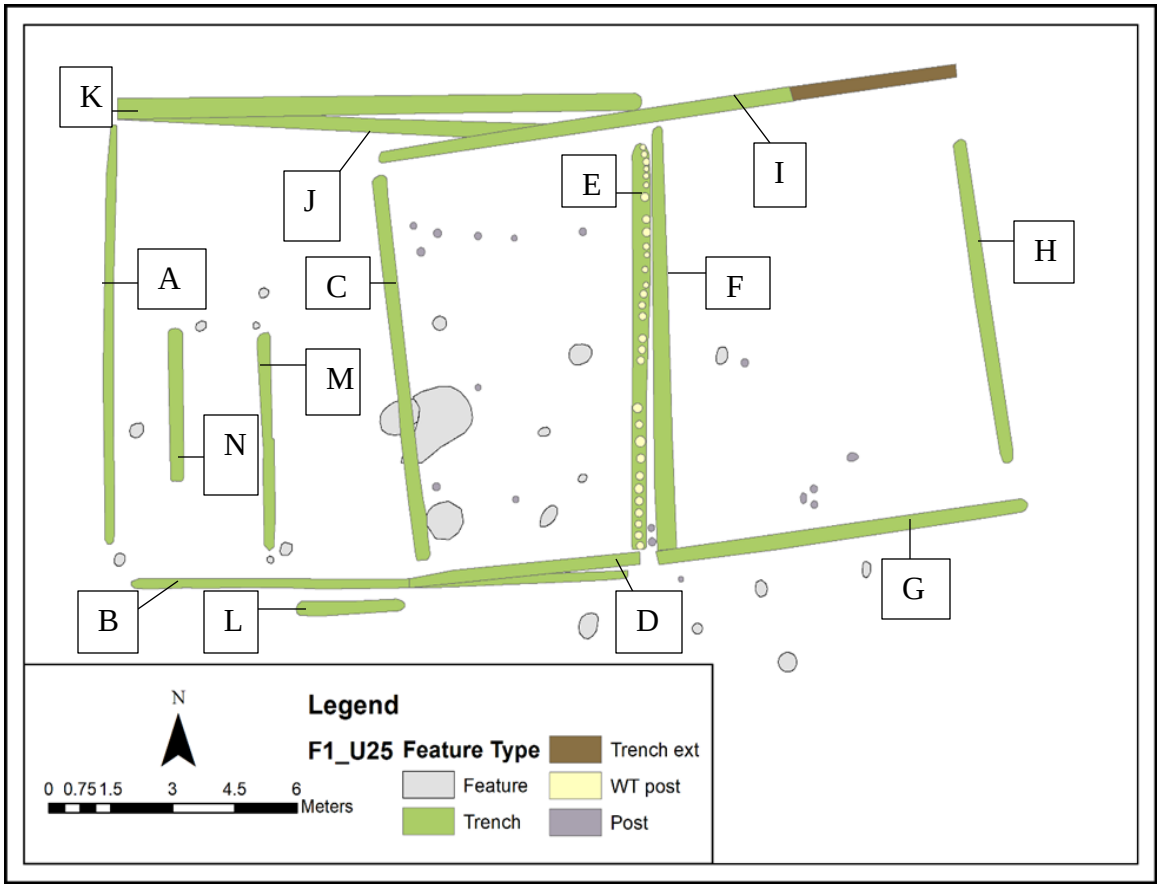

Figure 12: Structural layout of unit F1-U25.

Evidence of rebuilding can be identified by the superimposed wall trenches within unit F1-U25. There is a slight shift in orientation during each rebuilding episode. Shifts in orientation and the number of wall trenches suggests unit F1-U25 is a series of three superimposed structures. Figure 14 shows the structural layout of the three buildings within unit F1-U25.

Wall trench C was centrally located, and overlapped Feature 8 as mentioned above. A radiocarbon sample from wall trench C returned a calibrated date of AD 1270 to 1310 which

justified and established a connection between the town site and these structures. A discussion of the relationship will occur in the chapter 5.

Summary. Excavations of unit F1-U25 yielded evidence of three superimposed structures with associated features and wall trench posts, which were only found in Wall Trench E. These structures all fit the typical "Mississippian architectural grammar" (Lewis, Stout, and Wesson 1998:2). Each rebuilding episode of these structures had a slightly different spatial orientation but remained in the same general location.

4. Analysis

The analysis section will consist of a comparison of the structures found within unit F1-U25 to structures previously investigated at Ames, unit F1-U19 and unit F1-U2. Unit F1-U19 is like F1-U25 in shape, size, layout, and artifact assemblages. F1-U2, a residential domestic structure, is different from both unit F1-U25 and F1-U19. F1-U2 has a large collection of artifacts and evidence of multiple rebuilding episodes. Though all units express some form of rebuilding and superimposing F1-U25 and F1-U19 are different than F1-U2. The goal of this chapter is to determine the function of the structures within F1-U25.

In this chapter, first, will be an artifact analysis; where a comparison of artifact assemblages within units F1-U25, F1-U19, and F1-U2 is completed. Artifact assemblages were compared based on total count, the percent of total count, and the percent of weight. Second, an architectural analysis, where a comparison of structural remains including feature density and layout, is analyzed. Feature density examines the quantity and variety of features. The layout of the structures is compared using size and orientation. Finally, the chapter will conclude with a discussion of the radiocarbon results.

Artifact Analysis

In unit F1-U25, artifacts were sorted into the following classes: unidentified lithic, limestone, sandstone, ceramic, clay (burned, baked clay objects, and daub), organic, botanical remains, and chert. Table 4 lists the classes by total count and percentage of the weight. Figure 13 visually displays the artifact count by class from unit F1-U25. Figure 14 displays the percent of total by class for unit F1-U25.

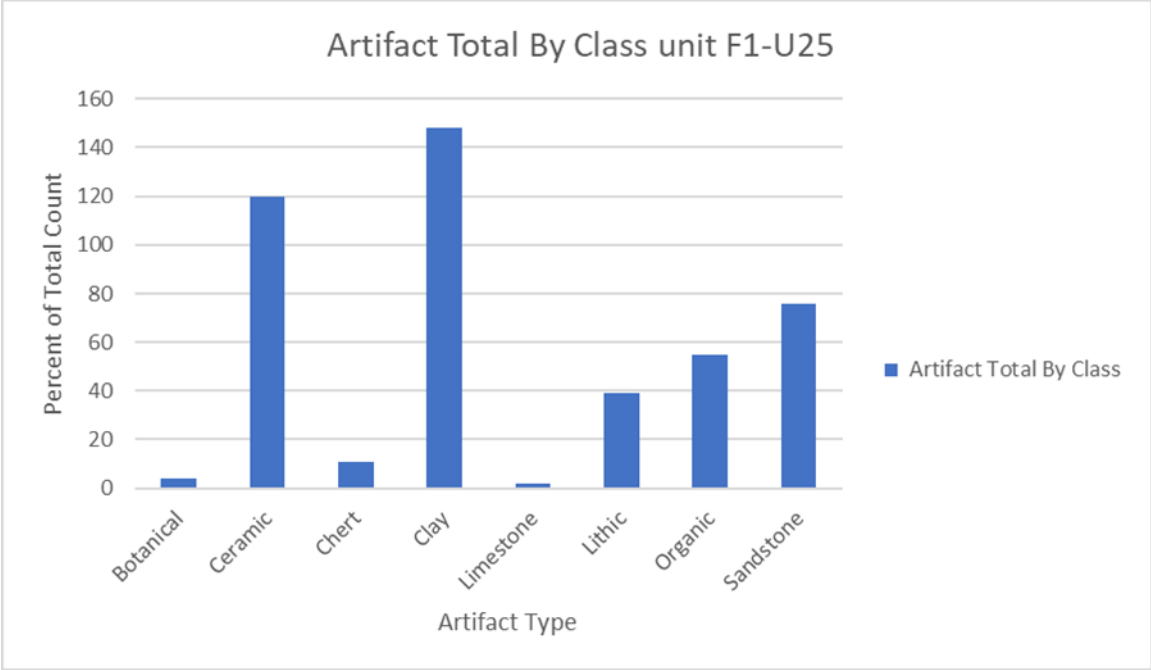

Figure 13: Artifact total count by class from unit F1-U25.

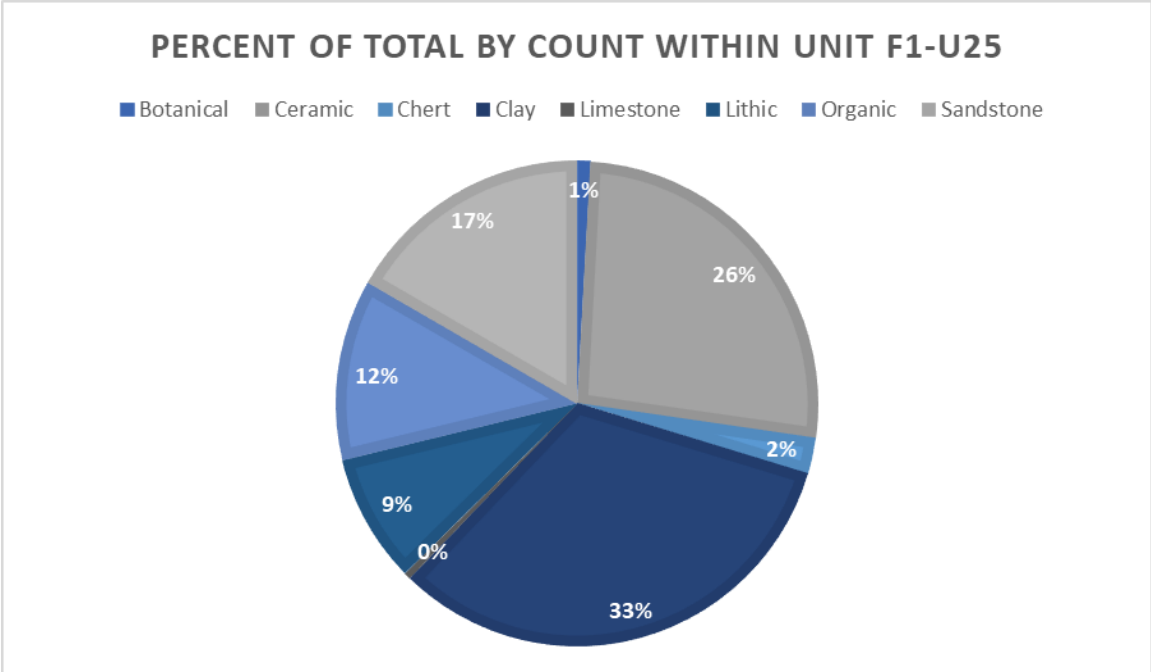

Figure 14: Artifact classes by percent of total by count within unit F1-U25.

Combined, these tables and figures show that clay was the most collected class of artifacts. Clay, in this case, is vague and represents daub, burned earth, and baked clay objects which were not ceramic. The class that follows closely behind is ceramic. Variations in the ceramic assemblage includes different tempering agents and surface treatments. Next, I will examine how artifacts collected in unit F1-U25 compare to artifacts collected from unit F1-U2 and unit F1-U19.

Artifact Assemblage. 455 artifacts were collected within unit F1-U25. In comparison with unit F1-U2, which had over 3,000 artifacts, it is a meager amount however, unit F1-U25 does compare to unit F1-U19 which had a total of 578 artifacts (Cross 2016, Guidry 2013). To begin the analysis, there will be a comparison of artifact assemblages between units F1-U25 and F1-U19. These structures are comparable in the total number of artifacts collected. For the first comparison, I examine the percent of total count of artifacts. Five categories of artifacts were selected for comparison; ceramic, daub/burned earth, historic, lithic/stone, and sandstone. These categories were selected because they were the most common and continuous throughout the years of excavations at Ames. Other categories not represented are charcoal, botanical remains, and bone. These categories were not accounted for in all units and therefore the choice was made to remove them from analysis. For unit F1-U25, the assemblage count was: Ceramic (26%), daub/burned earth (32%), historic (0%), lithic/stone (11%), and sandstone (16%). Compared to unit F1-U19 which according to Cross (2016) had an assemblage of: Ceramic (52%), daub/burned earth (19%), historic (0.3%), lithic/stone (13%), and sandstone (15 %). Figure 15 visually displays the percent of the total count of units F1-U25 and F1-U19. In both units Ceramic had the highest count, followed by daub/burned earth, sandstone, lithic/stone, and finally historic items.

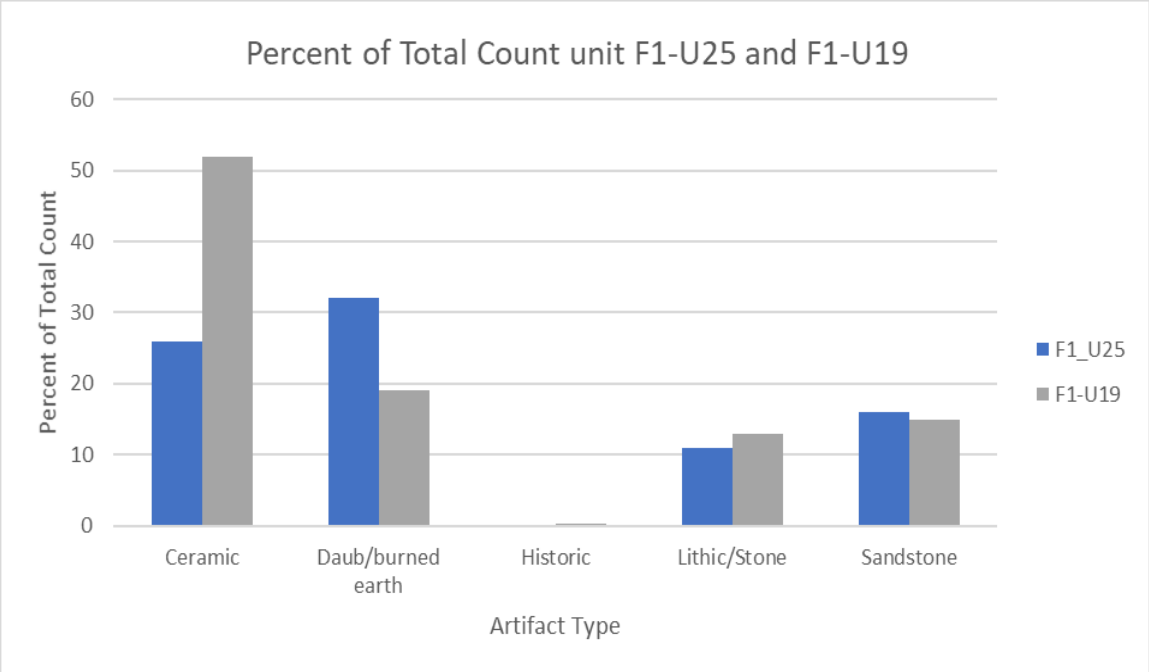

Figure 15: Percent of total count by class from units F1-U25 and F1-U19. (F1-U19 data from Cross 2016).

Unit F1-U2 is significantly different from both units F1-U25 and F1-U19. In unit F1-U2 there were over 3,000 artifacts collected (Cross 2016, Guidry 2013) while in units F1-U25 and F1-U19 there were 455 and 346 respectively. The artifact assemblages varied in context by unit. As discussed above the assemblages between F1-U25 and F1-U19 are strikingly similar but when compared with F1-U2, they are drastically different. The assemblage count for unit F1-U2 was, according to Guidry (2013): Ceramic (17%), daub/burned earth (14 %), historic (.24%), lithic/stone (9%), and sandstone (52 %). Artifacts collected from unit F1-U2 were mostly sandstone, followed by ceramic, daub/burned earth, and lithic. In all the units lithic and historic items were the least collected items. Figure 16 displays the differences in artifact assemblages across all three units.

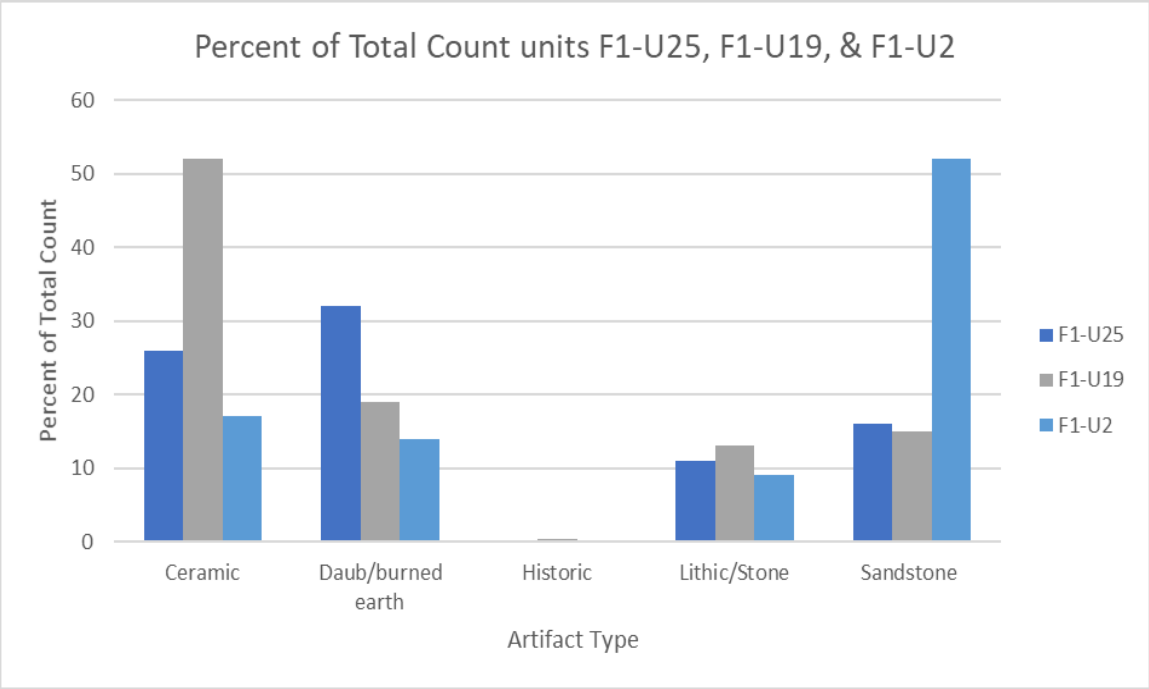

Figure 16: Percent of total count by class compared across all units F1-U25, F1-U19, and F1-U2 (data for F1-U19 and F1-U2 from Cross 2016).

Next, the percent of total weight was analyzed. To complete this analysis, the total artifact assemblage was added up in grams (g) and then each category was weighed separately for each unit. Table 6 displays the total weight of artifacts found across all three units.

Table 6: Total weight in grams across units F1-U25, F1-U2, and F1-U19.

Artifact Class	Weight in grams from F1-U25	Weight in grams from F1-U2	Weight in grams from F1-U19
Ceramic	12 %	16 %	39 %
Sandstone	66 %	59 %	48 %
Lithic	4 %	4 %	7 %
Daub/burned earth	17 %	19 %	6 %
Historic	0 %	0.1%	1 %

Figure 17 presents the differences of percentage of total weight by unit. Figures 18, 19, and 20 display the total each unit, F1-U25, F1-U19, and F1-U2 respectively.

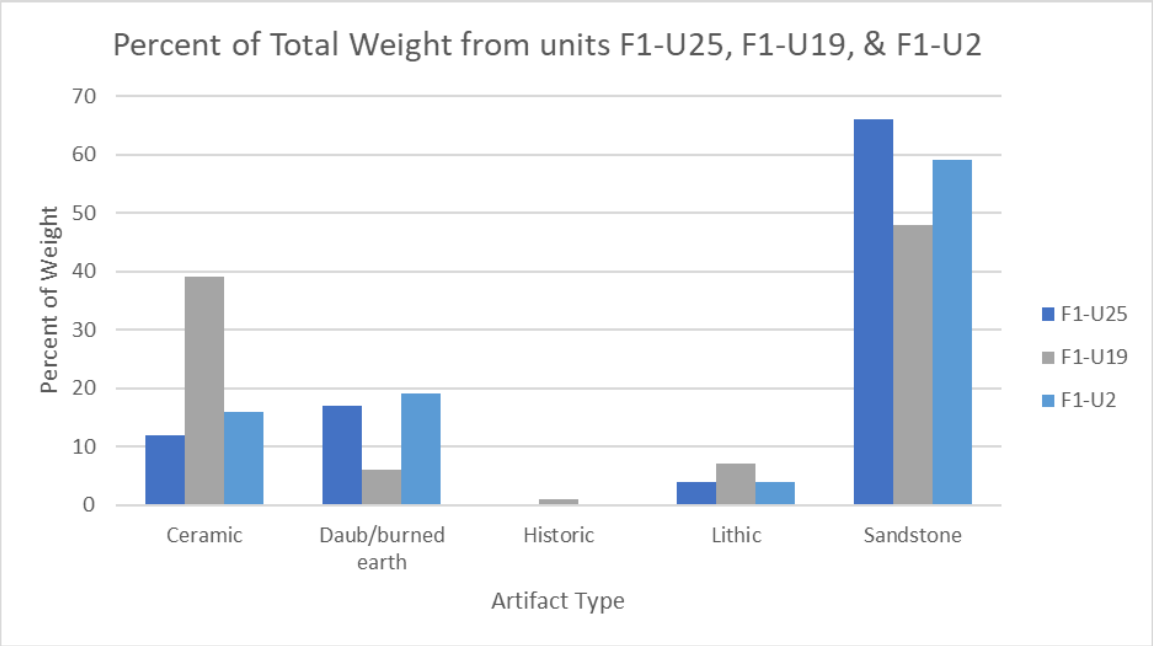

Figure 17: Percent of total weight by class from units F1-U25, F1-U19, and F1-U2. (Data for units F1-U19 and F1-U2 from Cross2016).

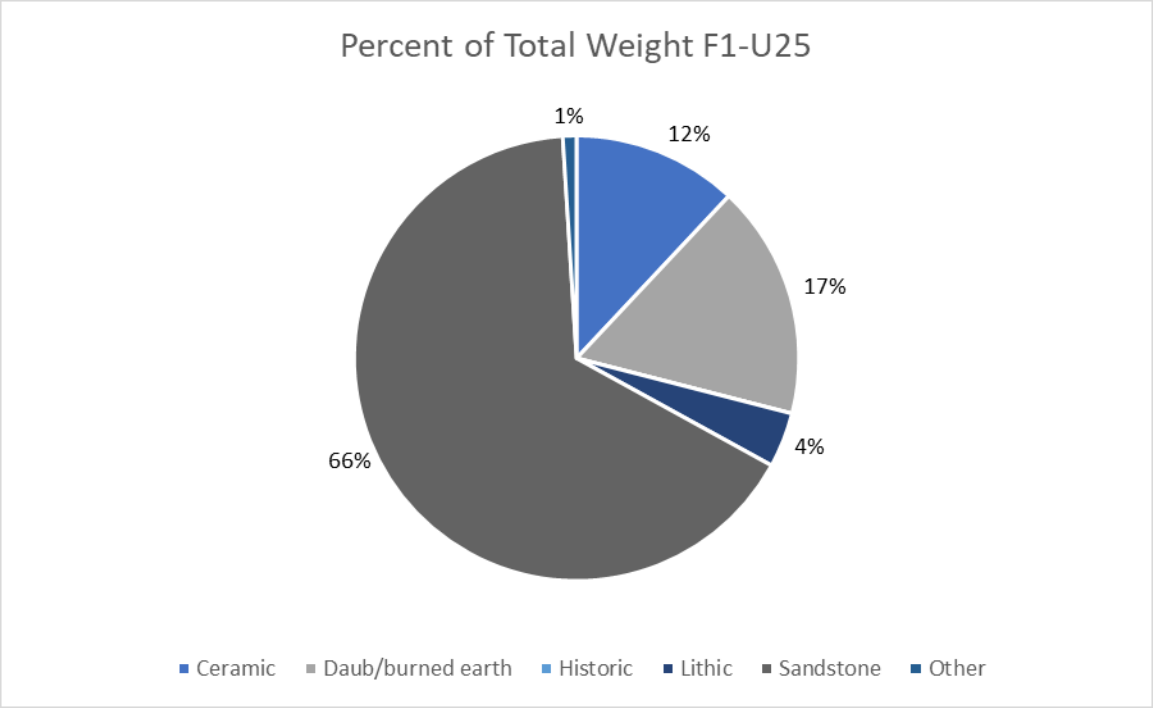

Figure 18: Percent of total weight by class for unit F1-U25.

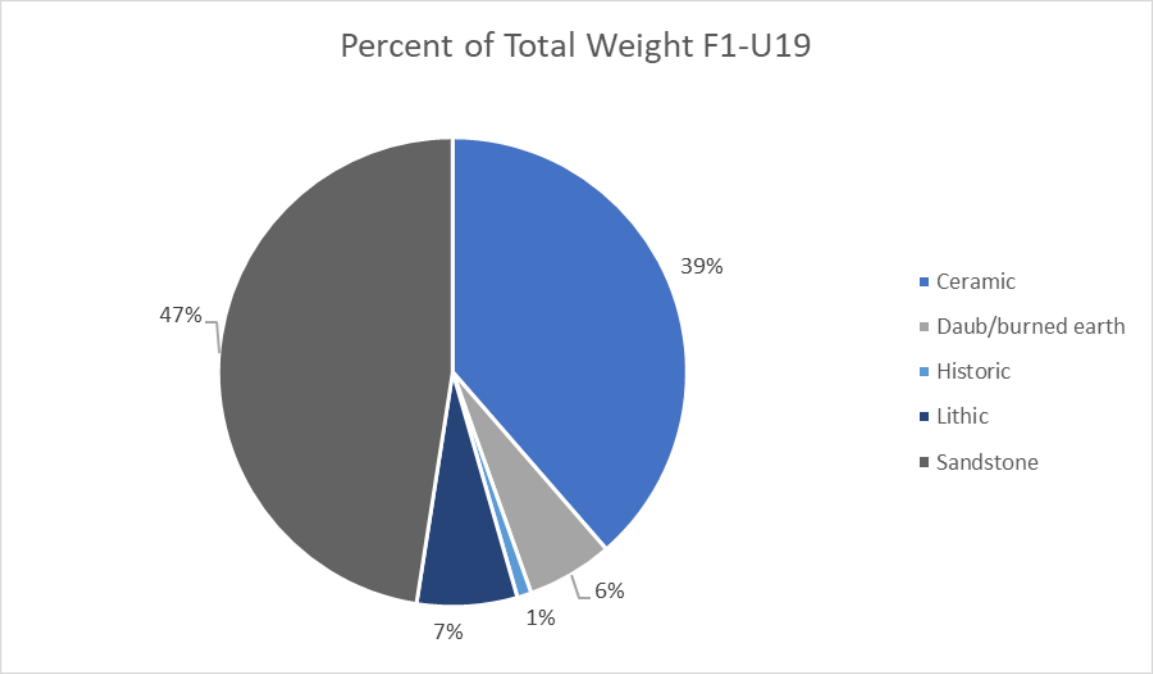

Figure 19: Percent of total weight by class from unit F1-U19 (data from Cross 2016).

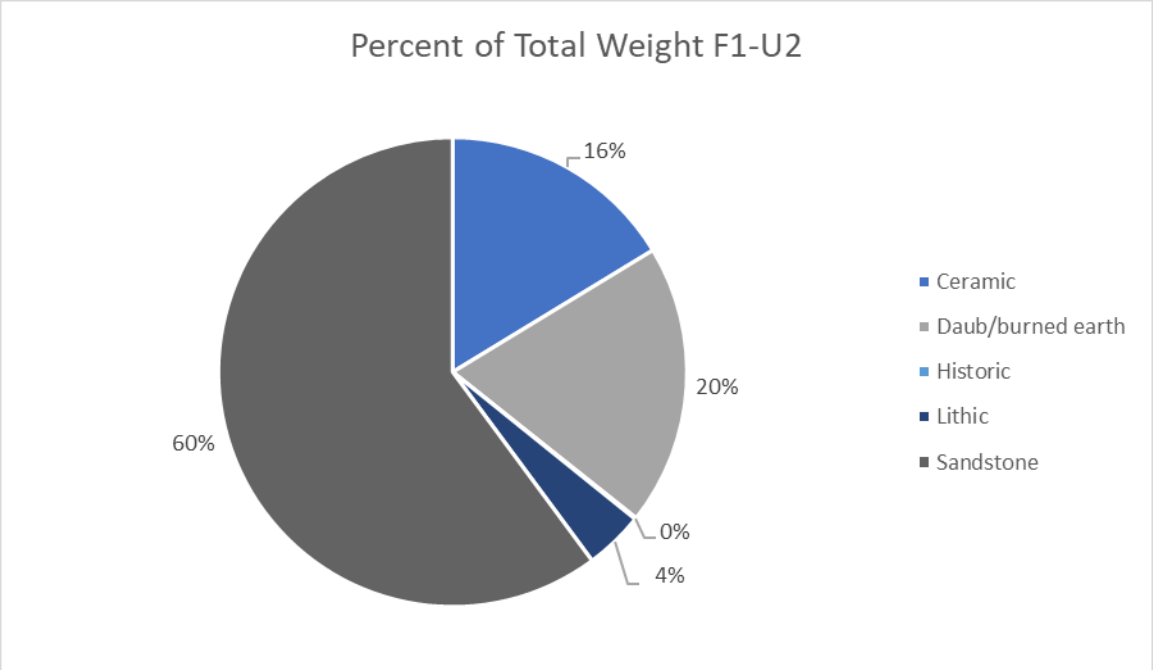

Figure 20: Percent of total weight by class from unit F1-U2 (data from Cross 2016)

By comparing the percent of total count and percent of total weight within units F1-U25, F1-U19, and F1-U2, it is assumed that there are differences in the activities taking place within each of the respective units. Though all the units were represented in terms of weight by sandstone, by count unit F1-U2 was mostly sandstone which is assumed by Cross (2016) to represent "chinking material to stabilize the posts in the trench." Units F1-U19 and F1-U25 had a majority of ceramics and daub/burned earth. The assemblages within units F1-U25 and F1-U19 are similar and therefore it can be assumed that similar activities were taking place in the structures. At this point in analysis, it can only be assumed that the structures in unit F1-U25 were non-domestic.

Architectural Analysis

Features. F1-U19 and F1-U25 were slightly different in the number of features found within the structure. F1-U19 had a total of 16 features (Cross 2016) while unit F1-U25 has 39 features. Features in unit F1-U25 varied in size from the smallest, Feature 34, at 4 cm wide and 5 cm deep to the largest Feature 8, 120 cm wide and 70 cm deep. The presence of post molds in unit F1-U25 reveals a difference between the group of structures. According to Cross (2016), "wall trenches in unit F1-U19 exhibited no postholes." Wall Trench E in unit F1-U25 contained around 30 post molds, suggesting a difference in construction methods between the two units. However, when compared to unit F1-U2, F1-U25 is like unit F1-U19 in terms of the lack of sandstone found within the wall trenches. Unit F1-U2 had approximately 52 % sandstone (Guidry 2013), most of which was from the wall trenches. Wall Trench E in F1-U25 was the only wall found to contain sandstone and post molds. The similarities between units F1-U25 and F1-U19 suggests the structures to have similar functions.

Structure Layout. Structures in both units, F1-U25 and F1-U19 show a series of two to three superimposed structures. Figure 5, page 20, displays the layout of unit F1-U19. When compared

to the structural layout of unit F1-U25, both structures are similar. To compare the structures, an overlay using ArcGIS, was created to view the similarities between these units (Figure 21). Figure 21 shows the likeness between units F1-U25 and F1-U19. Both are similar in size, layout, and orientation. When compared to Unit F1-U2, units F1-U25 and F1-U19 differ. Unit F1-U2 (Figure 22), identified a series of three superimposed structures with a palisade wall (Guidry 2013). The differences between the nature of the super-positioning are clear.

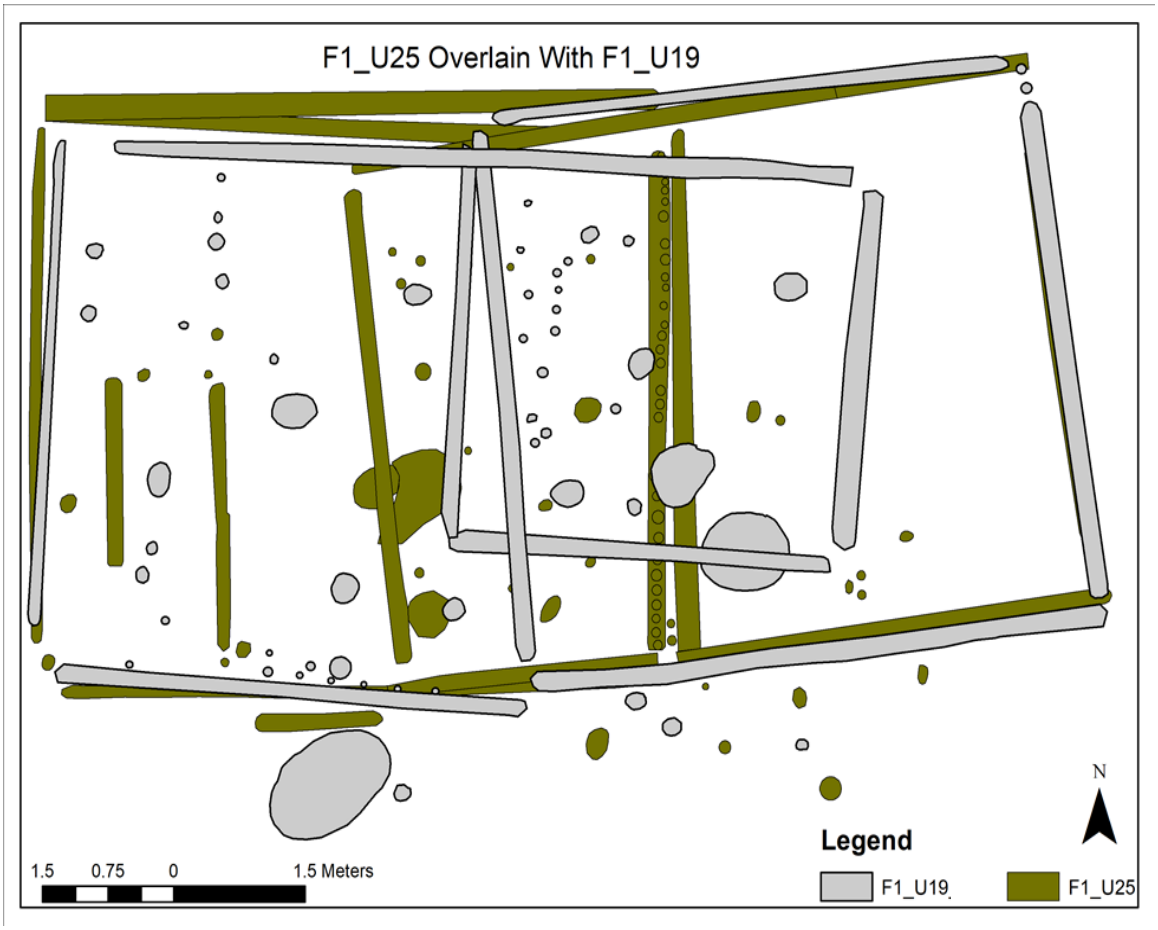

Figure 21: F1-U25 overlaid with F1-U19.

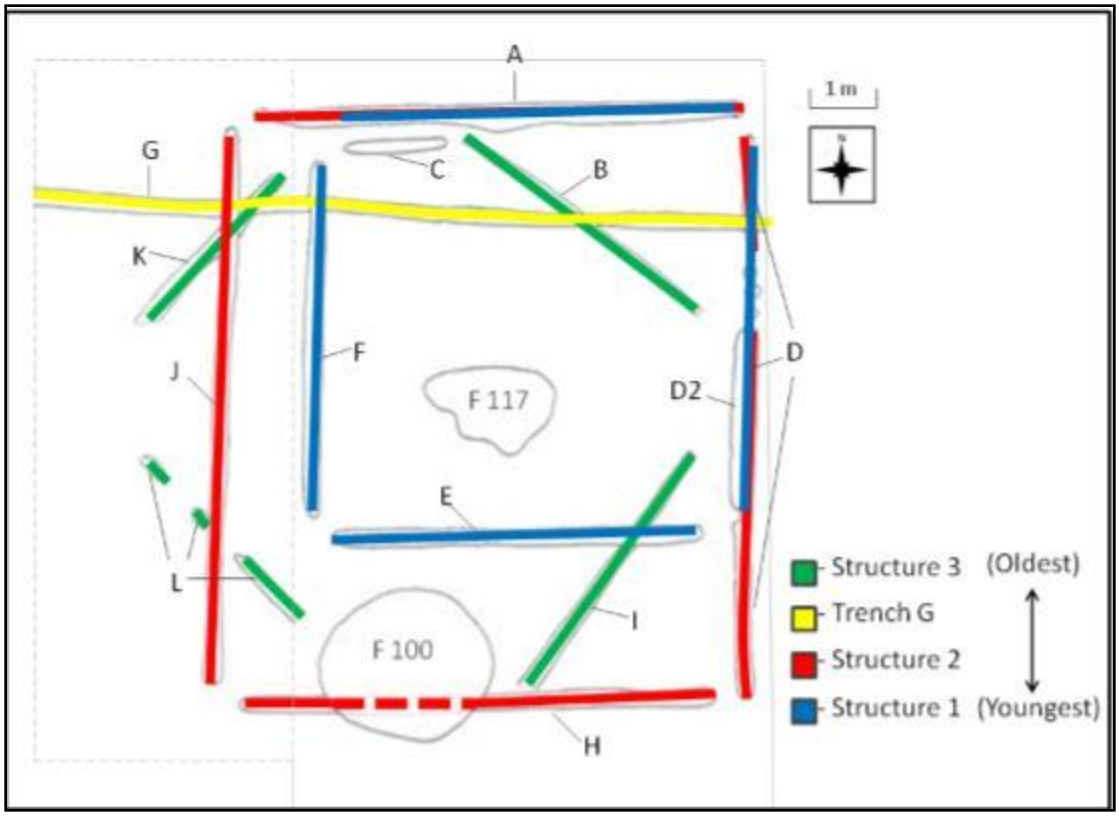

Figure 22: Excavations of unit F1-U2 revealed three superimposed structures crosscut by a palisade wall. (Guidry 2013: Figure 8)

Lastly, another clue to the function of the structures in unit F1-U25 which makes the use as non-domestic even more plausible is the solar alignments found in respect to the mounds and unit F1-U19. Both units F1-U19 and F1-U25 correspond to the summer solstice sunset looking to the northwest and from Mounds A and D both buildings correspond to the winter solstice sunrise. Figure 23 displays the solar alignments found at Ames with respect to unit F1-U25.

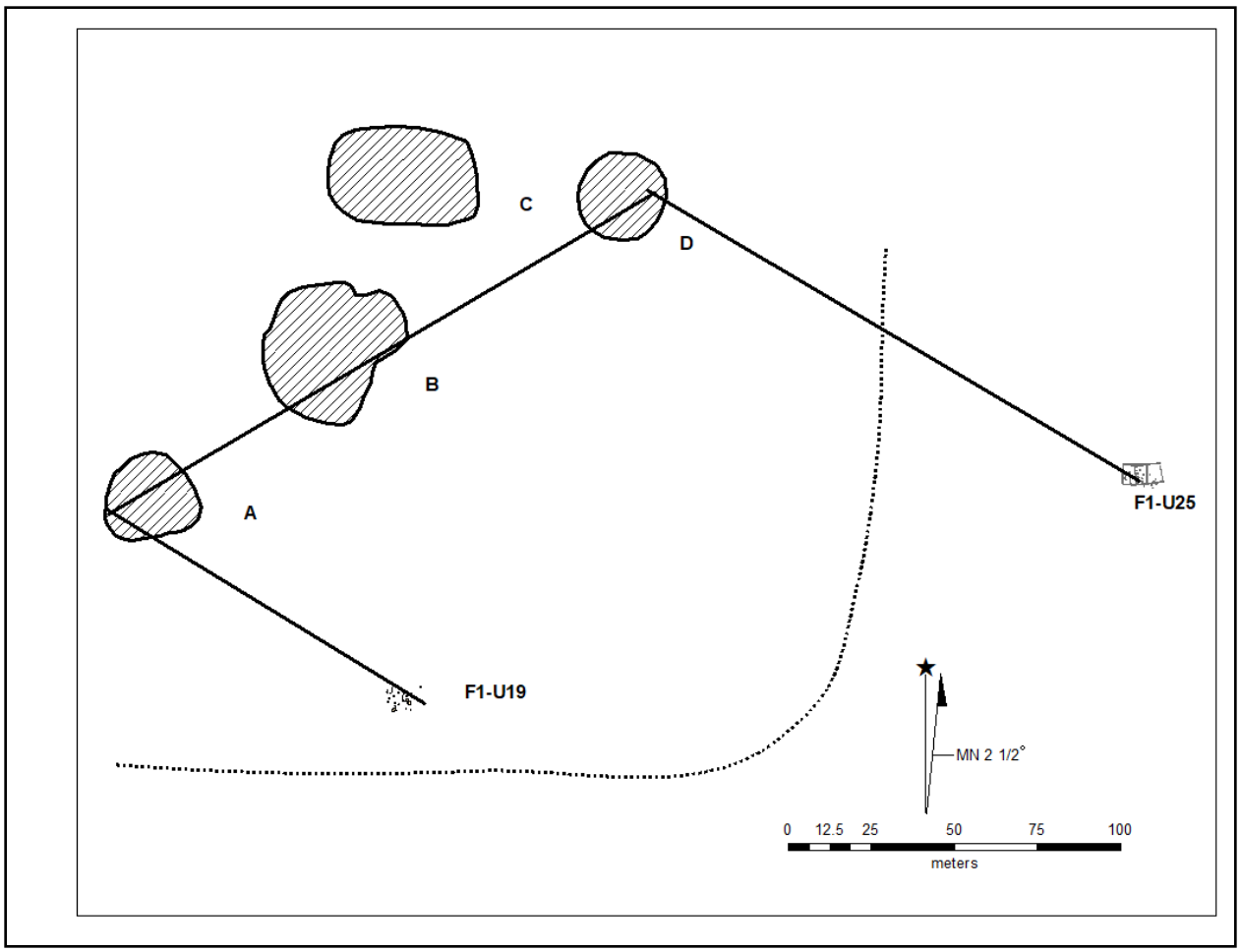

Figure 23: Redundant solar alignments with respect to structures F1-U19 and F1-U25. The same alignment is found for both buildings, corresponds to the summer solstice sunset alignment looking northwest from both buildings. As well as looking to the southeast to both buildings from Mounds A and D respectively is the winter solstice sunrise alignment.

Radiocarbon dates: Radiocarbon dating was used to determine the relationship between the structures in unit F1-U25 and the town site. These dates provide the ability to place unit F1-U25 within the temporal context of the Ames site (refer to Table 4 on page 36). Figure 24 displays the complete collection of radiocarbon samples collected at Ames since 2007. Based on radiocarbon dating results, the F1-U25 structures date to the middle of the Mississippian period. The structures are clearly temporally related to the town site.

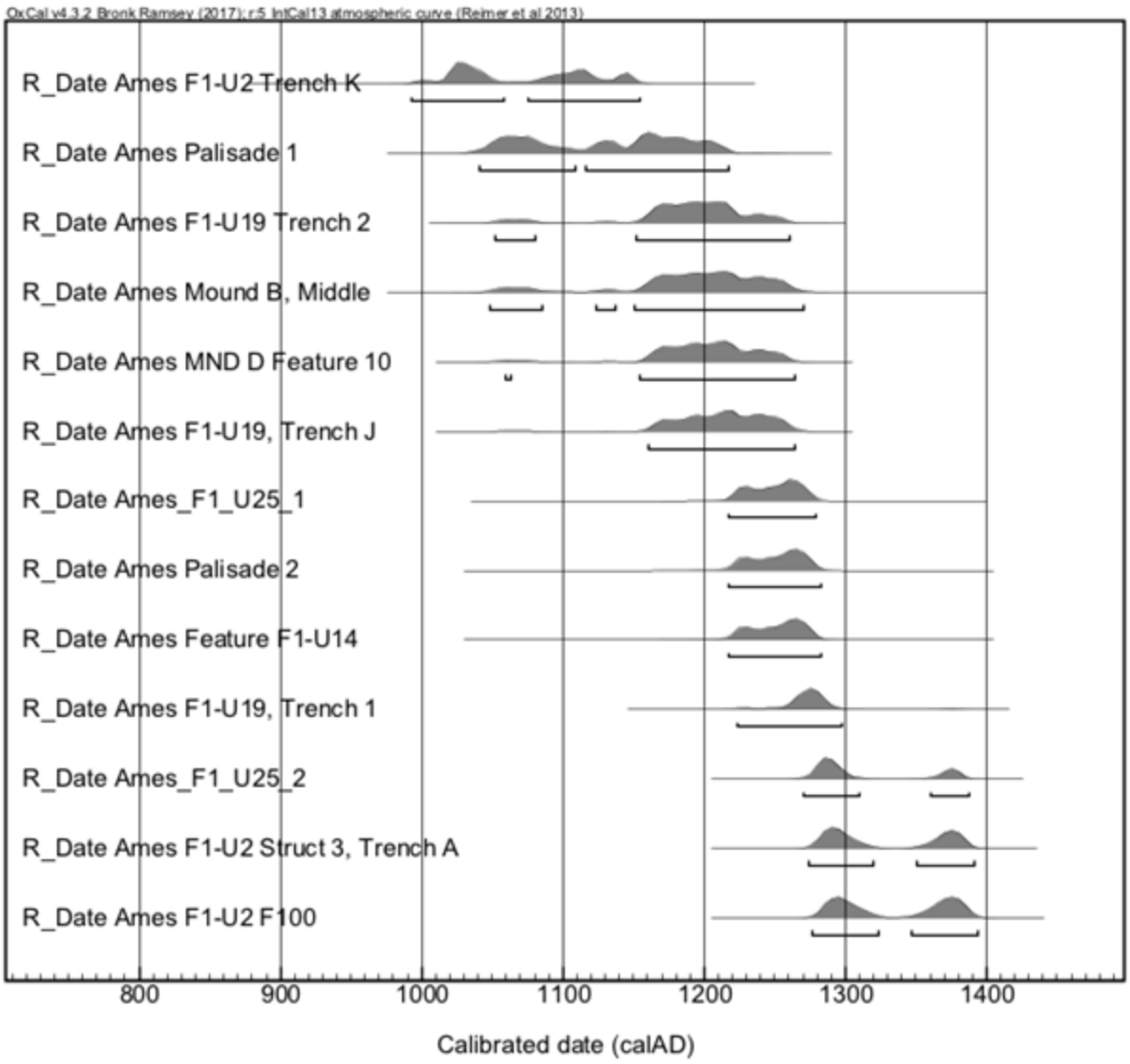

Figure 24: Radiocarbon ranges are for samples collected at the Ames site.

5. Conclusion

The rectangular structures in unit F1-U25 appear to represent the standard Mississippian architectural style. Radiocarbon dates collected during excavations of unit F1-U25 confidently placed the structures into the Mississippian Period and provided a temporal relationship with the town site at Ames confirming the first hypothesis H_1. The structures in unit F1-U25 are contemporaneous with the town site. The structures were dated to the latter part of occupation at Ames. The building and use of the structures could have been an example of how the elites at Ames were reasserting their power.

Upon analysis of unit F1-U25 structures' functions and after analyzing other structures found at Ames, unit F1-U19 and F1-U2, a determination was made that the structures are non-domestic in use. The structures are located outside of the furthest palisade associated with the Ames town site and therefore in a unique location. Radiocarbon dates suggest a continual occupation of the structures throughout most of the Mississippian period at Ames. The structures showed evidence of intentional burning. There is a possibility of the structures being burned for religious and/or ritual reasons. Another clue of function came regarding solar alignments found at Ames. The structures are aligned to the summer solstice sunset and winter solstice sunrise. Many non-domestic structures across the Mississippian world are aligned with important solar alignments, Pinson and Obion for examples (Mickelson 2020:255). The structures in the unit had few artifacts, features, and lacked common domestic debris. According to Cross (2016:67), "the lower densities of artifacts and features around U19, more ceramic than expected, and different construction method of the structures un U19 could all indicate the presence of a mound over a ceremonial structure or house." Unit F1-U19, is non-domestic in function. The similarities between F1-U25 and F1-U19 are practically identical. Therefore, the lack of artifacts and types

of artifacts which were found suggest the structures in unit F1-U25 to be non-domestic in nature and confirms hypothesis (H_2).

In conclusion, the series of structures found within unit F1-U25 are contemporaneous with the town site at Ames and probably functioned as non-domestic structures through time. There could be other explanations for the use of the structures in unit F1-U25. For example, they could have been used for different town functions such as workshops, a menstrual hut (Alt and Pauketat 2007:232), or other civic/ritual buildings. The location of the structures also poses a unique circumstance. As of current survey limits, the structures are located outside of the furthest palisade. There could be an additional palisade wall further out that has not currently been identified. However, this is highly doubtful. One aspect of Ames' community plan is that it changed through time and the structures in unit F1-U25 represent those changes. Excavations of unit F1-U25, will add to the knowledge of the Ames site and similar studies should be expanded to other regional sites. The conclusions reached from this study could be wrong, due to the limited data sets, however, for this research the conclusions seem most applicable. To better understand Ames, and its connections to other regional sites, future research needs to be done.

Future Work. Continued excavations of Field 1 are needed to identify any other structures. Also, geophysical surveys should be expanded to discover the possibility of another palisade, or other structures. A more in-depth artifact analysis could also be performed with looking at the complete collection from Ames. In order to identify similar community plans, more studies at other sites in the Western Tennessee Uplands need to be completed.

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Appendix A: Tables

Table 2: Details of the Features found within unit F1-U25.

Feature Number	Shape	Width	Depth	Contents	Type
1	Oblong	10.5 cm	10 cm	Small bits of charcoal, FCR	-
2	Circular	19 cm	5 cm	Charcoal	-
3	Circular	12 cm	17 cm	-	-
4	Circular	8 cm	6 cm	-	-
4a	Irregular	14 cm	5 cm at deepest	-	-
5	Circular	9 cm	4 cm	Charcoal	-
6	Circular	16 cm	8 cm	Charcoal	-
7	Oblong	32 cm	39 cm	Charcoal	-
8	Irregular	120 cm	70 cm	Ceramics, charcoal (sample 1) FCR, Lithics, burned clay	Large Post, Storage pit, Hearth
9	Circular	26 cm	23 cm	-	-
10	Circular	13 cm	9.5 cm	Daub, charcoal	-
11	Circular	7 cm	7 cm	Daub, charcoal	-
12	Circular	12 cm	8 cm	Daub	-
13	Circular	7 cm	4 cm	-	Post mold
14	Circular	8.5 cm	6 cm	-	-
15	Circular	11 cm	6 cm	-	-
16	-	-	-	-	-
17	Circular	36 cm	42 cm	-	-
18	Circular	23 cm	16 cm	Charcoal	-
19	Circular	8 cm	2 cm	-	-
20	Circular	16 cm	18 cm	-	-
21	Circular	35 cm	17 cm	-	-
22	Oval	14 cm	9 cm	Charcoal	-
23	Circular	9 cm	19 cm	-	-
23a	Irregular	8 cm	17 cm	-	-
24	Circular	9 cm	7 cm	-	-
25	Circular	36 cm	54 cm	-	-

26	Circular	17 cm	11 cm	-	-
27	Irregular	11 cm	15 cm	Charcoal	-
28	Circular	6 cm	5 cm	-	Post mold
29	Circular	8 cm	9 cm	-	-
Feature Number	Shape	Width	Depth	Contents	Type
30	Oblong	9 cm	18 cm	-	-
31	Circular	13 cm	16 cm	-	-
32	Circular	10 cm	10 cm	-	-
33	Irregular	14 cm	14 cm	Charcoal	-
34	Circular	4 cm	5 cm	-	Post mold
35	Square	9 cm	12 cm	-	-
36	Circular	9 cm	7.5 cm	-	-
37	Circular	28 cm	13 cm	-	-

Note: A – means no data available.
FCR = Fire Cracked Rock

Table 3: Wall Trench Analysis

Wall Trench	Width	Length	Contents	Notes
A	11 cm	538 cm	-	-
B	18 cm	665 cm	-	Trench B cuts through trench D
C	18 cm	487 cm	Charcoal, Carbonized seed fragment, bone	Radiocarbon sample 2 collected (D-AMS 036643)
D	15 cm	310 cm	Charcoal	Not connected to Trench G and under trench B
E	23 cm	516 cm	Sandstone	~ 30 wall posts
F	25 cm	545 cm	-	-
G	18 cm	503 cm	-	Not connected to trench D
H	18 cm	434 cm	-	-
I	18 cm	787 cm	Clay and ceramic	Cut through Trench J
J	21 cm	526 cm	Clay and ceramic	Under Trench I
K	25 cm	694 cm	Charcoal	Flotation sample collected
L	18 cm	145 cm	-	-
M	13 cm	272 cm	Charcoal	-
N	13 cm	193 cm	Charcoal	-

Note: Length and width are approximate. Measured with ArcMap.

Table 5: Artifact classes from unit F1-U25

Class	Count	Weight in Grams	Percent of Total by Count	Percent of Total by Weight
Botanical	4	0	0.88 %	0.00 %
Ceramic	120	90	26.37 %	11.63 %
Chert	11	4.9	2.42 %	0.63 %
Clay	148	132.18	32.53 %	17.08 %
Limestone	2	3.6	0.44 %	0.47 %
Lithic	39	28.6	8.57 %	3.70 %
Organic	55	2.4	12.09 %	0.31 %
Sandstone	76	512.2	16.70 %	66.19 %
Total	455	773.88	100.00 %	100.00 %