Interaction on the Frontier of the 16th-17th Century World Economy: Late Fort Ancient Hide Production and Exchange at the Hardin Site, Greenup County, Kentucky

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INTERACTION ON THE FRONTIER OF THE 16TH – 17TH CENTURY WORLD ECONOMY: LATE FORT ANCIENT HIDE PRODUCTION AND EXCHANGE AT THE HARDIN SITE, GREENUP COUNTY, KENTUCKY

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D I S S E R T A T I O N
__________________________

A dissertation submitted in partial fulfillment of the Requirements for the degree of Doctor of Philosophy in the College of Arts and Sciences At the University of Kentucky

By
Matthew James Davidson
Lexington, Kentucky

Director: Christopher A. Pool, Professor of Anthropology
Lexington, Kentucky

2016

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ABSTRACT OF DISSERTATION

INTERACTION ON THE FRONTIER OF THE 16TH – 17TH CENTURY
WORLD ECONOMY: LATE FORT ANCIENT HIDE PRODUCTION AND
EXCHANGE AT THE HARDIN SITE, GREENUP COUNTY, KENTUCKY

This study assesses the organization and intensity of hide processing from sequential occupations at the Late Fort Ancient (A.D. 1400-1680) Hardin Site located in the central Ohio Valley. Historical and archaeological sources were drawn on to develop expectations for production intensification: 1) an increase in production tool quantity, 2) an increase in production debris quantity, and 3) an increase in tool utilization intensity. Many Native groups situated on the periphery of early European colonies intensified hide production to meet demand generated by an emerging global trade in hides. As this economic activity intensified in the 16th and 17th centuries it incorporated and ever greater network of native communities. By documenting production intensification at the Hardin Site, this study evaluates the degree to which global markets incorporated regions beyond the colonial periphery before A.D. 1680. This study also examines the social dimensions of economic activity by asking who processed hides, who may have benefitted from the products of this labor, and whether or not either of these were influenced by participation in the tumultuous interaction sphere of the eastern North American Contact Period.

KEYWORDS: Endscrapers, Fort Ancient, Lithic Analysis, World Systems, Contact Period, fur / hide trade

Matthew J. Davidson

April 19, 2016
for Alyson Marie Layne-Davidson, MS, RD, LD

I will never have as many letters after my name
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I may not have pursued a graduate career if it wasn’t for many foreign trips with my uncle Bob. He was always game to explore archaeological sites; even the sweaty chicken busses, curvy mountain passes and endless flights of pyramid steps did not deter him from letting me pursue my interest in prehistory. Likewise, I wouldn’t have ended up in Kentucky if Dr. Chris Pool hadn’t invited me to assist with his research at Tres Zapotes, Mexico where I worked on my master’s thesis project. Even though my attention shifted to North American archaeology, Chris’s commitment to seeing me through my graduate studies kept me in Kentucky where I discovered my two great loves: Fort Ancient archaeology and, later, Alyson Layne-Davidson. Alyson's support has been central to the success of this project, from helping me choose the first test unit at the Hardin Site in 2012 to compiling my last table of figures.

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Chapter 1

Introduction and Theory

Overview

This study asks whether and to what degree hide processing intensified through time during the Late Fort Ancient Period at the Hardin Site. Much preliminary work was done to document the spatial extent and relative chronology of the site's late occupation. This work was just as important as the primary research question because without good spatial and chronological control any comparison of the site's latest components could be uninformative at best. This dissertation is thus divided into two major sections: the first half presents spatial and chronological information that was used to define the components to be compared and their relative age, the second half then focuses on specialized stone tool analysis and other data sets used to describe the hide processing industry and its relationship to nonlocal exchange.

Introduction

As “beachheads of empire” 16th -17th century European eastern North American colonies vigorously pursued trade relations with Natives to secure raw materials for export to various destinations of an emerging global market (Ethridge 2009:16-36; 2010:89-91; see also, Hollis 2004: 116). Pursuit of hides, slaves and other commodities stimulated new and intensified old economic activity throughout eastern North America. The conceptual structure of World Systems Theory provides a useful starting point for this analysis by framing the broad parameters of how early European colonies and the Native exchange sphere articulated with each other and what the consequences of this
interaction should look like (see e.g., Chase-Dunn and Hall 1997: Chapter 4). From the wide temporal and geographic lens of this model, Native societies have often been situated as marginally incorporated producers of commodities for the early global market (Hollis 2004:120-123). But while this conclusion may be generally accurate, it does not attend sufficiently to temporal and geographic variability in Native-European economic articulation (Wolf 1982:23).

Given that Native societies across eastern North America were linked by a broad exchange sphere it is reasonable to ask if and to what degree those located along the periphery of colonized regions may have responded to the early colonial economy. For example, the presence of European trade goods at Fort Ancient sites indicates their participation in a broad regional exchange system that linked them to distant coastal areas, but was this just a fortuitous consequence of the fact that Fort Ancient people had long been linked to coastal areas as evidenced by marine shell trade items? Or, was this linkage an entrée into the trans-Atlantic trade in skins and furs that Fort Ancient people took advantage of by increasing production to acquire new or more trade goods?

Just because we know most Native societies of eastern North America were ultimately assimilated as economic dependents, removed, or killed this fate does not accurately represent the entire temporal or geographic span of the contact period. The widely dispersed “commercial outposts” of the 16th and 17th centuries did not operate on their own terms (Ethridge 2009:16-19). Even with some advantages of technology and logistics, colonial entrepreneurs were located far from the powerful European core states they represented and in many ways had to operate within the parameters of the extant Native exchange sphere (Galloway 2009:338-339). For example, even though we know
interior Native groups like Fort Ancient were aware of colonial developments and the economic “opportunities” they represented, this does not mean they were necessarily interested in intensifying their participation in the regional exchange sphere of which they had long been a part.

At the same time, there is historical and archaeological evidence that interior groups such as Fort Ancient may have produced hides (or other goods) for long distance exchange (see e.g., Drooker 1997: Chapter 8; Pollack et al. 2002). Increased quantities of hide processing equipment and trade goods of European origin have been documented in many regions of the interior (Cobb 2000:86-92). Historical sources indicate the Ohio Valley was an important supplier of hides for the Susquehannock and Iroquois trade with Europeans by the early 17th century (Jennings 1968; Browne 2005). And yet even if we assume these early historical sources are referring to Fort Ancient in particular, it is hard to say whether hides from the interior represent exchanges that would have taken place without colonization or if they represent production and exchange stimulated by “insatiable European demand” during this time (Kardulias 1990).

This question has only been systematically evaluated at one site in the study area, the Fort Ancient Madisonville Site in southeastern Ohio. There is evidence this community in southern Ohio was involved in processing hides, and manufacturing metal and other ornaments for exchange. If the Native-European exchange sphere(s) had indeed enticed Fort Ancient communities to intensify production for exchange, the Hardin Site is ideally situated to take advantage of this circumstance as it is located at a crossroads of several major confluence areas of the Ohio River and Native trails leading to Iroquoia and the southeast. This study examines the large quantities of hide processing
implements recovered from the Hardin Site to evaluate whether they intensified hide processing, and examines patterns of trade goods to evaluate the possible relationship between production and exchange.

**Organization of the Volume**

Chapter 1 provides a brief overview of how culture contact and interaction have been studied by anthropologists and archaeologists and then describes the theoretical framework used in the study. Chapter 2 describes Fort Ancient culture and contextualizes Fort Ancient production and exchange patterns within broader regional developments during the early centuries of European colonization. Chapter 3 provides a history of research on the Hardin Site, and then describes the goals, methods, and results of the fieldwork that was conducted as part of this study.

The remaining chapters address four separate but related issues at the Hardin Site: 1) site structure, 2) occupational history, 3) the organization and intensity of hide production, and 4) examining the relationship between production and exchange over time. The sequence of chapters 4-10 is important because each builds on information presented in the previous chapter.

Chapter 4 builds on the spatial information documented by field and museum studies to parse out the spatial extent and relationship of the two Late Fort Ancient occupations present at the site. Chapter 5 presents the ceramic analysis which was used to build a relative chronology of the components described in the previous chapter. Chapter 6 presents the results of ceramic, lithic, and other chronological measures to make an argument about the occupational history of the site. Chapter 7 provides a
typological description of the lithic tool assemblage from the site. Chapter 8 describes the morphology of endscrapers in more detail than the previous chapter and the results of microscopic use-wear analysis. Chapter 9 presents the results of morphometric data collected to evaluate use intensity as a complement to the microwear data.

Chapter 10 has several goals. First, it describes hide processing tools, debris and facilities and makes predictions about how they change in response to production intensification. Second, it presents data from previous chapters to evaluate several measures of intensification. Third, it presents data on hide processing tools and trade goods associated with burials to examine the importance of hide processing and its relationship to exchange for nonlocal trade goods. Finally, Chapter 11 concludes the study by reviewing the major findings and examining how they reflect on the expectations of the theoretical framework presented in Chapter 1. Chapter 11 also makes suggestions about future research that could improve on the present study. This dissertation includes several appendices that include photographs and other information that was not vital to reading the volume, but provide additional details for readers interested in particular subjects.

Background to Interaction Theory

Pre-scientific Archaeology (ca. A.D. 1600-1900)

The study of culture contact – nonlocal exchange in particular – is a core subject of anthropological inquiry. The earliest models of Native American interaction in eastern North America were strongly shaped by historical context (Trigger 1989; McGuire 1992). Before the 19th century, the popularly held belief was that Native Americans were
culturally and intellectually impoverished, and therefore incapable of adapting to the lifestyle of the colonial era. This assumption was extended into reconstructions of the prehistoric past resulting in the early notion little change had occurred in prehistoric times.

The earliest models of Native American interaction were proposed by early colonists of the 16th to 18th centuries (Hudson 1976:35; Trigger 1989:67-69; Brose 1993:2-4; Feder 2011:162-173). As Euro-American colonization advanced westward observation of large mounds and earthworks seemed to contradict the popular notion that Native Americans were intellectually incapable of the technological and social development large scale architecture is assumed to require. Most early explanations for the apparent contradiction posited that Native Americans were recent arrivals to the continent and that one or more past civilizations (e.g., Vikings, Egyptians, etc.) built the mounds and either returned to the Old World or were exterminated by Native Americans.

A concentration of earthworks in the mid-Ohio valley makes the study area notable in early models of Native American interaction. A popular antiquarian explanation for the origin of these features was that their makers (“Moundbuilders”) represented a peaceful race who built them as defensive fortifications as they were pressed northward by the aggressive Native American hoards (Brose 1993:4). Not only did this explain the apparent contradiction between the perceived inferiority of Native American culture, but also reinforced the belief that they were inherently barbaric and needed to be assimilated or eradicated.

Early scientific examination of mounds and earthworks commenced largely in the 19th century. This work was characterized by more systematic examination of mounds
and earthworks that included mapping and excavation. While this development may have ruled out some of the relatively baseless speculation of previous centuries (above), most new information continued to be manipulated to reinforce the basic notion that modern Native Americans were recent interlopers that could not be credited for building mounds and earthworks (Trigger 1989:104-109). Another interesting development of this era was the manufacture of fake artifacts exhibiting Old World writing that were used to “prove” the European ancestry of Native sites. A more egregious example involved burial of fakes with Old World writing in mounds in Grave Creek, West Virginia and Newark, Ohio where they were later “discovered” and used as evidence the mounds were not of Native American origin (Feder 2011:175-180).

During the late 19th – early 20th century cultural evolutionism became the intellectual foundation of beliefs about Native American inferiority (Trigger 1989:67-69,104-147). According to this view, Native Americans occupied the bottom rung of both cultural and biological human development and therefore they could not possibly have built prehistoric mounds. This idea was so deeply entrenched in pre-existing views that mounting evidence of time depth (e.g., from stratigraphic excavations) was conveniently overlooked. Consequently, rather using newly developed scientific methods to test models of culture change, early systematic study of variation in the archaeological record focused on defining cultural areas that were simply assumed to lack time depth (Trigger 1989:122-123). Any evidence of diachronic development – historical or archaeological - that could be attributed to Native Americans was downplayed as minimal or was attributed to European or other external influence (Trigger 1989:126-127,
186-195). These views persisted well into the 20th century forming the basis of early scientific models culture contact which focused on the role of migration and diffusion.

**Culture Historical Archaeology (ca. A.D. 1900-1960)**

The accumulation of information from stratigraphic excavations gradually solidified into irrefutable local chronological sequences that demonstrated the in-situ development of archaeological cultures. This eventually undermined the long-held notion that Moundbuilders or other prehistoric “races” had been replaced by modern Native Americans (Trigger 1989:186-206). With most effort focused on local chronology building during the early 20th century, any attention to culture contact was limited to the role of diffusion and migration (Trigger 1989:148-206; Brose 1993:8-9). For example, the material culture traits central to the stages in Ford and Willey’s (1941) early chronological sequence for eastern North America were believed to have originated in Mesoamerica and made their way to eastern North America by way of diffusion. Despite the recognition of a long history of Native American occupation, little consideration was given to the specific processes that stimulated diffusion, and thus it was largely a generalizing descriptor for the presence of new material culture rather than an explanatory model (Trigger 1989:190-192, 206). More importantly, the idea that culture change resulted from external interaction is notable since it implies the continued belief Native North Americans lacked the capacity for innovation.

Ethnologists of the early 20th century used the concept of acculturation to model how materials and ideas acquired by diffusion were incorporated into local cultures. Boas argued that ideas and practices spread through diffusion were “remodeled according
to the patterns prevalent in their new environment” (1920:101). Variation in the conditions in which acculturation took place were documented and compared during the early decades of the 20th century (Bohannan 1967:xiv; Cusick 1998:128). By the 1930s synthesis of these findings stimulated Linton’s description of “acculturative types and processes” (Linton 1940; see also Spicer 1961). In an review of early 20th century culture contact studies in anthropology, Spicer (1961) described early attempts to promote systematic comparison among contact situations, which included Malinowski’s International Institute of African Languages and Cultures (in 1931) and the memorandum on the study of acculturation by the Social Science Research Council (in 1936).

Not until the mid-20th century were archaeologists making a relatively sustained effort to examine processes by which diffusion resulted in culture change. In 1955 a typology of contact situations arose from a Carnegie-sponsored seminar (Willey and Lathrap 1956). This represented an important development in archaeology and ethnology because it articulated some of the salient variables of culture contact. This typology was notable because it foreshadowed the generalizing tendencies of the cultural ecology-focused neo-evolutionary paradigm in archaeological theory.

**Functionalist / Neo-Evolutionary Archaeology (ca. 1960s-1990s)**

With the rise of functionalism, and especially ecological functionalism in the 1950s and 1960s, both archaeologists and anthropologists largely turned toward comparison and generalization. The timing of this theoretical turn was somewhat unfortunate for contact studies in archaeology because they had just reached a point of synthesis and comparison in the Carnegie-sponsored seminar mentioned above.
According to Schortman and Urban (1992:4), for several decades many archaeologists largely ignored contact, focusing instead on local ecological relationships framed in systems terminology. If interaction was incorporated into archaeological explanations, it was viewed functionally. In ecologically oriented models, for example, external contact and interaction functioned to keep cultural systems in balance, fulfill unmet resource needs, and reduced risk (Cobb 1993:60). Changes resulting from contact were considered secondary to those related to the culture core (i.e. subsistence system).

Processual models that broke from the strict cultural ecology mold often examined the technological, political, economic functions of exchange in evolutionary processes (e.g., Flannery 1968, 1972; Renfrew 1975, 1986). Early marxist approaches (e.g., Gilman 1981, 1984; Kohl 1978), on the other hand, emphasized that the role of exchange and interaction must be contextualized within historically particular circumstances rather assumed to be important based on universal functional or economic principles (Cobb 1993:61-62; Kristiansen and Rowland 1998:1; Patterson 2003:91-102).

In one early marxian example, Gilman (1976) critiqued Renfrew’s (1969) use of exchange as a driver of political evolution on the grounds it did not specify the social, economic or other relations that would have made exchange important in political development (Patterson 2003:77-78,92). Marxian (and non-Marxian) scholars have variously pointed out that early models incorporating exchange (e.g., Flannery 1968), as well as more recent “prestige goods” models (e.g., Welch 1991) have suffered from this problem (e.g., Cobb 1993:63-64; Patterson 2003:109; James Brown 2006). For them, nonlocal goods are not necessarily (i.e., inherently) valuable, powerful, or meaningful.
tokens that imbue leaders with power and authority; rather the significance of nonlocal goods (and the exchanges that produce them) is a consequence of historically particular social and political relations (Cobb 1993:61-62). So while both Marxian and other models have both emphasized the importance of exchange, they differed in specifying how / why it is important.

Patterson (2003:121-132) points out that Marxian and other approaches have converged to some degree in recent decades. Archaeologists interested in the relationship between political process and exchange have increasingly attended to the importance of context and scale. For example, recent approaches examine both internal and external political processes, while also accounting for the role of other variables such as climatic change, warfare, production, and exchange (e.g., Dye 1995; Blanton et al. 1996; Milner and Schroeder 1999; Pool 2003:90-98; 2008:147-151; Marcoux 2007).

World systems theory (hereafter, WST) is another approach that has been used by archaeologists to examine the role of nonlocal trade and interaction. In its original conception the world systems model only applied only to modern capitalist states since the 17th century (Wallerstein 1974). Wallerstein argued a world system is characterized by a core-periphery division of labor, profit, and resources that involves qualitatively different relations than those stimulated by the exchange of “preciosities” in other (non-capitalist) exchange systems. Wallerstein called these “riches trades” and considers them dispensable to both parties involved (2000[1973]:57). Those who subscribe to this vein of world systems theory (“qualitative transformationists”) argue that forms of exchange and interaction in “riches trades” have a minimal effect on participating societies (Chase-Dunn and Hall 1997:13).
This distinction was quickly contested by those who believe exchanges of preciosities can and do play a substantive role in shaping internal and external social relations (e.g., Kohl 1978; Wolf 1982; Blanton and Feinman 1984:676). Proponents of this usage of world systems theory (“logical continuationists”) take the central tenet of world systems – that inter-societal exchanges or relationships play an important role within each of the involved societies – and apply it to a variety of contexts (Chase-Dunn and Hall 1997:13, 20-23). Continued use and expansion of WST concepts is a clear indication that it continues to bring much needed theoretical attention toward examining variability in culture contact and how it relates to internal production and reproduction (e.g., Chase-Dunn and Hall 1997; Stein 1998; Hollis 2004; Kardulias 2007).

In summary, this chapter examined variability in how archaeologists have examined the role of exchange and interaction since the mid-20th century. In general it has been argued that culture contact theory was eschewed during the processual heyday (e.g., Adams 1974:240; Trigger 1989:331). This is perhaps due to the fact that external interactions often take place in spatially and culturally ambiguous contexts that did not fit nicely in typological schemes (Green and Perlman 1985:9). Adams (1974:240) also notes that like many theoretical trends, the avoidance of culture contact in the mid-20th century was at least in part a reaction to the over-use of the diffusion concept in early 20th century culture-historical research (see also, Cobb 1993:53-54). Even while contact theory per se may not have been a specific focus in mid-to-late 20th century archaeology, numerous studies examined how culture contact stimulates new types of institutions, ideas, and practices (e.g., Ford and Willey 1941; Binford 1962; Caldwell 1964; Adams 1974; see also above).
**Contact Studies in the Modern Era (ca. 1990s - present)**

The development of theory specific to culture contact was not re-examined intensively in archaeology until the 1990s. Examples of studies incorporating interaction and contact dating to the late-1970s and 1980s suggest that the recent focus is not entirely new (e.g., Price 1977; Blanton et al. 1981; Renfrew and Shennan 1982; Green and Perlman 1985), though the quantity of studies and their explicit attention to theoretical issues may be. Wendl and Rosler (1999) argue the resurgence in contact studies was the result of widespread political and social conflicts, border disputes, and continuously growing diaspora communities of the late 20th century. This recent focus has inspired a substantial body of theoretical language that is equipped to deal with variability in contact settings and the processes by contact leads to change.

A key product of recent contact studies has been examination of variability in the spatial contexts of culture contact (after Green and Perlman 1985; Lightfoot and Martinez 1995; Chase-Dunn and Hall 1997; Alexander 1998; Kopytoff 1999; Cusick 2000; Berend 2006; Naum 2010). Summarizing from a range of sources, at least four distinctive spaces or contexts of culture contact can be described. While political organization is the primary criterion for these types, it is not the only salient variable.

Frontiers are of two types, (1) one is the boundary between expansionist states and non-state societies typified by North America during the contact period. The other is the (2) internal frontier (after Kopytoff 1999); which is a sparsely populated region between two non-state societies. Internal frontiers are often populated by migrants from either or both sides. These are characterized by people who have similar values, beliefs,
and political cultures such that interaction is not a process of coercive forcing of one group on another, but reinforcement of traditional values. While Kopytoff describes these as culturally homogenous regions, a variety of such spaces also host multicultural populations (see e.g., case studies in Chase-Dunn and Hall 1997).

Borders represent the physical boundaries of nation states, and the spaces occurring between them are referred to as (3) borderlands (Rodseth and Parker 2005). Distinctive cultural groups occupy borderlands and bring the political institutions, values and practices from their places of origin. Finally (4) I propose exchange locales can be considered a final context that differs from those determined primarily by political organization because they occur in a diverse range of locales depending on the nature of exchange. Exchange locales include the variety of settings designated for interaction among culturally and socially distinct groups. These include market places located in public settings, frontier trading posts erected by entrepreneurs along colonial peripheries, and tribal/chiefly council houses. In some ways, these represent a subset of other categories since many exchange locales are intentionally located in politically and culturally ambiguous spaces where culturally distinct groups can interact.

A variety of models have been developed to examine the variables and processes that shape social, economic, and other relations in contact situations. Most extant models (e.g., peer-polity, world systems) focus on how economic goals and political organization shapes the nature of exchange (e.g., Wallerstein 1974; Renfrew 1977; Alexander 1998; Schortman and Urban 1998; Stein 1998, 2002; Rowlands 1998; Wendl and Rosler 1999). These models tend to start with more generalizing or typological frameworks and examine the degree to which particular case studies meet criteria specified therein.
Other models focus more specifically on social and cultural aspects of interaction; examining how distinct individuals and groups deploy and negotiate values and beliefs, and experiment with new practices and relations (e.g., Lightfoot and Martinez 1995; Lightfoot 1998; Cusick 2000; Scott 2001; Silliman 2001, 2005; Alt 2006; Naum 2010; Peelo 2010). These models tend to be more particularistic, drawing on practice theory and Marxist historical materialism. Historical archaeologists (but see Alt 2006) have been most successful with these models because they have access to data that allows them understand the rich historical details often needed to understand how values and beliefs are negotiated in daily encounters in multi-ethnic settings.

The distinction made here between political/economic and social/cultural approaches is somewhat of an oversimplification used to describe variation in the ways contact processes are being examined. In reality there is a varying degree of overlap between these approaches. For example nearly all perspectives, even those claiming a more particularist or interpretive theoretical orientation employ some type of universal or generalizing assumptions about the nature of interaction. Also, most contact studies are multi-scalar, bringing together datasets from regional, community, and household levels. This may be why WST was so popular before the resurgence of contact studies. Studies of interaction in colonial settings are good example of where traditionally opposed theoretical perspectives have been combined to accommodate comparison and a more nuanced understanding of complex cultural interaction (e.g., Lightfoot et al. 1995; Murray 2004; Cobb 2005; Stein 2005 Van Buren 2010).
Discussion

The focus on contact theory in recent decades has resulted in a cascade of new terms, and models that allow archaeologists to conceptualize an ever wider range of variability in contexts, relationships, and processes. Yet the middle range theory that connects these to archaeological patterning has been less forthcoming, especially for pre- and proto-historic contexts where basic spatial and temporal information about sites and regions has to be reconstructed before an attempt can be made to interpret the local consequences of interaction and exchange. In Fort Ancient archaeology for example, some trends in exchange and interaction have been identified, but the lack of chronological control and well-documented patterns at individual sites makes most interpretations somewhat speculative since so many alternative scenarios are possible.

This situation contrasts sharply with historic sites archaeology where many details about exchange can be modeled in advance with historic accounts. For this reason, general theoretical models such as world systems theory are a useful means of framing the overall research question and providing general expectations, but examining specifically how large scale interaction shapes local contexts requires mid-level theory that proposes testable expectations about the relationship between interaction and its material consequences. In the following, interaction theory is used to frame this study’s research questions.

Interaction Theory in the Present Study

This study examines how small scale societies such as Fort Ancient articulate with large-scale exchange systems. WST is used as a general theoretical framework for
this study because it has already proven to be useful for examining how eastern North American societies articulate with each other (e.g., Peregrine 1991; Dunaway 1996; Jeske 1996, 1999) and with European colonial entities (e.g., Kardulias 1990, 2007; Hollis 2004). The expansion of WST to accommodate the study of economic interaction among non-states and between state and non-state social formations has been very productive. Perhaps the most important aspect of such studies is a focus on the ways in which social formations are incorporated into broader spheres of exchange and how this influences each participant. Wallerstein defines incorporation as “the integration of [a society’s] production processes into the interdependent network of production processes that constitute the world market” (from Wallerstein and Martin 1979:193). In this model, the articulation of economies was not just exchanging things; rather, interacting parties reformulate their internal modes of production to specialize in a sector of a larger economy.

Broad applications of WST to eastern North America have keyed on identifying the degree to which Native societies may have specialized in the production (or exchange) of raw materials, food or prestige goods to the degree they came to depend on a regional exchange system (e.g., Peregrine 1991; Jeske 1999). I would argue that since Native economies were not organized to produce anything at the level of intensity found in capitalist states central to Wallerstein’s original model, we need not focus on his central criteria for economic incorporation – that is the internal reorganization of production to specialize in manufacture of goods, resources, etc. based on an exploitative relationship between producer and consumer. Other criteria for incorporation may be more relevant for eastern North America. Because Native economies were more or less
self-sufficient in terms of basic goods and resources. Their articulation in regional exchange spheres may not be easily identified by material culture if changes in production were not involved. As Galloway recently argued for the 18th century Choctaws “maintaining appropriate relationships was far more important to the Choctaws than the trade that made the relationships visible” (2009:351). What this exposes is that it is false to always expect a real distinction between the economic and the social; they are one and the same since social relations underlie economic production (i.e., they are part of the same “totality”; see Ollman 1971; McGuire 1992).

So while exchange tied Natives to a broader interaction sphere, it was a means to an alternative end. For example, social relations established by and through exchanges can be very important means of achieving certain goals such as alliance building, marriage and information sharing (Dye 1995). Even if more specialty goods were produced to accommodate intensified regional interaction of this sort, these items were relatively few in number compared to bulk goods (for the production residues in the latter case see Muller 1997). With the exception of some specialized regional centers (see e.g., Knight 2004; Marcoux 2007; Meyers 2011, 2015), the production residues of specialty goods could be difficult to identify even in the context of intensified regional interaction.

Of course the ability to identify production residues at Contact Period sites could be better if hides became a medium of social transactions. Even if the use of hides as an exchange medium was ultimately simulated by European demand, the function of exchanges among interior natives was probably still social. In this scenario, the exchange medium rather than the social consequences of exchange would have changed, especially for Natives in the deep continental interior (Galloway 2009:346-347). The important
difference for the present study is that in the context of protohistoric period, intensification of regional interaction may actually have a readily identifiable production residue: hide processing equipment and debris.

But even if we can identify production residues that may signify intensified regional exchange (or at least a new medium of exchange that has a more obvious material signature) this does not tell us anything about the effects of intensified regional exchange. Did exchange remain important largely in the social realm as described above, or did the use of a new exchange medium lead to changes in the social or material relations of production? Would it have had consequence for other social relations? For example, what segment of society made hides, if any, and who benefitted if they became an important exchange medium?

Traditionally, study of the 16th-18th century Native-European colonial economy has focused largely on the way in which Natives shifted the intensity and/or organization of production to meet demand produced by European colonial and global markets (see e.g., Hickerson 1973; White 1991). Part of this has been the nature of historic documents, which are more numerous for periods when Natives had increasingly fewer options. Land, resources, and traditional support networks diminished as European colonization expanded geographically (Richter 2001). But for the early contact period this paradigm can be flipped on its head. Before the 17th century, Europeans were relatively few in number, and they had to articulate with the extant Native exchange sphere.

European colonies may have represented economically and militarily powerful European states with the technological capacity to explore and colonize eastern North
America, but the degree to which these powers filtered to individual colonial settlements was quite variable through space and time. Early colonial enterprises repeatedly failed during the 16th and early 17th century due to limited resources, disease, and lack of familiarity with new landscapes. For example, it took a century for the French to establish a sustainable colony on the St Lawrence River, and the English equally as long to establish sustainable colonies on the Atlantic coast (Loren 2008:34-57; Parker 2010:31-32).

Beyond establishing sustainable settlements, early successes of colonies often depended on establishing profitable trade relations with Natives to justify their human and monetary cost (Kardulias 1990:42). The small scale societies with which they interacted did not individually make or break colonial efforts, but as a whole, the trade in skins, furs, and Native slaves was the backbone of early colonial economies in eastern North America (Loren 2008:29-57; Ethridge 2010; Marcoux 2010). From a broad perspective, understanding how this exchange sphere developed is important because its success was “instrumental in expanding and consolidating the nascent global economy” (Ethridge 2010:90). This point also underlines the importance of scale in the analysis of how social groups articulate in exchange systems. At the scale of individual colonies it could be argued that many early European communities were more economically specialized and therefore relatively dependent on the pre-existing Native regional exchange sphere. On the other hand, the economies of most Native societies, especially during the early Contact Period were not dependent on exchanges with the colonies; at least not specifically on the participation of Europeans, who were relative newcomers to a regional exchange system that had been developing and transforming for several
millennia (Brose 1990; 2001). As some archaeologists have recently argued, the Native trade in hides may have blossomed the century before European contact (Fitzgerald 2001; Abel 2015).

In the 16th – 17th century colonial enterprises in eastern North America were a specialized peripheral segment of a world-scale mode of production (Ethridge 2009:16-19). The Native exchange sphere(s) of eastern North America on the other hand was based on interaction among geographically redundant and largely independent social formations. In this sense, colonies had to articulate with two independent but converging exchange spheres: the world economy and Native American (Ethridge 2009:17).

To situate the middle Ohio Valley in this context, a good starting point is to identify the material evidence of articulation between Fort Ancient communities and the early colonies. As Hudson points out, the lack of historical evidence for interior societies (like Fort Ancient) puts us at a major disadvantage compared to traditional applications of world systems perspective which can rely on historic records and accounts (2002:xxi). So I start here with the most obvious evidence - the presence European trade goods at 16th and 17th century Fort Ancient settlements, which indicates they were linked in some way to the same regional exchange system as Europeans. If Fort Ancient people had a long-standing role in this exchange sphere we should ask if the availability of European trade goods had a unique influence on the way that Fort Ancient communities articulated with it. Or were European trade goods just new things available in an old “marketplace”?

In general this appears to be the case (Martin 1994:309; Galloway 2009:347). We know that interior Native groups participated to a varying degree in the hide trade in order to acquire European and other nonlocal goods in the 16th and 17th centuries. Most
European trade goods recovered from Native settlements in the interior dating to this time have been found in mortuary contexts suggesting they were incorporated into Native societies the same way as other long-distance trade goods (Martin 1994:311). This appears to be the case for at least parts of the Fort Ancient region, though little research has specifically addressed this issue (Pollack and Henderson 1983; Drooker 1997, 2002; Henderson and Pollack 1999). But if European trade items were incorporated into Fort Ancient society the same as other nonlocal goods, is there any reason to believe their availability would have stimulated an increase in nonlocal exchange?

Several reasons can be proposed, though none have been systematically evaluated. One way that 16th-17th century exchange may have been distinct from prehistoric period was that early colonial demand for Native goods was relatively unlimited, and may have stimulated higher levels of native production (Axtell 1992:130; Martin 1994:311). In eastern North America production rarely exceeded what was needed to replace household inventories (see below). Therefore it is plausible that the insertion of more or less unlimited demand for a certain commodity could have stimulated levels of production for which there had previously been no incentive. Moreover, the use of hides as long-distance exchange goods “made good sense” to native hunters; they could access many types of trade goods with a resource of which they had an abundant supply (Martin 1994:311). However, to assume the presence of demand alone would have stimulated intensification would rely on an implicit formalist economic rationale that may or may not apply in the case of Native economic practices (Galloway 2009:342).
Historic research indicates that Native exchange systems are better understood from a substantivist perspective which emphasizes the internal social factors that would have led Native communities to respond to increased demand for hides (e.g., Rothschild 2003:16-20; Galloway 2009). In eastern North America, nonlocal exchange relations were often based on developing and maintaining social and political relationships; the resulting material goods were a secondary consequence of these political encounters (Knight 1994; Martin 1994). However, success in these affairs and consuming or gifting the resulting exchange goods is widely viewed by archaeologists as important source of social standing in eastern North American societies (e.g., Peebles and Kus 1977; Anderson 1994; Marcoux 2007). A dual function for nonlocal exchange goods has been proposed in the Fort Ancient region as well (e.g., Henderson et al. 1992; Drooker 1997; but cf. Holmes 1994). Many who emphasize this aspect of exchange argue nonlocal goods were important both for maintaining and expanding political networks, and as fuel for status competition within and communities. If this is true, then (as discussed above) access to new and or more trade goods available via colonial-Native exchange networks would have provided an internal stimulus for intensifying hide production (Lapham 2004a, 2004b, 2005).

Though it is of interest, it is not the goal of this study to evaluate all possibilities of how Fort Ancient may have been linked to European export trade. This would require developing and testing other hypotheses well beyond the scope of this work. This study is primarily intended to provide a starting point for pursuing this and other questions by first evaluating the degree to which one type of craft production – hide processing – intensified at a 15\textsuperscript{th} -17\textsuperscript{th} century Fort Ancient community. The following section
discusses how archaeologists identify the basic material correlates of hide processing in the archaeological record, and then examines theoretical models that are used to examine organization and change in the intensity of craft production systems such as hide processing. Later, in Chapter 10, the information from these two sections is used to describe the hide processing industry at Hardin and assess the degree to which it may have intensified over time.

**Identifying Hide Processing in the Archaeological Record**

The study of hide processing has at least two advantages over other prehistoric craft production industries. First because of its widely documented importance through space and time, there is a great deal of historic, archaeological and experimental literature on hide processing (see, e.g., Richards 2004:223-231 and contributions to Thomson and Mould 2011). Second, the 16th-18th century eastern North American trade in skins and furs was widely documented by Europeans because of its importance for both colonial markets and for the trans-Atlantic export market (see above). Due to the level of European interest, we now have useful documentation relating to the timing, scale, and nature of hide production and exchange that is absent for other prehistoric Native industries. For example, during his foray into the Carolina back country in 1700-1701, John Lawson made various comments about hide processing (e.g., Lawson 1966 [1709]: 191,208). Information from these sources provides us with archaeological correlates that might be expected in terms of production residues, the use of space, and other variables. The following section uses a small sample of these sources to describe the basic goals and techniques of hide processing, and underlines some of the general material correlates that
can be expected archaeologically. Two sources are used as the basic foundation of this section (Richards 2004 and Thomson 2011), while others are cited individually when pertinent.

Hides are made of four basic components or layers (see Richards 2004:28 and McConnell 2011: Figure 177). The outermost layers are the epidermis and hair which provide a protective barrier against the elements. Below the epidermis is the grain (or papillary layer), which is composed primarily of mucus and living skin cells but also contains small fibers that provide structure to the layer. Next is the fiber network (or reticular layer), which is composed of collagen fibers and mucus that helps bind the fibers together and serves as a pathway for nutrients and amino acids that build the fiber network. At the microscopic level this fiber network appears as a three-dimensional structure of interwoven fibers and fiber bundles that gives them strength, flexibility, and other properties that make them ideal material for a variety of everyday uses (Richards 2004:28-30; McConnell 2011; Thompson 2011:3).

At its most basic level, processing hides involves a series of techniques that replace the organic components that support their fibrous structure with artificial components. These techniques can be conceptualized in two basic stages. The first is isolation of the fibrous structure of the skin by removing unnecessary layers. Isolating this structure, however, only removes unwanted portions of the hide (e.g., hair) and components of the hide (e.g., flesh, grain, mucus) that promote decay and/or prevent the application of curing and tanning techniques. These layers were the organic system that supported the fibrous structure and must be replaced or it will be susceptible to decay and the elements. Thus the second stage of hide processing preserves the fibrous structure by
replacing its organic support network with an artificial one. This can be done by curing (relatively temporary) or tanning (relatively permanent) procedures. Following Thomson (2011:6) curing is defined here as an expedient method of preserving hides by drying them or applying salt or acids to prevent the fiber structure from decaying. Tanning on the other hand provides a more permanent method of preserving hides by applying oils, fats, or other substances that protect and bind their fibrous structure. These preserve hides by preventing water from being permanently absorbed into the fibrous structure and causing decay.

The first stage of isolating the fibrous structure is often referred to as fleshing (e.g., Schultz 1992:334). Removing the flesh first is important because it is one of the components of skin most susceptible to rot. This is done in eastern North America and many other regions by laying a fresh hide over a thick log beam or pole set in the ground at an angle and scraping the flesh off with a "beamer" or "flesher" (see e.g., Baillergeon 2011: Figures 5-16). Beamers are long flattened-edge tools held with the hands at either end while using the mid-section of the tool to scrape. Fleshers are single-handed tools with a relatively narrow flattened or spatulate working edge on one end.

With the flesh removed, the hair, epidermis and grain are next. Before removing these layers the skin can either soaked or dried. Soaking in water or an alkali (e.g., wood ash) solution was very common because it causes the skin to swell up as it absorbs the solution, which makes the grain (upper) layer to be removed more visible. Second, saturation with water helps remove mucus from the fibrous layer. Removal of the mucus is important because it can lead to purification and can prevent the fiber layer from
absorbing the desired artificial replacement solution during the tanning stage (Richards 2004:33-34).

While most references indicate hides were soaked before removal of the hair, epidermis and grain (e.g., Lawson 1966[1709]:208; Howard 1981:59; Hudson 1976:266-267), there is also evidence hides were dried before processing (e.g., Yerkes 1987:133). Richards indicates that hides are more difficult and time consuming to process after they have been dried (2004:51). It may be the case that hides were dried before processing when they could not be soaked immediately after skinning and fleshing. An example would be during seasonal hunting trips when relatively constant movement and other technological restrictions may have made it difficult to process hides beyond fleshing and drying.

Removal of the hair, epidermis, and grain usually all take place at the same time. This was done by either draping the hide over the same log used for fleshing (e.g., Howard 1981:59), or by fixing it in place by staking or lashing it onto a wooden frame (e.g., see contributors to Biallergeon 2011). In some cases, such as Howard’s account of Shawnee hide processing, the hide was draped over a log to remove hair, but then strung up on a wooden frame to remove the grain (1981:59). A variety of scraping tools are known from archaeological and historical sources. These include expediently-produced bone, stone, or even wood implements with an appropriately sharp (but not too sharp) working edge (e.g., Hudson 1976:266; Yerkes 1987:Figures B-6 to B-16). More formalized tools such as hafted endscrapers have been documented at Paleoindian through Historic Period sites (see Chapters 7-9). Metal scrapers have been
documented from a variety of historic contexts (e.g., Lawson 1966[1709]:208; Baillergeon 2011: Figures 17-20).

After all components but the fibrous layer have been removed, the hide is then wrung out to remove any excess water or mucus. This prepares the fibrous layer to sufficiently absorb the tanning solution designed to replace the mucus and protect and bind the fiber structure. While many oil and vegetable based tanning solutions are known (e.g., Lawson 1966[1709]:191; Baillergeon 2011), one of the most commonly cited in eastern North America is to use the brains of the animal being tanned (e.g., Lawson 1966[1709]:208; Hudson 1976:267; Howard 1981:59). In fact, this method is so common that it is simply referred to as “braining” by Schultz (1992:334,339). Various methods such as pounding, rubbing, and soaking are used to saturate the hide with the tanning solution to ensure maximum absorption (see e.g., Baillergeon 2011). Sometimes implements such as shell and other broad hoe blade-like surfaces were used to rub or work tanning solution into the hide, and also to wring or “strip” the remaining solution from the hide after it has been worked sufficiently (Lawson 1966[1709]:208; Schultz 1992:334). Hides could also be stretched onto a frame to dry as a way of removing excess solution (e.g., Hudson 1976:276).

The final stage of hide processing that was widely practiced in eastern North America is hide smoking (Binford 1967). Smoking adds additional preservative qualities to hides that have been oil- or vegetable-tanned. Smoke impregnates the skin with resins that prevent the glue-like collagen bonds of the fiber structure from setting up and stiffening the hide. Like the oils used in tanning, resins provide an artificial replacement for the mucus that naturally protects the fiber structure of skin (McConnell 2011:138).
Howard describes a Shawnee example of hide smoking that is representative of many accounts from the region: “Mary Spoon smoked her hides by making a small fire of corncobs, then placing the hide, sewed into a conical shape, over this” (1981:59). Hudson adds that, among the Natchez, corncobs used as hide smoking fuel were placed in a shallow pit and a small dome of saplings was stretched over it to receive the hide (1976:267). Binford (1967) describes archaeological examples of small pits filled with charred corncobs from several contexts throughout eastern North America. Given their size (small) and contents (charred corn cobs, wood or bark), there is good reason to believe features of this type represent hide processing activities.

Curiously, despite the great deal of background information available to develop a detailed set of middle range expectations for hide production, very few studies have compiled this information to model the organization and intensification of hide production in eastern North America (but see Lapham 2005). Most archaeologists continue to focus on changes in consumption patterns of nonlocal goods as a proxy for inferring changes in production, while others have the advantage of historic accounts from their study area (e.g., see contributors to Brose et al. 2001). These approaches have been informative, but neither are used in the present study. The Fort Ancient region does not have the luxury of (specific) historical accounts for background information. Also, a potential deficiency of using consumption patterns as a proxy for production intensification is that it does not tell us anything directly about the organization and intensity of production. The benefit of a world systems framework is that it urges us to take the analysis beyond identifying economic articulation (i.e., consumption of nonlocal goods), to a direct examination of production. Therefore, the present study outlines a
a set of expectations to evaluate the degree to which hide production may have intensified through time at the study site. It is to this subject which we now turn.

**Modeling the Organization and Intensity of Craft Production Systems**

The primary goal of the present study is to describe and compare diachronic trends in hide processing at a single community. Therefore, a theoretical framework that was specifically suited for these two goals (description, comparison) is necessary. Archaeological literature on craft production meets these needs, and can be divided into two themes or issues of relevance to modeling changes in production: the distribution of artifacts in space (i.e., the spatial organization of production) and their quantity (i.e., intensity). Because this literature is broad, only the relevant sources will be considered. The framework used in this study for analyzing craft production systems draws heavily on Mesoamerican craft production and household archaeology literature (e.g., Santley et al. 1989; Arnold 1991; Bey and Pool 1992; Santley and Hirth 1993; Hruby and Flad 2007; Pool and Bey 2007; Hirth 2009; see also Muller 1997:296-300).

The identification of spatial and material correlates of craft production and associated refuse disposal have a long history in Mesoamericanist archaeology (e.g., Feinman 1980, 1982; Hayden and Cannon 1981; Killion 1987, 1990). One focus of this body of research has been identifying the material correlates of production intensification. An early scheme for modeling production intensification was outlined by Santley et al. (1989:108-110; after van der Leew 1976; Peacock 1982; see also, Santley and Kneebone 1993; Santley 2007:79-84). Santley et al.’s scheme divided production intensification into four modes or arrangements which describe how production entities
change in their spatial and material dimensions as production intensifies. From least to most intensive these were: household production, household industry, workshop industry and nucleated industry/manufactory (Santley et al. 1989:108-110). Table 1-1 provides expectations for 11 different dimensions used to define each mode (adapted from Santley and Kneebone 1993:Table 1). In the remainder of this section the household production and household industry modes are described and applied to examine craft production during the Late Prehistoric Period in eastern North America. This exemplifies the model’s utility for the present study and provides background information about the region’s craft production systems.

The vast majority of craft production in eastern North American prehistory would fall under the least intensive mode: household production (Muller 1997:289-353). This mode is non-specialized production undertaken by every household for its own consumption (Santley et al. 1989; Santley and Kneebone 1993). Production intensity is low because it need only maintain the household inventory. Product quality may vary because items are made for direct consumption, are not subject to standards or expectations external to the household, or because they are seldom produced. With some exceptions production is incorporated into everyday routines employing the same work areas and tools used for other tasks. Given the low output, production residues are minimal and are discarded along with other household refuse. Previous research indicates that utilitarian goods, such as ceramic vessels and lithic implements, were produced by all households whether in hamlets and small villages (e.g., Prentice 1985), or larger towns like the Mississippian Period Angel Site (McGill 2013). Even some nonlocal exchange goods such as shell beads and chert hoe blades once thought to be
restricted entirely to elite producers (e.g., Mason and Perino 1961) have, upon scrutiny, been demonstrated to be produced at both large political centers like Cahokia and rural farmsteads (e.g., Prentice 1983; Muller 1997). However, the production of some craft goods (e.g., display goods – see below) does appear to be restricted to larger scale settlements and/or particular contexts, which is a type of production that does not meet the expectations of the household mode of production.

If demand for craft products exceeds that needed to replace a household’s inventory, production is expected to intensify. This mode of production is called a household industry (Santley et al. 1989; Santley and Kneebone 1993). Goods produced at the household industry level of intensity are sufficient to meet internal household needs as well as for exchange. External demands may require adjustments to the work regime to provide goods at specific times, and product quality may become more standardized to meet external consumer expectation. Increased production may require shifts in the use of activity areas and produce enough refuse to require changing disposal location from primary to secondary refuse areas to reduce hindrance potential (see Santley 1992 for discussion).

One example of a household industry among Mississippian societies would be production of hides and furs for colonial exchange during the contact period (Kardulias 1990, 2007; Hollis 2004). For the most part this industry remained organized at the household level and employed technologies, facilities and work regimes similar to that required for meeting household needs. However, historic accounts and archaeological case studies indicate several aspects of hide production entities changed to produce goods for consumption beyond household needs (e.g., Lapham 2005). These include increased
quantity and quality of goods produced, new sources and levels of demand and the
introduction of new exchange mechanisms, and adjustments to work regime and
production context (see Table 1-1). Historical accounts indicate that intensification of
hide production among some Native groups became so great that some households
reorganized their settlement and subsistence systems to accommodate long term hunting
seasons that could maximize the quantity of hides produced (e.g., the Creek; see Braund
1993:61-80). Because hide production is the central focus of the present study, the
description of each variable and the associated material correlates is provided below in
the model developed for the present study (see Chapter 10).

Late Prehistoric salt production is another example of a household industry in
eastern North America. During the Mississippian Period (after ca. A.D. 900), the uneven
distribution of salines throughout the eastern North America required travel to salines to
carry out salt processing activities (Keslin 1964; Brown 1980, 2004, 2010; Muller 1997;
see above). In addition to requiring temporary relocation from permanent settlements,
salt processing required special facilities (e.g., hearths for evaporating saline solution)
and equipment (salt pans, briquetage) (e.g., Muller 1984, 1997; Eubanks 2014). Muller
(1984) has referred to this as site specialization because salt can only be produced in
certain locales. The presence of residential structures at some (e.g., Muller 1997:), but
not all (e.g., Brown 1999) salt processing locales in eastern North America indicates a
range of variation in how its production was organized spatially, and how it influenced
the regime of other production activities. Brown (1999:135-140) has suggested that most
salt production was a seasonal undertaking, largely for individual household consumption
and possibly limited exchange - views consistent with Santley et al.’s (1989) definition
of a household industry. Likewise, there is evidence households and communities intensified production of a variety of other exchange items during the late Prehistoric Period in eastern North America. Examples in the literature are consistent with the household industry mode of production. Most were resources and raw materials whose distribution is uneven on the landscape such as high quality chert, marine shell and some game and wild resources (see, e.g., Prentice 1985; Cobb 2000:190).

One type of production documented in eastern North American that does not fit well into Santley et al.’s scheme is for some non-utilitarian items (e.g., ritual paraphenelia, ornaments, etc.; hereafter referred to as display goods after Marcoux 2007). Many examples of display goods production have been documented in eastern North America. Production of display goods was low intensity (like household production), but differs in that production of display goods took place in special contexts such as communal structures and may have been limited to a restricted social segment. Likewise, consumption was often limited to a specific social segment (e.g., age, gender, experience) or for use in specific contexts (e.g., mortuary ritual, public events). In Fort Ancient communities, the production of at least some display goods was restricted to public or communal structures (e.g., Cook 2008; Ahler and Stoner 2010; Pollack and Henderson 2015).

Among Mississippian societies to the southeast, the production of some display goods is also restricted to specific contexts such as elite platform mound residences at Moundville (Knight 2004; Marcoux 2007) and a copper workshop at Cahokia (Chastain et al. 2011). However, the association of display goods and/or debris from their production with elite contexts such as platform mounds does not necessarily
demonstrate elites manufactured display goods. A more direct indicator of elite manufacture of display goods would be the association of production implements with elites in mortuary contexts.

**Discussion**

For the most part, specialized commodity production such as salt and display goods production meet the criteria of Santley et al.’s household mode of production because production intensity is typically low, but they take place in specific contexts outside of most residential activity areas. In such cases production refuse will be absent from typical residential contexts where evidence for most production activities can be found. In addition, production tools and facilities tend to be specialized and deposited in non-residential contexts. This presents a problem for the rigid typological structure of Santley et al.’s scheme, because it ties each level of production intensity to specific expectations about the use of space, the location and complexity of production entities and tools, and the quantity and quality of refuse and its disposal.

Recognizing the shortcomings of this rigid typological structure, more recent models have examined the relationship of production intensity to other variables as part of a continuum rather than fixed to a particular level of intensity (Pool 1992, 2003:56-58; Pool and Bey 2007; Costin 2001). While it holds true that some aspects of production intensification do result in a somewhat predictable material pattern (e.g., quantity of refuse), not all dimensions of a production system can be predicted by its level of intensity. Viewing the relationship between intensification and some dimensions of production entities as untethered is useful because it accommodates a greater range of
production entities through space and time. A growing body of literature has been focused on the relationship between craft production and various facets of society, such as political context (e.g., Costin 1991, 2001; Hirth 1996), social identity (Brumfiel 1998; Costin 1998) and performance / social reproduction (Spielmann 2002; Brumfiel and Nichols 2009; Miller 2015). While these have produced meaningful results, the present study draws primarily on older typological schemes because they are a strong source of middle range theory that relates production intensification to specific material pattern (see Chapter 10).
Table 1-1.
Dimensions (Variables) used to define modes of craft production (adapted from Santley and Kneebone 1993:Table 1).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>HOUShold PRODUCTION</th>
<th>HOUSEHOLD INDUSTRyY</th>
<th>WORKSHOP INDUSTRY</th>
<th>MANUFACTORY OR FACTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of specialization</td>
<td>None; production aimed at replacing household goods</td>
<td>Part-time specialization</td>
<td>Full-time specialization</td>
<td>Full-time specialization</td>
</tr>
<tr>
<td>Context of production</td>
<td>Farming household</td>
<td>Farming household</td>
<td>Special shop</td>
<td>Special shop or building complex</td>
</tr>
<tr>
<td>Size of production entity</td>
<td>Small</td>
<td>Small</td>
<td>Intermediate</td>
<td>Large</td>
</tr>
<tr>
<td>No. of goods produced</td>
<td>Few</td>
<td>Few</td>
<td>Intermediate</td>
<td>Many</td>
</tr>
<tr>
<td>No. of different types of goods produced</td>
<td>Same as household’s inventory</td>
<td>Same as household’s inventory; some specialization in types of goods produced</td>
<td>Variable depending on local demand</td>
<td>Variable depending on local and regional demand</td>
</tr>
<tr>
<td>Work regime</td>
<td>Serial use of space</td>
<td>Serial use of space except near craft facilities</td>
<td>Activity segregation within shop room</td>
<td>Extreme activity segregation with groups of specialists performing different tasks in different places</td>
</tr>
<tr>
<td>No. of facilities</td>
<td>Few</td>
<td>Few</td>
<td>Present in shop room or outside workshop</td>
<td>Many facilities for all stages of the production process</td>
</tr>
<tr>
<td>VARIABLE</td>
<td>HOUSEHOLD PRODUCTION</td>
<td>WORKSHOP INDUSTRY</td>
<td>MANUFACTORY OR FACTORY</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>Distribution of production loci</td>
<td>Throughout settlement</td>
<td>Throughout settlement</td>
<td>Location determined by access to labor, transport nets, resource deposits, or waste disposal loci</td>
<td></td>
</tr>
<tr>
<td>Product quality</td>
<td>Variable</td>
<td>Variable but may be standardized</td>
<td>Highly standardized</td>
<td></td>
</tr>
<tr>
<td>Mode of waste disposal</td>
<td>In general household trash</td>
<td>Special dumps in household contexts, or in general household trash</td>
<td>Different kinds of special dumps in nonresidential contexts; dumps may be very large in size</td>
<td></td>
</tr>
<tr>
<td>Type of Exchange</td>
<td>None</td>
<td>Reciprocal or monetary exchange at production site may involve middleman</td>
<td>Middleman exchange</td>
<td></td>
</tr>
<tr>
<td>Location of demand</td>
<td>Local settlement</td>
<td>Local settlement primarily; some regional trade</td>
<td>Regional and macroregional trade; some exchange locally</td>
<td></td>
</tr>
</tbody>
</table>

Table 1-1 (continued)
Chapter 2

Prehistoric and Historic Context

Prehistoric Context

Fort Ancient (Figure 2-1) developed in situ from Late Woodland precedents during the 10\textsuperscript{th} and 11\textsuperscript{th} centuries (Cowan 1987:9-10; Griffin 1992:53; Pollack and Henderson 1992a:282, 2000:210-215; Sharp 1996:166). Subsistence was based on swidden horticulture, hunting, and collecting. Society was structured by kin and other social segments (after Keesing 1975:9-16; Griffin 1992:53). Patterned distributions of artifacts from several sites have been interpreted as evidence of dual or multiple social divisions (Dunnell 1983; Drooker 1997:280; Cook 2012). Fort Ancient political organization has been characterized as tribal; wherein political relations are largely determined by kinship structure. As is the case in most tribal societies, age, skill and accomplishments also played a role in the assignment of special purpose/situational (e.g. warfare, ritual) leadership positions (i.e., “rank”, after Fried 1967:109). A variety of social roles have been inferred based on the association of grave goods, but none have strongly suggested the presence of permanent / ascribed social ranking in Fort Ancient society (Griffin 1992; Drooker 1997:279-280; Henderson 1998; Cook 2008, 2014; but cf. Drooker 2000:257). (for this section see also:Cowan 1987:19-23; Griffin 1992; Pollack and Henderson 1992a; Drooker 1997:279-280; but cf. Cook and Fargher 2008).

Models of Fort Ancient cultural origins have tended to emphasize either in situ development (e.g., Essenpreis 1978; Pollack and Henderson 1992a:283-284) and migration from or emulation of nearby Mississippian societies (e.g., Griffin 1943:257-258; Prufer and Shane 1970:258-262; Robertson 1980:77-78; Cook 2008). Over time
there has been a general shift in how Fort Ancient origins have been viewed (Cook 2008:40); migration and diffusion were emphasized in the mid-20<sup>th</sup> century, internal development was emphasized in the late 20<sup>th</sup> century, and today attention is once again being given to the role of migration and diffusion. For example, recent efforts by Cook and colleagues have explored the influence of Mississippian migration and diffusion on the development of Fort Ancient culture before A.D. 1400 (see Cook 2008; Cook and Fargher 2008; Cook and Schurr 2009; Cook and Comstock 2015; Cook and Price 2015). Fort Ancient interaction with neighboring cultures (including Mississippian) was present but varied throughout the A.D. 1000-1680 time period, so there is no question that they were influenced by these interactions (Pollack et al. 2002). At the same time, a sequence of development from local material cultural precedents has been established in most areas of Fort Ancient settlement (see above).

The Fort Ancient settlement system was based on a cycle of abandonment and re-occupation of selected locales (Nass 1988; Henderson 1998; Raymer 2008, 2014). This is indicated by the presence of stratified Fort Ancient components at most site locations. It has been estimated that most components represent a few decades of occupation, though length of occupation may have increased through time (Pollack and Henderson 1992a:287). This pattern is consistent with swidden horticultural system (Raymer 2008), which requires rotating between fallowed and used fields in the vicinity of settlements. Once all fields within a use-area were exhausted, the settlement locality was abandoned to allow soils to regenerate sufficiently before reuse. The time elapsed between components at Fort Ancient settlement locales ranges from less than a century to several centuries.
Fort Ancient settlement patterns show clear changes through time. Most early settlements were small linear or random clusters of dwellings and associated activity areas (but cf. Cook et al. 2015). By the 12th century most settlements consisted of a vacant central plaza encircled by concentric mortuary, residence, and activity/refuse disposal zones (Figure 2-2; Graybill 1981; Drooker 1997:72-76; Pollack and Henderson 2000). By the 13th century, house architecture, ceramic and lithic forms, and other material culture patterns identified as “Fort Ancient” were present throughout much of middle Ohio Valley and into parts of the upper Ohio Valley (Figure 2-1). A few villages were palisaded, but mostly along the border of the Fort Ancient area (Raymer and Moore 2011; Cook 2012; Moore and Raymer 2014:Figure 1). Fort Ancient communities also engaged in interaction networks that linked them to many nearby regions (Figure 2-3).

Fort Ancient relations with neighboring groups varied widely at this time. They lived in multi-ethnic villages with Castor people in central Indiana (McCullough et al. 2004; McCullough 2010), Mississippian people in the Falls of the Ohio area (French 2010; Ramsey 2010), and Ridge and Valley and/or Radford people in southern (Fuerst et al. 2010) and possibly central (Spencer 2011) West Virginia. While Fort Ancient multi-ethnic interaction in central Indiana and southern West Virginia appear to be the result of expansion into other ethnic territories, there are also examples of outsiders moving in small groups into Fort Ancient territory in southwestern Indiana (e.g., Cook 2008) and the southwestern periphery of the Kentucky Bluegrass area (Fuerst et al. 2010; see also Henderson 2008:781). As indicated in Figure 2-3, a variety of trade relations also connected Fort Ancient people with a large area of the midcontinent (see also, Drooker 1997:72-76).
Sometime between the late-14\textsuperscript{th} to early-15\textsuperscript{th} century numerous changes occurred in the mid-Ohio Valley. Settlement patterns shifted dramatically beginning in the late 14th century (Figure 2-4; McCullough 1997; Nolan and Cook 2010; Maslowski 2011:41; Davidson 2012). Villages and there were located mainly in the bottomlands along the Ohio River and its larger tributaries (“villages” area in Figure 2-5; Henderson et al. 1992; Pollack and Henderson 2000; Redmond 2000:429; Drooker and Cowan 2001:90; Maslowski 2011:41). Current settlement data suggests areas that had been expanded into during the 13\textsuperscript{th} and 14\textsuperscript{th} centuries (e.g., south-central Indiana) were no longer used for village settlements, but continued to be used for special purposes (“camps” area in Figure 2-5).

Data for site plans from 15\textsuperscript{th} century settlements is relatively limited, but available data indicates communities maintained a circular layout of residences around a central plaza (cfc. Henderson et al. 1992:269; see also Chapter 4). Substantive changes include an increase in the size of residential structures (e.g., Dunnell et al. 1971; Pullins et al. 2008; Ahler and Stoner 2010), and the cessation of mound construction (Henderson et al. 1992:270). Where earlier Fort Ancient communities disposed of refuse in abandoned house basins and pits, in the 15\textsuperscript{th} century people began to dispose of refuse in dispersed midden areas, and large, shallow overlapping basins, and gullies (e.g., Dunnell et al. 1971; Glowacki et al. 1993). Recent investigations of the early Late Fort Ancient components at Fox Farm and Petersburg indicate that house basins continued to be used for refuse disposal (David Pollack, personal communication 2015; see also Chapter 4). The larger houses from this time have been interpreted as multi-family residences, which may imply shifts in social structure and the organization of labor (Hanson 1975:18;
Small Fort Ancient fall-winter camps dating to the 15th century probably housed several families (Brose and White 1983; Purtill 1999; Riordan 2000; Mickelson 2001). This could be an indication that villages dispersed during part of the year into smaller settlements, perhaps determined by their longhouse or household affiliation. Evidence of limited Late Fort Ancient re-occupation of localities otherwise dating primarily the 11th-14th centuries have also been taken as evidence of this settlement system (e.g., Carmean 2010:91-93). In this scenario, village localities occupied in previous centuries would have been re-used for seasonal (or special purpose) occupation. This might suggest a shift toward a hunting focus at the expense of horticulture sometime before the late Late Fort Ancient Period (Drooker 1997:280). However it is important to note that there is some evidence of seasonal abandonment of Middle Fort Ancient sites (e.g., Schurr and Schoeninger 1995:330; Wagner 2008), so any shift toward this pattern during the Late Fort Ancient Period may be one of degree rather than kind.

Interaction patterns intensified during the 15th century (Drooker 1997:39-62; Drooker and Cowan 2001; Pollack et al. 2002; Maslowski 2011:36-54). Within the Fort Ancient region the collapse of ceramic stylistic variation into a single region-wide pottery series has been interpreted as a consequence of intensified intra-regional interaction (Henderson et al. 1992:267). This is consistent with the pattern of aggregation into larger communities located in an attenuated village settlement zone. The term Madisonville Horizon is often used to describe the simultaneous homogenization of Fort Ancient
pottery and coalescence of people into larger communities during the Late Fort Ancient Period beginning in the 15th century (Cowan 1988; see also Graybill 1988).

Interaction between Fort Ancient and external groups appears to have expanded and intensified beginning in the 15th century (Figure 2-6; Henderson et al. 1992:270; Pollack et al. 2002:210). Fort Ancient people intensified relations with communities in the lower Ohio Valley (Pollack et al. 2002), West Virginia (Spencer 2011), northern Ohio (Abel 2015), and southeastern Ohio (Carskadden and Morton 2000; Church 2001). In the Fort Ancient region, the intensity of these relations is indicated by the adoption of new ceramic forms, decorative motifs and surface treatments, architecture, burial treatments, and ritual symbolism (Pollack et al. 2002; French 2010; Spencer 2011; Cook 2012).

Relations with more distant contacts also intensified during this time. Non-local goods recovered from Fort Ancient sites also speak of interaction with Dallas Phase Mississippian groups to the southeast, Oneota to the west-northwest, Monongahela and Susquehannock to the northeast, and others (Drooker 1997:39-62; McCullough 1997, 2010; Pollack et al. 2002; Davidson 2014). In addition to encompassing a wider range of contacts, some have suggested the Fort Ancient nonlocal interaction sphere also intensified beginning in the 15th century (see above). However, as Drooker pointed out two decades ago (1997:48), the periodicity and nature of Fort Ancient external interaction still lacks quantitative diachronic analysis.

A major factor that impacted Fort Ancient lifeways beginning in the late 14th century was environmental instability of the Neo-Boreal Climatic Episode, which consisted of unpredictable fluctuations in temperature and moisture that significantly impacted food production (see also, McCullough 1997:75-85; E. Cook et al. 1999).
Nolan and Cook (2010) have argued that intensive external interaction during the Late Fort Ancient Period was an attempt by Fort Ancient people to strengthen links upon which they could depend in times of subsistence uncertainty. Others have suggested that the aggregation of communities into larger settlements and the adoption of multi-family dwellings may also have been a response to climate change (Hollinger 1995:154-158). Aggregation, it is argued, would increase the ability to pool labor for more intensive (or extensive) horticulture to buffer crop failures. While environmental circumstances surely played a role in shifting late Fort Ancient settlement and interaction patterns, a correlation of the two does not demonstrate a causal relationship, nor does it rule out many variables that have yet to be examined by systematic research.

Environmental change has also been used to explain the abandonment of most Mississippian settlement areas to the west and south by the 15th century (Williams 1990, 2001; see also Cobb and Butler 2002). With an already large internal periphery (i.e., “camps” area, Figure 2-5), this gave Fort Ancient people had access to an even more expansive resource extraction zone. A variety of raw materials including chert, cannel coal, and pipestone could have been used in exchanges for non-local goods. Other abundant resources included game and salt (Brown 1980; Henderson et al. 1992:276, Pollack and Henderson 1992b). The mid-Ohio Valley is one of the principal saline areas of eastern North America, a situation which has been used to suggest Fort Ancient people produced salt for long distance exchanges (Brown 1980:Fig.1; Boisvert 1984:31; Pollack and Henderson 1992b). There is suggestive but inconclusive evidence of salt production at Fort Ancient sites post-dating A.D. 1400 (Brown 1980:83-84; Boisvert 1984:31-34; Pollack and Henderson 1992b). So while salt has been posited as a trade item because it
is rare elsewhere, this hypothesis has not yet been examined beyond identification of possible tools used in processing.

**Protohistoric and Historic Context**

A variety of changes initiated in the 15\textsuperscript{th} century appear to have continued into the 16\textsuperscript{th} to late 17\textsuperscript{th} centuries. During this time the Atlantic and Gulf Coasts and the Great Lakes began to sustain increasingly permanent and numerous European colonies (Figure 2-7). Despite a great deal of circumstantial historical data, there is no strong archaeological evidence of direct interaction between Fort Ancient people and colonists (see e.g., Drooker and Cowan 2001:99; Drooker 2002; Warren 2014). Changes in settlement trends during this time include the continued growth of villages and domestic structures (Graybill 1981:167; Pollack and Henderson 1984:19; Holmes 1994:54; Ahler and Stoner 2010; Davidson 2012). The average size of post-A.D. 1550 structures is greater than 100 square meters at Hardin and Buffalo (Hanson 1966, 1975; see also, Shaffer 2014:58 for a recently excavated late Late Fort Ancient structure of this size).

At the Goolman site in central Kentucky a ring of several small dwellings encircles a larger communal structure. Botanical remains indicate the settlement was a seasonal / winter camp occupied by several families (Turnbow and Jobe 1984). This and other Fort Ancient localities with ephemeral Late Fort Ancient occupations (e.g., Carmean 2010:91-93) probably indicate the continuation of a possible shift toward greater use of seasonal settlements first documented in the 15th century.

The presence of non-local Native goods and the addition of European trade goods indicate external interaction remained strong during the 16\textsuperscript{th} and 17\textsuperscript{th} centuries. The
presence of European and Native non-local trade goods connected Fort Ancient people with colonial spheres all over eastern North America: the French in the Great Lakes, the Dutch and British on the north Atlantic Coast, and the Spanish on the south Atlantic and Gulf Coasts (Figure 2-8). Even though Fort Ancient people were acquiring and consuming European goods – like most nonlocal goods – they were used primarily for mortuary ritual. Some authors have argued that this indicates they had little impact on Native life (Drooker 1997; Henderson and Pollack 1999). However, though trade goods may have been used in the same context (mortuary) at most sites, the majority of European trade goods were interred with child burials (e.g., Holmes 1994). Since most nonlocal goods were typically buried with adults, this represents a clear shift in association that may indicate a new social function and/or meaning for at least some categories of trade goods. The reason for this shift in use has not been examined.

Long distance interaction and exchange involved very different risks and considerations during the Contact Period. The possibility of acquiring Old World diseases would have been a serious consideration, if Fort Ancient people were aware of the risk it presented. Historically documented trade paths connected the mid-Ohio Valley with most colonial settlement areas. This means Fort Ancient people could have engaged with Europeans and acquired disease directly. However, since many native territories were located between the mid-Ohio Valley and early colonies, it seems more likely down-the-line exchange systems would have brought disease into the region. Assessing these alternative possibilities has proven very difficult since fast-killing diseases are unlikely to result in skeletal lesions or remodeled bone (Drooker 2002).
It has been proposed that mass graves could be another criterion for measuring the impact of epidemic disease (Milner 1980; Smith 2002:260), but no Fort Ancient examples have been documented professionally (Drooker 1997:102, 208-209; 2002:131). Sites such as Augusta and Hardin in Kentucky (Henderson et al. 1992:276), Orchard in West Virginia (Moxley 1988:4), and Madisonville in Ohio (Cowan 1988:10-11) have been proposed as examples. However the Hardin and Madisonville examples have been discounted upon close examination (Holmes 1994:138-141; Drooker 1997:208-209), while the remainder were not documented professionally and lack sufficient information for evaluation. It should be noted that in addition to lacking systematic excavation or documentation, the Augusta example was also discounted as a mass grave by the professional archaeologist who examined the burial context (see Hale 1981:86-88; cfc Henderson et al. 1992:276).

Settlement patterns have been used in other regions to estimate the impact of disease. For example, in the Coosa paramount chiefdom (north Georgia/Alabama) settlements decrease in number but increase in size from the 16\textsuperscript{th} to late 17\textsuperscript{th} centuries (Smith 2002; Ethridge 2010:264-266). Marvin Smith (2002:262) notes that if the data on site size are accurate this pattern may indicate an attempt to maintain community size in the face of population loss. A preliminary study of Fort Ancient settlement patterns in central and northern Kentucky (also using state site files) found a similar pattern of increasing site size from the 15\textsuperscript{th} to late 17\textsuperscript{th} centuries. Villages dating A.D. 1550-1680 in the study sample were on average 5.2 hectares compared to 3.1 hectares for sites dating A.D. 1400- 1550 (Davidson 2012). Unlike the Coosa area however, there was an increase in the total number of Fort Ancient sites from 10 to 16 villages.
If Fort Ancient did bring contact diseases into the mid-Ohio Valley any of the major exchange/interaction corridors between the mid-Ohio Valley and European occupied areas are plausible routes for their transmission (see Figure 2-8). A good example of one route would be through their contacts in the Coosa chiefdom. Fort Ancient people had a long history of interaction with the southern Appalachian region and were almost certainly in regular contact with the Coosa when de Soto traveled through the chiefdom in 1540. Two of the most widely recognized protohistoric marine shell gorget types, Rattlesnake genre and Buffalo style, are highly concentrated in the Coosa area, and the latter are widely believed to have been produced by Coosa artisans (Brain and Phillips 1996; Hally 2007:221,226; Rodning 2012:46). This is significant because the mid-Ohio Valley exhibits the second greatest abundance of these two gorget types (Brain and Phillips 1996; Hally 2007:210-229).

Hally recently argued the large number of late gorgets documented in the Ohio Valley were probably transferred from their place of origin to the region by direct interaction “involving travel by one or the other, or by individuals specializing as long-distance traders” (2007:228; after Brain and Phillips 1996:400). Hally’s observations are important for several reasons. First, it illustrates that Fort Ancient people were regularly engaging with communities that had early and direct interaction with Europeans. By extension it implies a highly plausible disease vector because Coosa are thought to have been heavily impacted by European disease following de Soto’s trip through the area in 1540 (see above). Unfortunately, Fort Ancient settlement pattern data are not nearly as well understood as those for Coosa, and cannot currently be use as an indicator of disease-related demographic change.
Population displacement as a result of territorial conquest, slave taking, and raiding also influenced regions with which Fort Ancient had long term contact. A good example are the Late Prehistoric / Protohistoric horticultural groups (Whittlesey, Indian Hills) who occupied the south shore of Lake Erie in northern Ohio (Brose 1994:178-182, 2001). There is strong evidence of interaction between Fort Ancient and this region, especially in the late-16th to early 17th century (Brose 2001:58-59; Redmond and Ruhl 2002; Abel 2015). By the mid-17th century most of these people had been displaced by the Iroquois who sought control of new hunting grounds for the fur trade (Brose 2001a:58-59; Bowne 2005:49-52). Those who did not flee further west to Illinois and Wisconsin were either killed or incorporated into other nearby groups including the Iroquois and possibly Fort Ancient (Mazrim and Esarey 2007). Historic accounts of Iroquois activity in the Ohio Valley have been taken as evidence they proceeded to disperse Ohio Valley populations after claiming the territory along south shore of Lake Erie (White 1991; see also Drooker and Cowan 2001:100; Bowne 2005:52). A recently published account of an Iroquoian-held slave reportedly from the Ohio Valley adds new support to this idea (Warren 2014:57). However, no conclusive archaeological evidence has been documented to confirm these accounts (Drooker 1997:209-210; 2002).

Though it is somewhat speculative, one possible example of archaeological evidence of Fort Ancient captives in Iroquoia is the presence of several Madisonville Series-like pots with cut-out strap handles from the 1660s Seneca Dann site (Drooker 1997:104, 301). Current evidence indicates interaction between Fort Ancient and western New York Iroquois dates as early as the late 16th century, and has been interpreted by Drooker as evidence of early attempts by the Iroquois to establish trade relations with
Fort Ancient people (2002, 2015). The Dann Site was occupied almost a century after Fort Ancient - Iroquois relations were established. Importantly, it was occupied right after the Iroquois had dispersed Algonkian-speaking populations living along the south shore of Lake Erie. Some of these dispersed people likely migrated south into Fort Ancient communities, with whom they had a long history of interaction. Given this situation, it seems more likely the Madisonville Series-like pots from the Dann Site represent Fort Ancient captives (Griffin 1943:226-227) than they do peaceful relations (Holmes 1994:160), which were more characteristic of Fort Ancient - Iroquois interaction a century earlier. This example illustrates the circumstantial nature of data we currently have to evaluate the Iroquoian warfare model of Fort Ancient dispersal.

Even with more conclusive evidence for this model, continuous Fort Ancient occupation of the mid-Ohio Valley until at least 1680 indicates Iroquoian activity of any form during the mid-17th century did not result in immediate or widespread displacement.

It is now well-documented that during late 16th and 17th centuries massive epidemics, population displacement, warfare, and slave taking impacted regions with whom Fort Ancient communities had close ties. Gradually, these regions were absorbed into the colonial sphere while the mid-Ohio Valley seems to have been cushioned, perhaps only due to geography. Even so, it is still somewhat surprising considering the wide distribution of people with whom Fort Ancient interacted (Figures 2-6 and 2-8). Fort Ancient people must have been acutely aware of colonial developments abroad due to their geopolitical location (Alvord and Bidgood 1912; Olafson 1960; Griffin 1943:9-10; Henderson et al. 1986; Drooker 1997:47-48; Tanner 2006). The middle Ohio Valley was connected the north and south by large, historically documented overland
trails such as the Great Warrior Path (Myer 1928). They were connected west-east by the Ohio River and its many tributaries, as well as important Native trails through the Appalachian highlands (see Rountree 1993: Figures 1.2 and 1.3). The broad and largely depopulated area surrounding much of the Fort Ancient settlement area (see above) provided them with abundant resources to supply either Native or colonial markets.

Available research indicates the presence of east-west variation in the regions Fort Ancient communities targeted for interaction (Drooker 1996; 1997: Chapter 8). A strong case has been made that the Madisonville site, located on the western end of the Fort Ancient area, was an exchange hub that linked local Fort Ancient communities with Native settlements to the west (Drooker 1997:283-338). To contrast, the lesser-known eastern end of the Fort Ancient area may have had more intensive interaction with the colonial spheres to the east and south (Drooker 1997:337; Maslowski 2011:57-62). Large numbers of relatively late diagnostic trade goods have been recovered from several Fort Ancient sites in this area linking it to centers of colonial activity to the south and east through multiple trade corridors.

An attempt has been made in Figure 2-8 to illustrate some of the easterly trade corridors by which Fort Ancient accessed different Native-European colonial exchange spheres. As can be seen in Figure 2-7 each area represents concentrations of settlements backed by one or more different European states. Access to these various exchange spheres probably varied within the Fort Ancient region and through time, and information about this is relatively limited outside of various works by Drooker (e.g., 1997:326-337). So by necessity these maps are coarse-grained, but they do serve as useful starting points for conceptualizing these patterns. Since, as indicated above, there
is no direct evidence of Fort Ancient activity in colonized areas, at this point it can be assumed access to any of these regions would have been through intermediaries with whom Fort Ancient people were in direct contact.

An important omission from this map are routes to the somewhat later trade corridors that linked the middle Ohio Valley to the Native-European colonial interaction sphere centered on the western Great Lakes and the Mississippi Valley. This was omitted for two reasons. First, because the colonial interaction sphere of this region developed in earnest several decades later than those on the Atlantic and Florida Gulf Coasts (see Mazrim and Esarey 2007 for a recent overview). Second, since western Fort Ancient communities had relatively more intensive contact with this region, one could assume access to this exchange sphere by Hardin Village and other eastern Fort Ancient communities have been through western Fort Ancient intermediaries rather than through direct relations.

There are three general geographic corridors by which eastern Fort Ancient communities accessed Native-European colonial exchange spheres. Corridor 1 linked Fort Ancient people with French sources on the Great Lakes and St. Lawrence probably through Whittlesey or Indian Hills intermediaries. These groups, in turn, would have acquired trade goods from Iroquoian-speaking groups to the north and northeast (Jennings 1968; Lapham and Johnson 2002; Bowne 2005). Monongahela contacts directly to the northeast would have been an intermediary between Fort Ancient and Susquehannock, who controlled trade relations with European colonies in the Delaware Valley and the northern Chesapeake area (Johnson 2001; Browne 2005; Sempowski 2007). As many scholars have noted (e.g., Bowne 2005:44-53), much of the conflict
among Iroquoian people during the 17th century was over the struggle to control the flow of furs and skins from the interior. These conflicts appear to have resulted in shifting sources of European trade goods acquired by Fort Ancient and other residents of the Ohio Valley during the late 16th and 17th centuries (Drooker 1997; Johnson 2001; Lapham and Johnson 2002; Sempowski 2007).

Corridor 2 represents access to the Native-European interaction sphere on the mid-Atlantic coast. Fort Ancient access to this region would have been through groups residing in the Appalachian Highlands such as Monongahela, Intermontane and various protohistoric Mississippian cultural manifestations (see Fuerst 2005; Means 2007: Chapter 2; Meyers 2011: Chapter 2 for recent overviews). The northern arm of this corridor runs along the southern border of Pennsylvania and represents the historic Nemacolin’s Path which connected the upper reaches of the Ohio River to the Potomac (after Means 2006: Figure 2.4). The larger arm of Corridor 2 represents a combination of waterways and overland trails that connected southeastern Fort Ancient area to the mid-Atlantic colonies via Intermontane and Mississippian intermediaries.

Finally, Corridor 3 represents access to the colonial interaction sphere centered on the south Atlantic and Gulf Coasts. This colonial sphere of this region was primarily based on the Spanish mission system. It had an intermittent start as early colonies came and went in the late 16th century and intensified as the mission system became more established (Waselkov 1989; Waselkov and Smith 2000). The English finally established a foothold in the northern edge of this area with the founding of Charleston in 1670 (Milanich 1994; Beck 2009; Ethridge 2010). The distinction between the mid-Atlantic and the northern edge of the southeast is somewhat arbitrary since Fort Ancient people
most likely acquired trade goods from Appalachian intermediaries regardless of their place origin. One important distinction may be temporal since English trade goods predating the 1670s would originate in the mid-Atlantic while those post-dating the 1670s could have come from the South Carolina coast or the mid-Atlantic. This distinction could potentially be important since the intermediaries from whom Fort Ancient people accessed these colonial exchange spheres shifted over time.

Despite having a variety of long-distance exchange partners, the consequences of this interaction at Fort Ancient sites is ambiguous. Aside from new trade items and possible changes in settlement organization (see Chapter 4) the period 1550-1650 appears to be much like the preceding century. After about 1650 Fort Ancient settlements become increasingly sparse, and by 1700 they are absent. During this 50 year span, Madisonville Series-like ceramics, pipestone, and other artifacts sourced to the Ohio Valley or bearing resemblance to Fort Ancient materials (e.g., cut-out strap handles) appear at sites scattered across eastern North America. These include Seneca (Dann, Dutch Hollow), Susquehannock (Byrd Leibhart), possible Quapaw (Wallace Bottom), Shawnee (Riverfront) and Illinois (Zimmerman) sites (Kent 1984:377-379, Figure 105; Drooker 1997:104,301,319; Sempowski and Saunders 2001:170,258; House 2013; Whitley 2013:212-228; Mazrim 2015:48).

A variety of hypotheses have been proposed to explain the apparent depopulation of the Fort Ancient region including: European disease, warfare, environmental instability, and attraction to colonial markets (Baker 1988; Pollack and Henderson 1992a:290; Drooker and Cowan 2001; Drooker 1997:209-210, 2002; Henderson 2008:751; Jeter 2009). One popular theory is that Iroquois hunting or war parties
enslaved, killed or displaced Fort Ancient groups in an effort to expand their hunting territory and replace populations lost by contact disease. While an archaeological "smoking gun" is lacking (see Drooker 2002), this idea persists as a prime mover (e.g., Cook 2012:517-518; Lakomaki 2014). Its popularity among archaeologists is somewhat perplexing since it privileges ambiguous historical accounts over direct archaeological evidence of raiding and warfare (or the lack, thereof). An important potential avenue for evaluating this idea would be to examine the bioarchaeology of violence at Late Fort Ancient components dating after A.D. 1600 (e.g., Osterholt 2016).

It seems likely that a combination of the above scenarios stimulated Fort Ancient population dispersal, and they need not have had the same degree of influence among all Fort Ancient communities. Given the autonomous nature of tribal communities, they could easily have dispersed to other regions according to the varying political and economic ties (Drooker 1997; Warren 2014). An excellent example is the eastern Fort Ancient area, for which ties to southern Appalachia are present back to the 13th century (e.g., Applegarth et al. 1978; Fuerst et al. 2010). Artifacts of Native and European origin at Fort Ancient sites dating to the 16th and 17th centuries indicate ties to southern Appalachia in general, and possibly to the Coosa in particular (Drooker and Cowan 2001). Late-17th century trade goods (e.g., side-view brass animal effigies and copper arm bands) recovered from West Virginia Fort Ancient sites compare well to examples from Creek sites in Tennessee, Alabama, and Georgia (Drooker 1997:293; Drooker and Cowan 2001:103). By the end of the 17th century Fort Ancient villages are gone and some communities from the eastern Fort Ancient region may have relocated to live near the Creeks or other historical successors of the Coosa (Ethridge 2010; Warren 2014).
A variety of possible ethnic affiliations have been attributed to Fort Ancient (Griffin 1943; Prufer and Shane 1970:262-270; Henderson et al. 1992:277-278; Lakomaki 2014; Drooker 1997:103-106; Warren and Noe 2009; Warren 2014). Most have generally found Shawnee or other Algonkian speaking groups to be the most likely candidates (e.g. Pollack and Henderson 1984; Cowan 1987:30-31; Graybill 1988). Siouan-speaking groups are another strong candidate (Spencer 2006; Jeter 2009; Maslowski 2011; House 2013). Unfortunately, the lack of historic accounts of the region dating to the pre-Fort Ancient dispersal period precludes a definitive assignment (but cf. Alvord and Bidgood 1912). Given the strong evidence of inter-ethnic interaction along the peripheries of the Fort Ancient region it is most likely that the ethnic successors of Fort Ancient are represented by multiple linguistic groups (Warren 2014).

The most recent (and most comprehensive) effort to examine the historic successors of Fort Ancient was completed by Stephen Warren (2014; see also, Warren and Noe 2009). Warren’s model of Fort Ancient – Shawnee ethnogenesis builds a strong case by synthesizing recent Fort Ancient archaeology with historical accounts (including those reviewed by Griffin) and new ethnohistorical research of his own. The strength of his model is that it accounts for the various hypotheses which have been proposed for Fort Ancient dispersal and ethnic identity. Downplaying the role Iroquois raiding, Warren (2014:74) emphasizes instead that Fort Ancient utilized their widely dispersed exchange relations in eastern North America to help position themselves on the colonial periphery several decades before a substantial Iroquois presence in the Ohio Valley (but cf. Lakomaki 2014). Rather than positioning Shawnee as disparate bands of displaced people on the colonial periphery, Warren empowers them as agents of their own destiny.
who took advantage of the colonial sphere. One weakness of this model (not by any fault of Warren’s) is that terminal Fort settlement trends have not been documented well enough to specify the relative timing of Fort Ancient dispersal, early Shawnee settlement patterns abroad, and Iroquois activity in the Ohio Valley. We simply have too few detailed studies of Fort Ancient settlements dating after A.D. 1630, which may support Warren’s model but only by the rule of negative evidence.

**Discussion**

The Late Fort Ancient Period was a tumultuous time for Fort Ancient communities. The highlights include widespread settlement re-organization, environmental uncertainty, intensive internal and external interaction, the collapse and depopulation of adjacent regions. Aside from a few studies in recent decade (see above), relatively little research has focused on developing and testing specific hypotheses to examine relationships among these wide-ranging phenomena. A critical problem is that most of what we know is based on broad generalizations that have not been examined with intensive study at many individual sites. This underlines the utility of closely examining the hide production industry at the Hardin site. Not only will it set the stage for further evaluating the nature of contact period Fort Ancient interaction, it will provide a model that can be applied and tested at other Fort Ancient sites.
Stockaded villages date before and after A.D. 1400. See Moore and Raymer 2014 for more information.

Base map: Cartographic Research Lab, University of Alabama (2010), used with permission.

Figure 2-1: The Fort Ancient region at its maximum extent circa A.D. 1400. Adapted from Moore and Raymer 2014:Figure 1.
Figure 2-2: Example layout of a Fort Ancient circular village, showing functional zones as represented at the Slone Site in Pike County, Kentucky. With the exception of the central plaza, relative position of zones varies widely throughout Fort Ancient region. Figure adapted from Dunnell et al. 1971: Figure 28.
Figure 2-3: Fort Ancient interaction network, ca. A.D. 1200-1400. Base map adapted from Anderson 1991: Figure 3.
Figure 2-4: Contraction of Fort Ancient village settlement area, circa. A.D. 1350-1450. Basemap after Moore and Raymer 2014: Figure 1 and Drooker and Cowan 2001: Figure 8.6. Note that new information has resulted in slightly different pre- and post-15th century boundaries than those in Anderson’s base maps (1991: Figure 3 and Figure 5) used in Figures 2-3 and 2-5. Base map: Cartographic Research Lab, University of Alabama (2016), used with permission.
Figure 2-5: Generalized Late Fort Ancient settlement distribution, circa. A.D. 1400-1680. Showing Location of selected sites mentioned in the text. Base map: Cartographic Research Lab, University of Alabama (2016), used with permission.

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Figure 2-6: Fort Ancient interaction network, circa. A.D. 1400-1680. Base map adapted from Anderson 1991: Figure 5.
Figure 2-7: Cumulative distribution of selected European settlements and exploration routes circa A.D. 1500-1680. Sources continued on next page.
Figure 2-7 (continued)

Basemap: University of Alabama Cartographic Research Laboratory (2016), used with permission.

Other sources: Burpee 1927; Bailyn 1955; Hudson 1990; Clark and Rountree 1993; DePratter 1994; Milanich 1994; Worth 1994; Steele 1994; Beck 2009
Figure 2-8: Primary trade corridors by which Fort Ancient engaged (indirectly) with eastern colonial areas, ca. A.D. 1500-1680.

Basemap: University of Alabama Cartographic Research Laboratory (2016), used with permission. Sources: Rountree 1993a Fig.1.3; Drooker 1997; Lapham and Johnson 2002 Fig.4; Bowne 2005: Chapter 1, 3; Means 2006:Fig 2.4
Chapter 3

The Hardin Site Locality

Site Setting

The Hardin Site is situated on the south bank of the Ohio River where it cuts through the western edge of the Appalachian Plateau (highlands) physiographic province (Figure 3-1). It is a well-known multicomponent site referred to in the literature as "Hardin", "Hardin Village" and "the Hardin Site". The Interior Low Plateau is within a day’s walk from the site, as are several major river confluences and native trials, which places it at an important boundary area (Figure 3-1). This location also places the site at what appears to be an intra-ethnic boundary within the Fort Ancient region (Figure 3-2). Differences in material culture, settlement layout and mortuary ritual between eastern and western Fort Ancient settlement areas have been recognized since Griffin defined the Fort Ancient Aspect (1943; see also Mayer-Oakes 1955:155-227). Griffin suggested that east-west differences were present throughout the Fort Ancient sequence (1978:556, Figure 1), a distinction that continues to be recognized (e.g., Graybill 1984; Drooker and Cowan 2001; Spencer 2006; Pullins et al. 2008:120). Not surprisingly, the location of Hardin at the boundary of eastern and western Fort Ancient areas has resulted in its inclusion in archaeological phases for both areas.

Several authors (e.g, Dunnell 1961:34-36; Hanson 1975:93) have considered Hardin to be more culturally related to the eastern Fort Ancient people based on the presence of many traits originally used to define the eastern Fort Ancient Clover Complex (see Mayer-Oakes 1955:Table 5). Most of the traits central to Mayer-Oakes’s definition of Clover are now known to relate to a broad temporal and geographic range.
of Fort Ancient sites (e.g., ceramic disks, marine shell beads, fish hooks, triangular points). With better chronological control, many of these more general Fort Ancient traits have been removed from the Clover concept, which is now recognized as a post-A.D. 1400 eastern Fort Ancient Phase (Griffin 1978:556; Graybill 1981, 1988:24-30; Pullins et al. 2008:84). Even with this improvement, the attributes that once distinguished Clover Phase sites from contemporaneous Fort Ancient sites to the west continue decline in number. For example, most of the characteristics used to define the Clover Phase (e.g., disk pipes, European metal artifacts, thin strap handles, claw/tooth-shaped cannel coal pendants, ceramic bowl and pan forms) are now known to occur ubiquitously throughout much of the Fort Ancient region after A.D. 1400 (see Drooker 1997:76-102).

However, it is notable that a few Clover Phase traits are still more common in, but not exclusive to, the eastern Fort Ancient area. These include European glass beads, side-view animal effigy cut-outs, mask shell gorgets, shell ear plugs, simple stamped pottery, and pottery pestles. Of these, pottery pestles show a clear concentration at late Fort Ancient components in the northeastern Fort Ancient area and generally in the area Clover was originally defined (see Chapter 5 discussion of ceramic cylindrical objects). Though some archaeologists continue to refer to Clover as a meaningful archaeological construct (e.g., Pullins et al. 2008), it seems to have lost much of its original distinctiveness.

In recent decades, the Hardin Site has more frequently been included in the geographic boundaries of more westerly Fort Ancient cultural constructs. Most of these have simply included it based on proximity rather than new research (e.g., Griffin
1978:Figure 1; Graybill 1984:Figure 1). However, based on an unpublished re-analysis of some of the Hardin ceramic materials Henderson and Turnbow (1987) included the Hardin site in the northeastern Kentucky Montour Phase (dating A.D. 1550-1750), which by default identified it culturally with other more westerly Fort Ancient sites. Clearly the cultural affinity of the Hardin Site within the Fort Ancient region remains unresolved. This situation will not be resolved by the present study given its narrow chronological and analytical goals. However, some observations made by this study will be useful in pursuing this issue in future research. All that can be summarized at this point is that some previously recognized attributes link the site culturally to the east, others to the west. To add to this complicated picture, the presence of sandstone discoidals, burials inside structures, and the presence of porticoes on the structures at Hardin suggest definite affinities to the southeastern Kentucky/ western West Virginia Woodside Phase (Davidson 2012, 2014; see below). These varied cultural affinities are probably a testament to the location of Hardin at a geographic and cultural transition between the Appalachian Plateau to the east and the interior Low Plateau to the west.

The Ohio River and the flat expansive floodplains surrounding the site contrast markedly with the dissected upland ridgetops bracketing the horizon surrounding the site (Figure 3-3). The adjacent ridgetops are easily accessible less than a kilometer from the site. This location provided access to both upland and lowland/ riverine environmental zones provided the site’s inhabitants with a great variety of floral and faunal resources. Recent study of botanical remains from 2013 excavations (Lansaw 2014; Lansaw et al. n.d) indicate corn, beans and squash were supplemented by chenopodium and other minor cultigens, a pattern consistent with other Fort Ancient sites (Rossen 1992, 2010;
Rossen and Edging 1987). The identification of hickory and walnut in the same study indicates the adjacent upland areas were also utilized for collecting wild botanical resources. A notable identification by Lansaw’s study was the presence of one, and possibly two, types of tobacco. At least one type of tobacco was present in the Middle Fort Ancient and both Late Fort Ancient contexts.

Relatively little is known about the faunal exploitation at the Hardin Site. This is due in large part to the culling of faunal remains from the WPA collections. However, a small representative collection of non-artifact faunal material is curated still. Judging from this and the fauna represented by bone artifacts reported by Hanson we know that minimally deer, box turtle and turkey were probably the most common game procured (Hanson 1966:141-165). The collections indicate fish, mussels, beaver, raccoon, mountain lion, black bear and others were also taken at the site. Some of these, like bear, elk and mountain lion may have been more common at this site compared to less mountainous lowland Fort Ancient sites further west (Breitburg 1992:230-241).

Several notable animals represented in the WPA collections include two dog burials (Feature 20 and Feature 139), and a bison element (associated with Burial 225). The bison element was tentatively identified by the author and Bruce Manzano at the University of Kentucky Program for Archaeological Research by examination of attributes described by Olsen (1960). This identification was confirmed by Dr. Chris Widga at the Illinois State Museum who noted that it represents an ulna (see Appendix J, Figure J-1, top). Breitburg notes the near absence of bison remains at protohistoric Fort Ancient sites despite their frequent mention in 18th century Euroamerican accounts of the
region (1992:241). This apparent contradiction has been hypothesized as the result of epidemic-induced depopulation of the mid-continent just prior to Euroamerican colonization, which would have stimulated an eastern expansion of plains bison herds immediately prior to contact (Griffin and Wray 1945; Breitburg 1992:241).

However, more recent studies have identified bison remains associated with post-A.D. 1400 dates or Fort Ancient material culture at Big Bone Lick (Tankersley 1986, 1992; Widga 2006), LeBus Circle (Henry 2008), and the Hardin Site (Davidson 2014). This provides support for Breitburg’s idea that bison are sparse at protohistoric Fort Ancient sites due to sampling deficiency (1992:141). If bison herds were present in the middle Ohio Valley well before the 18th century, Griffin and Wray’s (1945) logic that depopulation (between the Illinois and Miami River Valleys) stimulated herds to move east may be correct. However, recent settlement pattern studies indicate earlier demographic shifts between the late 14th and late 15th centuries are a more likely stimulus for precontact bison migration (Williams 1990, 2000; McCullough 1997; Cobb and Butler 2002; Nolan and Cook 2010; Maslowski 2011:41).

The majority of the Hardin Site occupies a levee on the first terrace that is rarely submerged by annual flooding, while the surrounding floodplain below the levee typically has standing water several times a year. The floodplain surrounding the site is about 1.5 miles wide and consists of well-drained alluvial soil classified as Ashton silt loam (Hanson 1966:3; Hail et al. 1979; Holmes 1994:41). These highly fertile soils would have been one of many local environmental resources that stimulated horticultural communities to reoccupy this locality for hundreds of years.
Both the Hardin site and the Fort Ancient region are situated within one of the largest concentrations of saline springs in eastern North America (Figure 3-4; Brown 1980:11-19; Biosvert 1984). This is because the region overlies the largest rock salt deposit in eastern North America. Numerous localities (e.g., Big Bone Lick) and features (e.g., Licking River) within the region attest to the abundance of this resource. Its value as a trade product may have been magnified after A.D. 1400 with the fragmentation of nearby Mississippian population centers who once produced salt (Brown 1980:58-59; Muller 1984). The first appearance of pan forms in Fort Ancient ceramic assemblages around this time suggests Fort Ancient people could have absorbed the role of salt production (Pollack and Henderson 1992b:93; but cf. Muller 1997:308-332).

Archaeological and historical evidence indicate it was an important trade item well into the contact period (e.g., Hudson 1990:76-77; Eubanks 2014). The question of Fort Ancient salt production remains unresolved since pans have not been recovered adjacent to saline springs in the Fort Ancient region (Brown 1980; Boisvert 1984). This is problematic because salt processing facilities should be located in the vicinity of springs since it would be logistically very difficult to transport saline solution very far.

The bedrock geology of the site vicinity provided access to a variety of stone raw materials used by the site inhabitants (Figure 3-6). The deeply cut stream beds originating in the uplands near the site expose both Pennsylvanian and underlying Mississippian rocks. The Olive Hill Clay bed residing near the base of the Pennsylvanian system bears high quality plastic clay and flint clay (“pipestone”) (Patterson and Hosterman 1960). Pipestone objects manufactured from this material are typically attributed to the Fuert Hill outcrop near the confluence of the Scioto and Ohio Rivers (Wisseman et al.
However, samples were recently recovered from an outcrop immediately south of Fuert Hill in Kentucky, which indicates a closer source was available to the residents of Hardin. Regardless of the specific source employed, the Olive Hill Clay Bed is the same geologic formation that produced the Fuert Hill Outcrop (see Patterson and Hosterman 1960).

Below the lower Pennsylvanian rocks are exposures of chert in the Newman Formation of upper Mississippian rocks. Cherts in this formation exhibit wide variation in quality and texture. Abundant quantities of lithic artifacts made of Newman chert at the site indicate it was procured regularly for use in a variety of contexts (see Chapter 7). A natural source was identified approximately two kilometers west-southwest of the site. At this location, tabular blocks litter a deeply incised stream bed north of an exposure of Newman Formation rocks (Figure 3-5).

The site is situated within a day’s walk of several large river confluences that provided transportation and communication corridors to the surrounding cultural and environmental regions (Figure 3-6). The Scioto River confluence is located 12km upstream and would have provided access to communities in the northern extent of the Fort Ancient area, as well as to several cultural groups occupying the drainages flowing north into Lake Erie. The larger confluence with the Big Sandy River is located approximately 50km upstream to the south/east. The main upper reaches of the Big Sandy (Tug and Levisa Forks) provided access to the interior uplands of southeastern Kentucky and West Virginia, while the smaller upper reaches extend all the way to the western end of Virginia.
Immediately adjacent to the site are several smaller streams (Figure 3-6) that would have provided access to nearby Fort Ancient settlements in the dissected interior uplands of southern and southeastern Ohio and northeastern Kentucky. Several important overland trails also converge near the Hardin Site (Figure 3-7) and would have provided additional transportation routes to both local and distant regions.

**Research History**

**Before 1939**

The overall research history is presented in Table 3-1. Little was known about the Hardin Site before 1939. Despite its well-known status among locals, the site does not appear to have been documented by Funkhouser and Webb in their 1920s and 1930s survey work in Greenup County (e.g., Webb and Funkhouser 1928:318, 1932:152-157). An archaeological site survey form dated May 1938 at the Kentucky Office of State Archaeology is the earliest formal documentation of the site. No mention of professional work pre-dating 1938 is made on the form.

**1938-1939 Fieldwork**

Knowledge of the site’s 1938-1939 fieldwork was gathered by two primary and two secondary source documents. The largest primary source was field notes from the 1938-1939 WPA-funded archaeology at the site. These notes, curated at the William S. Webb Museum of Anthropology, are in excellent condition and contain meticulously recorded provenience information, illustrations, and descriptions of features, burials, a possible palisade and at least nine structures (see below). Most of these documents were digitized to aid in spatial analysis and collections research for present and future research.
The second primary source document was the archaeological site file which provided key information on the original 1938 site survey. Two secondary sources were also used. The most detailed was Lee Hanson’s 1966 publication The Hardin Village Site (Hanson 1966). This work published the first map of the WPA-funded excavations (Figure 3-8) along with Hanson’s analysis and description of collections from the project.

The Hardin Site was one of many sites investigated by the New Deal-funded Works Projects Administration between 1937 and 1942 (Milner and Smith 1988). Its inclusion in New Deal archaeology is significant because this was the first time archaeology was conducted in Kentucky using what, at the time, were the most advanced scientific field and laboratory methods. This work produced large, well-documented material and spatial datasets that provided the basis of Kentucky’s current prehistoric culture-historical sequence, and continues to be mined for new information (Milner and Smith 1988). Fortunately for this study, excavations at the Hardin Site were particularly well-documented thanks to the meticulous recording standards of field director Charles Bohannan. Considering his relatively high standards, it is not surprising Bohannan later studied and co-author a book on military tactics that is still used in military training today (Roberts and Cotter 1999:1-14).

According to the 1938 site survey form, the site was first investigated by William Webb, director of the University of Kentucky Archaeological Survey; John Cotter, director of the WPA-funded archaeological survey; and Charles Bohannan, field supervisor of the subsequent excavations at the site (Webb 1938; see also, Roberts and Cotter 1999:1-14). At the time of the survey, the site was located on land owned by the McKell family and was being farmed by Frank Hardin, after whom the site was named.
The surveyors noted that it was “an extremely rich site” covering roughly 100 yards wide by 500 yards long along the bank of the Ohio River. They collected a sample of ceramic, stone, and bone artifacts from the surface and made plans to return December 9th to dig test pits. The survey form notes that “test pits” had previously been dug by Frank Hardin. This information, along with Bohannan’s 1938 illustrations of local collections from the site indicates that it had been well-known in the area for some time.

The first excavations at the Hardin site consisted of “five pits to determine the depth of the midden” (Figure 3-9; Bohannan 1939b:1; Hanson 1966:3). From these test pits several large trenches were opened and later expanded into large blocks according to the density and type of features encountered (Figure 3-9). The first areas excavated were two north-south oriented trenches along the river bank (Bohannan 1939a; Hanson 1966:Fig.1). The southernmost trench (near Area “K”) was not as productive, so subsequent excavations focused primarily on expanding from the other north-south trench (near Area “C”). Next, an east-west trench was opened perpendicular to the original along a “low ridge” near the center of the site. Bohannan selected this ridge because it showed “a large amount of archaeological material on and detritus on the surface” (1939b:1). A series of expansion areas (A-E) were opened from these two intersecting trenches forming rough T-shape (Figure 3-10; Hanson 1966:Fig.1). With the expansion areas in progress, a long discontinuous east-west oriented trench was opened up to document the stratigraphy of the long axis of the site (Bohannan 1939a:3; Hanson 1966:5). Eight of these trench segments were expanded to explore notable deposits; usually burial areas. Judging from Bohannan’s field notes, expansions were carried out for three reasons: to explore burial concentrations, to uncover house structures, and to
to sample dense artifact concentrations. Hanson, who was the first to catalog and describe the 1939 excavations, tabulated “9 structures, 250 features, 301 burials, and more than 25,000 artifacts” (1966:5).

Documentation by the WPA project was excellent. Bohannan controlled space with a 5 foot grid system based on arbitrary east-west and north-south baselines. Excavation was conducted in 5x5 foot squares in 6-inch levels. The elevation and location of every excavation square was documented with a transit. In addition, the elevation and coordinates of every burial, feature and post hole were recorded in duplicate logs. Standard forms and plan view maps were recorded for each feature and burial. Bohannan also kept notebooks with duplicate information and additional remarks. Information recorded on standard forms includes coordinates, soil type, artifact contents and associations, feature morphology and feature condition (particularly for burials). For burials and features, an attempt was usually made to determine their association to other features. Finally, Bohannan typed up a series of daily field notes (Bohannan 1939b – 1939j) and general observations about the trenches and expansion areas (Bohannan 1939a). Many of these were extremely useful in shaping the 2011-2013 fieldwork, and with corroborating and interpreting findings from this fieldwork.

Research 1940-2010

There are no publications or any other documented activity on the collections for the period 1940 to 1960. From 1960 to 1963 Lee Hanson worked on the Hardin collections for his Master’s degree in anthropology at the University of Kentucky. Hanson (1963) was the first (and only person) to catalog, analyze, and produce a
descriptive report of the WPA collections. Hanson can also be credited developing the
first occupational sequence for the site (1966). He proposed that each of the four 6-inch
evels excavated throughout most of the site represented a distinct occupational episode
(1966:176-181). He describes the type frequency of pottery traits and other unique
artifact types for each of his four occupational episodes. Based on the observation that no
pottery type changed by more than 12%, and that central site midden was only two feet
thick, he argued that the overall sequence represented a relatively short span. A
beginning date of 1500±50 A.D. and an ending date of 1675±5 were postulated for the
Fort Ancient sequence at Hardin (Hanson 1966:171-175).

Following the 1966 publication of Hanson’s monograph, published research on
the site and it’s collections has been focused almost exclusively on the human burials and
associated material culture. Over 20 years elapsed before any attention was given to
Hanson’s occupational sequence. This was made possible by the ceramic chronology
that arose from the 1983-1984 Kentucky Fort Ancient Research Project (Henderson
1992a). Henderson and colleagues attempted to include the Hardin site in this project,
but could not get permission for excavations. In January 1983 the site was visited by
Charles Hockensmith and David Pollack to collect information to complete a National
Register Nomination Form (Hockensmith 1983), but the landowners have never given
permission to submit the form. The ceramic chronology that arose from the Kentucky
Fort Ancient Research Project (Henderson and Turnbow 1987; Turnbow 1991; Turnbow
and Henderson 1992) dated U-shaped lugs – prominently featured in Hanson’s sequence
– to the Manion Phase (A.D. 1200-1400). Other ceramic attributes and forms described
by Hanson (e.g., triangular strap handles, pans) were dated to phases post-dating A.D.
1400 (Gist and Montour). The presence of Euroamerican artifacts alongside these late ceramic types led Henderson et al. (1990:335) to select a Montour Phase association (A.D. 1550-1650) for the later occupation of Hardin (see Chapter 6). Where Hanson had proposed a maximum range of A.D. 1450-1680, the work of Henderson et al. (1990:335) indicated that this sequence had minimally two components dating sometime between A.D. 1200 and 1650.

The only other critique of Hanson’s occupational sequence was based on William Holmes’s (1994) detailed study of the WPA excavation records for his thesis project. Holmes’s project examined patterns of mortuary goods by age and sex across the site. Following Henderson et al. (1990:335) he recognized at least two Fort Ancient components (Holmes 1994:47). Holmes examined the site’s stratigraphy as a part of his study and pointed out there is no reason to believe that arbitrary excavation levels necessarily equate to distinct occupational episodes (1994:187). He also pointed out that collections from the site are heavily skewed toward the large excavation blocks in the center of the village and cannot, as Hanson assumed, be assumed to be representative of the site as a whole (Hanson 1966:176; Holmes 1994:188). Hanson notes that he did not analyze 20% of the pottery, “primarily from features, burial fill, and fringe areas of the site” (1966:77), which means the pottery sample upon which his sequence is based was derived primarily from the center of the site where most mixing has occurred (see Chapter 4, “overlap area”).

Following Hanson’s publication, most research on the Hardin collections have been bioarcheological (Cassidy 1972, 1984; DeLorenze 1977; Garten 1997; Nagy 2000). The research focus on the bioarchaeology of the Hardin site owes to the fact that the 1939
collections have preserved one of the largest late prehistoric or protohistoric skeletal populations in the Ohio Valley. Each of the four major bioarchaeological projects has focused on a distinct aspect of biological variation in the Hardin population. Cassidy’s study was the earliest and most comprehensive, documenting patterns of age, sex, dental health, disease and trauma. DeLorenze (1977) focused more specifically on comparing robusticity of dentition between a sample of adults and children (n=68) to evaluate the degree to which this attribute has a selective evolutionary advantage. Brioda (1983, 1984) analyzed bone composition to assess the predominant source of plant-based dietary intake (i.e., proportion of corn in the diet).

Garten (1997) re-examined the entire skeletal population to document patterns of treponematosis and tuberculosis. Finally, Nagy (2000) examined patterns of degenerative joint disease and musculoskeletal markers as independent measures of human activity patterns. Like Cassidy, Nagy compared the Hardin Site and Indian Knoll populations to assess the degree to which diachronic change could be identified. She also assessed the degree to which changes in health over time in health could be linked to status, but no strong patterns emerged.

As with most studies on the site’s collections to date, the results of these studies need to be re-assessed in light of the fact that burial population represents at least two, and most likely three or more distinct components (see Chapter 4). The enormous task of parsing out the component-association of each burial will be necessary to re-evaluate these studies, and for any future analyses of the burials and associated artifacts. Also, since the four available datasets touch on distinct aspects of human biology, there is great need for a synthesis that draws out this new information.
Non-bioarchaeological studies of the Hardin Site collections include mortuary patterns, contact period chronology and developments, and botanical remains. Until recent fieldwork was completed analysis of Hardin Site paleoethnobotany were limited to a few wood, corn and cordage samples curated from the WPA project (Hanson 1966:169-170). As part of her PhD project, Gail Wagner published an earlier analysis of carbonized corn cobs from post #815 (Cutler n.d. in Wagner 1984; 1987:151-152). More recently, a sample of botanical remains from the 2013 excavations were analyzed for an undergraduate guided research project at the University of Kentucky (Lansaw 2014).

Several studies included temporally sensitive protohistoric artifacts from the Hardin Site (Hanson 1966; Sigstad 1973; Henderson et al. 1986; Holmes 1994; Drooker 1997; Robertson and Gersch n.d.). Most of these provide descriptions or lists of diagnostics from both WPA and looted collections (Hanson 1966; Henderson et al. 1986; Holmes 1994:93-96 and Table 6.1; Drooker 1997; Drooker 2015; Robertson and Gersch n.d.). Four studies have used chemical analysis to identify the source of possible trade items (Hanson 1966; Sigstad 1972; Drooker et al. n.d.; Robertson and Gersch n.d.). Hanson (1966) determined the metal artifacts were made of both brass and copper, while Robertson and Gersch (n.d.) later added that all but one specimen in their sample (n=17) was of European origin.

Sigstad (1972) sampled several pipestone artifacts and reported that as many as six source locations were represented, though ongoing analysis (Drooker 2015a, 2015b) indicates the entire pipestone assemblage can be sourced to locally available flint clay deposits. Holmes (1994:Table 6.1) and Drooker (1997:79-103 and Table 4.3, 4.9-4.13, Figure 4.18) have developed a tighter relative chronology for the site by cross-dating,
narrowing the range of protohistoric occupation at the site down to a 75 year window (circa A.D. 1550-1625).

Only one project has focused specifically on the impact of protohistoric exchange at Hardin (Pollack and Henderson 1983; Henderson and Pollack 1999). The goal of this project was to assess the long-standing hypothesis that, upon contact, Natives would have rapidly abandoned aboriginal technology in favor of presumably superior European equivalents. Pollack and Henderson compared several classes of material culture from Hardin to the nearby historic Lower Shawnee Town site (which encompasses 15Gp15, 15Gp27, 15Gp28, 15Lw13). They found that the only category of European material culture present at Hardin were ornaments which did not replace, but were added to, the range of material culture choices available. At historic Lower Shawnee Town some categories of material culture - such as bone tools and marine shell ornaments - had been replaced, while others - such as ceramic vessels and stone tools - had not been replaced. Based on this information it was concluded that adoption of European material culture was selective and gradual, rather than passive and rapid as assumed by earlier acculturation models (Pollack and Henderson 1983; Henderson and Pollack 1999).

William Holmes’s (1994) study of mortuary patterns at the site is the most substantive non-bioarchaeology study of the collections. Holmes (1994:79-85) examined and error-checked records from all mortuary contexts, and then entered the resulting age, sex, and artifact associations by type into a relational computer database to calculate statistics and generate graphics of spatial patterns. As at most Fort Ancient village sites, Holmes found that interments were not located within domestic structures, but adjacent to them. Given the relatively limited spatial representation of the excavated area, no site-
level pattern of burial location could be identified. The most general finding with regard to grave associations was that “there were few clear rules for what materials were buried with an individual of a particular sex or age”, though objects that were placed with the dead tended to be ornamental rather than functional (Holmes 1994:189). Nonetheless some tendencies were present. Children 1-5 years of age, and individuals over 50 years of age were most likely to grave goods, while all other age groups were equally likely to be interred with objects. The only strong association was that the majority of metal and marine shell were interred with infants.

**Summary and Discussion of Previous Research**

A great deal of information has been produced about the Hardin Site using the 1939 WPA collections. However, much of the information now needs revision due to developments in Fort Ancient chronology and spatial analysis over the last half century. For example, the ceramic and lithic typological schemes employed by Hanson (1966), while meeting the standards of his own time, have been replaced by others now backed by radiocarbon chronologies and region-specific phase-associations. Nonetheless Hanson made several important lasting contributions. First, Hanson labeled and catalogued the entire collections - a substantial accomplishment considering they are one of the largest at the William S. Webb Museum of Anthropology. Perhaps more importantly, his publication on the site has probably stimulated most subsequent research by advertising the massive amount of data available for the site, particularly that which has subsequently been identified as temporally significant (e.g., metal artifacts, gorget styles, longhouses).
Chronology

Our understanding of Hardin Site chronology had made significant progress since the publication of Hanson’s thesis (1966) which equated arbitrary strata with occupational episodes and proposed a range of A.D. 1450 to A.D. 1680. Subsequent developments in Fort Ancient ceramic chronology (see Chapter 5) have made Hanson’s sequence untenable on two levels. First it demonstrated the presence of at least two Fort Ancient components; one Manion Phase (A.D. 1200-1400) and one Montour Phase (A.D. 1550-1750). Second, the presence of mixed 13th through 16th century diagnostics in the lowest level of the WPA excavations means that a substantial amount of mixing has taken place and that absolute depth is not equivalent to temporal depth across the site. This means for the present and future projects, both vertical and horizontal spatial analysis of any data class will require careful evaluation and selection of contexts before they are used. For some purposes, some contexts may not be usable at all. As will be discussed in the subsequent data analysis chapters, this information was critical to the present study in selecting, assessing, and later “cleaning” samples of mixed contexts.

Site Structure

The WPA excavations opened a very large area, and documented contextual information with description and illustration far beyond early 20th century standards. And yet the sheer size of the site, combined with its intensity of occupation have made the areas opened up seem insufficient for reconstructing broad spatial patterns. To make matters worse, overlapping burial and structure areas have complicated an already narrow window of spatial resolution. Hanson speculated the presence of overlapping ring
villages may have resulted in the overlap area (1966:16). Hanson did not attempt to evaluate this idea because he thought available spatial data were insufficient. Like Hanson, Holmes considered the possibility of overlapping ring villages but did not think enough data were available to evaluate the idea (1994:55). However, by demonstrating how WPA artifacts can be plotted using Bohannan's grid coordinates, Holmes advanced our ability to examine spatial patterning of the site. Using Holmes's example, features, structures, and artifacts were plotted and compared to spatial data collected by new fieldwork. The WPA spatial data also made it possible to plan fieldwork targeting the specific needs of the present study.

**Protohistoric Fort Ancient**

The Hardin Site is ubiquitously cited for its protohistoric component in regional and even continental overviews of protohistory, and yet we still know relatively little about the site's protohistoric component. Most of what we know derives from description and, to a lesser degree, analysis of both European and Native trade goods. Chronological information derived from items like brass and copper ornaments, engraved marine shell ornaments, and smoking pipes have been useful in narrowing the estimated protohistoric occupation to a 75 year window (circa A.D. 1550-1625). Several studies have determined the source provenience of trade goods and have used this information to speculate about exchange patterns. Finally, only one study has attempted to use artifact patterns to examine the local influence of protohistoric exchange. Despite this work, many basic questions require addressing before future study can maximize the currently available collections.
Current Project Description

Introduction

Fieldwork for the present project took place in five sustained episodes over a three year period from 2011-2013: 1) Summer 2011 initial site visit, reconnaissance and mapping; 2) Spring 2012 first test excavation; 3) Fall 2012/spring 2013 geophysical survey; 4) Spring 2013 second test excavation; and 5) summer 2013 primary excavations. Each phase produced important new datasets but also shaped plans for subsequent phases in important ways (after Redman 1973). For example, analysis of spatial data from initial phases of fieldwork dramatically altered the project goals. The original research proposal for this project followed previous interpretations of the site suggesting it was organized in clusters or pairs rather than in a circular pattern (e.g., Henderson 2008:831). Thus the original intended goal of fieldwork had been to collect additional artifact samples from areas adjacent to each of the four pairs of houses.

However, after compiling and examining the spatial data collected in the 2011 field season it became apparent that the site probably consisted of several overlapping midden rings. The process by which this site structure model arose is described below. This section describes the goals, methods, and general accomplishments of each phase. Therefore, descriptions and figures relating to each phase are intentionally general. More detailed descriptions, maps and figures are presented in subsequent chapters relevant to each dataset.
2011 Preliminary Work

At the initiation of the project several key pieces of basic information had to be established. The first thing that needed to be documented was the site boundaries. The 1939 WPA excavation map (Figures 3-8 and 3-9; see also Hanson 1966: Figure 1) shows a sinuous line on the western edge of the site map labeled “apparent limits of site” along the western side of the site, but no description of the basis for this site limit was in Hanson’s monograph, nor has any relevant information been found in Bohannan’s otherwise meticulous field notes. Moreover, the descriptor “apparent” did not impart much confidence this represented the actual site limits. In any case, the overall extent of the site had to be relocated on the ground in order to select a primary datum location for subsequent work.

The other goal of the initial 2011 fieldwork was to collect information about the site’s cultural deposits, which would be useful for planning for test excavations. In particular depth, texture, and artifact density would be key determinants in the area that could potentially be opened during initial test excavations. A related goal was to document the location of the 1939 excavation areas. Since soil cores were being used to examine stratigraphy and describe the site’s deposits, it was expected that backfilled trenches from the WPA excavations should be identifiable. This information would ideally have enabled me to avoid previously excavated parts of the site during test excavations.
Initial Site Visit and Reconnaissance

The initial site visit took place on May 14, 2011 in the company of Christopher Pool, David Pollack, and the landowner Jerry Bentley. Recent rains had flooded the site, and the field in which it is located was covered in corn stubble from the previous year’s crop. Inspection of the river bank indicated high waters from recent precipitation had caused some erosion of the site into the river and the landowner indicated this was a common occurrence. We noted several areas where artifacts were eroding from the cut bank but no dense concentrations or obvious features were identified. Inspection of the field identified a diverse surface scatter of artifacts that varied in density throughout the field. In most places surface artifacts were easily visible despite only about 25% of the surface was visible through ground cover. From north to south the surface scatter of artifacts indicated the site extended between the tree line to the south and the farm access road to the north.

Christopher Pool paced the east-west axis of the site and estimated a dense scatter up to 120 meters west of the river bank, and a lighter scatter extending up to 240 meters to the west. Three transects of soil cores (n=17) were used to examine stratigraphy of deposits in the center of the site where surface artifacts exhibited the highest concentration. Sub plowzone deposits varied from sterile subsoil to 20cm thick midden. An unsuccessful attempt was made to document the location of the 1939 excavation area by coring in the area where Hanson’s site map suggested their location. The lack of a formal site grid or familiarity with fixed landscape features made it difficult to accurately estimate the location of 1939 map features. While only preliminary information was gathered, this initial visit established some critical basic information:
the site was easily identifiable based on surface distribution of artifacts, the approximate extent of the central area was estimated to be about 300 meters north-south by 120 meters east-west, erosion was observed but was not catastrophic, and intact deposits were still present but not uniformly distributed.

**Establishing Modern Site Grid**

The second visit to the site took place on May 28-29\textsuperscript{th} 2011. Work during this visit established a modern site grid and the location of landscape features to assist with geo-referencing the WPA map (Figure 3-11 and Table 3-2). Additional soil cores were conducted to further examine the site’s stratigraphy and nature of deposits. Using the approximate site dimensions documented on the last site visit a primary site datum was established along the southern end of the site along the treeline. The datum was centered on the east-west axis and was given the coordinates N1000, E1000. This datum marker was destroyed by plowing because it was too close to the field edge, but the location of 5 other permanent markers is shown on Figure 3-11 and their coordinates are provided in Table 3-2.

With the datum in place a 40x40 meter grid of flags was established to conduct a systematic soil coring program at a 20 meter interval. A 2cm diameter Oakfield split spoon soil core was used. Two north-south transects were conducted: one between N1000-1320 on the E1000 line and one between N1140-1320 along the E1040 line.

Using the 1939 excavation map (Figure 3-8) it was estimated that the main east-west WPA trench would be located somewhere between N1120-1160. The two soil cores conducted between these northings lacked intact deposits, as expected, but the deposits
were not unique from other areas of the site lacking intact sub-plowzone deposits so the trench location remained inconclusive. Only five of the twenty-six cores conducted identified intact deposits, confirming the findings of the previous soil coring effort that intact deposits were present but not uniformly distributed. Based on this information it was decided that test units would have to be placed only were cores identified intact sub-plowzone deposits, and that the 1939 east-west trench may be located between N1120-1160 and would be avoided.

**Site Mapping**

Systematic surface reconnaissance, artifact collections, and mapping were conducted over a sequence of three visits on June 23-24\(^{th}\), 29\(^{th}\), and July 11\(^{th}\) 2011. The initial visit on June 23-24\(^{th}\) involved two University of Kentucky students (Arlis Johnson, Caitlyn Rogers) and one volunteer (C. Martin Raymer). East-west and north-south walking transects were conducted with the goal of placing pin flags at the northern and western boundaries of the primary midden concentration. Our strategy of identifying the midden stain boundary was to walk in parallel transects starting on the east side of the site along the river bank. We proceeded by walking west through the highest density zone and placing flags where it dropped off markedly in density. The same strategy was used to identify the northern edge of the core site area. Soil color was not as useful as would normally be expected since soil moisture from recent rain made the entire field appear to be the same color.

After the preliminary site boundary was established several passes were made back and forth across the proposed boundaries to adjust the flag locations based on inter-
observer correspondence. Approximately 50 flags were placed in this manner to mark the primary boundary of core area of the site (Figure 3-11). During this work, two areas in the northern and southern ends of the site were marked with flags because they almost completely lacked surface artifacts. Initially, the southern area devoid of artifacts was thought to be a large looter pit described by an informant as “big enough to fit an SUV in”. The northern area devoid of artifacts was thought to be the possible location of the 1939 WPA excavation block. All of the flag coordinates were documented with a Sokkia Set 6/10 total station, and the location of the 28 flags making the site core boundary were also documented with a Garmin GPS-72 handheld GPS receiver.

**Systematic Surface Collections**

Systematic surface collections were conducted over a period of two site visits on June 29th and July 11th, 2011. The goal of these collections was to examine the distribution of diagnostic materials over the extent of the site. In addition, these materials were expected to provide information about areas of the site not excavated in 1939. On June 29th all 8 University of Kentucky fieldschool students assisted with walking the field on a 5 meter interval. Diagnostic artifacts were flagged during reconnaissance. Later, on July 11th the flags were numbered and their coordinates documented with the Sokkia total station and subsequently collected and bagged individually by provenience.

**2012: First Test Excavation**

After the close of the summer fieldwork spatial data were transferred from field notebooks into a Microsoft Excel spreadsheet. Total station coordinate data were plotted
using Golden Software’s Surfer (Version 8). Comparison of the new field site map to aerial photographs and the 1939 site map strongly suggested the presence of at least two overlapping midden rings each defined by a circular stain and artifact concentration around an artifact free “plaza” area (Figure 3-12; see Chapter 4 for more details and overlays of aerial photos and WPA site map). Hereafter these two primary midden stains are referred to as Ring 1 (to the south) and Ring 2 (to the north) and the area where there overlap as the “overlap area”. With this new information, the testing program had to be changed dramatically in order to evaluate this new hypothesis. At this point in the study, the possibility the center of the site represented multiple occupations had to be addressed before proceeding since the primary research questions involved diachronic change. Thus the first test excavations at the site aimed to document the relative age and basic characteristics of stratigraphy associated with each of the proposed midden rings. Test excavations were conducted over a period of several weekend trips in spring 2012.

Knowing that the overlap area would provide ambiguous temporal information, test units were placed far from this zone in each midden ring. Test unit locations were selected based on the presence of surface artifact concentrations and or intact deposits documented from previous fieldwork. In each proposed ring several short transects of soil probes were conducted in order to find the most ideal unit locations.

A 1x2 meter area was excavated in each midden ring; Units 1-2 in Ring 1 and Units 3-4 in Ring 2 (Figure 3-12). Descriptions of the unit stratigraphy, features, and other contexts are provided in the results section below. Note that in Units 1-4 depths were recorded below surface in contrast to Units 5-22, which used an arbitrary datum for depth measurements. In both test units (1-2, 3-4) deposits originally thought to be feature
matrix were actually looted contexts. However a scatter of intact prehistoric post holes and associated cultural deposits were documented in both unit areas. Carbonized nutshell was obtained for radiocarbon dating from post holes in each of the units. Results of the radiocarbon analyses indicated an earlier occupation in Ring 1 and a later occupation in Ring 2 (see Chapter 6).

Geophysical Survey

Introduction

The geophysical survey hoped to address three goals simultaneously. The first goal was to address the primary research question by identifying, sampling, and dating refuse deposits containing information about hide processing. The second goal was to evaluate the spatial extent and relationship of the proposed overlapping midden rings. The third was to securely identify the location of the WPA excavation trenches and georeference the two project grids. This survey followed promising test grids conducted in summer 2011 and spring 2012 which indicated magnetic gradiometry and electrical conductivity would be the most effective and efficient survey methods.

Principles of Geophysical Data

Geophysical survey is a type of remote sensing that measures variation in the properties of buried deposits to document patterns of interest. In archaeology, geophysical surveys exploit patterned differences or contrasts between the properties of natural background conditions – such as naturally deposited soils, sediments, and objects – and the properties of relatively shallow archaeological deposits (Aspinall et al.
2008:27-28; Kvamme 2008:66). Most geophysical instruments collect information about buried deposits by deploying or emitting a specific signal into the ground, which is then altered by the properties of the deposit, and the machine records the resulting signal. Patterning in the recorded signal across a survey area provides meaningful information about how deposits vary through horizontal and sometimes vertical space. This is because deposits behave according to fundamental magnetic and electrical principles expressed in mathematical form (Sharma 1997:65-66). Because this relationship is predictable, it can be assumed (at least tentatively) that similar geophysical anomalies patterned across a survey area represent similar features or objects.

Decades of testing and verification of anomaly patterns has gradually determined what sampling density and signal sensitivity are required to detect some types and sizes of features. These dimensions must be considered when selecting instrumentation and sampling strategy. For example, even though its fill may exhibit a distinctive signal, a small archaeological feature such as a post hole requires high sampling density to isolate its boundaries. It has been suggested that sampling interval be no greater than half the size of the smallest feature or object one wishes to detect (Weymouth 1986:347; Kvamme 2008:77). While larger features that exhibit a very weak signal may not require as high a sampling density to encounter, greater signal sensitivity may be required to identify a contrast between them and surrounding deposits. Even large features are overlooked if sufficient contrast does not exist between them and surrounding matrix. Selection of the appropriate instrument for detecting the feature or deposit of interest is just as important as sampling density and signal sensitivity. The properties of deposits often react most strongly to specific types of signal (e.g., magnetic, electromagnetic) such
that even the highest sampling density and signal sensitivity will miss certain features or
deposits if the appropriate type of signal is not used (Kvamme 2008:75-76).

Even when sampling density, signal sensitivity, and other variables have been
controlled before data collection, using geophysical datasets to interpret buried deposits is
typically not straight-forward. Several challenges have to be overcome before
geophysical data can be effectively interpreted. The first issue is that geophysical
instruments often record signal of both the deposits of interest, and that produced by
other properties of the local environment (Aspinall et al. 2008:76-84). All signal that is
not of interest is considered noise. Some is systematic and can be easily controlled by
selecting specific instruments or instrument settings. For example, in magnetic surveys,
archaeologists are typically interested in variation in shallow deposits rather than deeply
buried geologic strata. In electromagnetic and radar surveys, for example, this can be
accomplished by selecting a signal frequency appropriate for detecting variation at a
limited depth. For magnetic surveys archaeologists eliminate the background signal
produced by deep, large scale deposits, by collecting the magnetic gradient rather than the
total field. This way systematic noise is easily filtered out or eliminated as data are
collected.

Other forms of systematic noise can be eliminated by processing the data using
computer software. For example, collecting magnetic data in parallel survey lines can
result in low-level linear patterns in the data that can be eliminated using well-established
and effective processing techniques (Aspinall et al. 2008:120). Non-systematic noise
also complicates geophysical datasets. For example, modern metal debris, lightening
strikes, and modern cultural features often result in a range of patterns in geophysical
datasets. Some of these can be controlled by documenting surface features in the field. Others exhibit characteristic patterning in the data that allow them to be identified and eliminated. Decades of archaeological geophysics now provides a large background literature that is useful in identifying and eliminating various sources of noise (e.g., Aspinall et al. 2008:78-84).

Once noise has been removed from the dataset, several methods are used to evaluate and interpret the remaining geophysical data. The first is pattern recognition, which uses the form, size, distribution, and context of anomalies (Kvamme 2008:67-75). For example, at the recently investigated Fort Ancient Guard Site rectangular anomalies measuring 4-6 meters on a side encompassed smaller circular anomalies measuring 2 meters or less in diameter (Cook et al. 2015:Figure 2). The rectangular anomalies were surrounded by numerous small diameter anomalies. The relative size of the rectangular anomalies and their arrangement in a circle is consistent with previously excavated Fort Ancient villages patterned as a ring of structures. Following this analogy, the smaller circular anomalies inside and surrounding the rectangular anomalies (structures) represent a variety of pit features. Trenches and test units at the site confirmed this anomaly-feature type relationship (Cook et al. 2015:Figure 3).

Additional pattern recognition is sometimes possible when data density is increased (Clay 2001). However, increasing the sampling density also increases data collection, downloading, and processing time. Rather than increasing resolution of a single method, researchers often opt to use multiple methods because they provide complementary information (e.g., Clay 2001; Kvamme et al. 2007; Hargrave 2011). A well-known and highly successful example of multiple methods survey comes from an
early-to-mid-19th century Mandan village (Kvamme 2003; Kvamme et al. 2006:254-255). Electrical resistivity, ground penetrating radar, and magnetic gradiometry were conducted at the site and each produced unique information about residential areas. The GPR survey identified the interior living floor and entry way to the house. These features resulted in high amplitude radar reflections because the floor area was compacted and resistant to penetration by the radar signal. The electrical resistivity survey identified a ring of anomalies around the central floor. This ring of higher resistivity was thought to represent an accumulation of sediments eroded from the roofs, which were known to have been earth covered. Finally, the gradiometry survey identified a scatter of small magnetic anomalies inside the structures. These represent internal house features such as central hearths and storage pits.

**Previous Geophysical Survey of Fort Ancient Habitation Sites**

Most large scale geophysical survey of Fort Ancient habitation sites has only been conducted in the last decade (e.g., McCullough et al. 2004; Brady-Rawlins 2007; Cook and Burks 2009; Nolan 2010; Davidson 2013; Cook et al. 2015). There are several reasons for this. First, most Fort Ancient archaeology has taken place as part of cultural resource management (CRM) compliance projects, which do not necessarily require this data (Johnson and Haley 2006). Even in cases where geophysical methods are used for CRM, the survey area is determined by the needs of the compliance project which may not require detailed information about site structure. Secondly, the midden ring/plaza patterning of typical Fort Ancient villages has been well-established since the 1980s and geophysical survey is not necessarily needed to determine overall site layout.
Finally, even today, geophysical survey and data processing equipment, and specialized training are not available to all researchers. Even when these have been available the sampling density required to identify detail beyond general site layout requires either a great deal of time or relatively modern and expensive equipment. For example, the magnetic survey equipment used for the present study was borrowed from the Earth and Environmental Sciences Department at the University of Kentucky. Though it was sufficient in terms of signal sensitivity, the equipment configuration was not ideal for surveying at the sampling density required for documenting intra-site spatial patterning. A month of full-time work was required to survey the site with the magnetic gradiometer.

**Expectations Based on Previous Work**

Previous magnetic gradient surveys of Fort Ancient sites has resulted in varying degrees of success. In general those conducted at sites represented by one intensive Fort Ancient occupation (e.g., Cook and Burks 2009; Cook et al. 2015) provide better data than those represented by multiple Fort Ancient occupations (e.g., Genheimer 2010). In most cases moderate resolution (0.5x0.12m) magnetic gradient surveys have identified the spatial patterning and extent of hundreds of anomalies. Anomalies range between $\pm 10$ nT/m, though a 5 nT/m range captures most variation in magnetic signature. The distribution of anomalies typically forms a circular, oval, or oblong pattern with the highest concentration of anomalies forming a ring around a central area exhibiting relatively few anomalies. The Hahn site (Genheimer) discussed above is a good example of this pattern. Ground-truthing has confirmed that the areas with the highest
density of magnetic anomalies are in fact the habitation zones of circular villages, while the central areas lacking anomalies represent plaza areas typically lacking features.

At least two magnetic surveys of Fort Ancient sites have provided enough detail to discern more than general site layout. These are the Guard Site in Indiana (Cook et al. 2015) and Mercer in Kentucky, where standard resolution (0.5x0.125m) magnetic gradient surveys identified rectangular magnetic anomalies within the habitation zone. Testing these anomalies determined that they represented structures. This finding is significant because surveys at the Hahn and Fox Farm sites used the same sampling density but did not recognize structure outlines. One important variable appears to be the intensity of occupation. At Hahn and Fox Farm, excavations determined that a thick layer of midden from their terminal occupations obscured deeper features. It seems the magnetic signature of the overlying midden obscures geophysical patterning of deeper strata (Genheimer 2010). To contrast, Guard and Mercer do not appear to have intensive later occupations that left behind deep expansive midden deposits. Thus, the different results obtained at each pair of sites can be accounted for by the presence of a thick upper midden at the Hahn and Fox Farm sites.

In order to deal with noise created by stratified deposits, specific instrumentation is required to collect signal at varying depths. This was accomplished at the Fort Ancient Hahn Site in Ohio (Genheimer 2010; Genheimer and Hedeen 2014). Magnetic gradient, magnetic susceptibility and (limited) ground penetrating radar survey were conducted at the site. The magnetic gradient survey identified a dense ring of high intensity anomalies. The highest magnetic values documented by the susceptibility survey also formed large ring-shaped pattern. Both surveys indicate a circular-shaped pattern of
probable features surrounding a central area with a relatively low magnetic signature indicative of a plaza area typical of circular Fort Ancient villages. However, neither survey identified structure outlines, and test units indicated the presence of a thick upper midden stratum in some parts of the site.

A test unit over one anomaly at Hahn exposed a structure wall. To see if the rest of the structure could be identified by geophysical methods, ground penetrating radar survey was conducted over a 10x10m area adjacent to the unit before the remaining structure was excavated (Genheimer 2010). The GPR did not identify what was later revealed by excavation to be a 6 by 5 meter wall trench structure, but it did identify several anomalies including one Late Fort Ancient pit feature that damaged a portion of the Middle Fort Ancient-aged wall trench structure.

The possibility that an upper midden zone could obscure geophysical patterning was taken into consideration when planning the geophysical survey of the Hardin Site. The WPA excavations and the 2012 test excavations at the Hardin Site indicated that a midden stratum and a buried plowzone might overlie and obscure deposits of interest. While it was hoped that house outlines could be detected by the geophysical survey, previous studies indicated the buried plowzone and upper midden were likely to obscure house patterning if a gradiometer was the primary survey method. Therefore, an electromagnetic profiler (GSSI Systems, model EMP-400) was selected to add an additional geophysical dataset capable of examining variation in buried deposits at different depths. Unfortunately, an equipment malfunction, source of noise, or other variable resulted in data that were un-usable for the subsequent phases of the project.
Therefore, the dataset from the electromagnetic profiler is not discussed further here. An attempt will be made in the future to further examine and make use of this large data set.

**Survey Area and General Procedures**

A magnetic gradiometry survey was conducted over a 320 x 160 meter area (4.64 hectares). The survey was conducted in 20x40 and 40x40 meter data collection grids (Figure 3-13). Before the survey began, semi-permanent datum stakes were established on a 40m grid. One collection grid (40x40 or 20x20) was completed at a time. A standard procedure was used to collect data in each grid. To begin each grid east-west baselines were established, and then north-south data collection lines were set between the baselines. The east-west baselines were marked at a one meter interval that was used to set each north-south collection line. Collection lines were marked at a 50cm interval. Both the baselines and the collection lines were secured with plastic stakes.

Data were collected in a north-south zig-zag pattern using the collection lines to control spacing between lines and sampling interval along each line. After data were recorded for all collection lines, the data were saved in a file labeled with the grid number. Stakes were pulled and lines were moved to the next collection grid. Data collection files were downloaded and saved in duplicate every night.

**Instrumentation**

A GEM Systems, Inc. model GSM-19G magnetometer was used to conduct the magnetic gradiometry survey. The GSM-19G is a relatively advanced proton precession magnetometer. Proton magnetometers apply a polarizing field to a proton rich fluid and
the spin of protons causes dipoles to orient in the direction of the polarizing field. The polarizing field is approximately perpendicular to the direction of the Earth’s magnetic field. When the polarizing field is switched off, dipoles experience torque which makes them precess and the precession frequency is proportion to the ambient magnetic field. The magnetic signature of the ambient field is thus indirectly measured by the precession frequency. The magnetometer records the precession rate and its variation over a survey area is used to interpret the nature of buried deposits (Aspinall et al. 2008:41-48).

There are two methods for synchronizing and measuring proton precession (Sharma 1997:77-79; Aspinall et al. 2008:41-48). Standard precession magnetometers generate a polarizing field with electrical coil to synchronize proton precession. However, the coil generates a magnetic field stronger than the ambient field, and so has to be paused briefly to let the protons precess at a rate matching the ambient magnetic field. Measurement has to be taken quickly while proton precession is still controlled by the ambient field, and before thermal agitation forces them out of alignment.

Overhauser proton magnetometers, on the other hand, use an RF signal to generate a polarizing field (Sharma 1997:77-79; Aspinal et al. 2008:41-48). The RF signal generates a weak magnetic field that does not influence the ambient field, so the polarizing field does not have to be paused to take readings. Because of this, overhauser principle-based instruments can continuously measure the ambient field and take readings at a higher rate. In addition, precession frequency is much higher in overhauser machines so signal sensitivity is higher. The combined benefits mean higher sampling rate with greater sensitivity. Finally, the RF signal used by Overhauser machines has extremely
low power consumption. The GSM-19G used for the present study was ran all day without charging.

The GSM-19G magnetometer consists of a console, magnetometer sensors, and mounting equipment. The arrangement used for the present study employed two pairs of sensors stacked vertically 56cm apart. With each pair arranged as a gradiometer, collecting the vertical gradient of the total field is measured in nanotesla (nT). The pairs were spaced horizontally 50cm apart so that two collection lines were done simultaneously. Theoretically, since the sensor pairs collect data simultaneously, the horizontal gradient between them could also be calculated to increase survey resolution. Each sensor pair was mounted to one side of a three-wheeled push cart. Initially there was some concern that undulations in the recently harvested bean field would be too rough to maintain the sensors in stable vertical orientation. The presence of some noise in the data indicates this was indeed an issue, but one that was ameliorated with the appropriate processing techniques (below).

The machine was operated in continuous mode automatically recording 1 reading per second. The operator walked along nylon collection lines marked every 0.5m. A pace was achieved such that one data point was collected every 0.5m. A major limitation of the machine was the lack of an audio indicator (e.g., a metronome) to tell the operator when each data point has been collected. The console display shows readings as they are collected, so the operator had to simultaneously watch for the 0.5m traverse marks on the collection lines laid down as each data reading appeared on the console display. The GSM-19G does not stop collecting even when the all the points for a traverse of specified
length have been collected, so it had to be paused manually at the end of each traverse and commanded to move to the next.

Data Processing

Files for each grid were imported into excel where each data column was relabeled, and a series of x/y coordinates were generated. These modified files were then imported into Geosoft’s Oasis Montaj v7.2, a specialized geophysical data processing program. Each grid was processed independently to identify and resolve issues such as data collection errors. Initially, each grid was plotted as a contour map to observe the overall quality and patterning of the magnetic data. After processing each grid they were combined into a single site-wide plot for interpretation. The processing techniques are described below. The final processed data images are presented in the figures for this chapter while images of the raw and partially processed data are provided in Appendix A for readers interested in this information.

Examining the unprocessed data immediately revealed the presence of several types of noise in every collection grid. One form of noise appeared as linear bands of high intensity magnetic readings oriented at a slight diagonal (NNW-SSE). The other obvious noise consisted of lower intensity linear bands oriented vertically (N-S). The vertical bands of noise are often referred to as striping. This type of noise can result from data collected with multiple side-by-side sensors, or from collecting data in zig-zag mode (Aspinall 2008:120). The somewhat rough terrain of the recently harvested agricultural field probably also resulted in some vertical striping as a result of sensor wobble. The contribution of each of these factors is unknown. The most common processing
technique used to deal with striping is a zero-mean traverse filter, which calculates the mean value for each line and subtracts it from all data points along that line. This filter was applied to each grid using the mathematical expression dialogue in Oasis Montaj.

Removal of striping merely resulted in isolating and accentuating the diagonally oriented (NNW-SSE) noise. This diagonal noise was wider and higher intensity than the striping. The presence of this noise made it impossible to interpret any magnetic patterns of interest. Kvamme indicates this form of systematic noise is common in agricultural fields because plowing leaves ridges and furrows at the base of the plowed stratum (2003:136 and Figure 3, 2006:238). The deeper furrows contain magnetically enriched topsoil that contrasts with the magnetic signature of unplowed deposits (ridges) at the base of the plowed stratum. Plow furrows were documented at the base of the plowed stratum in all 22 excavation units, and ranged from 2-8cm deep and 5-15cm wide (Appendix A, Figure A-4). The orientation of these plow scars is identical to that of the diagonal noise in the magnetic data and is therefore the most likely source of this noise.

Directional cosine and analytic signal were the two filters applied to the dataset in an attempt to remove noise generated by plow scars. These are both Fourier transform filters, which are based on transforming the data from the space domain to the wave number domain (Netleton 1976:159; Whitehead 2010:8). When the data are represented in the wave number domain, they can be manipulated to enhance or remove properties of the signal. The ability to apply such a filter was especially important for the present dataset since it enabled separation of desired signal from the noise generated by plow scars.
A directional cosine filter was the first applied to the data because it is designed especially to remove directional features from the dataset (Geosoft 2014:14). This was an ideal means of eliminating the noise probably resulting from plow scars. To apply the filter one only has to supply the azimuth of the features to be removed. In this case, the plow scars were oriented at approximately 352 degrees. The directional cosine filter was set to reject patterns occurring at 352 degrees which removed only some directional noise. The problem with applying this filter was that the resulting color data plot contained little interpretable patterning. When the data resulting from this filter were replotted on a shaded (rather than color) relief map an obvious large circular anomaly in the northern portion of the site, an east-west string of anomalies down the center of the site, but little else that was obvious.

Analytic signal was the most effective at removing noise from the plow scars while leaving behind sufficient signal of interest. This filter has long been recognized as an effective means of identifying the edges of magnetized 2-D sources and can approximately locate 3-D bodies (Nabighian 1972; Sharma 1997:86; Whitehead 2008:32). Only in recent decades has its potential been heavily exploited for archaeological applications (e.g., Tabbagh et al. 1997; Milea et al. 2010). Applying this filter in addition to the directional cosine filter produced the gridded data used for the coring and excavation program in the summer of 2013. The results are described below.

**Results of the Magnetic Survey**

The processed plots of the magnetic gradient survey of the Hardin Site (Figure 3-14 and 3-15) produced hundreds of anomalies exhibiting a wide range of aerial extent and
magnetic field gradient (in nT/m). Clearly, the large number of magnetic anomalies recorded by the survey will offer avenues for research that reach well-beyond the scope of the present study. Therefore, this section will provide a brief overview of the most notable site-wide patterns, and remaining discussion will focus solely on addressing questions posed by the present study. The geophysical survey was intended to answer three questions: 1) do geophysical patterns support the model of overlapping circular villages? 2) Is sufficient resolution present to identify the location, size, and patterning of structures? And 3) does the dataset provide enough information to systematically target and sample refuse disposal areas?

**General Patterns**

The vast majority of anomalies represent just a 5 nT/m range. Five concentrations of anomalies characterize the magnetic gradient dataset at the site level (Figures 3-16 to 3-17). Concentrations 1-2 are east-west bands of high intensity anomalies, 3 is an amorphous oblong cluster, and 4-5 are circular or arc-shaped patterns.

Concentration 1 is a linear band of high intensity anomalies running east-west along the northern edge of the survey area (Figure 3-16). The orientation, location, and shape of the concentration strongly suggest it represents the road used to access the field. An overlay of the anomaly boundary onto the 2012 aerial photo places it somewhat to the south of the current road indicating that perhaps it has been moved slightly in the past. A high magnetic signature associated with a road could be the result of the rock type used in the road bed, fragments of rust or broken vehicle parts and farm equipment, or trash associated with its use.
Concentration 2 is a linear band of large, high intensity anomalies running east-west through the center of the survey area (Figure 3-16). These were the most expansive and highest intensity anomalies documented by the survey. Along with Concentration 1, this was the only anomaly that was visible in the raw, completely unprocessed data. This pattern is consistent with the location of the main east-west WPA excavation trench. The intensity of the anomaly would be consistent with a backfilled area because the properties of the soil (e.g., structure, composition) used to refill the trench after excavation would contrast sharply with the adjacent unexcavated areas. In addition, it is likely that WPA excavators would have left at least some trash or other magnetically enhanced debris in and around the trenches since they worked in each area of the trench for several months at a time. Two excavations tested areas that produced this anomaly during the current field project and the results are discussed below.

Concentration 3 is an elongated cluster of high intensity anomalies along the northwestern edges of the survey area (Figure 3-16). This is perhaps the most intriguing anomaly even though its distance from the overlapping midden rings may indicate its source is unrelated to the present study. This concentration is interesting both because it appears to extend into the unsurveyed portion of the site and because it represents the highest intensity anomaly that bears no relationship to any obvious modern activity. If it is prehistoric, it is the most magnetically enhanced feature in the survey area. While no excavations were placed in this area, surface collections and soil coring were conducted. The results of these efforts are presented in the fieldwork results section below.

Concentration 4 is an arc-shaped pattern of moderate intensity anomalies in the southern 120m section of the survey area (Figure 3-17). The arc is defined in part by the
relative paucity of anomalies inside the arc, and outside the arc in the southwestern portion of the survey area. A notable aspect of the area inside the arc is a lower density of anomalies, but those present are relatively high intensity and tend to be located at the transition between the central area and the arc. Overall the pattern formed by this concentration matches fairly well to Ring 1 identified by earlier work and in the aerial photo of the site. Where the outside of the ring lies within the survey area it measures approximately 140-160m in diameter. The less magnetically enhanced central area measures approximately 60-80m along its northwest-southeast axis and 40-50m along its northeast-southwest axis. These dimensions are comparable to the size, shape and geophysical signature of previously documented Fort Ancient ring villages. In particular, the oblong less magnetically enhanced central area and the overall size are very similar to that documented in the gradient data at the Hahn Site discussed above (Genheimer 2010; Genheimer and Hedeen 2014). Five excavation areas were placed in the portion of the site represented by this concentration. The results are presented below and the relationship between this concentration and Ring 1 is evaluated in Chapter 4.

Concentration 5 is clear circular pattern of anomalies in the northeastern section of the survey area (Figure 3-17). The outer diameter of the ring measures 80-90m. The high intensity concentrated band forming the circle measures 20-30m wide. The center of the ring exhibits markedly fewer anomalies which are lower intensity. This area measures 30-40m in diameter. The concentration represents the most distinctive pattern in the dataset that likely relates to prehistoric ring village. The overall diameter of the ring, and the less magnetically enhanced central area are consistent with the size, shape, and geophysical signature of previously documented Fort Ancient ring villages with
central plazas. However, it is nowhere near the proposed overlapping Fort Ancient rings (see Chapter 4). Units 3-4 and 20 were placed within or along the southern portion of this anomaly and are discussed below.

2013: Second Test Excavation

The second test excavations (Units 5-7) took place during the spring of 2013 and had two goals. First, I wanted to field test my proposed ground-truthing program by examining a large magnetic anomaly documented in 2012. It was thought this anomaly might represent expansion “Area A” from the WPA excavations (Figure 3-12). Testing this anomaly would thus evaluate the ground-truthing procedure, and potentially locate the 1939 grid. Magnetic anomalies were ground-truthed using a multi-staged approach shown to be both time- and cost-effective (after Pacheco et al. 2005; Hargrave 2006:277-281). First, maps were produced of the processed gridded data showing the anomalies to be examined. Second, the site grid had to be re-established in order to demarcate the area that produced the anomaly of interest. This anomaly was thought to represent the west end of “Area A” from the WPA excavations, and was located in the area between N1120-1160 and E940-980 (Figure 3-18). To begin, I staked out the four corners of this area and strung east-west baseline tapes between the two northern stakes and two southern stakes. Then north-south tapes with meter intervals marked on them were placed between the east-west baselines. A series of soil core transects were conducted along the north-south tapes, perpendicular to the anomaly (Figure 3-18).

Different colored flags were planted for each type of deposit identified. These included: 1) no deposits below plowzone (i.e., subsoil); 2) intact deposits below
plowzone; and 3) possible trench backfill deposits. A paper map showing the magnetic gradient was marked with a symbol for the appropriate deposit type at each core location. After the initial series of soil cores were finished and plotted on the map, the pattern of deposits was consistent with the expected trench dimensions. It appeared that we had defined the easternmost end of Bohannan’s trench expansion Area A. A series of additional transects, varying in length, were carried out to refine the proposed edges of Area A.

A total of 100 cores were carried out. The grid location and stratigraphy were described for each core and documented on a standard form. Based on the unexpectedly high level of correspondence between the geophysical survey data, the WPA map information, and the soil core transects, it was decided to skip the shovel testing stage of the program and place test excavations. In retrospect, this undermined the strategic advantage of the ground-truthing program that had been planned.

In total, two 1x2m meter units (Units 5-6) and one 1x1m unit (Unit 7) were strategically placed to encounter a back-filled portion of WPA “Area A” (Figure 3-27). Unit 5 documented the western wall of the WPA trench, and Unit 6 was placed immediately to the north and encountered the northwest corner of the same WPA trench (Appendix B, Figure B-1). These two units established the current grid coordinates of a northwest corner of 1939 excavation Area A (Figure 3-19). For the purposes of the project these test excavations met their goal of identifying the 1939 trench location (and by extension the 1939 grid), and carrying out a truncated version of the anomaly ground-truthing program.
In addition to encountering the WPA trench section, these units also documented a thin (>10cm) stratum of intact deposits (Stratum II) at the base of plowzone between 32-35cmbs. A concentration of post holes was documented intruding into Stratum II.

Though not recognized during excavation, examination of field records indicates Stratum II exhibits two zones. Stratum II Zone 1 is a mottled deposit of silty loam with inclusions clayey loam containing very few artifacts. This zone was characterized by the presence of many fragments of degraded sandstone and fire-cracked rock, most about 1-5cm in diameter. This zone was observed in Units 5 and 6 only. Stratum II Zone 2 was a silty loam with a notably greasy texture and a high density of small artifacts and a few charcoal fragments. It was clearly present in Unit 7 and may have extended south into the north half of Unit 6. Only one level of Stratum II was excavated so its final depth is not known for certain. A third stratum, possibly sub-soil, appeared to be present in the base of many of the post holes suggesting that Stratum II probably does not extend much deeper than perhaps ten more centimeters.

The 20 post holes in Units 5-7 originated in Stratum II and penetrated well into Stratum III. Examination of the final plan view of Units 5-7 indicates they likely represent the western wall of House 1 that had been mostly exposed by “Area A” in 1939 (Figure 3-19; Hanson 1966:7; see also Chapter 4). It is notable that Stratum II Zone 1 is mostly to the south and west of the post holes, while Zone 2 is mostly around the post holes, especially in Unit 7. It is tempting to suggest this difference has some relationship to the architecture represented by the posts, but more information needs to be collected by expanding excavations in the area.
Geophysical Anomaly Ground-Truthing Program

After the spring 2013 work, a number of important aspects of the site had been documented including its boundaries, variability of intact sub-plowzone deposits, and the tentative identification of overlapping midden ring areas for which radiocarbon dates now indicated a relative chronology. In addition, control of space had been established with a permanent modern site grid and the current grid location of WPA expansion “Area A” (Figure 3-19). With these issues worked out, most of the remaining fieldwork could be focused on sampling deposits in each of the two midden rings. At the outset of the field season it was proposed that four areas in each midden ring would be sampled. An additional trench was placed in the overlap area of the two rings. This trench served to further refine the location of the WPA grid with respect to the modern grid, and to document and understand the overlap area with greater confidence.

The summer 2013 fieldwork began by re-marking the field with 40m grid stakes. A multi-stage anomaly ground-truthing program was conducted much like the spring, but with the additional step of shovel testing when necessary. The program began by selecting areas with dense concentrations of magnetic anomalies. Selection of areas was not simply based on anomaly density. Having several datasets relating to site structure made it possible to focus the ground-truthing program on specific areas. Several data layers indicted the midden rings surrounded vacant plaza areas in the center, and that the plaza areas were likely surrounded by a mortuary zone, both of which were avoided. In addition, it was also possible to demarcate and avoid most of the 1939 excavation area with a high level of confidence. For the most part, this area would not produce ideal comparative information because it represented the overlap between the midden rings.
Finally, available information indicated that the habitation and trash disposal areas surrounded the plaza and mortuary zones. These were the focus of the ground-truthing program and subsequent excavations.

Different strategies were used to ground-truth discrete and spatially extensive anomalies. The strategy for discrete anomalies was to find their grid location on the surface using the method described for the spring 2013, and centering an initial core on the center of the anomaly. If the core encountered intact deposits, at least one additional core was placed 50-100cm away to confirm and the location was marked for further evaluation by shovel testing. If the initial core did not identify clearly intact deposits, up to four radial cores were typically placed in cardinal directions to clarify the nature of deposits. This was important because it is well documented that depending on the anomaly source, the gridded data output may show a peak that is spatially offset from the actual source (Tabbagh et al. 1997, Milea et al. 2010). To test spatially extensive anomalies a transect of cores was placed through the center of the area at 1 or 2 meter spacing (depending on anomaly size). Radial cores were conducted on either or both sides of the transect areas exhibiting the most promising stratigraphy.

In total, approximately 450 soil cores were conducted to investigate over 60 anomalies, with the stratigraphy and coordinates for each documented on standard forms. About 30 anomalies exhibited what appeared to be intact midden deposits below plowzone, of which 15 were further investigated by shovel testing. Time permitted only half of the highest potential anomalies to be fully evaluated by the ground-truthing program. Numerous cores exhibited potentially intact deposits below plowzone but were not evaluated, and offer great potential for future work. Data from the remaining cores
provide several other types of information. Cores that identified no anthropogenic deposits below plowzone indicate areas of the site that have been deflated by historic deep plowing. It should be noted however, that a lack of midden stratified below plowzone does not rule out these areas for investigation since plowzone-truncated features could be present. In fact, units 1-2 and 5-7 all exposed post holes below plowzone but no midden. Cores in these areas would have appeared to document “deflated” areas of the site unless they per chance encountered a post hole.

Several types of non-midden anthropogenic deposits were encountered below the plowzone. These include possible 1939 excavation backfill, looter backfill, burial fill, burned soil, and a range of mottled or otherwise difficult to interpret soils. One obvious problem with interpreting many cores is that the split spoon window only offers about a 2cm wide window of the stratigraphy. Even with cores spaced at 50-100cm, site stratigraphy often varied greatly in this area which further complicated the task. In many cases it was impossible to rule out whether this variability indicated the presence of a feature boundary, matrix variability within a feature, or an area previously disturbed by looting or previous excavation.

Two types of non-midden deposits repeatedly occurred. The first type, which I have interpreted as possible burial fill, was characterized as finely mottled clay and very dark gray brown to black silty loam. This soil was soft, loose, and had a relatively high moisture content. If the finely mottled clay particles had not been present, it would be almost identical to midden soil. The justification for interpreting it as a “burial fill” was that it was associated with all five soil cores that produced small fragments of what
appeared to be human bone. The type was also observed at approximately ten other locations where bone was not recovered, but further work was avoided at these locations. I suspect that this soil type occurs where burial shafts were excavated into subsoil, some of which was later incorporated into the burial after interment of the individual. Considering that most burials excavated in 1939 contained refuse in the fill, it is likely grave shafts were placed in areas where trash had previously accumulated. The midden-like soil in the possible grave contexts encountered by the soil coring program is consistent with this idea. In fact, one burial pit exposed in the 2013 (unit 11) was encountered by three different core holes. However, because none of the cores hit bone and the matrix lacked clayey subsoil inclusions typical of deeper burial shafts, it was thought to be a trash pit and was excavated accordingly until human remains were encountered. In this case, the burial shaft had been excavated entirely in a midden stratum and so the soil was not diagnostic. While anomalies with this soil type had to be avoided, they incidentally provided important information about site structure (see Chapter 4).

The second type of soil repeatedly encountered consisted of a very characteristic pattern of thin lenses of clayey subsoil, mottled clayey subsoil and midden soil, and midden soil. The lenses varied widely in thickness but were typically discrete as if recently deposited. In addition, the mottled lenses were comprised of clayey subsoil inclusions with very sharp boundaries suggesting they had not incorporated very well with the midden soil. These soils were first identified in 2012, but were not associated specifically with 1939 backfill until the second test excavations encountered an actual trench section (spring 2013, above). At the same time, a similar type of deposit was also
encountered in the looted burial context in Units 1-2 excavated in spring 2012 (see below), and it is likely that at least some anomalies associated with this type of deposit represent looted contexts. At least two looter pits documented in units 10 and 12 had modern metal trash in them, which likely contributed to the magnetic signature of the anomaly with which they were associated. Considering that the 1939 excavation map is now somewhat accurately georeferenced to the modern site grid, this information can be used to rule out whether anomalies associated with this soil type represent 1939 excavation areas or looter pits.

2013: Primary Excavations

The above description of fieldwork was intended to lead the reader through the stages of fieldwork, with a description of the goals, area(s) of the site being targeted, and the general methods employed. The following section provides descriptions of stratigraphy, features and other findings from each excavation area. Appendix C provides plan views of the excavation units, Appendix D provides illustrations of stratigraphic profiles, and Appendix E provides descriptions of stratigraphy and features. These are provided as a reference to the reader who may wish to examine specific aspects of the excavated areas.

Figure 3-20 shows the location of all units excavated between 2012 and 2013, and their location relative to the WPA excavations. Description of the excavations is divided into three areas of the site: Ring 1, Ring 2, and overlap area (Figure 3-21). The primary goal of excavation was to collect artifact samples that will enable comparison between the two midden rings. The excavations were strategically placed to document areas
overlooked by the WPA in each of the two rings, which would provide a more spatially representative sample for the current study. In total, four areas were tested in each midden ring for this purpose. In addition, Units 5-7 and Unit 9 and adjacent Trench 1 (Units 13-19) were carried out in the overlap area (Figure 3-21). The purpose of these units was to document the location of the primary 1939 excavation trench and use this information to georeference the 1939 and current grids.

**Description of Excavation Units and Findings**

This section focuses on describing the stratigraphy, features and artifact content of each excavation area/unit. This information is then used to interpret the relative chronology represented in each unit. Further assessment of site level chronology is provided in Chapter 6.

**Ring 2 Excavations**

The Ring 2 excavations targeted deposits in four separate areas (Units 3-4, 10/12, 11, 20) for a total of 18 square meters. Intact deposits dating to the Late Fort Ancient Period were encountered in every unit, while Late Woodland and Middle Fort Ancient deposits were identified as well. Note that Units 3-4 are described here for organizational purposes even though they were conducted in 2012.

**Units 3-4**

Unit 3 (1x1m) and Unit 4 (1x1m) sampled the northwest quadrant of Ring 2. The long axis of this 1x2m area is oriented east-west. Relatively little information was
available to place Units 3-4 since the geophysical survey had not yet been completed. Aerial photographs and surface collections allowed us to identify and avoid the proposed plaza area, and we used surface density to target areas for soil coring. Several short transects of soil cores identified what appeared to be intact deposits below plowzone, and units 3-4 were situated to encounter them.

The plowzone was stripped off units Units 3-4 at the same time and screened through ¼” hardware cloth. These units, along with Units 1-2 were the only areas where this was done. This was done in order to gage plowzone artifact density. The extremely high density of artifacts from test units in both villages made it clear that 100% sampling from the plowzone would not be feasible for later excavations. The unit was excavated in 5cm levels to provide refined control over stratigraphy that would be useful for interpreting planned radiocarbon analysis of associated botanical remains. The plowzone interface was encountered at 22cmbs (centimeters below surface), and the deepest plow scars extended to a depth of 25cmbs. The entire unit was leveled at 25cmbs at which three horizontal soil zones and a single post hole were documented. Zones A and B consisted of dark brown to very dark brown silty loam mottled with chunks of yellow brown clay that varied in size. There was great variation in the frequency and size of clay chunks, and as zones A and B were excavated this variation appeared as amorphous “patches” of clayey mottling that shifted horizontally with depth. The outline of these zones exhibited a sharp boundary with a distinctive scalloped pattern indicative of a pit excavated by a modern shovel.

Leveling of the unit at 30cmbs to remove undulation from plow scars confirmed this pattern for Zones A and B. With the exception of a small area in the southwest
corner of the unit, Zone A extended to a depth of 40cmbs. It never held a clear border and the base of the deposit was undulating and pocked with divots, likely from the tip of a looter’s shovel. This zone had the largest and most abundant faunal remains, and abundant quantities of diagnostic and non-diagnostic chert and ceramic artifacts. Other notable artifact types recovered from Zone A were debitage and modified fragments of bone, pipestone and cannel coal. Modified (abraded) and unmodified fragments of hematite were also recovered.

As Zone B was excavated an undulating but discernible pit boundary was identified and it designated Feature 2. Mottled clay inclusions were more concentrated in Zone B relative to Zone A. Though artifact density was lower, the same types of artifacts were recovered from this context. A scatter of disarticulated and highly fragmented human remains was identified between 70-80cmbs and excavation was terminated at this point. The base of this feature was not exposed so its final depth is unknown. The burden of evidence indicates Zone B was a looted grave context. The deposits in adjacent Zone A appear to be somehow related to this grave looting event.

Zone C consisted of a homogenous dark grey brown silty loam lacking in the clay mottling characteristic of Zones A and B. Artifact classes recovered from this zone were identical to Zones A and B, but they were generally smaller and more fragmentary. Between 40 and 45cmbs an east-west trending scatter of 7 post holes was identified. The deepest of these was chinked with rocks and clay and extended to a depth of 81cmbs. Two carbonized fragments of nutshell recovered from the fill were submitted for AMS radiocarbon dating. Five of the remaining six for which final depths were recorded extended to 52-54cmbs. The apparent alignment of these posts and similar beginning and
ending depth suggest they are associated with the same unidentified architectural feature. All of these posts were excavated into Zone C.

While this unit is small, sufficient evidence from stratigraphy and feature associations is available to suggest a relative chronology. The earliest period represented is early Late Woodland in age as indicated by the presence of limestone tempered pottery recovered from Stratum II Zone C, and an AMS radiocarbon date on nutshell recovered from this zone produced a date of $1271 \pm 26$ B.P (see Chapter 6). However, both of these contexts also produced Late Fort Ancient (A.D. 1400-1650) diagnostics indicating the Late Woodland materials were not in their original context. No sealed Woodland contexts were encountered in Units 1-2. However excavation was terminated before Zone C was excavated to its deepest extent, so it is plausible that intact Late Woodland contexts lie below 45cmbs (the base of the terminal level).

Artifacts diagnostic of late Fort Ancient were recovered from all levels of Zone IIC. These include bifacial teardrop-shaped endscrapers, type 6 and type 9 triangular projectile points, and pipestone and cannel coal artifacts. Post 9 was excavated into Zone IIC and fill from the post hole produced an AMS radiocarbon date of $347 \pm 23$ (see Chapter 6). The last episode of activity is represented by Zone A and Zone B (Feature 2), which represent a historically looted mortuary context. The concentration of human remains between 70-80cmbs suggests a grave in this location was disinterred, the remains pillaged for grave goods, and reburied with grave fill and whatever other midden soil was present in the vicinity. While numerous prehistorically disturbed graves were encountered by the WPA excavations, modern looting leaves a distinctive type of disturbance. First, the outline of Feature 2 (Zone C) exhibits a scalloped appearance
characteristic of excavating with a modern spade-bit shovel. Second, the majority of prehistorically disturbed burials have a pattern of disarticulated human remains that are less fragmentary and have been intentionally re-interred in a pile either at the head or the foot of the later grave. Finally, Feature 2 soil is characterized by large chunks of clayey subsoil that are not well incorporated into the matrix, and texture that is compact in some areas and loose or soft in other areas. An almost identical pattern was observed in Feature 1 (Units 1-2, below).

Unit 20

Unit 20 (2x2m) sampled the northeast quadrant of Ring 2. The unit is located between N1229.3-1231.3 and E1042.9 and 1044.9. This unit location was determined by soil coring a large magnetic anomaly located between N1227-1230 E1042-1045. Soil cores documented a lens of intact deposits below plowzone that ranged from 0-30cm thick associated with the north edge of the magnetic anomaly. The unit was placed over the two cores with the thickest deposits. The concentration of features encountered in the southern 1x2m area likely represents the northern portion of the magnetic anomaly.

The base of plowzone (Stratum I) in Unit 20 was first encountered at 30cm below datum (hereafter, cmbd), but deep plow scars required leveling the unit at 40cmbd. Deposits from this first uneven level of Stratum II were dry screened. Artifact density was very high in Stratum II, level 1 (30-40cmbd), and decreased dramatically through level 2 (40-50cmbd). Bone, chert, and ceramic artifacts were common in this stratum. Shaped cannel coal, cannel coal debris, and diagnostic ceramic artifacts recovered from this stratum are consistent with a Late Fort Ancient occupation (A.D. 1400-1650).
At 40cmbd three features and six possible post holes were identified in Stratum II. One possible post hole (PP20-3) was bisected and given a feature designation (Feature 12) since its entire perimeter was encircled with stone chinking. The relatively small number of possible post holes identified in this unit and their lack of patterning precludes any observation about their association or function. However, it is notable that while six possible post holes are present, none intrude into the two burial contexts represented.

Feature 9 and Feature 10 were both burials that intruded into Stratum II. It was believed the unit was located outside of the proposed plaza/mortuary area, and no human remains were encountered in the upper levels of these burial shafts, so they were thought to represent pit features until articulated human remains were encountered in both. The fill of both features had two zones. Zone I was a shallow deposit covering only part of each feature and consisted of a heavily mottled matrix of yellow brown clay chunks and dark to very dark grayish brown silty clay. Zone II was the same soil types but with an inverted ratio of clay and silty clay. The clay in Zone II typically consisted of smaller chunks.

The human remains interred in Feature 10 (Burial #3) were completely exposed within the limits of the unit, drawn, photographed and mapped, and then reinterred. The individual was an adult male who was associated with a variety of items that were probably intentionally placed with him as grave goods. These items include 3 triangular and 1 rectangular shell pendants scattered around his neck, and a cluster of items placed above his head. The cluster included two groundstone tools, a large rodent incisor at least 5cm in length, two fragments of faceted hematite, one leaf-shaped knife, and at least five other chert artifacts, the identity of which could not be determined since they were
left in context. One of the fragments of faceted hematite appeared conical in shape and was possibly faceted near the tip as if it had been suspended. The groundstone tools were either celts or adzes, perhaps one of each. The large rodent incisor appeared to be wrapped around or resting on one of the groundstone tools. The elliptical knife is diagnostic of the Late Fort Ancient Period. Marine shell ornaments similar to those associated with Feature 10 occur in both pre- and post- A.D. 1400 contexts, and are therefore not temporally diagnostic.

Only a very small portion of the Human remains interred in Feature 9 (Burial #2) were exposed. A pair of very small longbone diaphyses, a femur, and an unfused patella were identified by several bioarchaeology students which was enough evidence to confirm the feature represents a juvenile human burial. After this identification was made the feature excavation was terminated, plan views and profiles were drawn, and the context was photographed and back-filled. Since little of the individual was exposed, it is not known whether any artifacts were associated with them, though a very large rim sherd was interred in Zone II from 10-30cm below the top of the grave shaft. While it is quite possible the rim sherd incidentally occurred in the pit fill, that it was the largest artifact in the portion of the grave excavated, and its prominent location near the top and centered on the grave suggest it may be an intentional inclusion. The shallow trailed design on the rim, which exhibits a flared orientation both suggest a Madisonville Series assignment. Other diagnostic artifacts recovered from the grave fill include additional Madisonville Series ceramics, cannel coal debris, and a shaped cannel coal object.

After Features 9 and 10 were backfilled, Stratum II, Level 2 (40-50cmbd) was excavated. Stratum III consisted of a 20cm thick (50-70cmbd) sandy silt deposit devoid
of artifacts. Below this the top of Stratum IV was exposed revealing a scatter of five possible post molds. The posts were mapped and one was excavated to collect the soil for flotation. Several limestone tempered sherds, but no shell tempered sherds were recovered from the post fill suggesting that Stratum IV may relate to the Late Woodland component identified in Units 3-4. Since Features 9, 10, and 12 all penetrate into this stratum, it would follow that the abundant limestone ceramics recovered from several contexts in this unit originally came from this buried component.

The occupational sequence in this unit is somewhat complicated by multiple strata and several intrusive features. The earliest occupation appears to be a buried Late Woodland occupation lying approximately 70cmbd and capped by a 20cm thick sterile sandy deposit, perhaps from a flood episode. The second activity would be the deposition of midden soils from a Late Fort Ancient Period occupation indicated by the diagnostics recovered from Stratum II. At some point after about 15-20cm of midden accumulated from this occupation Features 9, 10, and 12 were excavated into this stratum. Since they were all first identified at the same depth and none of them intrude into each other there is no means of assessing their relative age. Zone I in Features 9 and 10 may be represent the latest deposit since it is stratified above the primary fill of both features, and they intrude into Stratum II.

Units 10 and 12

Unit 10 and Unit 12 comprise a 2x4m area that sampled the southwest quadrant of Ring 2. The location of Unit 10/12 was determined by a single transect of 5 soil cores through a small moderate intensity magnetic anomaly. Four of the five cores exhibited
midden deposits 20-30cm thick, two of which were underlain by a 5-10cm thick lens of ash. The fifth core was the western-most of the transect and contained little intact deposits below plowzone. Based on coring and shovel testing in other areas of the site, it was clear that this location contained intact deposits ideally suited for excavation, so a shovel test was not conducted. Excavations revealed an in situ thermal feature below the highest intensity portion of the anomaly adjacent to an ash dumping pit, and trash pits described below.

Stratum I was a 32cm thick plowzone that was stripped off Units 10/12 as a single level and tossed. Diagnostic artifacts were non-systematically collected from the plowzone as it was being removed. The Base of Stratum I encountered intact deposits and a series of plow scars. Stratum II Level I (32-35cmbd) flattened the base of the unit to the bottom of the plow scars. Subsequently, Stratum II Level 2 (35-45cmbd) and Level 3 (45-55cmbd) were excavated. Stratum II consisted of a dark gray brown to very dark gray brown silty loam with a high moisture content and moderate compactness; it was largely homogenous (vertically and horizontally) in texture, color, and moisture throughout. The exception is that a concentration of burned clay and charcoal fragments were observed in the southeast quadrant of Unit 12 (in Level 3), which may derive from the underlying Feature 14 (described below).

The artifact density of Stratum II was extremely high; and compared to Units 11 and 20 it exhibited an even greater concentration of large faunal and pottery remains. Level 1 contained cannel coal ornament manufacturing debris, pipestone debitage, Madisonville Series jar, bowl, and pan forms, a bifacial teardrop-shaped endscraper, and Type 2, 4, 5 and 6 triangular projectile points. With the exception of Type 2 projectile
points (n=3), all of these materials indicate a Late Fort Ancient Period occupation. Subsequent levels of Stratum II exhibited a similar pattern of diagnostic materials, but with the addition of a small proportion of Middle Fort Ancient diagnostic ceramics. These included vertical jars with flattened dowel-notched lips and cordmarked lips and thick strap handles attached by rivets. Type 2 triangular projectile points, which tend to occur in Middle Fort Ancient occupations, were also present in Levels 2 and 3.

Three looter pits and five possible post holes were initially identified at the base of Stratum I (32cmbd), and confirmed at the base of Stratum II Level 1 (35cmbd). The looter pits were designated Feature 2, Feature 4, and Feature 13. These features were characterized as a mixture of Stratum I/II soils and chunks of clayey subsoil. Similar to the looter pits in Unit 3/4 all three exhibited scalloped shovel marks along the sides, divots in the bases, and random concentrations of un-incorporated clayey subsoil in a heavily mottled matrix characteristic of modern back fill. This type of backfill is common in both looter pits and WPA trench backfill at the site. The scalloped cut marks along the pit walls exhibit a sharp clean soil boundary between the backfill and the intact soils into which the pits were dug. To be sure, Features 4 and 13 both contained Armour potted meat cans near their base.

Careful consideration of the possible post holes determined at least some were also looter holes. For example, possible post 10-1 initially appeared to be a prehistoric feature but photographs and plan maps show distinctive shovel marks along the feature perimeter. The other possible post in Unit 10 (10-2) and two of the three possible posts in Unit 12 (12-1, 12-3) appear to be good prehistoric contexts but contained the same soils as the looter pits and possible post 10-1. The final possible post 12-3 does not
exhibit any indication that it is a looter hole. In sum, there is reason to question assigning
most of these features as prehistoric posts. Evaluating the remainder will require more
expansive excavation to rule out the possibility they belong to an architectural feature of
some kind.

Given that several larger adjacent features originating at the same depth were
confirmed as looter holes, it is entirely plausible they are all looter holes. Further, the
three looter hole features are located where prehistoric deposits are deepest, while the
smaller pits in question are in the area where deposits are relatively shallow. This might
suggest that the “possible posts” are small because they looter “test” holes aimed at
locating a more concentrated area, while the “features” are larger because a looter
expanded a test hole after identifying deeper more productive deposits. Not including the
questionable post holes, a total of 1.4 square meters or 17.5% of the 8 square meters
excavated by Unit 10/12 were disturbed by these three pits, which might be considered
“heavily” looted. However, careful documentation and removal of these disturbed areas
successfully exposed numerous intact contexts providing a wealth of information.

Most sealed feature contexts identified in this unit were first identified at the
Stratum II/III interface at approximately 55cmbd. Stratum III has the same soil
characteristics as Stratum II, but had an even higher density of artifacts. Several
additional attributes distinguish Stratum III. First, at 55cmbd clayey subsoil was exposed
in the western portion of Unit 12 and eastern portion of Unit 10 that confined the
remaining portion of the midden deposit within a recognizable boundary forming a
northwest-southeast oriented area. This area occurs almost entirely between two lines of
post holes with the same axis and also first recognized at 55cmbd. Finally, Features 14 and 15 were also definitively recognizable at this depth.

The pattern of artifacts in Stratum III is distinct from Stratum II, consisting almost entirely of Middle Fort Ancient diagnostics. Ceramics from this stratum include exhibit a variety of attributes consistent with Middle Fort Ancient ceramic types (e.g., Fox Farm Cordmarked) vertical to slightly in- or out-slanting jar rims, flattened lips with cordmarking or cord-wrapped dowel notching, riveted strap handles and molded loop/strap handles, and u-shaped lug handles. Diagnostic lithics were not common. Only one triangular projectile point was recovered, a Type 4. A chipped sandstone disk fragment was also recovered. Typically made of limestone, chipped disks are common at many Middle Fort Ancient sites in Kentucky. No Madisonville Series ceramics or lithics were recovered from this stratum. Four fragments of bone beamers were recovered, which are typical of, but not exclusive to Late Fort Ancient components.

Feature 14 was the first feature identified in Stratum III, and measures 98cm north-south by 138cm east-west. As mentioned above, Feature 14 may be identifiable as early as Stratum II, Level 3 (45-55cmbd). Plan views, photographs and unit/level forms indicate burned clay and large charcoal fragments were concentrated in the area directly above Feature 14 (Stratum IIB) and extending into the south wall of Units 10 and 12. However, these inclusions did not form any kind of boundary or coherence until Feature 14 was defined at the top of Stratum III. This situation suggests natural and or cultural formation processes disturbed and re-deposited the upper portion of Feature 14 into the lower levels of Stratum II. When it was first defined at 55cm below datum Feature 14 consisted of two related but distinct zones. Zone A is the central and eastern portion of
the feature and consists of a fire-hardened clay surface. The soil immediately
surrounding the fire-hardened surface has a concentration of charcoal chunks and
fragments. Zone B is the western portion of the feature and consists of a narrow linear
area following the western margin of Zone A.

Since the Unit10/12 edge roughly split the feature it was decided to use this as a
bisection line and the portion of Feature 14 located in Unit 10 was excavated. The
bottom of Feature 14 forms a shallow circular basin which was filled with a high density
of pottery and faunal remains. The portion of Feature 14 located in Unit 12 (including all
of Zone B) was not excavated due to time constraints.

Diagnostic artifacts from Feature 14 are exclusively Middle Fort Ancient. These
include Type 2 and 5 triangular projectile points, a triangular-based drill. Ceramics
include vertical jar rims with flattened, cord-wrapped down-notched lips, and u-shaped
lug handles. One fragment each of cannel coal and pipestone debitage were recovered
from the feature. Artifacts made from these materials are much more common during the
Late Fort Ancient, but not exclusive to it. Moreover, both raw materials are available
locally and may have sporadically been used before the Late Fort Ancient. This feature
also contained dense concentration of faunal remains and non-diagnostic ceramics.

Feature 15 was also recognized at 55cmbd. This feature is an ash dump
measuring 115cm east-west by 75cm north-south. Small ashy inclusions were common
throughout Stratum II above the feature. This feature exhibited two 5cm-thick strata of
ash that extended to a maximum depth of 70cmbd. The lower stratum has a larger
horizontal area in the unit than the upper stratum. The entire contents of the feature were
collected for flotation, which has not yet been processed. The matrix appeared to be
almost entirely ash. Only a few thick cordmarked body sherds and no diagnostic artifacts were observed during excavation.

Finally, the two lines of post holes mentioned above occurred entirely at the base of stratum III being identified only in contrast to surrounding Stratum IV, a clayey subsoil. There are 9 posts in Unit 12 Stratum IV; they average 11.6cm in diameter and originate between 55-60cm below datum. Excavation of all nine indicate they are prehistoric post holes. Five of the six largest post holes run in a nearly straight line, while the other four are scattered to the east. While it is clear they originate below Stratum II and therefore predate it, their relationship to the Features 14 and 15, and the basin is indeterminate. The proximity of these post holes to the firing activities that generated Feature 14 suggest they are not likely contemporaneous because the fire would have been a hindrance to whatever wooden architecture they represent.

There are also 9 possible post holes in Unit 10 Stratum IV, but none were excavated. These originated at 58-60cm below datum outside of the Stratum III basin and 63-72 cm below datum at the bottom of the Stratum III basin. Those inside the basin were first identified at its base. The prehistoric excavation of the basin appears to have truncated the tops of the post holes identified inside it. Although the possible post holes in Unit 10 probably all originated at approximately the same depth as those in Unit 12, there is some reason to believe they represent different architectural features. First, the possible post holes in Unit 10 average only 7.2cm in diameter, as compared to 11.6cm for those in Unit 12. Second, those in Unit 10 form an arc toward the northeast, away from the straight line represented by those in Unit 10. The two sets do not form a pattern that
appears to converge or be related. Further evaluation of the relationship between these post hole lines will require more expansive excavation in the area.

The occupational sequence represented by this excavation area is fairly straightforward. The super-position of Stratum III over the line of small diameter posts in Unit 10 indicates the latter represent the earliest activity in the unit. The age of occupation represented by the post holes in Unit 10 cannot be evaluated since were not excavated, though the superposition of the Middle Fort Ancient – aged Stratum III indicates they date to the Middle Fort Ancient or earlier. Both Stratum III and Features 14 and 15 intruding into it are Middle Fort Ancient in age (A.D. 1200-1400). No clear diagnostics post-dating Middle Fort Ancient were recovered in these contexts. The string of posts in Unit 12 were identified at the Stratum II/Stratum III interface. All that can be said of these posts is that they predate Stratum II. Their contents were collected for flotation but have not yet been analyzed.

The lower two levels of Stratum II contain a mixture of Middle and Late Fort Ancient diagnostics. However, only a small proportion of diagnostics are Middle Fort Ancient. The re-deposition of the top of Feature 14 into the lower portion of Stratum II level 3 and the smattering of Middle Fort Ancient diagnostics in the stratum indicates use of the area during the Late Fort Ancient period disturbed Stratum III deposits in a predictable manner. Almost no Middle Fort Ancient diagnostics were recovered from the uppermost level of Stratum II indicating mixing with lower deposits was minimal by the time 20cm of deposits had accumulated on top of the Middle Fort Ancient occupation. Lastly, several features (2, 4, 13) and possible post holes were later identified as looter holes of mid-late-20th century age.
Unit 11

Unit 11 is a 2x2m area that sampled the eastern portion of Ring 2 between units 3/4 and 10/12. This unit was an extra sample of the east portion of the Ring 2. It was conducted in lieu of a unit in the southeast quadrant which has mostly been excavated by WPA excavations. The small remaining area was near the proposed plaza and had to be avoided due to the high probability of encountering burials. The location of Unit 11 was determined by highly productive soil coring around a scatter of low intensity magnetic anomalies between N1195-1205 and E965-975. Two transects of cores in this area documented 10-30cm stratum of artifact rich midden-like soil above a thin stratum of burned clay. A shovel test placed over one core confirmed the nature of deposits and Unit 11 was centered over the thickest documented deposits.

The plowzone (Stratum I) was stripped from Unit 11 as a single level and tossed. The Base of Stratum I encountered intact deposits and a series of plow scars between 25-30cm below datum. After removing Stratum I soil from plow scars, Stratum II was excavated in two levels (1:30-40cmbd, 2:40-50cmbd). Stratum II consisted of a brown silty clay loam with a moderate moisture content and compactness; it was largely homogenous (vertically and horizontally) in texture, color, and moisture throughout. The artifact density of this first stratum was extremely high. At the base of Stratum II, Level 2 (50cmbd) the eastern half of the unit still exhibited a high artifact density while the western half was nearly sterile and was transitioning to a clayey subsoil.
Stratum II, Level 1 contained the full array of Madisonville Series pottery including jar, bowl, and pan rims. In addition, at least one middle Fort Ancient diagnostic rim was recovered from this level; a direct thickened rim with a flattened lip, cordmarking on the rim and poorly smoothed-over cordmarking on the neck. The sherd was coarsely tempered and the lip, rim, and neck were all over 7mm in thickness; higher than the average thickness for Madisonville Series pottery at Hardin (see Chapter 4). These attributes are all consistent with published descriptions of Middle Fort Ancient types such as Fox Farm Series (Turnbow and Henderson 1992), though this assemblage needs to be more systematically examined before they are assigned to a specific type or series. Other chronologically sensitive artifacts from this level include several bone beamer fragments, cannel coal debris, pipestone debitage, nine Type 6 triangular projectile points, one Nodena triangular projectile point, and one uniface endscraper. A single small fragment of twisted copper scrap metal was also recovered from the 1/16” artifact sample from Level 1. Level 2 also contained typical Late Fort Ancient diagnostic artifacts Madisonville Series jar and pan rims, shaped cannel coal object fragment, pipestone debitage, and a bone beamer fragment. A radiocarbon determination on a Zea Mays cupule from Stratum II Level 2 produced a date of 375 ± 23 B.P. (see Chapter 6).

Three features, one artifact concentration, and one possible post were documented in Stratum II. Feature 5 is an oblong area (30cm E-W x >100cm N-S) of intense in situ burning that was first encountered in the shovel test used to confirm the stratigraphy identified in the soil cores. Small fragments of burned clay were first encountered near the base of Stratum I but the feature outline was not clarified until the unit was leveled off at the middle of Stratum II, Level 1 (35cmbd). Feature 5 Zone 1 is the central area of
the feature that was exposed to the greatest amount of heat; it is very hard, reddened, low
moisture silty loam. Zone 1 is a shallow lens of little more than 10cm thick (35-47cmbd).
No artifacts or microartifacts were observed in association with this zone in the field,
though a flotation sample collected from this context may prove otherwise.

Zone Ia is a small concentration of ash to the north of Zone I and may be from the
use of the feature. Zone II surrounds Zone 1 in plan view and underlies it
stratigraphically. Zone II consist of a softer silty clay matrix that contained a low density
of microartifacts. This zone is about 20cm thick and extends down to the interface of
Stratum II (midden) / III (clayey subsoil). Both zones exhibited small ashy inclusions.
The full long axis dimension is unknown since the north wall of Unit 11 bisects the
feature. While the four flotation samples from this feature have not yet been processed,
several artifacts observed in the field indicate a Late Fort Ancient age. These include a
Type 6 triangular projectile point with shallow serrations along one margin and a
fragment of pipestone debitage. An AMS radiocarbon determination on a Zea Mays cobb
fragment from Zone 1 produced a date of 451 ± 23 B.P. (see Chapter 6).

Feature 8 (Burial #1) was encountered near the base of Stratum II, Level 2 at
approximately 48cmbd. Feature 8 is a human burial with a grave shaft measuring 70cm
by 190cm with the long axis oriented about 10 degrees west of south. The burial
contained an adult female in fully extended position with her head pointing the south and
her hands at her sides. The axis of her resting body was between 1 and 4 degrees west of
south. While many artifacts were distributed in the grave fill, only three had possible
associations with the interment. The clearest burial association consisted of two mussel
shell implements lying face up and adjacent to each other just above her groin. These
items exhibited rounding along the edge opposite the hinge. Another somewhat less clearly associated item was a very well-crafted uniface endscraper made of an unidentified chert type. Rounding and possible polish could be observed on the bit edge without magnification indicating heavy use, and at least part of the tool appeared to be covered with an unidentified residue.

Close attention was paid to possible artifact associations as the individual was exposed for documentation, but since artifacts were not collected from the burial fill other possible associations may not have been accounted for. Several aspects of the burial indicate it dates to the Late Fort Ancient Period. First, the uniface endscraper possibly associated with the interment is a type occurring primarily after A.D. 1400. Second, extended burials, while present before A.D. 1400, are the predominant burial position after A.D. 1400. Finally, a Type 4 projectile point, a shaped cannel coal object fragment and cannel coal debris recovered from the upper level of grave fill (identified in Stratum II, Level 2 before it was recognized as burial) tend to date after A.D. 1400.

A notable artifact concentration was identified outside of the burial shaft in Stratum II, between the burial and the east unit wall. These items occurred at the same depth as the burial shaft depth of origin (48cmbd). This unassigned feature consists of many large faunal remains including a complete turtle carapace, crania from two small mammals, a large antler section, and half a dozen large pottery sherds, some with residue adhering. Even more interesting was a disarticulated human carpal was documented on the burial side of this artifact concentration. Excavation notes indicate it was located outside of the burial shaft about 20-30cm to the east of the burial. A second human skeletal element, the proximal epiphyses of a tibia, was observed in the northeast
50x50cm area of the unit, clearly outside of the burial shaft. While the hand bones were scattered within the burial shaft and it is possible one could have been somehow disinterred as part of a post-mortem mortuary ritual, the tibia fragment could not have been from the individual in Feature 8 since both of her tibiae were present.

Several possibilities could account for the artifact concentration and human elements in Stratum II, Level 2. Mortuary ritual involving removal of selected skeletal elements has been documented at several late Fort Ancient sites including examples in the 1939 Hardin Site burials (see also Pollack et al. 1987), which may suggest the artifact concentration is a ritual (feasting?) deposit associated with the mortuary feature. At the same time, Stratum II contained a high density of artifacts and the proximity of the burial to the artifact concentration may simply be fortuitous. Many prehistoric features documented by the WPA had cut into (prehistorically) and disturbed portions of earlier graves (e.g., Burials 264 and 285). Apparently this activity occasionally resulted in the deposition of miscellaneous skeletal elements in non-mortuary contexts. This phenomenon is evidenced by the periodic identification of miscellaneous skeletal elements in a variety of non-mortuary contexts at several sites excavated by the author.

Finally, a relationship to the unassigned feature encountered in the southeast corner of the unit cannot be ruled out until it has been documented. This unassigned feature is much closer to the artifact concentration. Many burials excavated by the WPA intruded into earlier burials. In most cases, the prehistoric grave excavator placed most of the remains in a pile near the head or the foot of the person being interred.

All of the features and strata in this unit contained Late Fort Ancient diagnostic artifacts. A single rim sherd diagnostic of the Middle Fort Ancient period was recovered,
and may relate to deeper deposits not yet excavated in this unit (terminated at the top of Stratum II, Level 3), or to unidentified contexts near the unit. Thus the earliest solid context documented in this unit would be the midden accumulated at the base of Stratum II, Level 2. The artifacts recovered from this level of the midden however are not chronologically sensitive enough to determine whether this lower midden dates to the early late Late Fort Ancient Period. After a few centimeters of midden had accumulated above Level 2 (to 48cmbd) Feature 8, a burial pit, was excavated into the deposit and an adult female was interred. The artifact concentration in the southeast corner was deposited at the same depth as the origin of the burial pit, suggesting they may be contemporaneous. The nature of the artifact concentration compares well to others that have been interpreted as the remains of mortuary rituals such as feasting and ritualized manipulation of the dead. In particular, a phalange (and a fragmentary tibia to the north), and a pile of large residue-encrusted pottery sherds and faunal remains support this interpretation. However, the areas to the east and southeast should be examined to rule out the possibility that these are not related to the unassigned feature protruding from the southeast corner of the unit.

Following the mortuary activities related to Feature 8, the area appears to have been used solely for refuse disposal for some time. Dense midden accumulated above the origin of Feature 8 (48cmbd) up to about 35cmbd. The large quantity of type 6 projectile points to the near exclusion of any other types might alone suggest this midden dates to the late Late Fort Ancient Period. However, a small scrap of copper from this Level is consistent with this age. Feature 5 was excavated into the midden when it had reached 35cmbd. The feature reached down quite far through Stratum II disturbing the northwest
edge of Feature 8 and contacting subsoil on the west side of the unit. The presence of several centimeters of midden capping Feature 5 indicates the area continued to be used for refuse disposal for an unknown time after this fire area had been abandoned.

**Ring 1 Excavations**

The Ring 1 excavations targeted deposits in four separate areas (Units 1-2, 8, 21, 22) for a total of 10 square meters. Intact deposits dating to the Late Fort Ancient Period were encountered in every unit. Note that Units 1-2 are described here for organizational purposes even though they were conducted in 2012.

**Units 1-2**

Units 1 and 2 (1x1m each) were adjacent to each other and sampled the southwestern quadrant of the Ring 1. As with Units 3-4 (described above) relatively limited data informed the placement of these first two test units. This unit location targeted an area of high artifact surface density located in the southern portion of Ring 1 in what we thought was outside of the plaza. Several short transects of soil probes spaced every 5 meters identified a small area containing 5-10cm of apparently intact midden deposits below the plowzone. Unit 1 was centered over a core that identified about 20cm of deposits below plowzone. Unit 2 was opened to the west of Unit 1 in order to increase horizontal exposure of a possible post hole pattern identified as the base of plowzone in Unit 1.

The plowzone (Stratum I) was stripped off Units 1-2 and screened through ¼” hardware cloth. These units, along with Units 3-4 were the only areas were the plowzone
were dry screened through ¼” mesh to gage artifact density. The extremely high density of artifacts from the plowzone in Units 1-2 reinforced the finding from Units 3-4 that 100% sampling from this stratum would not be feasible for later excavations. Like Units 3-4, Units 1-2 were excavated in 5cm levels to provide refined stratigraphic control.

The base of the modern plowzone (Stratum I) was first encountered at between 22-25cmbs and the plow scars extended to depth of 30cmbs. Stratum II was a very dry and compact, which distinguished it from Stratum I which had a higher moisture content and was loose. Stratum II also had fewer large artifacts, but some small charcoal flecks. As with Units 3-4, a second set of plow scars extended from the base of Stratum II into the top of Stratum III. The presence of plow scars at the base of Stratum II indicated that it was a buried historic plowzone. They were oriented in the same direction as the plow scars extending from the base of Stratum I. Most of Stratum II extended to 35cmbs, while the plow scars extended to 40cmbs. Both Stratum I and Stratum II contained diagnostic artifacts consistent with a Late Fort Ancient occupation: Madisonville Series jar, bowl, and pan rims, Type 5 and 6 triangular projectile points, unifacial and bifacial teardrop-shaped endscrapers, and debitage and shaped fragments of cannel coal and pipestone.

Stratum III (subsoil) consisted of a culturally sterile, semi-compact, yellowish brown clay loam. No levels were excavated from this Stratum. Five possible post holes and Feature 1 intruded into the top of Stratum III. Feature 1 was the focus of excavation in Stratum III. It consisted of a brown silt loam mottled with chunks of yellow brown clay in various sizes. The matrix was unconsolidated and the clay chunks were sporadically mixed with darker areas of prehistoric midden-like soil. The prehistoric
midden-like soil contained all artifact types, charcoal fragments, and numerous microartifacts. This feature, like Stratum II was excavated in 5cm levels. After a few levels had been excavated several disarticulated and possible human bone fragments had been recovered. In the field, it was indeterminate whether this represented modern looting, or prehistoric disturbance of a burial, both of which are common at the site. The feature was excavated in 5cm levels to 75cmbs (its base) in the west 1/2 of Unit 2 and to about 70cmbs in the east 1/2. Fragmentary human remains were recovered all the way to the base of the feature, often mixed with chunks of subsoil and pockets of artifact rich midden-like soil redeposited into the looted grave shaft.

The pockets of midden-like soil in Feature 1 matrix contained the range of artifacts and inclusions typical for midden: charcoal bits, microartifacts, mussel shell, chert debitage and tools, pottery, and faunal remains. Small marine shell beads (n=7) were recovered in four of the six levels that also contained human remains, suggesting these may have been grave goods. The beads are small marginella shells with one end ground to provide a hole to sew or string them onto something. Diagnostic artifacts recovered from this context indicate a Late Fort Ancient occupation: Madisonville Series jar and bowl forms, bifacial and unifacial teardrop-shaped endscrapers. A single Type 2 triangular projectile point was the only diagnostic inconsistent with the overwhelming burden of evidence indicating a Late Fort Ancient occupation for this context.

The five possible post holes (PP1-PP5) occurred along the periphery of Feature 1. Like many of the possible posts documented in Unit 10/12 their proximity to the looted burial in Feature 1 raises the possibility they are random shovel divots. This would imply that the AMS date from nutshell recovered from post 2 represents an unknown context,
perhaps fill from the burial or midden that had been overlying it before it was looted. Possible post holes 1, 3, and 4 are the best candidates for actual prehistoric features in these units; their outlines and bases were regular, their fill contrasted both Stratum III and the looter backfill in Feature 1, and they all extend to approximately the same depth (40-43 cmbs). Possible Post #2 appears to be a tree root, and possible post hole #5 is an unknown context extending into the southwest corner of Unit 2. The south and west profiles of Unit 2 exhibit the same mottling as Feature 1, which might suggest possible post hole #5 is another looted area.

The contexts represented in Units 1-2 include only a looted burial and a scatter of post holes all of which are intrusive in Stratum III. Artifacts from these contexts, as well as the two overlying plowzones overwhelmingly indicate a Late Fort Ancient occupation. Madisonville Series pottery jar, bowl, and pan forms were recovered alongside endscrapers and projectile point types (5 and 6), and cannel coal and pipestone debris and shaped objects consistent with this temporal assignment. Finally, an AMS radiocarbon determination on a fragment of *Carya Sp.* nutshell produced a date of 448 ± 28, which is consistent with these temporally sensitive artifact types (see Chapter 6).

Unit 21

Unit 21 sampled the northwest quadrant of Ring 1. This unit was located at N1119.5-1120.5 and E983-985. This area was on the southern border of the “village overlap area” which was generally avoided when sampling for each village, but also north of what appears to be the plaza of Ring 1. Its location was determined by soil coring a small moderate intensity magnetic anomaly. Soil cores documented a possible
midden stratum of about 10cm thickness in a 3x2m area where the anomaly was detected. A small 2x0.4m trench was excavated to remove plowzone in place of a shovel test, revealing intact deposits below plowzone. A 1x2m unit was expanded from the original test trench.

Stratum I (plowzone) was not screened, but several artifacts were collected during its removal. Among these were a fragment of cannel coal debitage, two Madisonville Series jar rims, and a thick shell-tempered strap handle fragment. One of the jar rims exhibits a unique rectilinear guilloche pattern that forms a swastika-like design. Based on this information alone, the artifacts in Stratum I represent a Late Fort Ancient occupation, though other occupations cannot be ruled out since the stratum was not systematically screened for artifacts. Four plow scars extended from the base of Stratum I into Stratum II to a depth of 36cmbd.

Aside from the plow disturbed areas, Stratum II was detected at approximately 31cmbd. Only one level was excavated from Stratum II (Level 1:31-36cmbd) to flatten the unit at the base of the plow scars and collect a sample of artifacts from the intact deposits. Time constraints prevented excavation of a second level in Stratum II. At the top of the stratum three zones were documented. Zone 1 represented the intact midden identified in the test trench, Zone 2 a looter pit on the east end of the unit, and Zone 3 a rodent disturbed area that may have once been several post holes. At the Stratum I / II interface, several concentrations of burned earth inclusions were mottled in discontinuous sections of Zones 1 and 2 suggesting that a thermal feature may have once been present in the area but has subsequently been destroyed by looting, plowing, or rodent disturbance. Stratum III, a silty clay subsoil, was observed in the walls of the looter pit.
and in the east profile of the unit. Its depth of origin at approximately 65cm below datum suggests several more levels of Stratum II could be present.

Since most of the area of the unit was disturbed, little deposits were sampled and none of the areas produced diagnostic artifacts. However, several diagnostics were collected from the top of the level before the zones were defined. These cannot be confidently associated with a specific zone. These include one each Type 4, Type 6 and Nodena triangular projectile points, and one limestone tempered body sherd. The projectile points are Late Fort Ancient diagnostics, while the limestone tempered sherd probably dates to the late Woodland Period.

A scatter of 12 possible post holes was also documented in Stratum II. Only 8 of these were fully evaluated while the others were written off due to their location in the rodent disturbed area. Only possible post holes 1-5 are good candidates for prehistoric features while the remaining 3 likely represent rodent disturbances. Only one potentially diagnostic artifact was recovered from the post hole fill, which was collected and processed by flotation since these represent some of the only intact deposits from which carbonized remains could be submitted for radiocarbon analysis. A small fragmentary rim sherd was recovered from Post #4, and compares well to a pan form, but its small size precludes confident identification.

To summarize, intact deposits are represented by a small area of Stratum II, Zone 1 and 5 post holes. These contexts produced only one questionable pan rim. Thus, no diagnostics recovered from this unit can confidently be associated with the documented intact deposits. It is possible that unprocessed <1/4” artifact fractions may contain diagnostics, but these have not yet been processed. At the same time, that majority of
diagnostic artifacts recovered disturbed contexts (Stratum I, Stratum II, Zones 2-3) contexts almost exclusively point to a Late Fort Ancient occupation. In addition, the presence of a limestone tempered body sherd and a Middle Fort Ancient rim sherd from the same disturbed contexts indicates pre-Late Fort Ancient occupation. Until a larger area can be exposed to collect more spatial information and larger sample of artifacts all that can be said is that multiple components are represented and that the Late Fort Ancient material is most well-represented.

Since Unit 21 was relatively small and failed to document a substantial quantity of artifacts or information about features, it should be considered a test unit. The midden deposits represented by Stratum II were not dense, which is why no diagnostics can be confidently associated with it. This situation is unique among units with limited sub-plowzone deposits, because all others still produced a moderate to high density of artifacts. Therefore, this area represents a distinctive type of deposit that warrants further investigation to determine its nature. The presence of a post scatter may suggest these deposits represent a maintained activity area, perhaps near or within a dwelling structure. Future testing should focus on the area south and west of the unit since the largest area of intact midden extend into these walls. The displaced burned deposits encountered at the Stratum I/II interface were concentrated in the north half of the unit so future excavation targeting this deposit should focus on the area north of Unit 21 to evaluate the presence of a burned feature.
Unit 22

Unit 22 (1x2m) sampled the southeast quadrant of Ring 1. This unit is located at N1036.25-1038.25 and E1052.75-1053.75, roughly centered on a large magnetic anomaly. Systematic soil coring at the anomaly location identified 20-40cm thick intact deposits below the plowzone and a 1x0.5m test trench was excavated using the same method as for units. Stratum I was excavated to a depth of 22cm below surface where intact deposits (Stratum II) containing a concentration of artifacts were identified. Based on this information the test trench was expanded to encompass a 1x2m area.

Plow scars extended from the base of Stratum I (plowzone) and were removed to reveal Stratum II at 22cmbd. Stratum II consisted of a mostly homogenous midden, a brown silty loam with charcoal flecking, burned soil inclusions, artifacts and microartifacts of all varieties. Two undefined areas were identified at the top of Stratum II. The first was a small patch of darker soil that contained an artifact concentration in the south half of the unit. This would later be recognized as Feature 16. The second was a small area of reddish brown burned sandy loam in the southwest corner of the unit. Patches of this reddish burned soil were observed sporadically in the south half of the unit in subsequent levels, but were never discrete enough to define them as a feature or excavate them separately. Stratum II, Level 1 (22-32cmbd) recovered typical undecorated Madisonville Series jar rim sherds, a single pan rim sherd, a Type 4 triangular projectile point, and cannel coal and pipestone debitage. Based on this information, this level represents only a Late Fort Ancient occupation.

At the top of Stratum II Level 2 (32cmbd) the outline of Feature 16 was exposed along with several distinct soil zones in the north half of the unit. A radiocarbon date on
a *Zea Mays* cupule from this stratum outside of Feature 16 produced a date of 471 + 24 B.P., while a date on a *Zea Mays* kernel fragment from near the base of Feature 16 produced a date of 956 + 27 B.P. (see Chapter 6). In the south and central areas of the unit, the homogenous midden (Zone 3) continued from Level 1. Most of the north half of the unit consisted of Zone 6, a mottled matrix of medium to dark brown silty loam (75%), and inclusions of light gray ash (15%) and reddish orange burned soil (5%). Like Zone 3, Zone 6 contained many inclusions of microartifacts, notably flecks of mussel shell, burned bone, and charcoal fragments. A small 25x25cm area in the northeast corner of the unit (Zone 6A) exhibited an even higher concentration of burned soil and large charcoal fragments.

**Stratum II Level 2 (32-42cmbd)** consisted of excavating a 1x0.5m area encompassing most of Zone 6. Before the area was excavated Zone 6A was sampled for flotation. No particularly diagnostic artifacts were recovered from any zone in this level, probably owing to the fact that only a small area of each was excavated. One thin strap handle was recovered from Zone 6, which is typical for Madisonville Series ceramics, though this artifact is not a particularly strong temporal indicator by itself. It should be noted that a single limestone tempered sherd was recovered from both zones in this level.

Excavation of Level 2 revealed that Zone 6 contracts to the south at 42cmbd exposing more of Zone 3 in the northwest corner and west wall. Bound by Zone 3 to the south at 32cmbd and to the north at 42cmbd suggests that Zone 6 is a lens or feature within Zone 3. Without additional excavation, the identity of this context will remain indeterminate. A 50x50cm area of Zone 3 was sampled from 42-52cmbd was excavated from the test trench located in the northeast quadrant of the south 1x1m area. Artifact
density was much lower in Stratum II Level 3, but Zone 3 continues below the base of this level as indicated by reddish mottled burning at 52cmbd. Level 3 did not produce any diagnostic artifacts. However the recovery of shell tempered ceramics from this level indicates that late prehistoric occupational deposits continue at least to 52cmbd in this unit.

Feature 16 originates at the base of Stratum I (22cmbd) in a small area, and was fully defined at 32cmbd. The East wall profile of this unit indicates that the removal of Stratum II Level 1 (22-32cmbd) unavoidably truncated about 5cm of the top of the feature since it was not known that the zone at the base of Stratum I was a feature. Since a thin lens of Stratum II matrix covers most of the top of Feature 16 it can be deduced that the feature was created sometime late in the occupation of the area, which continued to be used for at least some time after the feature was completely filled with refuse and abandoned.

Feature 16 was excavated in ten cm levels from 32-72cmbd, and a flotation sample was drawn from each level. The south wall profile of the feature identified two strata. Feature 16, Stratum I is a 35-45cm thick deposit of dark brown sandy loam mottled with about 25% yellowish brown sandy clay inclusions and frequent flecks and chunks of charcoal. Flecks of burned clay, burned bone, and mussel shell were also present. This stratum contained two artifact concentrations. The first artifact concentration was documented at the top of the feature from 25-30cmbd, the second at about 40-50 cmbd. Feature 16, Stratum II consisted of a deposit similar to Stratum I, but with a higher proportion of sandy clay inclusions (>50%). This stratum did not contain any artifact concentrations. Only the artifact concentrations in the upper stratum
produced diagnostic artifacts. These included most of a plain Madisonville Series flared rim jar, a bifacial teardrop-shaped endscraper, and a bone beamer. Also recovered from this part of the feature were lithic debris and non-diagnostic tools, ceramic body sherds, bone, and several fragments of quartz debitage. The remaining areas of the feature produced only low quantities of debitage, bone, and small ceramic body sherds. The lower levels of the feature also produced a handful of limestone tempered ceramic body sherds.

A variety of deposits were documented in Unit 22 despite the relatively small area opened up. Though most contexts produced few diagnostics, they consistently indicate a Late Fort Ancient occupation. The lower levels also produced a few limestone tempered ceramic sherds relating to an undefined Late Woodland or possibly Early Fort Ancient occupation. Since these sherds occurred exclusively in contexts that also produced Late Fort Ancient diagnostics it is certain that no intact Woodland contexts were documented, though the presence of deposits below the base of the terminal level of the unit cannot be ruled out since it was terminated before reaching sterile deposits. In fact, the presence of pottery relating to Late Woodland – Early Fort Ancient and Late Fort Ancient occupations suggests this feature was excavated during the latter period and churned up earlier deposits. One notable aspect of this Unit is that only one triangular projectile point was recovered from all contexts, which contrasts their ubiquity in other areas of the site.

Based on the artifacts and radiocarbon date from Stratum II, the excavated intact deposits appear to represent just one occupation dating to the Late Fort Ancient Period. This occupation is represented primarily by Zone 3, which occurred in every level of the
unit. The other primary contexts, Zones 6 and Feature 16, are sealed within Zone 3 and also produced Late Fort Ancient diagnostics. The sequence of these contexts begins with Zone 3 which began accumulating at an unknown depth up to 32cmbd. Zone 6 and Feature 16 were both clearly observed for the first time at 32cmbd, which suggests they are contemporaneous. A lens of Zone 3 was deposited on top of these contexts and accumulated to at least 22cmbd. The final thickness of this deposit was truncated by plowing. A few limestone tempered sherds scattered among these contexts and radiocarbon date from the near the base of Feature 16 indicate the presence of a terminal Late Woodland – Early Fort Ancient component somewhere in the vicinity, perhaps below the excavated portion of the unit.

Unit 8

Unit 8 (2x2m) sampled the northeast quadrant of Ring 1. This unit is located from N1068.5-1070.5 and E1077-1079. This location was selected based on an east-west transect of soil cores originally intended to identify a north-south WPA trench. The trench was not identified based on the cores, but a thick midden deposit was identified at the end of the soil core transect. After a single core identified potential deposits, radial cores were used to define its boundaries. A shovel test was subsequently placed near the center of the feature and excavated to verify the nature of the deposits. A dense concentration of artifacts was documented in the shovel test and Unit 8 was subsequently placed at the location. This unit was somewhat fortuitous since it was located based on a core transect that extended well outside of the geophysical survey boundary. However, the most concentrated refuse deposits excavated by the WPA were trash-trash filled.
ravines near the river bank. Time was expended on this unit in hopes that it would document such a deposit.

The base of the plowzone (Stratum I) observed in the shovel test was about 35cm below datum, so the unit was stripped to this depth. The transition to Stratum II was approximately 35 cmbd in the west wall of the unit and about 45 cmbd along the east wall (sloping toward the river). Stratum II (35/45-48/56 cmbd) consisted of a dark brown sandy clay loam mottled with yellowish brown clay. It contained no charcoal or other small inclusions but did contain both historic and prehistoric artifacts. The dry and very compact soil in this stratum compared well to the buried plowzone observed in Units 1-2.

The soil characteristics combined with the presence of 20th century wire nail fragments indicates that this stratum probably represents a buried plowzone. Since radial soil probes did not identify any intact deposits around this feature artifacts in the buried plowzone likely relate to the feature just below it. Artifacts from this stratum are very typical for a Late Fort Ancient occupation. These include Type 4 and 5 triangular projectile points, a bifacial teardrop-shaped endscraper, cannel coal and pipestonedebitage, and Madisonville Series jar and bowl forms (but no pans).

Stratum III consisted only of Feature 3, which intrudes into Stratum IV, a culturally-sterile yellowish brown sandy clay (sub-soil). Profiles and plan views of Feature 3 show it expanding in vertical thickness and horizontal area toward the river, indicating it was a shallow ravine that had been filled with trash. Two zones were documented for Feature 3, both of which ranged from 5 to 10cm in thickness. Zone 1 was the primary feature fill and consisted of a dark brown silty loam with few charcoal flecks and a very high density of artifacts of all classes. Zone 2 is a mottled matrix of re-
deposited midden soil from Zone 1 and clayey soil from Stratum IV. It occurred north and south of Zone 1 in a lens of varying thickness and artifact density. Little charcoal or other flecking was observed. The characteristics of this zone suggest it is colluvial or alluvial soil mixing with the contents of the trash-filled ravine.

Feature 3 was the only intact context documented in this unit. Similar to the artifacts in the above Stratum II, artifacts from Feature 3 indicate a Late Fort Ancient occupation. However, 5 limestone tempered sherds greater than ¼” size, and 30 less than ¼” size were recovered from this context which relate to an earlier Woodland occupation identified in many secondary deposits throughout the site. The Late Fort Ancient diagnostics include Type 4, 5, 6, and Nodena triangular projectile points, bifacial and unifacial teardrop-shaped endscrapers, cannel coal and pipestone debitage, typical Madisonville Series jar, bowl and pan forms, and a portion of a pipestone disk pipe bowl. Both surfaces of the disk have been engraved with lines that initially appear like random scratches. After digitizing the image using line thickness to represent engraving depth an interesting pattern emerged on the top of the disk that compares well to images of the Oneota bird man motif (Davidson 2014).

There is only one intact context represented here and no overlying midden deposit, so the only occupation represented dates to the Late Fort Ancient Period. The limestone tempered sherds present a problem with this interpretation. If this is a trash filled ravine dating to the Late Fort Ancient Period, then how are earlier Woodland period artifacts getting in the fill? The majority of all units on the site, regardless of location, have at least a few limestone or other rock tempered sherds probably dating to the Woodland Period. In Unit 20 a large number of limestone tempered sherds were
redeposited into the upper strata of the unit despite the fact that the Woodland occupation was documented deeply buried below. In that case excavation of post holes and burial pits during the Late Prehistoric occupation churned up earlier Woodland deposits into the upper strata. In the case of Feature 3, which is a shallow feature, this is probably not the case. However, the trash filled ravine does appear to be cutting into the stratum below, which may contain Woodland deposits despite that it appeared to be sterile upon observation in the field.

Whatever site formation process brought Woodland pottery into Feature 3, it is important to recognize these materials for two reasons. First, their presence means other artifacts dating to the Woodland could be in the fill of Feature 3; notably charcoal which, if submitted for AMS analysis, could result in a Woodland date for what appears to be a Late Fort Ancient Period feature. Second, knowing the distribution of earlier pottery on the site will be important for future research on Woodland Period use of the site.

**Overlap Area Excavations**

Introduction

The goal of the overlap area excavations was to identify of the east-west 1939 WPA trench in two separate locations to accurately georeference the WPA and current site grids. These excavations covered a total of 23 square meteres and included Units 5-7 located along the west side of the site, and Units 9 and 13-19 (Trench 1) located near the center of the site.
Units 5-7

Units 5-7 encountered a portion of WPA expansion Area A located near the (magnetic) west end of the main (grid) north-south WPA trench. The location of these units and other details of these excavations can be seen in Figures 3-18 and 3-19 and in Appendices B, C, and D. The deposits were already described above in the section labeled “second test excavations”. This excavation was significant because it confirmed the location of the WPA trench on the modern grid and exposed the southwest corner of House 1.

Unit 9 and Trench 1

Unit 9 and Trench 1 (Figure 3-20 and 3-21) were used to document the WPA trench in a second location (expansion Area B) and are described here. WPA Area B (see Figure 3-12) was documented using the same strategy as for Area A. WPA Area B was thought to be located near the center of anomaly concentration 2 in the 2012 magnetic survey (Figure 3-16). In order to test this idea, two north-south oriented transects of soil cores were carried out perpendicular to the long axis of the anomaly concentration; one on the E990 line and one on the E994 line (not illustrated). The transects were 20 meters long and cores were spaced 2 meters apart. Stratigraphy was recorded for each core, paying special attention to the presence or absence of characteristic “WPA backfill” (see description of Units 5-7 above).

Based on a preliminary overlay of the WPA and current grids (Figure 3-20) it was expected that the E990 soil core transect would be west of WPA Area B and the E994 transect would be inside Area B. This proved to be correct. The stratigraphy observed in
the E990 transect exhibited no “WPA backfill” lenses suggesting it was outside of Area B. Some, but not all of the cores in the E994 transect produced back-filled lenses indicating that it was either inside WPA Area B, or somewhere along the WPA trench. Initially, an ambitious trench was planned to bisect Area B completely, but time limitations reduced this to a 15m trench (Units 13-19) with a 2x2m unit (Unit 9) at the south end (Figure 3-22). Unit 9 was designed to explore a high intensity magnetic anomaly associated with a burned lens 4cm thick. Since a partially excavated structure (House 2) was located in Area B, it was expected that this burned lens may relate to it.

Trench 1 and Unit 9 were very successful (Figure 3-22). The deposits documented in Unit 9 and the south half of Trench 1 (Units 13, 15, 16) were mostly distinctive from those in the north half of Trench 1 (Units 14, 17-19) though some stratigraphic relationships are present. Units 9, 13, 15 and 16 will be described first. Unit 9 was the only one containing evidence of looting (Stratum IIA) and a buried / historic plowzone (Stratum IIB). Stratum III represents the primary intact deposit of interest, and it exhibited two horizontal zones. Zone A occurred throughout most of Units 9 and 15 and consisted of 2-15cm of silty loam midden deposit. At its origin, Stratum III Zone A covered the features in Unit 9, but not the features or possible post holes in Unit 15 (including Feature 7). In most areas of Unit 9 it extended to a depth of about 45cm below datum. Stratum III Zone B occurred only in Units 15 and 16 and consisted of a very dry, compact sandy clay deposit containing sparse patches of Zone A, as well as small micro-artifacts. Its presence only around the concentration of possible post holes in Units 15 and 16 suggests it is somehow related to them. The east wall profile of Units 15 and 16 indicate that Zone A intrudes into Zone B and therefore post-
dates it. Since both zones of Stratum III terminate at the same depth above Stratum IV in Unit 15, they were given the same stratum designation even though technically they should be considered separate since one overlies the other.

A variety of possible post holes and features were encountered in STRIII. Feature 7 and the three possible post holes were encountered first because they originated at the top of Zones A and B. Removal of about 5cm of Zone B from Unit 9 exposed Features 6 and 11 and a possible post in the northeast corner balk. After all the features and posts had been documented, the remainder of Zone A was removed. Examination of the east wall profiles of Units 9 and 15 indicates that Stratum III Zone A represents a shallow basin which originates at the post concentration running through Unit 15 and continues south into Unit 9. Examination of the Unit 9 south wall profile indicates the basin continues south for an unknown distance.

Feature 7 was the only one identified at the top of Stratum III Zone B. In plan view it first appeared as a sub-rectangular outline with a darker circular stain offset from the center. The outer area of the feature consisted of a mottle of clayey subsoil and midden, while the central circle was primarily darker midden. Bisection of this feature indicates it was a post hole that was re-filled with a mixture of clayey subsoil after insertion of a post. The south wall profile of Feature 7 exhibits a lens of burning 3cm below its origin suggesting that it may have intruded into the north end of Feature 6. This suggests Feature 7 post-dates the earliest use Feature 6. The relatively shallow origin of Feature 6 (35cmbd) supports this relative chronology.

Feature 6 originated a few centimeters below the top of Stratum III Zone A (at 38cmbd) and consists of a very hard fired surface. An exploratory trench on the west
side of Unit 9 cut through the western edge of Feature 6 and documented that the fired surface ranges from 1-8cm thick. There is also a secondary zone (not labeled) of fire-reddened soil around central area of burning.

Feature 11 first exhibits clear plan shape at 45cmbd, though a faint outline may be visible as shallow as 38cmbd (at the same depth as Feature 6). The most intriguing aspect of Feature 11 was a short (~5cm tall) remnant of a post burned vertically in situ, which occurred between 50-55cmbd. The post had originally been set in a large pit, which was then back-filled with midden-like soil. The pit fill and post remnant were documented in place and then collected as a single intact block of soil (40x40cm by 50cm high) for future research.

The post hole concentration originating in Unit 15 extended north into the south half of Unit 16. In plan view the posts in Unit 15 appear to form a line along the boundary of the basin containing Zone A and Features 6, 7, and 11. The relative position of the two possible post holes in Unit 16 suggests they form a second line. Many of the structures documented by the WPA, including House 2 immediately to the north, exhibited double lines of post holes along their outer walls. Stratum III Zone B occurred exclusively around these two lines of post holes.

A second midden deposit (Stratum IVB) was encountered below Stratum III in Unit 9 from approximately 45-55cm below datum, though its presence was only identified in the wall profiles. Removal of this deposit exposed a scatter of soil stains originating in Stratum V, a sandy clay subsoil. Time constraints permitted only rudimentary documentation of these possible features. At least two of these originate below, and therefore predate Feature 6. A soil core placed in the largest stain (northeast
corner of Unit 9) indicates it occurs from 55-75cm below datum. While it is certain that at least some of these stains predate Feature 6, little else can be said about them at this time.

Stratum IVA is first encountered in the north end of Unit 15 and continues north all the way to Unit 19. This stratum consists of a buried A Horizon that appears to have a low density of microartifacts and charcoal fragments. It was not excavated though two flotation samples (35-40 / 40-45cm below datum) were collected from the south half of Unit 16. Stratum III Zone B overlies Stratum IVA in Unit 15 and appears as a thin, wedge-shaped lens that tapers out before reaching the north end of the unit. Continuing north into Units 13 and 16, the only features documented at the top of Stratum IVA were two possible post holes in Unit 13 (PP13-1 and PP13-2).

In the north half of Trench 1 (Units 14, 17-19) Stratum IIC and a scatter of previously excavated features and post holes intrude into Stratum IVA. Stratum IIC is primarily a very dark brown silty loam mottled with chunks of yellowish brown silty clay loam and is interpreted as a deposit previously excavated by the WPA excavations. This stratum was documented in two horizontal areas of the trench, both of which were demarcated in plan view by sharp, straight boundaries. These boundaries are assumed to represent the edges of back-filled excavation areas. The largest area, about 4.6m north-south, extends from the south ½ of Unit 14 to the south ½ of Unit 18. It extends east-west into the walls of the trench and continues for an unknown distance. Figure 3-22 shows that the southern boundary of this area occurs approximately where the southern boundary of WPA expansion Area B is expected. If this is correct, the entire north end of the trench should lie within Area B. This appears to be the case given that the post holes
and features in the north end of the trench all appear to have been excavated previously (see below).

A small area of Stratum IIC was (re)excavated in parts of Units 17 and 18 to determine its final depth and expose a profile of the deposit. The unit plan views and west wall profile of this area indicates the WPA excavations were more than 30cm deeper in this part of the trench, extending to a final depth of 66cmbd. The overlay of the trench plan view onto the 1939 plan view of Area B indicates the north end of this deeper area coincides with a line of post holes representing the north wall of House 2. This area was excavated deeper by the WPA to document the centerline features and north wall posts associated with House 2 (Bohannan 1939a:2-3). Bohannan specifically states that the north wall posts of House 2 had to be documented by vertically slicing them in half because they were difficult to observe in plan view. Photographs of the north profile of the re-excavated area show two post hole profiles, which confirm this idea. It is also notable that the west wall profile of Unit 18 shows that the base of the Stratum IIC excavations may represent the contour of a basin that begins at possible post 18-1 and dives down to the south. This may suggest that House 2 was set in a shallow basin (see Chapter 4).

The second area containing Stratum IIC is located in the north end of Trench 1. It originates in the north half of Unit 19 and extends into the unit’s north wall. The location of this back-filled area and the orientation of its southern edge (north-south) is consistent with the expected location and orientation of the WPA exploratory trench that preceded expansion Area B (Figure 3-22). This area was not re-excavated.
The portion of Trench 1 located between the areas of Stratum IIC contained a scatter of circular stains in the subsoil (Figure 3-22 and Appendix C). These stains contained the same mottled soil as the back-filled sections and are interpreted as post holes and a pit previously excavated by the WPA. Notably, two circular stains immediately north of the southern back-filled area appeared to be unexcavated post holes. It is not a surprise that the WPA crew missed a few posts considering how difficult they were to identify.

**Discussion**

The deposits documented in the north half of Trench 1 and Units 5-7 identified the location of WPA expansion Areas A and B on the current site grid. The WPA and current site grids were georeferenced by fixing the coordinates for Areas A and B on each grid in the same position. Area A was matched first, and then Area B. As can be seen in Figure 3-22, the southern extent of the larger back-filled area in Trench 1 extends beyond the southern edge of Area B. This indicates georeferencing of the current site grid and the WPA grid is still slightly off, but only about 2-3 meters at most. Considering that excavations were able to predict the location of the WPA grid in two different locations with a minimal amount of testing – 5 square meters to locate Area A and 13 square meters to locate Area B – we can be confident about the relative placement of the two grids even if it is not perfect.

Since the site measures approximately 320 meters north-south by 160 meters east-west, 2-3 meters of distortion can be considered minimal. More importantly, it is not expected that this inaccuracy will result in any errors when spatial information based on
the two different site grids is combined for the present study. The georeferenced site grids will also enable future research at the site to tie new excavations to the old grid, or to relocate and expand on other sections of the 1939 excavation blocks.

As a final note, the artifacts from Unit 9 and Trench 1, as well as those from Units 5-7 were not included in the ceramic and lithic analyses in this study. These areas were investigated with the primary intent to document the current location of the WPA grid, though the results will surely be useful in future research. These artifacts, along with paleobotanical remains could be used to date House 1, House 2, and House 3 previously documented by the WPA. As discussed in Chapter 4, Houses 1 and 2 appear to be oriented toward the central plaza of Ring 2, but their location in the overlap area leaves this association in question until absolute dates are obtained. Additional excavation will also be required to evaluate whether the deposits in Units 9, 15 and 16 represent a house area. The stratified deposits in Unit 9 may also be useful in parsing out the association of structures and features in the overlap area, but more area needs to be excavated in order to evaluate the relationship of these stratified deposits.
Figure 3-1: Proximity of Hardin Site to western edge of Appalachian Plateau and major river confluences (each ring = 50km / ca. 1 day walking)

Major River Confluences:
1. Scioto River Confluence; 2. Big Sandy River Confluence; 3. Licking River

Figure 3-2: Hardin Site location and nearby Late Fort Ancient Phases, A.D. 1400-1750*

*Base map: U.S. Geological Survey, The National Map (2016); Sources: Purrington and Smith 1967; Griffin 1978:Figure 1; Graybill 1984:Figure 1; Henderson and Turnbow 1987; Spencer 2006; Henderson 2008; Ahler and Stoner 2010; Maslowski 2011: Figure 18

**Woodside Phase sites date primarily A.D. 1200-1400, but several date to the 16th and 17th centuries (see, e.g., Pullins et al. 2008:85).
Figure 3-3: Hardin Site vicinity topography and hydrology*

Figure 3-4: Location of Fort Ancient region, Hardin Site and saline spring distribution in eastern North America. Basemap represents population distribution A.D. 1540 (adapted from Anderson 1991: Figure 5). Saline Areas from Brown 1980: Figure 1.
Figure 3-5: Hardin Site location relative to geologic features and resources. See continuation page for map key and sources.
Figure 3-5 (continued)

Hardin Site

Alluvium

Lower Pennsylvanian

Olive Hill Clay Bed

Upper Mississippian

Newman Formation Chert Source

Lower Mississippian

*Sources: USGS GQ-312 (Sheppard 1964); Patterson and Hosterman 1960
Figure 3-6: Distance to permanent stream confluences (each ring = 10km / ca. 2hrs walking).

Stream Confluences:
1. Little Scioto R.
2. Pine Cr.
3. Tygarts Cr.
4. Scioto R.
5. Little Sandy R.
6. Kinniconick Cr.
7. Salt Lick Cr.
8. Big Sandy R.
Figure 3-7: Hardin Site location relative to historic overland trails. Adapted from Myer 1928:Plate 15; Moore and Raymer 2014: Figure 1. Base map: U.S. Geological Survey, The National Map (2016).
Table 3-1: Previous research at Hardin Site.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PERSON</th>
<th>PURPOSE</th>
<th>SUBJECT</th>
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<tbody>
<tr>
<td>1938</td>
<td>William Webb et al.</td>
<td>Original Site Survey and Record</td>
<td>Survey</td>
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<tr>
<td>1939</td>
<td>Charles Bohannon</td>
<td>WPA excavations</td>
<td>Excavation</td>
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<td>1960-1963</td>
<td>Lee Hanson</td>
<td>Thesis project</td>
<td>Museum</td>
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<td>1966</td>
<td>Lee Hanson</td>
<td>Thesis monograph</td>
<td>Dissemination</td>
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<tr>
<td>1972</td>
<td>Claire Cassidy</td>
<td>Ph.D. Project</td>
<td>Bioarchaeology</td>
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<td>1977</td>
<td>Robert DeLorenze</td>
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<td>Bioarchaeology</td>
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<td>1983</td>
<td>Charles Hockensmith</td>
<td>Site monitoring, NRHP form completed, but not submitted</td>
<td>Survey</td>
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<td>Mary Broida</td>
<td>M.A. Project</td>
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<td>1984</td>
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<td>Secondary publication</td>
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<td>1986</td>
<td>Gwynn Henderson</td>
<td>Professional Research, Document Greenup Co. Collections</td>
<td>Contact Period Study</td>
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<td>Gwynn Henderson, David Pollack</td>
<td>Ceramic Analysis</td>
<td>Chronology</td>
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<td>1993</td>
<td>Audry Adkins</td>
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<td>1994</td>
<td>Will Holmes</td>
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<td>Professional Research PIXE/PIGE metal analysis (unpublished, raw data only)</td>
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<td>Endscraper morphometrics (unpublished, raw data only)</td>
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Figure 3-8: Original 1939 excavation map. Adapted by Hanson (1966: Figure 1). Figure courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 3-9: Location of WPA test units (black) and excavation areas (gray).
Figure 3-10: Designations of WPA expansion areas (red). Based on WPA archives, courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 3-11: Modern site grid, datum locations ( ), and midden stain mapped in 2011.
Table 3-2: Description and coordinates for the site data shown on Figure 3-11.

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<th>EAST</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
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<td>996.243</td>
<td>1024.567</td>
<td>In tree line north of borrow pit</td>
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<tr>
<td>D4</td>
<td>1322.769</td>
<td>1043.743</td>
<td>Spike adjacent to metal pipe sticking out of the ground in northeast corner of site at end of farm road, just southeast of tree at end of road. Original spike removed, but located on the southwest side of pipe</td>
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<td>D8</td>
<td>999.941</td>
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</tr>
<tr>
<td>D9</td>
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<td>D11</td>
<td>1100.023</td>
<td>1080.014</td>
<td>In tree line on river bank</td>
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Figure 3-12: Location of Ring 1, Ring 2, and 2012 test excavations.
Figure 3-13: 2012-2013 geophysical survey area showing individual collection grids.
Figure 3-14: Processed magnetic gradient map of Hardin Site (analytic signal). Pink = highest magnetic intensity, Blue = lowest.
Figure 3-15: Processed magnetic gradient map of Hardin Site (shaded relief). Black= highest magnetic intensity, White=lowest

- Figure showing a processed magnetic gradient map with marked features such as farm, access road, tree line, river bank, and orientation of mag. N.
- The map highlights areas of highest and lowest magnetic intensity.
Figure 3-16: Magnetic gradient anomaly concentrations 1-3.
Figure 3-17: Magnetic gradient anomaly concentrations 4-5.
Figure 3-18: Investigation of large magnetic anomaly believed to represent WPA expansion Area A (yellow dashed). Showing soil core transects (black dots) and excavation units (black polygons).
Figure 3-19: Location of Units 5-7 relative to “Area A”. Showing post holes in Units 5-7, and portion of 1939 excavation area encountered in Units 5-7.

<table>
<thead>
<tr>
<th>KEY</th>
<th>post holes</th>
<th>WPA excavation</th>
<th>back-filled soil</th>
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- UNIT 6
- UNIT 5
- UNIT 7

HOUSE 1

limit of WPA “Area A” excavations

not excavated

excavated
Figure 3-20: WPA excavation areas referenced to current grid, showing also the location of 2013 excavation units 1-22 relative to WPA excavation areas.
Figure 3-21: Location of 2013 excavation Units 1-22 referenced to Ring 1 and Ring 2. Showing also overlap areas of rings.
Figure 3-22: The relative position of Unit 9, Trench 1 (Units 13-19) and WPA Area B.
Chapter 4

Site Organization

Introduction

Before the field and museum studies conducted for the present research, relatively little concerted effort has been made to understand the spatial layout of the Hardin Site. The initial proposal for the present study, like many before it, had planned to avoid this complex problem. However, spatial data gathered during the first field season strongly indicated the presence of multiple overlapping circular midden stains. This suggestion was reinforced by two subsequent field seasons and analysis of WPA archival information. In this chapter information from the WPA excavations, modern excavations and remote sensing is combined to develop a working model of the spatial extent and horizontal relationship of the two primary midden stains. During the course of this work, spatial information relating to several other components was identified. These are described in sufficiently for the purposes of this study, but not exhaustively.

Background

Charles Bohannan (1939a-j) was the first person to document information about the internal organization of the Hardin Site. As the director of the most extensive excavations at the site, Bohannan had a great deal of direct experience observing and mapping the site’s stratigraphy and many features. He made many useful observations about these aspects of the site, but made only a few general statements about overall site organization. Those that are relevant are incorporated in this chapter where appropriate. Hanson (1966:16) and Holmes (1994:55) both made the tantalizing suggestion that two overlapping rings of houses may be present, but neither pursued evaluating the idea.
Despite these suggestions, and the numerous studies of its WPA collections the spatial layout of the Hardin Site remains poorly understood. Avoidance of this issue is somewhat disconcerting since most researchers have treated the site’s human remains and associated grave goods as a single unit of analysis. Given the information currently at hand, some of which has been available for decades, the site clearly represents at least several spatially and chronologically distinct occupations.

Previous research on the organization of the site is limited, though some information can be gained from a review. Hanson’s publication provides both direct and indirect information about the organization of the site. Hanson’s direct interpretation of the site structure was ambiguous. He was cautious “due to the limited nature of excavations”, and stated that the site “must be treated as a single component without regard to any village plan which can be inferred” (1966:16, 176). However, between the publication of Hanson’s thesis on Hardin (1963) and the resulting monograph three years later (1966), excavations at the Fort Ancient Slone site (Hanson et al. 1964:84-86) documented a circular community plan. Having worked on the Slone site and co-authored the resulting compliance reports, Hanson suggested this pattern may be present at Hardin (1966:16) though he cautiously insisted that more information was needed to evaluate the idea. In particular he cited the thickness of the midden and the clustering of houses in the central WPA excavation area as evidence of an overlap area between two occupations (Hanson 1966:16).

Hanson’s (1966) published artifact images and descriptions of a variety of artifact types also indicate the presence of multiple occupations. Either Hanson himself or subsequent research has identified the chronological significance of these items (see
Chapter 6). Minimally these indicate the presence of multiple Archaic, Woodland, and Fort Ancient components; yet the spatial information present in the WPA archives has not been used to evaluate their vertical or horizontal relationship. With regard to the Fort Ancient components alone, researchers have considered the readily available maps and descriptions in Hanson’s monograph insufficient to interpret the site’s layout (Holmes 1994:55; Henderson 2008:831). Nevertheless, the same researchers have all proceeded to assert that the site consists of clusters of houses, (Holmes 1994:55; Pollack and Henderson 2000:207; Henderson 2008:831), rather than a series of circular communities as Hanson (1966:16) and Holmes (1994:55) suggested.

To be fair, the initial plan for the present study was to avoid dealing with the spatial complexity of the site by targeting only the protohistoric component. Following the predominant view of the site’s layout (e.g., Hanson 1966:16, 176; Holmes 1994:55; Henderson 2008:831), it was assumed that the structures documented in the central WPA excavation area (Areas A-E; Figure 3-10) represented a scatter of paired or clustered structures. Based on the large quantity of protohistoric diagnostics from the site, and the protohistoric assignment of the structures by other researchers (e.g., Pollack and Henderson 2000:207, Figure 6.12; Henderson 2008:831), this area of the site was assumed to represent a single protohistoric occupation. Each of the four clusters (pairs) was to be considered a unit of analysis (i.e., potentially a household) and the surrounding unexcavated areas were going to be tested to gather additional information.

However, data collected during the 2011 field season stimulated me to re-evaluate the site’s layout before continuing. An overlay of the new site map, the WPA site map, and aerial photos seemed to support the hypothesis that the site may represent
overlapping circular villages (Hanson 1966:15; Holmes 1994:55). With this information in hand at the end of the 2011 field season it appeared that the central portion of the site likely did not represent a single protohistoric component, and no longer could be treated as such. Subsequent fieldwork plans had to incorporate efforts to further evaluate the “overlapping circular villages” hypothesis, and to document which (if either) of the postulated rings represented the protohistoric occupation.

In the remaining sections of this chapter I present relevant data from the WPA archives and recent fieldwork to re-evaluate the spatial organization of the Hardin Site, focusing primarily on the “overlapping rings” area. Beforehand I describe alternative models proposed for Late Fort Ancient site organization, which will allow the reader some independent measure of evaluating my findings. It should be noted that this is not intended to be an exhaustive analysis of available spatial information, but it is felt that it is sufficient to identify spatially and temporally distinct comparative samples to address the primary research question regarding protohistoric hide processing. Diagnostic artifacts and charcoal samples were recovered in 1939 from most of the seven structures. Dating the structures however was outside the scope of the present study since I was able to obtain collections from other areas of the site necessary to answer my primary research questions without having to disentangle the multicomponent center of the site were most of the structures are located. Studying their age and contents in the future will provide an important test of the model presented here.
Previous Models of Late Fort Ancient Settlement Organization

At least three different layouts have been proposed for Late Fort Ancient villages: nucleated-circular, dispersed-circular, and scattered. The nucleated-circular layout consists of dwellings, refuse disposal, mortuary, and other activity areas organized in concentric rings around a central plaza area (Figure 2-2, Figure 4-1a and Figure 4-1b). This layout was adopted throughout the mid-Ohio valley by the late 12th to early 13th century (see, e.g., Henderson 2008:Figure 7.2; Cook and Price 2015:Figure 3), and continued to be used well into the Late Fort Ancient Period (e.g., Figure 4-1c-d; Graybill 1981:136-139; Drooker 1997:72-76; but cfc. Henderson et al. 1992:269-270, 273-274).

In general, Late Fort Ancient villages are distinguished by a larger footprint and larger structures (Graybill 1981; Henderson et al. 1992:269; Davidson 2012; but cfc. Kennedy 2000:147). Also, mounds were not constructed after A.D. 1400, though it does appear that Late Fort Ancient communities re-used woodland earthworks (e.g., Henry 2009; Hermann et al. 2014). Mounds documented at sites with Late Fort Ancient components invariably date to the Middle Fort Ancient or earlier (e.g., Brady-Rawlins 2007; Carmean 2010). A confounding factor in understanding Late Fort Ancient site layouts is that they are often imposed on earlier village plans resulting in a melee of structure, palisade, and feature outlines that is extremely difficult to separate (see e.g., Drooker 1997:107-134; Genheimer 2010).

Examples of both early Late Fort Ancient (A.D. 1400-1550) and late Late Fort Ancient (A.D. 1550-1680) settlements exhibit versions of the nucleated-circular plan throughout much of the Fort Ancient area. Early Late Fort Ancient examples include the Burning Spring Branch (Pullin et al. 2008), Slone (Dunnell et al. 1971), Buckner 2
Late Late Fort Ancient examples include Buffalo (Hanson 1975), Clover (Graybill 1981; Freidin 1987; Pullins et al. 2008:94), and Madisonville (Drooker 1997:121-133). Aerial imagery of several late Late Fort Ancient sites in West Virginia (e.g., Rolf Lee) exhibit circular midden stains with central plazas (Maslowski 2010), which suggests the presence of the circular-concentric pattern.

Most known examples of Late Fort Ancient villages exhibit a nucleated-circular arrangement of structures in a single or double ring (Figure 4-1). Variability in this layout (not shown in Figure 4-1) includes an oval rather than circular arrangement of structures, different relative positioning of houses, burials, and activity zones (see e.g., Henderson 2008: Figure 7.2), and the presence/absence of palisades (see e.g., Dunnell 1983:159-161; 1972: Figure 17n; Nolan 2010: Figure 7.14). Some nucleated-circular villages exhibit a partial or incomplete ring of structures (Figure 4-1c and Figure 4-1d). These may represent smaller communities that failed to attract enough households to complete the ring, or simply lack the time depth for this process to take place before they were abandoned (see e.g., Capitol View, Kentucky - Henderson 1992: Figure 5; Wildcat, Ohio - Cook and Burks 2009: Figure 10). Another possibility is that some villages were intentionally planned for a space between residential areas or for a gap in the ring of structures (e.g., New Field - Henderson and Pollack 1996). To contrast, incomplete rings of structures at some sites accommodated palisade openings (e.g., Dunnell 1972: Figure 17N), or village placement on bluff edges (e.g., Burning Spring Branch - Pullin et al. 2008: 234, Figure 7-3).
A second possible village layout, nucleated – non-circular, implies a breakdown of regular plan of the nucleated – circular layout. The nucleated – non-circular layout consists of a scatter of residential structures (or clusters of structures) and associated activity and cemetery areas (Figure 4-1e; Henderson et al. 1992:268-273). This layout is probably best represented by the Larkin site in central Kentucky (Pollack et al. 1987). Rafinesque’s 1848 plan map of the Larkin site shows several clusters of “dwellings”, which Pollack et al. suggested may be associated with small midden and cemetery areas scattered about the site (1987:188-189). Unfortunately, not enough of the Larkin site has been excavated to confidently reconstruct its layout.

Another possible example of the nucleated – non-circular layout may be present at the Late Fort Ancient component at Fox Farm, where ongoing fieldwork has documented several residential areas scattered throughout the site (David Pollack, personal communication 2016). The central axis of the residential structures from this component is the same, and they do not presently appear to be related to a central plaza, which would be consistent with a nucleated – non-circular layout. While the Fox Farm project is ongoing, the presence of this layout is of great significance because it would represent its earliest Late Fort Ancient example.

A variant of the nucleated – non-circular plan consists of a linear scatter of structures and associated burial and activity areas along streams (Figure 4-1f; Turnbow 1988:290-291). Henderson et al. (1992:268-269) proposed that this was the predominant type for the early Late Fort Ancient Gist Phase in northeastern Kentucky. However, with the exception of Hardin, the lack of published examples makes this model difficult to evaluate. At Hardin, WPA excavations documented a concentration of residential
structures and midden areas, which in plan view appear as a string of houses perpendicular to the Ohio River bank (Pollack and Henderson 2000:207; Henderson 2008:831). In fact, the earliest research proposal for the present study considered this site layout since it is so intuitively read from the WPA excavation plan view (Hanson 1966:Figure 1). However, detailed analysis of previously unpublished archival data and subsequent fieldwork indicate that the site represents a variant of a circular plan (see Chapter 4).

A second version of the non-circular is a dispersed layout, which consists of a widely dispersed but related group of hamlets, farmsteads or house groups within a several kilometer area, each represented archaeologically by a relatively small midden stain (Figure 4-1g). This site layout has been proposed for a locality along Hickman Creek in Jessamine County, central Kentucky (Turnbow 1988:290). Here a late cemetery (15Js16) is situated on a bluff overlooking the floodplain where two midden stains (15Js14, 15Js60) are strung along the creek. Surface diagnostics indicate all three sites to date to the late Late Fort Ancient Period, though no excavation has been conducted at the potential habitation sites. This settlement plan has also been proposed for the Orchard Site in West Virginia, which consists of a large nucleated settlement surrounded by at least five related “satellite encampments” within a 2 kilometer area (Graybill 1988:33). Graybill argued this settlement plan was a defensive tactic designed to accommodate easy dispersal in the event of conflict (1988:34).

Finally, some researchers have suggested that community organization dissolved completely, being “nothing more than hodgepoodles of houses with no particular village arrangement” (Cowan 1987:15; see also Henderson et al. 1992:273). However, this
claim was based on unreferenced sites, and / or the Madisonville Site which had a poorly understood plan map at the time. A decade later Drooker (1997:107-134) used archival information to geo-reference maps from all previous excavations at the Madisonville Site. The resulting composite map exposed the presence at least one, and possibly two or more, plaza areas at the site (Drooker 1997:121, 197-202, Figures 5-8 to 5-13, 6-53). Based on presently available information the characterization of Late Fort Ancient site layout as a random scatter of houses appears to have proliferated in the literature since it was originally (but erroneously) identified at the type site (Drooker 1997:119).

It should also be noted that small seasonal settlements have also been documented for the Late Fort Ancient Period (e.g., Purtill 1999; Pollack and Henderson 2000; Riordan 2000). A good example is the Goolman Site in central Kentucky which consists of a ring of small dwellings around a central communal structure and associated activity areas (Turnbow and Jobe 1984). Other examples consist of one or more structures lacking observable patterning (e.g. Mickelson 2001; Shaffer 2014). While important for interpreting the overall Late Fort Ancient settlement system (e.g., see Turnbow and Jobe 1984; Pollack and Henderson 2000:207), this site type is not relevant to interpreting site structure at Hardin since it is a larger, more permanent settlement.

To summarize the above, of the four types of village organization proposed for the Late Fort Ancient Period, but only versions of the nucleated – circular plan (Figures 4-1a-d) have been documented at multiple sites where broad horizontal excavation can confirm the pattern with confidence. While enticing, evidence for the other three types (Figures 4-1e-g) is inconclusive due to a lack of published examples, or limited (published) excavation at sites where such a plan has been hypothesized. The notion of
completely un-patterned communities appears to persist perhaps in part due to its early but erroneous identification at the Madisonville Site. It’s hypothesized presence at both the Madisonville and Hardin sites may in large part be due to intensive and extensive use of these localities and the resulting melee of feature patterns. In fact, later villages have repeatedly been characterized as relatively larger, but this may simply be the result of long term re-use and resultant gradual accumulation of feature and midden deposits at geographically or culturally significant localities.

Due to an apparently complex occupational history at Hardin, it became clear early on that a comprehensive analysis of the site’s internal organization would be outside the scope of the present study. However, a substantive analysis of the site’s layout was deemed necessary to identify the spatial extent and relative chronological position of the components being compared. As a consequence of this analysis, a variety of independent spatial data layers were accumulated. This data has allowed the author to distinguish the spatial extent of the components of interest, and to confidently select samples from each for comparison (see Chapers 4-7, 9-10).

Methods and Data Sources

WPA Archives (1939)

The WPA archives include three sources of vertical data. First, Bohannan drew representative stratigraphic profiles for much of the site. Second, Bohannan’s field notes provide many details about these profiles as well as stratigraphic patterns from other areas of the site. The third source of vertical data includes elevations for the unit stakes, structural posts, and burial, pit, and thermal features. Unfortunately, the location of his
primary datum is not known, but geophysical survey and test excavations successfully pinned down this original grid (see Chapters 3 and 8, and below). In future work at the site, it may be possible to reverse-calculate the location of the primary datum now that the current and WPA grids have been georeferenced.

Detailed scaled plan maps ("plats") were drawn in the field in 1939 for the main (grid) north-south trench, and excavation block areas A-DD. Area A provides an example of the detail provided by these maps (Figure 3-19). Plan maps for the east-west trenches along the N10 and N67 lines have not been found among the WPA archives. However, in addition the large scale plan maps, more detailed smaller scale plan views were drawn of every individual burial, pit, and thermal feature such at areas without plan maps can be reconstructed. Each feature has its own recording form with the central coordinate location, depth, description of contents, and associated artifacts.

For the present study, the coordinates of prehistoric features from all 336 burial forms, 257 feature forms, and 1,900 post hole locations were entered into an excel database (mostly by Michael Arthur). All spatial data were plotted by type as layers for spatial analysis in the Surfer 10 software program. Plotting feature distributions was critical for parsing out the spatial relationship of the components of interest to develop the model presented below.

In addition to the large amount of spatial data provided by the profiles, plan views, feature forms and coordinate information, Bohannan also produced a short document titled “miscellaneous observations” which provides both general and particular details about each excavation area. This information will be incorporated below when appropriate. Finally, Bohannan also duplicated and sometimes expounded upon all of the
feature and burial records in a series of personal field notebooks. These have not yet been digitized and likely contain additional information that would likely improve the settlement layout model presented below.

2011-2013 Spatial Data

The 2011-2013 fieldwork produced many spatial datasets. The methods for each phase of fieldwork were described in Chapter 3 and each map layer is presented here individually before they are synthesized below.

Aerial Photos and Digital Elevation Model

Many historic and current aerial photos of the Hardin Site vicinity show a large and obvious anomaly representing the site. In photos without vegetation the anomaly appears as a soil color contrast. In those with vegetation the anomaly appears as an elevation contrast. The 1995 aerial photo is a black and white image of the site vicinity without vegetation. The 2004 aerial photo is a color image of the field when crops or other green vegetation covered the site. In 2011 the U.S. Geological Survey released images of surface topography based on 0.5 meter resolution LiDAR data. LiDAR imagery provides an independent source of information about the topography of the site. This was useful as an independent check on the raised areas suggested by the 2004 aerial photos.
Field Collected Datasets

As described above several datasets from 2011-2013 feildwork each provide independent lines of evidence that are used to model the site’s layout. Mapping the midden stain boundary and surface collections provided baseline information that guided all subsequent work.

Geophysical survey was used to collect additional information about site layout (and to identify excavation loci). The subsequent anomaly ground-truthing program involved soil coring high potential geophysical anomalies. The many stratigraphic profiles recorded by soil coring provided a secondary spatial dataset that distinguished disturbed, intact midden, and fired/burned deposits. Finally, a total of 51 square meters of excavation representing a total of 10 independent areas provided information about subsurface feature patterning in areas not covered by the WPA excavations. Two of these areas were desinged to relocate the 1939 grid.

Reconstruction and Proposed Model

Site Boundary and General Layout

Both the 1995 and 2012 aerial images of the site without vegetation show a very dark gray area exhibiting several lighter elliptical or circular areas along the center of its long axis (Figure 4-2). The pattern appears to be several overlapping rings with light colored central areas (Figure 4-3) which, as discussed in the previous chapter were identified on the ground as midden rings referred to as Ring 1 (south) and Ring 2 (north). These compare well to aerial images of other Fort Ancient villages where excavation has confirmed a circular site layout. For example, aerial imagery of the Buffalo Site (Figure
4-4) is very similar to the Hardin locality. Excavations at the Buffalo Site (Figure 4-4; Hanson 1975) indicate the darker outer ring represents refuse disposal, residential and activity areas, while the lighter colored central area is a relatively midden-free zone often interpreted as a plaza (Hanson 1975; Drooker 1997:Table 5.9).

The 2005 aerial image shows the same anomaly pattern at the site location, but the field is in crops (Figure 4-5). The lighter circular areas are higher in elevation than the darker central areas and surrounding area. The dark central circular areas are in the same location as the light “plaza” areas observed in the 1995 aerial photo, while the lighter raised areas are equivalent to the dark “midden” rings on that aerial photo. The digital elevation model (Figure 4-6a) indicates raised areas largely consistent with the aerial images. A modified version of the 1995 aerial with color shading as an indication of soil color and elevation (Figure 4-6, right), exhibits other features (see below).

The central focus of this study is on the two midden rings outlined on and labeled the 2012 aerial photo (Figure 4-7). As discussed above, they are consistent with what would be expected for midden rings (higher elevation, darker soil) encircling a plaza (lower elevation, lighter soil). The relatively low elevation of the plaza and lighter colored soil would be expected if this was an area maintained free of refuse, while the higher elevation and darker soil would be consistent with an area midden accumulated for a long period of time. When the outlines of the rings observed in the aerial imagery are placed in the same location on the composite (aerial/DEM) the pattern is generally consistent, especially for Ring 1 (Figure 4-8). Ring 2 exhibits a more ambiguous pattern on the composite image compared to the aerial photo. Rather than forming an obvious
ring, the anomaly appearing as Ring 2 in the aerial imagery appears on the composite as a pair of elongated raised areas that do not clearly encircle the lower central area (“plaza”).

The difference may be due to the fact that the aerial imagery and DEM used to make the composite represent different aspects of the same anomaly. The surface coloration observable in the aerial photo without crops represents the enrichment of the soil during the most recent occupation, while the raised areas from the DEM could potentially represent multiple components that do not all exhibit a soil color difference. The soil characteristics of all but the terminal components (Ring 1 and Ring 2) may be obscured by later activities or environmental processes (e.g., river sediment). If this is true, then the consistent anomaly patterning produced by different remote sensing techniques in the southern portion of the site would suggest the area represents a single component, while the northern area of the site may represent multiple components. A third ring-shaped anomaly (hereafter, Ring 3) may be located to the north of Ring 2. Evidence for Ring 3 consists solely of a faint circular area that could represent the plaza of an otherwise obscured midden ring. The hypothetical outer midden area of Ring 3 is presumably obscured because it overlaps so much with Rings 2 and 4.

During the first field season (2011) the surface midden stain was mapped and surface collections were carried out. It is important to note that the aerial photos described above were not acquired until after this first season of fieldwork. So the 2011 survey work was conducted without awareness of the circular anomalies observed in the aerial photos and DEM. The extent of the midden stain was mapped on the surface by flagging the boundary of the darkest color and highest artifact density area (Figure 4-9). Two areas almost entirely lacking artifacts and exhibiting light colored soil were also
flagged in the field (dashed circles, Figure 4-9). In the field, it was thought at least one of these represented backfilled soil (i.e., mixed with subsoil) from one of the WPA excavation blocks.

The aerial extent of surface-collected diagnostics exhibited a pattern generally consistent with the midden stain boundaries (Figure 4-9). The lack of diagnostics in the light colored areas within the midden stain was notable. The diagnostics recovered from the surface were almost exclusively late prehistoric. Projectile points are primarily types dating to the Late Fort Ancient Period, though a handful of Type 2 triangles suggest the presence of a middle Fort Ancient component (see below). The latter finding was not a surprise since Hanson’s publication on the site illustrates numerous middle Fort Ancient diagnostics (see below).

An overlay of the mapped site boundary was also consistent with the aerial photo (Figure 4-9). An initial attempt to relate the surface patterns documented in 2011 to the 1939 excavation areas was made by overlaying the site map from the WPA excavations onto the aerial photo (Figure 4-10). Landmarks including the farm access road, the southern tree line, and river bank edge were used to geo-reference the maps. Note that the placement of the farm road in 1939 is south of the road shown on the aerial photo. This is not believed to be an error in the map overlay; the DEM and the geophysics (below) indicated that the 1939 farm road was south of the current road by a few meters. It is unknown why the road location changed.

Figure 4-10 shows the relative position of the WPA excavation area to the light-colored circular areas lacking artifacts, which indicates they do not represent previously excavated areas as had been thought during the 2011 field season. Second, only about 10
of the 300 surface collected diagnostics (3.3%) were recovered from areas excavated in 1939. This supports the placement of the 1939 excavation map since few artifacts would be expected from previously excavated areas.

The final set of remote sensing data is magnetic survey of the site (Figure 4-11). The purpose of the magnetic survey was to identifying anomalies to target excavations, identify site wide patterns of possible features that would be informative about site structure, and to identify the general location of the 1939 excavation trenches. The site wide patterning of magnetic anomalies was useful for evaluating the midden rings apparent in the other datasets. The midden rings appear as bands or arcs of relatively high intensity anomalies, while the low areas in the center of the rings exhibit relatively low magnetic signature. Most of the anomalies forming these patterns exhibit a gradient of -5 to +5 nT/m (see Chapter 3). The patterns match fairly well to the boundaries generated by the aerial imagery and the 2011 site map (Figure 4-11). However, the magnetic data suggest the subsurface distribution is somewhat wider (solid lines, Figure 4-11) than indicated by other data (dashed lines, Figure 4-11). This is somewhat counter-intuitive since it is often thought that plowing disperses feature contents over an area wider than their original dimensions. However, in floodplain contexts it may be that lower portions of a site may regularly be covered by alluvium thereby obscuring soil differences associated with midden.

Ring 4 as represented by the Aerial/DEM composite does not appear to be represented in the geophysical data (Figure 4-12). However, a remarkable finding in the magnetic dataset was a 5th ring-shaped anomaly in the northern portion of the site (referred to in Chapter 3 as magnetic anomaly Concentration 3; referred to hereafter as
Ring 5. Ring 5 originates just south of the farm road and extends south overlapping Ring 2, and extends east to the edge of the surveyed area on the river bank (Figure 4-13). Ring 5 is intriguing since the surface collections and midden stain mapping did not suggest anything substantial might lie in this part of the site. It is noteworthy that the location of Ring 4 is inconsistent with Ring 5 suggesting the two anomalies represent different archaeological phenomena. While intuitively it seems that some error in the map layers may be making it appear to be two different rings, the aerial photo and aerial/DEM composition both indicate Ring 4 either abuts or is partially under the road and is further from the river bank, whereas Ring 4 does not appear to extend all the way to the road but does extend to the river bank. No other data appear to relate to Rings 3 or 4 and their identity remains uncertain.

Additional information possibly relating to Ring 5 includes collections from the river bank, as well as findings in Units 3-4 and Unit 20 (Figure 4-13). Deposits collected from the eroding river bank (black bar, Figure 4-13) adjacent to the east edge of Ring 5, included a dozen limestone tempered late-woodland like sherds; as well as flakes, biface fragments, fire-cracked rock and faunal remains that were observed but not collected. No Fort Ancient materials were recovered along the bank from this area. Units 3-4 produced similar limestone tempered pottery, blade-like flakes, and a calibrated (2 sigma) AMS date of A.D. 667-779 (see Chapter 3). The location of this unit along the southwestern edge of Ring 5 makes its contents worth note. Moreover, since the boundary of Ring 5 is based only on the magnetic data, it may not be very accurate.

Unit 20 (Figure 4-13), which is clearly located within Ring 5 produced large quantities of limestone tempered pottery sherds mixed with late prehistoric materials.
The most substantial finding in Unit 20 was deep cultural stratum (STR IV) sealed below intact Fort Ancient stratum (STR II) and a 20cm thick stratum of alluvium (STR III). A scatter of five post holes were documented in Stratum IV; one produced a few small limestone tempered sherds. This suggests the limestone tempered sherds recovered from the upper stratum (II) were probably displaced from this sealed deposit (Stratum IV). In fact, several features originating Stratum II were excavated through Stratum III and into IV.

It is proposed that Ring 5 identified in the magnetic dataset represents this buried stratum. This hypothesis is consistent with the fact that no evidence of a site appears on the surface in this part of the site, but Units 3-4, Unit 20, and the river bank all produced limestone tempered pottery from deep deposits. Likewise, Ring 5 does not show up in aerial photos or in the DEM, but appears as an anomaly in the magnetic data which independently suggests it represents a buried archaeological phenomenon. Because it does not relate to the research questions addressed by this study, it will only be given additional consideration when relevant. Future study of this ring should focus on testing another area of the anomaly to further evaluate what it represents.

One of the most prominent features of the magnetic map was linear east-west series of high intensity anomalies (Figure 4-14). This was referred to as Concentration 2 in Chapter 3 (Figure 3-16) and exhibits excellent contrast in the shaded relief gradient map (Figure 3-15). An overlay of the WPA excavation areas onto the magnetic map suggests Concentration 2 represents the back-filled east-west excavation trench (Figure 4-14). Excavations in two separate areas along this east-west line of anomalies documented the edges of back-filled WPA excavation areas (Figure 4-15). Detailed results of these
excavations were described in Chapter 3 as they pertained to georeferencing the WPA and current site grids. New information about structures documented in these areas is described here.

Units 5-7 examined the west end of magnetic anomaly concentration 2 and identified the corner of WPA expansion Area A (Figure 3-18, Figure 3-19 and Figure 4-16). Area A was excavated to fully expose and document House 1 (Bohannan 1939a:1; Hanson 1966:7, Figure 1). A series of post holes documented in Units 5-7 appears to represent the unexcavated southwest corner of House 1. Unit 9 and Trench 1 examined the central area of magnetic anomaly concentration 2, which encountered the southern edge and interior of WPA expansion Area B (Figure 3-22 and 4-17). Trench 1 (Units 13-19) encountered a distinctive edge of the WPA expansion Area B just over 5 meters north of Unit 9 and variation in the depth of the backfilled area was consistent with the types of features excavated in that block. As argued in Chapter 3, the deep back-filled areas encountered in Trench 1 appear to be the result of WPA excavators documenting the north wall of House 2. They had to vertically slice the post line representing this wall in order to document it (Bohannan 1939a:2-3). It should be noted that the initial attempt to georeference Trench 1 with the WPA map was slightly off due to an unknown source of distortion (see Figure 3-22). Figure 4-17 shows the corrected position of Trench 1 where it is thought to have actually encountered WPA Area B.

Overall the magnetic survey and testing program were very effective at predicting the location of the back-filled WPA excavation areas and georeferencing the WPA and current site grids. Accurately referencing the WPA and current grids allows for comparison of the WPAs findings to relative to those from recent fieldwork. Of
particular interest is how the distribution of Houses 1-8 relates to the proposed boundaries of Rings 1 and 2 (Figure 4-18 and Figure 4-19). Several of the structures appear to exhibit different orientations; 5 and 7 appear to be oriented toward Ring 1, while 2, 3, and 6 appear to be oriented toward Ring 2. House 1 is also generally oriented toward Ring 1 though it is somewhat ambiguous suggesting it may lie outside of either formal ring as is the case with several houses at the Buffalo Site (see Figure 4-4a). Houses 4 and 8 are very ambiguous and could be oriented toward either ring. The structures with unambiguous orientations were used to suggest a boundary for each ring (Figure 8-28). Figure 8-29 shows the adjusted boundaries of the rings accounting for the structure patterns. House 1 was included in Ring 2 because it is generally oriented with that ring; though this relationship remains to be demonstrated by additional excavation in the vicinity.

The distribution of features excavated by the WPA is also informative about the relationship between the rings (Figures 4-20). The distribution of features is not particularly informative about the boundaries of the rings (Figure 4-21), though some patterns are notable. The feature distribution on the west and southwest side of Ring 1 exhibits a clear arc shape. It is also notable that the three areas excavated closest to the proposed plaza of Ring 1 lack features.

In general, the distribution of features in Ring 2 is most concentrated on the southeast side of the ring near the proposed plaza. There is also a fairly restricted arc of features along the east side of this ring. There is a notable absence of features between this arc and the proposed plaza (Figure 4-21). The distribution of features in the southern portion of this ring is not particularly informative since most are in the overlap area.
These are just initial impressions based on the distribution of all feature center points rather than their type, size, shape and orientation. In the following sections each feature type plotted independently with the goal of exposing additional information about the site layout.

_Burials_

Mortuary contexts were the most common feature type (not including post holes) documented by the 1939 project, and have been the most studied part of the collections (see Chapter 3). A total of 335 burial forms were filled out by the WPA project, though many contexts were repeatedly re-used and therefore represent multiple individuals. Estimates of the total number of individuals represented by the burial population include 350 (Garten 1997:79), >359 (Hanson 1966:24), and 445 (Cassidy 1972:X). The primary cause of this discrepancy is that a large proportion of burial contexts (contained more than one individual as a result of repeated re-use of some burial areas.

For example, several areas described by Bohannan as “nests”, consist of clusters of burials whose interment disturbed previous interments (e.g., 1939a:6). In some cases disturbed burials were re-united with their missing elements (see below, Holmes 1994:52), but since neither Holmes (1994) nor Garten (1997) provides a table showing this information, it is unclear how many were reunited or if their attempt was exhaustive. Cassidy does not comment on her methods for dealing with this (Holmes 1994:52). Hanson’s estimate of the number of mortuary contexts has occasionally been reported as 301 (e.g., Henderson 2008:833), but it should be clarified that this was a count of the number of mortuary context types represented, not a population estimate. For example, a
count of 1 was given to his type “double bone, single extended”, which actually represents 3 individuals. Using this method, a breakdown of Hanson’s types into individual counts produces a minimum of 359. A maximum is not possible since he had categories “single”, “double” and “multiple” where multiple only indicates more than two. In my estimate, a count of 3 was given to each “multiple” to calculate a minimum total population estimate.

It should also be noted that Holmes recognized Hanson’s count was of burial types rather than individuals, and did not use it as a population estimate. Holmes also pointed out that Hanson erred in combining primary and secondary burial events, often considering them the same mortuary event (1994:50). While this appears to be true, a close reading of Hanson’s burial descriptions indicates he was unresolved about the issue. Hanson first describes his “bone” category as “bones of single individual heaped in a pile after the flesh had decayed” (1966:46-47), which suggests he considered “bone” to represent a primary interment of a defleshed individual. However, in the next paragraph he notes many instances where “interments were close enough to others to suggest that they were removed to make room for later interments. This hypothesis is strengthened by the occurrence of other types of burials where bone interments were found to one side or at the feet of an articulated skeleton” (1966:47). This contrasts his original suggestion that these represented primary interments.

Whatever Hanson actually believed, his comments allude to the fact that we cannot always know whether a disarticulated individual was interred as such because it was disturbed by a subsequent interment, or as a result of decay and manipulation before interment. The possibility that both are represented is highly plausible considering there
is some evidence of Fort Ancient multi-staged mortuary practices involving processing individuals and interring them in corporate mortuary facilities and mounds (e.g., Turnbow 1988:283; Drooker 2010).

In this chapter, overall spatial distribution of these contexts will be used to evaluate the settlement layout. Though numerous variables could be examined, attention here is devoted to mortuary contexts by burial position since this tends to be informative about the chronology and use of space. To date, every study of the burial population at Hardin has treated it as a single unit of analysis even though most recognized the presence of multiple components (e.g., Holmes 1994:87-92; see also Chapter 3). The presence of multiple Fort Ancient components at the site suggests these patterns should be re-evaluated, which is what is attempted in this chapter.

A total of 13 additional mortuary contexts were documented by the present project even though an attempt was made to avoid them. Burials were documented in 5 of the 10 excavation areas and represent 3 intact burials and 3 looted burials (Table 4-1). In addition 7 soil cores documented possible mortuary contexts.

Figure 4-22 shows the spatial distribution of all 348 mortuary contexts documented at the site. This includes the 335 contexts documented by the WPA, and the 13 documented by the present study. This map is of mortuary contexts rather than individuals because only one set of coordinates was documented for each context by the WPA regardless of whether multiple individuals were interred. Because plan maps were produced of every mortuary context, it would be possible to use them to calculate the exact coordinates of every individual and plot this distribution. This was not done for this project because the scale of the map is too large to display this resolution. In fact, as
can be seen from Figure 4-22 many of the individual points representing burial contexts already merge together. The large excavation blocks obviously skew available data toward the Ring 1 / Ring 2 overlap area. However at least some data are present for other areas. Even with the deficiency of excavation in some areas a somewhat clear pattern emerges of mortuary contexts forming an arc around each ring.

Table 4-2 provides my estimate of the frequency and location individuals by burial position. To be clear, this estimate is of total number of individuals by burial position (343) rather than total number of mortuary contexts (335). This was tabulated by examining the original WPA burial forms (Table 4-2). A count was given to each individual as represented on the plan maps and descriptions of each mortuary context. This method is not as reliable as determining the minimum number of individuals by examining the human remains from each context, but this was outside the expertise of the author.

The main potential source of bias that may result from this method would be the underrepresentation of disturbed individuals. It is notable that this study independently achieved a count (n=343) similar to that of Holmes (n=335), but his count not used here because his sample was not divided by individual and therefore could not be split by ring location for spatial analysis (1994: Table 7.2). My count is also similar to Garten’s (n=350), whose estimate is undoubtedly more accurate because she was able to directly examine the human remains and combine this information with the burial forms. This resulted in reuniting individuals artificially separated by WPA excavators in areas with multiple interments disturbing each other, as well as identifying additional individuals not
recognized on the burial forms (Garten 1993:79-81; see also Holmes 1994:52). However, a difference of seven should not affect the overall patterns presented here.

Examining the distribution of individuals by burial position is important for the present study because previous research has identified that burial position has chronological significance in the middle Ohio Valley (see, e.g., Henderson et al. 1992). While extended is the predominant burial position through time in the western Fort Ancient area (Drooker 1997:87), there appears to be a shift from flexed position during Middle Fort Ancient Period (A.D. 1200-1400) to extended position during the Late Fort Ancient Period (A.D. 1400-1650) in the eastern Fort Ancient area (Henderson et al. 1992; Drooker 2010:8 and slides 45-47). If burials are present from earlier occupations, it may obscure spatial patterning of the components of interest. As a very rough estimate of age based on depth below datum, the average depth of each burial position is provided in Table 4-2. The assumption that extended burials are generally later and flexed are generally earlier is supported by the fact flexed burials exhibit the greatest average depth, followed by semi-flexed, and then flexed.

The spatial patterning of flexed burials (Figure 4-22) is clearly concentrated in the largest contiguous excavation area. The near absence of flexed burials in other areas were large blocks were excavated is notable, and may suggest the concentration of flexed burials was a locus of middle Fort Ancient activity. Without examining the grave associations of each individual to identify diagnostic material culture, several other lines of evidence may suggest they are relatively early burials. First, Bohannan notes that flexed burials were in a relatively “crushed and disintegrated condition…as contrasted to the extended ones”, which he suggests may be “attribute[d to] somewhat greater age”
Second, the average depth of the 29 flexed burials is deeper than for semi-flexed or flexed burials.

To examine this possibility, the distribution of middle Fort Ancient ceramic diagnostics and Type 2 triangular projectile points was plotted along with flexed burials. The distribution is similar and supports the idea this was a locus of middle Fort Ancient activity (Figure 4-23). The distribution of all shell tempered ceramics from the deepest (non-feature) WPA excavation levels exhibits the same distribution. This is telling because the deepest contexts containing shell tempered ceramics should relate to the earliest Fort Ancient occupation. Finally, both of the 2013 excavation units that documented middle Fort Ancient diagnostics are located in this same area (compare Figure 3-20 to Figure 4-23). One of these, Unit 10/12, may have identified the edge of a structure dating to that period, but additional excavation will be required evaluate this possibility (see also Chapter 3).

It is also notable that the trench area between WPA expansion Areas B and C (Figure 3-12) only contained a few flexed burials. Even when all middle Fort Ancient diagnostics for this area were plotted this area remained nearly vacant. This area was also lower in elevation on the aerial/DEM composite than was expected based on the midden stain (Figure 4-24). That this area lies in the center of the total distribution of middle Fort Ancient diagnostics may suggest the location of a plaza associated with that occupation. Further evaluation of this apparent concentration of middle Fort Ancient artifacts and features should focus on examining the mortuary goods associated with the flexed burials to determine their relative age, and examining the type and distribution of features with middle Fort Ancient diagnostics.
If flexed burials are removed from the plot the remaining burials (semi-flexed, extended) exhibit a relatively more restricted distribution (Figure 4-25). Comparison of the burial distribution with and without flexed burials shows greater separation between the burial concentrations in the east-central portion of the site (compare Figure 4-22 to Figure 4-25). The distinct arc-shaped burial distributions are strong enough to propose defined mortuary zones associated with Ring 1 and Ring 2 (Figure 4-26).

The inner boundary of this zone was defined by the location of the plaza and the outer boundary was defined by burial distributions. It is notable that all 6 burials documented during 2011-2013 fieldwork fall within the proposed mortuary zones (Figure 4-26). All three of those for which position could be determined were extended burials. In addition, all but two of the possible mortuary contexts identified by the soil coring program also fell within the proposed mortuary zones. Finally, with the exception of House 3, the structure pattern documented by the WPA is also consistent with the proposed mortuary zones.

Another issue these burial patterns speak to is the suggestion some areas containing burial concentrations (Bohannan’s “nests”) represent mass graves related to either violence or epidemic disease from European contact (e.g., Henderson et al. 1992:276). This has not been supported by close examination of the evidence (see also Holmes 1994: 102, 138-141). Examination of burial forms and Bohannan’s field notes reaffirms Holmes’ conclusion that neither burial concentrations nor double burials at Hardin should be considered evidence of epidemic disease. The burials that make up concentrations (Bohannan’s “nests”) represent individual interements, many of which intruded on earlier interments rather than representing the simultaneous interment of
many individuals. Even some of the contexts Hanson called “double burials” can be
ruled out as simultaneous interments since the burial forms themselves often contain
evidence the individuals represent discreet interments. For example, the burial form for
Burials 271 (a subadult) and Burial 273 (an adult female) note an “ash bank” and
“refilled material” separating the two. However, others may represent multiple
interments (e.g., Burials 54 and 55); though as Holmes notes double burials represent less
than 4% of the population (1994:141).

Even though extended and semi-flexed burials clearly exhibit a ring-shaped
distribution, the proposed mortuary zones are not flawless. The pattern is relatively
clearer in Ring 1. While nearly all burials in Ring 1 fall within the mortuary zone, there
is a scatter of burials outside of that proposed for Ring 2. To deal with this issue, only the
most concentrated burials were used to define the mortuary zone for Ring 2. It is likely
that some of the burials falling outside of the proposed mortuary zone for Ring 2 relate to
the middle Fort Ancient concentration in this part of the site. Other possible explanations
include error in defining the burial zone, or that it is not circular. If Ring 2 is relatively
later than Ring 1, the less restricted nature of burials may indicate a partial break down
(or unidentifiable alteration) of the mortuary zone. Such a break down has been suggested
for late Late Fort Ancient components and is therefore quite plausible in this case. The
presence of an entire structure within the proposed mortuary zone for Ring 2 appears to
present another problem. However, analysis of house patterns (below) indicates that this
is an anomalous structure that may have had a mortuary-related function. Further
assessment of the house’s function and its relation to the mortuary zone is provided
below.
Another important insight from this exploration of burial patterns is that the proposed mortuary zones provide some independent support for the proposed plaza areas (Figure 4-27). This is particularly true for Ring 1 since more excavation has been conducted within or near the proposed plaza. Little support if provided for the proposed plaza in Ring 2. The paucity of burials on the inner east side of the proposed mortuary area in this ring may suggest the edge of a plaza. If a lack of burials or other features is indicative of a plaza, then burial patterns in Ring 1 indicate the plaza is as large as 70 meters in diameter. This is larger than any other data set (above) has suggested. However, a 70m diameter plaza is not outside the documented range for villages dating to the Late Fort Ancient Period (Drooker 1997:128, Table 5.9).

**Fired Areas (Thermal Features)**

Even though 55 fired areas (thermal features) were documented between the 1939 and current projects, they were much less common than burials or pit features (Table 4-3). They exhibit little obvious patterning (Figure 4-28). Five of six structures (Houses 1-2, 5-7) contained a central fire hearth when this area was excavated. The structure lacking a central hearth (House 3) is anomalous in several other ways (see below). Additional information is provided by the soil coring program which documented burned sediment in 44 distinct contexts (Figure 4-28).

When fired areas are plotted against the proposed spatial zones some patterning can be observed (Figure 4-29). Excluding those located in the overlap area, excavated fired areas exhibit a similar frequency by spatial zone in Ring 1. In Ring 2 their frequency in the mortuary zone is greater than that in the domestic zone by nearly a
ratio of 4:1. This disparity may be in some part due to a larger sampling area in Ring 2. Clearly fire areas are heavily concentrated in the southeastern portion of that ring. Unfortunately, the same area of Ring 1 has had little excavation.

It is notable that nearly all burned deposits identified by coring were in the proposed mortuary zones. However, this pattern should be viewed cautiously in light of several biases in this dataset. First, the coring program was targeting high intensity magnetic anomalies, which is why so many were encountered though this was not a feature type of interest. Second, some grid areas were not tested at all by the coring program due to time constraints, so thermal features may be over-represented in areas that were examined by coring.

Judging from the excavated areas alone, fired areas are more or less restricted to the interior of structures in the domestic zone, while in the mortuary zone they are less patterned but more frequent. While coring data must be used cautiously, the fact that so few fire areas were documented by cores outside the mortuary zone may confirm the pattern suggested above for the domestic zone: they are primarily restricted to structures in this zone.

**Pits and Refuse Disposal Contexts**

Pits were one of the most common feature types excavated by the WPA (Table 4-3). To draw the most information from them regarding site layout, pits were classified into three types based on morphology: simple, complex, and basin. The three types exhibit important differences in area, thickness and thickness/area (Table 4-4). Refuse
disposal contexts are also included here because they typically occur in pits, though they were sometimes documented as surface concentrations or in ravines on the river bank. Simple pits are defined as a single depression or excavated hole in the ground. Simple pit morphology generally consists of a circular to oblong orifice, vertical walls, and a flat to slightly concave base. The distribution of simple pits is widespread, occurring both within and outside of structures (Figure 4-30).

Compound pits are defined as multiple depressions or excavated holes in the ground that are part of the same feature. They have the same morphology as simple pits, but have an aerial extent more than twice that of simple pits (Table 4-4). They appear to be more heavily utilized versions of simple pits. Compound pits were originally recognized by Bohannan who defined them as:

“large pits…with a few deep holes, usually from a foot and half to two feet in diameter, and number of small postholes…The whole [pit] is usually filled with moderately dark dirt, containing many small clods of yellow [clay]. Rarely in the center of a large hole, before excavation, a small (0.6-0.8 foot) slightly softer and darker spot can be found, evidencing the size of the contained post. In one or two instances, chocking rocks have been found in place, allowing us to determine quite exactly the size of the post. Evidently all of these compound or post-pits, represent, when excavated, the original holes dug to receive larger posts, with small ones possibly contemporaneous, irregularly clustered about them. The fill we find is mostly that packed in around the posts, or kindked in, after the posts were pulled. Had they not been pulled, more evidence than a rare soft spot would remain to tell us of their presence. Thus material from these pits is either
contemporaneous with the destruction of the house, or earlier.” (Misc. Obs., Sept., Page 2).

Bohannan and Hanson interpreted compound pits located along the center line of structures (see below) as receptors for central support posts (Bohannan 1939j:2; Hanson 1966). This is how a similar pattern of interior pits has been interpreted for recently excavated longhouse at the Sweet Lick Knob site in Estill County, KY (Ahler and Stoner 2010; but cf Pollack and Henderson 2015). Others argue that Fort Ancient longhouses had bent pole roof architecture which would not have required central support posts (Pollack and Henderson 2015).

Interestingly, despite the prevalence of this idea in Fort Ancient literature, many Fort Ancient structures are depicted with pitched rather than bent pole roofs (e.g., Warren 2015:39). Moreover, illustrations of Shawnee structures typically show pitched roofs (e.g., Howard 1981:Plate 1) even though other documentary sources indicate some Algonkian-speakers used bent pole architecture (Kennedy and Carter 2015:343).

Assuming Fort Ancient is ancestral to the Shawnee, it might be expected that this architectural form originated some time during the Late Fort Ancient Period. The presence of multiple lines of interior post holes in the longhouses at Hardin suggests that either some post holes represent architectural members used in the construction of a simple flexed roof structure and then later removed, or they are permanent indicating a more complex architectural form such as curtain wall framing where rigid interior and exterior post lines support a flexed roof (see Kennedy and Carter 2015:343-344 for definitions). In many ways the interior posts on Hardin site longhouses resemble historic
Pamunkey (Algonkian) longhouses (Hargrove 1978:Figures 82-89), which had pitched roofs like those of the historic Shawnee.

Close examination of plan views and feature notes indicates that in most cases post holes and center line pits can be seen in close proximity along structure center lines, which may suggest the interior pits were multifunctional, or contained a single original function and were sometimes reused as receptors for posts. House 3 lacks simple or compound pits, but has a pattern of interior posts where the pits are located in other structures. This suggests that if this architectural form employed center line support posts, they did not necessarily require holes as large as the simple and compound pits documented in other structures. As Bohannan observed, actual post molds in the center of simple and compound pits were relatively rare. Most were simply soft, dark circular stains, though some exhibited rock and or clay chinking. More importantly, the diameter of post molds is the size of typical post holes (<1 foot), which is fraction of that documented for simple (1-3 feet) or compound (2-4 feet) pits. This further suggests reuse of former activity pits as receptors for posts.

One attribute that may be unique to post receptor holes are ramps. Kennedy and Carter describe these as “long sloping cuts that represent post ramps used for setting a very heavy or tall post” (2015:336-337; Figures 12.8-12.9). They also suggest that “jumbled or secondary fill” may be distinctive of vacated post holes (2015:337). Both patterns were documented among the simple and complex pits within structures at Hardin. A complete analysis of the distribution of interior pits and post holes using these more detailed criteria would be useful in parsing pits used for architectural posts from
others. If the primary function of simple and compound pits was something other than post receptors, the lack of them in House 3 is unique (see below).

In summary, it appears that many pits may have been multifunctional. Evidence of rebuilding in most structures suggests they had a long lifespan, and therefore it should not be a surprise that their internal features were reused. The distribution of complex pits indicates they were located primarily in the structures documented by the WPA (Figure 4-31). Those scattered somewhat randomly outside of structures may have had a different function, or could potentially indicate unrecognized structure footprints. A plot of both complex and simple pits shows that they tend to occur either within structures, or primarily in the proposed mortuary zones (Figure 4-32).

Basins are the third type of pit documented by the WPA project (Tables 4-3 and 4-4). They exhibit the largest aerial extent and are the most shallow pit features. Their shallow nature is confirmed by the fact they also have less thickness per unit of area than simple or complex pits. Their distribution is almost exclusively outside of structures (Figure 4-32). The two exceptions are complex pits that were defined by the vertical thickness criterion used to divide basins from shallow pits. Basins are concentrated in the same area as the previously discussed concentration of middle Fort Ancient diagnostics, and absent elsewhere. This suggests they are associated with that occupation. Analysis of their contents is needed to evaluate this possible association.

Finally, refuse disposal contexts varied more widely than pits in their morphology even though only 7 were identified by the WPA project and 3 by recent fieldwork (Table 4-3; Figure 4-33). They consisted of trash-filled ravines on the river bank, trash-filled pits, surface concentrations, and trash middens with unidentifiable boundaries.
Relatively few of these contexts were identified as features by the WPA project, perhaps because it is often difficult to distinguish the boundary of refuse concentrations in general midden contexts. In fact, two of the refuse contexts identified during recent excavations consisted of refuse concentrations lacking discrete boundaries. These were not given feature designations but can nonetheless be designated as refuse disposal contexts. The punctuated distribution of these refuse concentrations may suggest that the occupants of one or more houses shared a discrete refuse disposal area. This idea is supported by the presence of a concentration adjacent to every house area. The refuse concentration documented in Units 10/12 was associated with a posthole pattern that probably represents a structure (see Chapter 3 and “Unit 12 Possible Structure” below). By extension, the apparent association of these refuse contexts with residential areas may suggest that a structure is located in the vicinity of Unit 11 (see “Possible Structure near Unit 11” below).

Trash-filled ravines are no different than refuse concentrations in midden but are more likely to be designated as features because ravines form a natural boundary that can be used to identify a boundary. Feature 19 is the largest at the site and encompasses all of an excavation block extension in the northeastern part of the 1939 excavation grid (Figure 3-12). A concentration of Middle Fort Ancient diagnostics in the lower levels of this feature (Figure 4-23) indicates a very long history of use. This compares well to the trash-filled ravine documented at Madisonville, which contained stratified deposits representing Middle and Late Fort Ancient episodes of use (Glowacki et al. 1993). Feature 3 documented in 2013 (Unit 8) is another example of a refuse context that was given a feature designation only because it was defined by the ravine it occupied. The
two trash middens documented in 2013 (Units 10/12 and 11) exhibited equally high concentrations of refuse but were not given feature designations because they lacked boundaries.

**Structures**

While some attention has been given to diachronic change in Fort Ancient architecture over time (e.g., Turnbow 1985; Henderson et al. 1986:207-210; Pollack and Henderson 2000, 2015), little attention has been given to variation in longhouse-style structures represented at Hardin and Buffalo sites (but see Pollack and Henderson 2015). While the structures from Hardin are frequently mentioned in overviews of protohistoric Fort Ancient architecture, attention to detail has been restricted to estimating the number of occupants based on floor space (e.g., Holmes 1994:53-55). Several authors have suggested their relatively large size is an indication they were multi-family dwellings (Henderson et al. 1986:210; Holmes 1994).

At least 8 structures were excavated by the WPA in 1939. It is uncertain how many of these were recognized by Bohannan during the WPA excavations. His plan maps show only House M1, House M2 and House N. The designations M and N suggest they were preceded by Houses A-L, but maps and records in the WPA archives provide no information. Hanson designated the structures he observed in the WPA records House 1 through House 8, and labeled them more or less in order from WPA grid north to south (Hanson 1966:Figure 1). He also provided detailed descriptions of them (1966:7-16). Hanson’s House numbers are used here (see e.g., Figure 4-18). Assessment of structures by the present study has two goals. The first is to identify variation among them that
could be used to associate them with either Ring 1 or Ring 2. The second goal is to use spatial software to manipulate feature and post layers to determine if other structures can be identified. The information will be used to further evaluate the site layout model.

**General Layout**

A single general overall layout is present among Houses 1-7. House 8 was not excavated sufficiently to even speculate about its patterning. House 5 exemplifies the general layout, and is the only completely excavated structure that did not overlap other structures or feature concentrations (Figure 4-34, Figure 4-35 and Figure 4-36). This may be why Hanson chose to illustrate this structure in his monograph (1966: Figure 4). In general, the houses can be characterized by an elongated rectangular plan similar to longhouses from several areas of eastern North America. Most of the structures were rebuilt and or extended as indicted by double rows of post holes.

Structure width seems to have been restricted as its range was less than two meters (7.5-9.2m), while length varied by six meters (15.7-21.7m). This restriction has been observed among Iroquoian longhouses which have a relatively fixed width, and were extended to accommodate additional family groups. On the structure interior are two rows of pits inset about a meter from the exterior long walls, a third row of pits and a large fire place along the central axis, and a doorway on the east end of the structure (Figure 4-35).
**Exterior Post Lines and Features**

Exterior posts were the smallest type and were set in a single, relatively straight row. All structures except House 3 appear to have had at least some sections of exterior posts replaced as indicated by a second line of posts paralleling the first. This is most obvious on Houses 5 and 7. Doorway areas are characterized by a concentration of small exterior posts, the outside of which typically formed an arcing string of posts (screen?) on either side of an opening. This pattern is most clear on Houses 1, 5 and 7 (Figure 4-36). Where exterior post patterns at the ends of structures were not entirely clear, Hanson inferred that any gap in the post line was the doorway (e.g., Houses 3 and 6).

The double lines of exterior posts indicates rebuilding or maintenance of the structures. The placement of the fireplaces over center-line pits and post holes is consistent with this model, as is Bohannan’s observation (1939c) that, in House 5, half of the pits occurred at 1.5’ while the other half occurred at 2.0’ depth. Hanson interpreted a pattern of post holes on the western end of Houses 4 and 5 as “extensions” (1966:11-13). This pattern is also present on Houses 5 and 7, but is difficult to distinguish with certainty due to the intersection of House 6. The possibility of extensions is discussed further below.

**Interior Post Patterns and Features**

Structure interior areas were defined by three lines of simple or compound pits (described above); one about a meter interior to each outer wall (hereafter lateral lines) and one down the central axis (hereafter, center line). When the central area was excavated, all but one structure (House 3) contained a central hearth. Central hearths
were very large measuring about 2 x 4 meters with the long axis running parallel to the long axis of the house. Invariably, hearths were built over simple or complex pits along the centerline. This situation can be seen clearly in House 5 (Figure 4-34). Bohannan interpreted this pattern as evidence of rebuilding with old central support holes covered by a later fire hearth. Evidence of rebuilding at all but one structure at Hardin suggests this is the most likely scenario. The same interpretation was made for a recently excavated longhouse in Estill County, east-central Kentucky (Ahler and Stoner 2010).

As discussed above, however, if these structures had bent pole roofing, central supports would not have been necessary (Pollack and Henderson 2015:310). Given this possibility several alternative functions are possible. One is that they centerline pits received poles for scaffolding during house construction, and then either filled in or capped by features used during the occupation of the structure. Pollack and Henderson argue strongly against an architectural function, suggesting instead that re-used centerline pit features represent a ritual involving setting and removing central poles. They cite the presence of multiple holes in a single pit feature, clay lining and capping, rock chinking, and deposition of personal objects in these features as indicators of ritual rather than architectural use. However, all of these attributes were present in the complex pits along the centerline of the Hardin structures. The Hardin structures differ in that they were likely residential rather than public structures. Given that all excavated structures currently documented at Hardin are likely related to late Late Fort Ancient occupations of the site (but see Chapter 6 discussion), they probably post-date all public structures discussed by Pollack and Henderson (2015). The public structure at Fox Farm was dated to the early 15th century, which relates to the very early Late Fort Ancient Period. What
was a public structure at this time may have transitioned into a domestic form of architecture.

*Ancillary and Miscellaneous Features*

Three patterns of smaller posts were observed on several structures. The first are single or double lines of small interior posts that have been interpreted as partitions or walls for extensions (Hanson 1966). A straight run of a single line of posts can be observed at the east end of House 3. A double line of interior posts occurs most clearly on Houses 5 and 7, but also on House 4 (Figure 4-37). These examples form short straight runs and arcing patterns. The arcing patterns appear similar to those forming entrances on the ends of structures and may suggest the presence of interior doorways. If the “extensions” are real, then the doorways in the interior partition would have to be original to the exterior before the extension was added. If the original structure lacked a door, and the post line for that exterior wall became the partition, excavators would only see the interior partition represented by the original post pattern whether a door had been present or not.

The second post pattern is a small circular area of post holes on the interior east end of House 1 (Figure 4-38). This pattern may also be present in the melee of posts present in the other structures. It has also been documented in earlier (e.g., Cowan 1987: Figure 22) and contemporaneous (Hanson 1975) Fort Ancient Structures. The third post pattern was observed most clearly on Houses 5 and 7 (Figure 4-34 and Figure 4-35). This pattern is an arc or semi-circle of posts along the northern exterior long wall. Structure 2 may also exhibit this pattern. This feature is comparable to the
“porticoes” attached to structures at Woodside Phase Fort Ancient villages (e.g., Figure 4-39), which date to the middle Fort Ancient Period (A.D. 1200-1400) and early Late Fort Ancient (A.D. 1400-1550) (Dunnell 1972:47; Henderson 2008:845-848). Examples include Slone in Pike County, Kentucky (Hanson et al. 1964:74-78), the Mayo Site in Johnson County, Kentucky (Dunnell 1983:132), and Burning Spring Branch in Kanawha County, West Virginia (Figure 4-39; Pullins et al. 2008:Figure XII-58).

Porticoes were first described at the Slone Site as concentrations of storage pits and fire features enclosed by small rectangular structures attached to the plaza side of houses (Hanson et al. 1964:74-78). The rectangular structures were defined by a single line of small posts. The porticoes identified at Burning Spring Branch (on 6 of 24 structures) were not associated with features which led Pullins et al. (2008:834) to infer that they did not have the same function as those at Slone. The examples at Hardin compare to the Burning Spring Branch in that they lack a regular association with either storage pits or fire hearths.

A final pattern was observed in excavation profiles from the WPA and recent excavations. Bohannan’s trench profile along the R15 line indicates Houses 1 and 3 were set in basins comparable to the recently excavated longhouses at Fox Farm and Sweet Lick Knob. No other trenches bisect fully excavated structures so the presence of associated basins cannot be evaluated. However, profiles of two of the possible structures (B-1, D-4) indicate they may have been set in basins like Houses 1 and 3.
Discussion

While the general plan and features of Houses 1-7 are relatively consistent, Houses 3 and 6 present some anomalous features that require additional comment. House 3 was completely excavated in 1939 with the exception of a small area of the northwest wall near the corner (Figure 4-40; see also Hanson 1966:9). In Hanson’s published site map (1966: Figure 1) he delineates the house outline as having a narrow long axis (5.5m), but includes a line of posts paralleling the structure to the north as a 5.5m long “passage”. He interprets the east end of the passage to be the entrance to the house (1966:9).

However, when I plotted the post holes recorded for this structure in Surfer it became apparent that Hanson’s “passage” is actually the north exterior wall of the structure (Figure 4-40). What Hanson interprets as the north exterior wall is actually the north interior support wall. When the post pattern is re-interpreted in the present manner the architecture of House 3 is more consistent with the others; the main difference being the lack of large compound/post-pits.

The presence of numerous burials (not shown in figure) in place of compound pits may suggest it was used to store the dead rather than food. However, post holes intruding into 15 of 17 burials in the structure led Hanson to argue the house post-dated the use of this area of the site for burials (1966:9). And while this may be the most plausible argument given no other structures house a burial concentration, the presence of intrusive posts can only demonstrate they predate the last maintenance episode in use-life of House 3. The burials could have been placed in the structure after it was built but before any post replacement.
The lack of a large central fire hearth is also notable (not shown in figure). A large amorphous thermal feature is present in the southeast end of the interior not far from the proposed doorway; but it is intruded on by many post holes. Many aspects of the structure compare well to early 1600s European descriptions of Pamunkey (Algonkian) mortuary structures. Like House 3 they exhibited the same general layout as domestic structures, contained an interior hearth at one end near the door, sometimes contained an interior platform to hold corpses before burial, and numerous burials were placed in the floor (Hargrove 1981:70-72).

The plan view of House 3 is also comparable to House Type B at the contemporaneous Buffalo Site (Hanson 1975:14). Hanson observes that “these houses were used for sleeping and burying the dead, perhaps those who had slept there”. Of the 43 houses Hanson classified by type over 37% were Type B, an indication of how common interior burials were at Buffalo. This was not the case at Hardin, though this fact alone cannot rule out a mortuary function for House 3.

The ultimate interpretation of House 3 hinges on whether it was built over a pre-existing burial area, or rebuilding accounts for the number of burials intruded on by post-holes remains unclear. What is clear is that compound pits and a central fire hearth are lacking. If this structure did not have a specialized mortuary function, then alternative functions can be inferred from the lack of fire hearth and compound pit features. For example, it may not have been used long enough to invest in storage facilities, or it was used during a portion of the year when these were not needed. Further analysis of feature associations will be required to fully evaluate the relative chronology of the structure and burials.
Hanson’s House 6 also requires additional comment. Hanson’s description of House 6 indicates it is asymmetrical (1966:11-13), which would be unique for the village. He also indicated that the house had been intruded on by the overlapping House 7, which, according to the present evaluation appears to be the case. However, I do not believe that this structure is asymmetrical in shape as Hanson believed. Rather, careful examination of the post hole distribution associated with this structure (Figure 4-41), and comparison of it to others indicates they exhibit the same plan.

As Hanson observed, the construction and use of House 7 intruded on House 6; but I would go further in suggesting that it destroyed the southeast long wall and the northeast corner of House 6 (represented by red dashed line in Figure 4-41). I propose that the post lines Hanson interpreted as the southeast wall of House 6 actually represent the extension (or partition) wall inside House 7. As described above, this interior feature is clearly present on west end of Houses 4 and 5 and if examined closely can also be observed on the same end of House 7 and probably also House 6. This interpretation for House 6 is consistent with all other houses and is therefore more plausible than suggesting it represents a form unknown at the site or at any other Fort Ancient site.

Several other attributes of House 6 also support the interpretation that it has been heavily disturbed by, and by extension is earlier than House 7. First, the two most prominent features of the house (233 and 66) are intruded on by numerous posts whose initial depth is higher in elevation. In fact, the average depth of posts and features are more shallow for House 7 compared to House 6. Feature 233, the central fire hearth of House 6, is the largest feature in this structure, a pattern found among all other structures.
at the site. It is intruded on by a large pit running along the centerline of House 7, and which also has the same dimensions as many of the other pits on this centerline.

Another important attribute of House 6 is Feature 66, a prepared floor area. The feature occurs above several posts (Bohannan 1939a), but is also intruded on by at least 5 very small posts. The small posts intruding into Feature 66 appear to be part of the House 7 extension wall, while those sealed under Feature 66 are most likely associated with House 6. Not including Features 233 and 66, most of the remaining features that can be associated with House 6 were identified at base of the occupational stratum intruding into the lower sandy clay (Fea.84, 105, 181, 234). To contrast, many of the prominent features of House 7 occur near the top (Fea. 51, 54, 57, 59) or within (62, 65, 67, 70) the occupational stratum.

Finally, House 6 was the only structure containing an interior refuse pile (Fea. 113), which occurred in the occupational stratum. Interior refuse piles were not observed in any other house. Coupled with the other information gathered here, it can be suggested Feature 13 post-dates Structure 6. In fact, re-use of abandoned house basins for refuse disposal was a common practice at Fort Ancient sites the author has excavated. Today these basin features contain important concentrations of refuse, especially on sites where plowing has truncated site middens leaving only deeper feature contexts.

**Possible Structure Areas**

Bohannan suggests several structure areas in his Miscellaneous Observations paper which are discussed here. He usually referred to them as “houses” but because we do not know their potential function, they are referred to more generally as structures.
Others are proposed based on post hole and feature distributions from plan views and trench profiles. The location, orientation and features of possible structures suggested by these sources are presented in this section (Figure 4-42 and Table 4-6). There are several reasons why some of the possible structures discussed below have not been recognized. The primary reason is that little attention has been given to spatial analysis of WPA archives. Other reasons include field methods, priorities, and variability in worker skill during the WPA project.

To be clear, the WPA excavations at Hardin were well above contemporary standards at the time, but this does not mean they were flawless. At a minimum, these circumstances may lead to new discoveries in the WPA archives. While Bohannan kept thorough records, it is unknown how he evaluated whether something was documented as a feature, a post hole or passed over. For example, he mentions while excavating Feature 19 (trash-filled drain) in Area DD “out of some fifty [post holes] staked out, thirty-one seem satisfactory. This is about a normal percentage…” (Bohannan 1939e:4). This suggests that while over 2000 post holes were recorded, many may have gone undocumented. This situation was already described above for refuse contexts. In addition, some features were clearly not recognized due to the variable skill of the WPA crew. This is evident on about ten feature forms which indicate burials and pits were destroyed by excavators before they could be fully documented. Another important factor is that if WPA excavators were concentrating on documenting dense feature concentrations it seems likely they may have overlooked posts, especially if they were considered relatively less important.
There is evidence for two possible structures in the vicinity of WPA expansion Area B (location shown on Figure 3-12). As described in Chapter 3, Unit 9 and Trench 1 documented a large intensively burned thermal feature set in a shallow basin bounded to the north by a line of post holes (Figure 4-43). Initially it was believed the post holes located on the northern edge of this possible house basin represented the southern wall of House 2. After the 1939 and 2013 grids were referenced, it became clear that the thermal feature in Unit 9 and most of the post holes in Trench 1 were too far from House 2, and was therefore unrelated. The thermal feature, basin and post hole concentration in Units 9, 15 and 16 are considered here to be a related group of features and will be referred to as PS B-1.

The size of the thermal feature in Unit 9 and the intensity of burning indicated by almost ten centimeters of extremely hard burned sediment are consistent with central fire hearths documented by the WPA in Houses 1, 2, 5, and 7. The post holes most distant from the thermal feature (16-1 and 16-2) are 2.5 meters away, which would make PS B-1 about 5 meters wide (Figure 4-43). This is narrower than any of the houses documented by the WPA, but is not out of the range of known Fort Ancient structures dating to the Late Fort Ancient Period. Finally, the south profile of Unit 9 and Units 15 and 16 to the north (part of Trench 1) indicate the presence of a 15-20cm deep basin. The basin begins at the northern-most post holes in Unit 16 (16-1 and 16-2), descends toward the south extending under the thermal feature in Unit 9, and continues for an unknown distance to the south beyond Unit 9. Bohannan’s trench profiles indicate House 1 and House 3 were set in the same basin-like feature, as are recently excavated Late Fort Ancient structures.
at Fox Farm, Sweet Lick Knob, and Petersburg (Ahler and Stoner 2010; Kreinbrink 2014; Pollack and Henderson 2015).

Turning back to House 2, several post holes documented in Trench 1 (13-1 and 13-2) were located about 1 meter north of those associated with PS B-1 (Figure 4-44). It is believed they represent the south exterior wall of House 2 because they are about 3 meters from the structure’s centerline. The same distance was measured between the house’s north exterior wall posts and its centerline (see above, and Figure 3-22, Figure 4-17, Figure 4-43 and Figure 4-44). As mentioned in Chapter 3, the profile of Unit 18 suggests that the north wall posts associated with House 2 may also occur at the edge of a basin (see profile in Appendix D).

Area B Possible Structure 2 (PS B-2)

PS B-2 is based on two concentrations of post holes (Figure 4-45). The first is a scatter of 8 post holes in Unit 21. The second is a line of 4 post holes which were documented in the profile of a short WPA trench section located north of Unit 21. Bohannan generated profiles for most of the trenches and noted or illustrated post holes and other features. The total evidence for PS B-2 structure is limited, but does warrant further examination in the future.

Area I Possible Structures (PS I-1 to PS I-4)

Evidence for 5 possible structures is present in and near WPA expansion Area I (Figure 4-42). No post hole patterns were recorded in Area I, but according to Bohannan “both the nature of the fill and the profiles seem to suggest that [a structure] should be
located somewhere in the vicinity of 74L50” (Bohannan 1939a:3). He added further “It would seem there is a house nearby [ in the vicinity of 67L50]…excavation in this direction would reveal a house site more or less paralleling the general line of the graves in the graveyard” (Bohannan 1939e:7,25). To evaluate his prediction, I examined the WPA excavation map of this area to distinguish any patterns. Five potential candidates arose.

Excavation Area I is comprised almost entirely of burial concentrations (Figure 4-46). The burials in this area, which Bohannan often referred to as “nests” in his field notes occurred primarily in linear concentrations. Each concentration consists of a group of individuals who were successively interred, each overlapping the previous person’s head or legs thus extending the linear concentration in one direction or the other. A second observation about these concentrations is that there are often a few burials that are oriented perpendicular to the long axis of the linear concentration (Figure 4-47). This situation made it seem that either a second component was present to which the perpendicular burials belong, or, if they are all contemporaneous an unknown preference or condition is determining this un-intuitive pattern.

At the contemporaneous Buffalo Site, located upriver from Hardin in West Virginia, it was observed that over 37% of all structures contained burials that “lined the walls” (Hanson 1975:14, 23, Figures 17, 20). Also comparable to Hardin are burial patterns in some areas of the Madisonville Site in southwestern Ohio. Drooker (1997:133) has pointed out that some burial concentrations at the site exhibit linear or L-shaped patterning sometimes in association with thermal features, pits, and postmolds. In at least one case, Drooker suggests this burial pattern “might be defined by structure
walls” (1997:133, Figure 5-9, 5-10, 5-13). While the pattern at Buffalo is associated with post patterns and is therefore unquestionable, the pattern at Madisonville is nearly identical to Hardin in that both burial and feature patterns suggest the presence of an architectural feature, but the post pattern is missing.

Using the information from Buffalo and Madisonville as a guide, I plotted a generic house shape around the primary burial concentration in Area I. This exercise unintentionally revealed that the second burial concentration in Area I appeared to have a similar pattern to the first, but that the axis on which the linear burial concentration lies was clearly different. In addition to a small spatial gap, the slightly different axes of the linear concentrations in each cluster created a “natural” break between the two which guided the placement of speculative house perimeters for PS I-1 and PS I-2 (Figure 4-48). Overall the patterns seem to match what Hanson illustrates for the structures containing burials at Buffalo (Figure 4-49).

After drawing the “house” perimeters around both burial concentrations it became clear the long axes of PS I-1 and PS I-2 appear to encircle the plaza as one would expect. This observation may be somewhat circular thinking since burials in circular Fort Ancient settlements typically ring the plaza regardless of whether they are confined to an architectural feature. Moreover, patterned interment around a circular area does not explain why these burial concentrations occur in patterned groups consisting of linear concentrations punctuated by single interments oriented perpendicular to the long axis of the linear concentrations.

Additional information supports the proposed house areas. First, both ends of PS I-1 are bound by the “natural” breaks in burial orientation and spacing. The east and west
limits of PS I-1 are indicated by a lack of burials or features. Using these parameters to estimate the boundaries of PS I-1 produced a rectangular structure with a length and width comparable to Houses 1-7. Finally, a scattering of compound pits was documented in and around the burials in PS I-1. As discussed above, this type of pit feature is rare outside of the completely excavated structures. Similar feature patterns were observed in two areas adjacent to PS I-1, and they were designated PS I-2 and I-3 (Figure 4-48).

PS I-4 is more speculative. It is based on the presence of a looted grave pit documented in Units 1-2 whose long axis followed the arc formed by the other Area I possible structures (Figure 4-48). There were also a scatter of post holes adjacent to and following the axis of the grave pit in Units 1-2. Further analysis of these structure areas will require determining feature associations within the proposed structure areas.

PS I-5 is the last identified in Area I (Figure 4-42). PS I-5 was originally proposed by Bohannan, who thought a structure might be located just west and south of Area I. He also believed it would have the same orientation as the burial concentrations. Specific evidence for PS I-5 includes Feature 41 and a single post hole. Feature 41 is a simple pit typical of those found in Houses 1-8. The single post hole was shown in Bohannan’s profile drawing of the N67 L61 section of the intermittent WPA trench. Though many of Bohannan’s speculations have proven correct, the lack of specific evidence for this structure makes it speculative at best.

Area D Possible Structure 1 (PS D-1)

Four possible structures were identified in WPA expansion Area D. PS D-1 is the strongest and most obvious candidate based on post hole patterns alone (Figure 4-50).
The presence of a structure in this area first became apparent when I plotted the post holes in the southeast portion of Area D. The post hole pattern in this area forms a somewhat clear rectangular shape, though the south end is almost completely lacking post holes. Bohannan mentions that this area of the site was extremely eroded toward the river (1939a:4-9), so it is perhaps not a surprise that some areas of the structure cannot be discerned. A profile drawing along the R30 line passes directly through where the post hole pattern indicates a structure, but no post holes or basin were documented. The lack of posts on this profile indicates the trench section must have cut through the area were absolutely no posts were present. It is also possible these posts were high up in the “occupational” zone (midden below plowzone) and could not be distinguished when the profile was drawn.

Other information for PS D-1 includes a possible fire hearth that is roughly centered in the post outline, and several simple pits along the same axis. The orientation of the structure suggests it faces the proposed plaza of Ring 2. Its position relative to House 6 leaves a gap sufficient for one other structure (Figure 4-42), though only an apparently random scatter of features is present. It may be that an additional structure was present at that location, but its features were too eroded or difficult to distinguish by the WPA field crew.

Area D Possible Structure 2 (PS D-2)

The remaining proposed structures for Area D are all located within what has been referred to as the main burial area at the site (Figure 4-42). The possibility of structures in Area D had not been given consideration until I found a note by Bohannan
indicating: “the row of pits in the northeast corner of Area D in all probability represents a house site largely destroyed by the graves found there…” (1939a:6). After reviewing all feature and burial records from this part of the site I designated it PS D-2. In total 20 burials, 5 pits, one post hole were documented within the proposed structure area. The feature forms indicate several pit features in the area intrude into burials but not vice versa, suggesting the burials are earlier. However, like the burials in the proposed structures in Area I, a very low proportion of burials in PS D-2 were disturbed by post holes or pits. Also like Area I, the burials in PS D-2 from linear concentrations. The axis of the concentration faces the proposed plaza of Ring 2.

The line of pits in PS D-2 consists of three compound pits, two large simple pits, and a single post hole. Most of these features exhibit cylindrical interior shapes with flat bottoms, and are patterned in a line just like the large pits in Houses 1-8. The axis of the pit alignment is the same as the burial alignment (facing the plaza of Ring 2).

The association of burial concentrations and possible structure areas in areas D and I at Hardin is similar to one described for the contemporaneous Madisonville (Drooker 1997:133,141-143) and Buffalo (discussed above) sites. It is notable that all three sites are protohistoric. As at Hardin, Drooker’s analysis of structure patterns at Madisonville was hindered by a lack of recorded post holes. Whether the patterns at either site indicate the presence of structures remains indeterminate. The presence of this pattern in multiple areas of the Hardin site begs further consideration. The paucity of post holes but the presence of pit and burial features may suggest that if structures were associated with these features, the post holes were relatively shallow and were truncated by plowing.
Area D Possible Structure 3 (PS D-3)

PS D-3 (Figure 4-42) is suggested by two concentrations of post holes at the same easting as Houses 4 and 8 but further north (WPA grid location: N22-23 R15-21). These concentrations exhibit a gap that compares well to the entrances of more completely excavated structures. In addition, the maximum width of the area containing these posts is in the range of the short axis of known structures. Unfortunately most of this information is circumstantial and no other data are available. If a structure was present here and it was aligned with Houses 4 and 8, it would indicate the domestic zone of Ring 1 contains three rings of structures.

Area D Possible House 4 (PS D-4)

Evidence for PS D-4 includes a scatter of post holes, a scatter of simple and complex pits, one or more fired areas, and a possible house basin. A house basin is suggested by post holes and a depression illustrated on one of Bohannan’s profile of the trench that went through Area D. This profile illustrates one post at N10 R21.8, and three equidistant from each other between N10 R27-28. There is a difference of 5 inches (12cm) from top of posts and base of “brown occupational” zone forming a depression between 10R21.8 and 10R27-28 that is consistent with Fort Ancient house basins. However, no attempt can presently be made to even speculate on an outline because no clear alignments of features can be discerned to suggest a structure orientation or boundary. The only reason that a specific structure is suggested here is the presence of shallow basin between N10 R21.8 and N10 R27-28 (WPA grid). One or more post holes are located on either side of the basin, which consists of a 10-15cm depression observable
in a profile Bohannan drew of the original trench through this part of Area D. This possible structure location is designated on Figure 4-42 with the notation “PS D-4”.

Additional Structures in Area D

A large portion of Area D exhibits an extremely convoluted and dense concentration of features that could potentially be assessed to identify additional structure locations. Of specific interest are several linear concentrations of burials. Interspersed between the burial concentrations are fired areas, simple and complex pits, and scatters of post holes. Hanson and Bohannan both considered this to be a burial area, though the frequency of features intruding into others, and the presence of several feature types that tend to be associated with structures strongly suggests the area was used for both purposes. It is impossible to tell with the present information whether these functions were contemporaneous or sequential. The apparent association of burial concentrations and architectural features in PS D-2, and possible structures in Area I, and the presence of this situation at the Buffalo site indicate this is certainly plausible.

Area DD Possible Structure 1 (PS DD-1)

Evidence for PS DD-1 includes a scatter of post holes, a scatter of simple and complex pits, and one fired area. The central location of the fired area within this group of features suggests the presence of house with a central fire hearth. The feature from for this fired area indicated it was the “remnant of a very large fire area destroyed by graves 290 and 293”. Feature forms for many of the simple and complex pits suggested they had once contained post holes. Several of these may have been intruded on by burials as
well, suggesting this was once a house area but was later used for mortuary activities. Despite the suggestive evidence, no attempt can presently be made to even speculate on a structure orientation or boundary. This possible structure location is designated on Figure 4-42 with the notation “PS DD-1”.

Unit 12 Possible Structure

Evidence for a structure in the vicinity of Unit 10/12 includes two alignments of posts, and a fired area (Figure 4-51). There were also several post holes documented in the profile of a WPA trench section located about 3 meters south of Unit 10/12. It can be tentatively suggested the post holes in the WPA trench represent a wall opposite to the alignment documented in Unit 12. The distance between the post hole alignment and the post holes in the WPA trench is approximately 6.7 meters, which falls within the range documented for Houses 1-8.

Possible Structure west of Unit 11

Evidence of a possible structure west of Unit 11 consists of 4 posts documented in the profile of a WPA trench section (N67 R60). The possible structure location is indicated on Figure 4-42 as “PS 67R60”. As discussed above, the presence of a refuse concentration in Unit 11 a short distance away supports the idea that a structure may be present here. This possible structure could be evaluated by extending a trench from Unit 11 to the west where one would encounter the post line documented by the WPA.
Possible Structure in vicinity of Unit 3-4

Evidence of a possible structure in the vicinity of Units 1-2 consists of a scatter of 7 post holes. The possible structure location is indicated on Figure 4-42 as “PS U3-4”. No other evidence exists for the presence of a structure here.

Discussion

The quantity and quality of data available for each proposed structure varied widely, so they were plotted according to the strength of supporting evidence (Figure 4-42 and 4-52). Three levels are present: Level 1 (n=1) Post lines and internal features consistent with fully documented structures; Level 2 (n=5) a pattern of internal features large enough to strongly suggest the location of a structure, and the presence of post holes but lacking a recognizable pattern; or a combination of a few internal features and recognizable post pattern (i.e., alignment), and Level 3 (n=8) a recognizable pattern of post-lines with limited additional supporting evidence, or an unrecognizable scatter of posts and/or features.

The specific evidence available for each proposed structure was reviewed above. If the strictest criteria of a post hole outline is followed, structure D-1 is the only new one that can be confirmed by this study. D-1 possesses a nearly complete post hole outline and internal features consistent with Hanson’s fully excavated examples. The second level of proposed structures, and certainly the most interesting, are those whose outline was proposed based on burial patterning (I-1, I-2, I-3, D-2).

At first this pattern was remarkable but completely un-interpretable. However, an identical burial pattern was observed at the Buffalo site, which serves as the basis of
interpretation here. Hanson indicated that over 70% of burials at the site were interred “lining the walls” of Type B structures (1975). Comparison of the burial patterns in Area I to that identified for Type B structures at the Buffalo Site (Hanson 1975:Figures 17-20) shows remarkable similarity. The paucity of internal features in House Type B led Hanson to interpret it functioned for sleeping and burying the dead. The presence of simple and compound pits associated with some of the proposed (mortuary) structures at Hardin thus differs somewhat from Buffalo Type B structures. The Madisonville site may be more comparable since it too had linear burial patterns in association with pits and other features.

If the pattern at Hardin and Madisonville does indicate the presence of structures, they would have had a more diverse function than has been interpreted for Type B structures at Buffalo. But if these structures were built for diverse functions, then why are clear post patterns not associated with them? It may be that these structures combined shallow set posts or stakes that have been obliterated by plowing leaving only the deeper features intact.

Finally, all of the possible structures containing burials (and structure 3) were located exclusively in the proposed burial zone. This observation also suggests they would have been specialized for mortuary purposes. This compares fairly well to Buffalo. There were four concentric rings of structures at the Buffalo site; 63% of burial structures (Type B) were in the outer house ring and nearly all of the remainder were located in the adjacent ring, suggesting that at Buffalo there was some segregation of functional zones. The possibility of “burial houses” at three protohistoric Fort Ancient
settlements is also notable since the Shawnee were known to have had burial structures, though they were designed to cover individual graves (Voegelin 1944:247, Table 1).

At least one other broadly significant observation was made about architecture at the Hardin Site: the presence of house basins. This finding is significant since these would potentially represent the latest Fort Ancient house basins. Until recently, it has been thought that Late Fort Ancient structures were surface dwellings (e.g., Cowan 1988; Graybill 1988:28); though others have suggested that the lack of basins associated with late structures is more likely due to the paucity of excavated examples and / or that they are more likely to be plowed out (David Pollack, personal communication 2014). Though regional variation cannot be ruled out, the latter position seems to be correct. House basins are present at Hardin and were recently identified at early Late Fort Ancient components at Sweet Lick Knob, Fox Farm, and Petersburg.

**Analysis of Structure Patterns with Regard to Site Layout**

Figure 4-52 shows the placement and orientation of all confirmed and proposed structures. Figure 4-53 shows their location relative to the proposed functional zones. The analysis of structures had two goals. The first was to identify their orientation and distribution relative to the proposed model of overlapping rings. This goal was largely successful since all of the structures whose outlines can be confirmed (House 1-8 and PS D-1) exhibit patterning consistent with the overlapping rings model (i.e., they form two overlapping arcs). Even if all of the proposed structures were later rejected, this exercise was informative in that no evidence was produced that strongly contradicts the overlapping rings model.
The second goal of this analysis was to determine if any variation among the structures could distinguish Ring 1 from Ring 2. In this regard the investigation produced limited results since only one general plan was observed among structures 1-8. Some important variation was identified among the 15 possible structures, but none of this was specific to either village.

Among previously documented structures, only one variant of the general plan was identified (House 3). House 3 follows the same general layout as the other structures, but the lack of any kind of large interior post or pit feature suggests it was either utilized less intensively than any other documented structure, or was adapted for a special purpose. The unique presence of (17) interior burials, and its location in the proposed mortuary zone suggest a mortuary function.

Like Houses 1-8, the 15 possible structures exhibited only one variant structure type. Like House 3, this variant contained numerous internal burials. Also like House 3, this structure type was restricted to the proposed mortuary zone and the internal burials were oriented with reference to the plaza (Figure 4-53). However, unlike House 3, the possible structures containing burials typically contained a scatter of internal pit features. In addition, burials in the proposed structures were patterned in linear concentrations like house type B at the Buffalo Site. This was not the case in House 3. So while House 3 and the proposed structures had a mortuary function, the presence of patterned burial arrangements and internal pit features is unique to the proposed structure areas.
Summary and Discussion

The data presented in this chapter provide a great deal of information about the internal organization of the Hardin Site. In particular, this was used to evaluate the idea first proposed by Hanson (1966) and Holmes (1994) that the primary Fort Ancient occupation of the site consists of overlapping midden rings (Ring 1 and Ring 2). It should be noted while some observations have been made about the entire site, evaluation of the overlapping rings area is the central focus and contribution of this analysis. The final plan of structures, possible structures, burials, and proposed spatial zones for this portion of the site is presented in Figure 4-54. Each data set independently evaluated a part of the overlapping rings model. Overall the data strongly support the model of overlapping rings, and moderately support the proposed spatial zones. The relatively lower confidence in the proposed spatial zones is reviewed below.

The midden stains and associated clear areas representing Rings 1 and 2 were first defined on the surface based on soil color and artifact density. Overlays of aerial photos and a DEM supported these findings suggesting the presence of overlapping midden rings. The DEM indicated the dark, artifact-laden ring areas are higher in elevation while the light colored, artifact free central areas are lower in elevation. As the introduction described, this pattern is well-documented for Fort Ancient sites with midden rings surrounding open plazas. The possibility that one or both of the clear areas represented backfilled WPA excavation blocks was resolved when the 1939 site map was referenced to the midden stain. This and subsequent data sets made it clear these areas do not represent backfilled excavations.
The geophysical survey also indicates the presence of a circular village layout. The magnetic gradient map exhibits arc-shaped bands of high intensity anomalies (midden rings) which surround areas with relatively few anomalies (plazas). The pattern was very clear in Ring 1, while less clear but still present in Ring 2. Several datasets indicate the presence of spatially overlapping components in the northern portion of the site which may be obscuring the geophysical signature of Ring 2.

WPA and recent excavation data also support the overlapping rings model. The 8 structures excavated by the WPA occurred in the center of the site and provided information on how the rings overlap. These structures, and an additional structure (PS D-1) identified by plotting the 1939 post locations indicates they arc around the proposed plazas and follow the shape of the midden rings. Features exposed in 1939 are concentrated in a patterned arc similar to that of the structures, and both encircle the proposed plazas. The location and orientation of 14 additional proposed structures also tentatively support the model of overlapping circular villages. Even if the proposed structure locations and or orientations are later refuted by additional evidence, no strong evidence contradicted the model proposed here despite nearly exhaustive searching archival and other datasets. It should be noted for future reference that several of Bohannan’s notebooks were not digitized or read for this project due to time constraints. These may hold valuable information to further evaluate and improve the model presented.

The proposed plazas are strongly supported by the findings. The lack of features in the WPA excavations, low magnetic intensity, lower elevation, and lack of surface collected artifacts all support the interpretation of the proposed plaza areas. It is also
believed that data are sufficient to propose a third zone in each ring, a mortuary area. Burials were distributed around the plazas with their long axes forming a circle. In Ring 1 burials are concentrated in a very restricted band encircling the proposed plaza. In Ring 2 the burial distribution also forms an arc-shaped pattern, though the total distribution is much wider than in Ring 1. The relative paucity of excavation in the western and northern areas of Ring 2 made it more difficult to evaluate burial distribution. Some data are present from the 1939 north-south trench along the N67 line and from soil cores and 2013 excavation units in the west (Units 10-12), and north (Units 3-4, 20) portions of the site. The distribution of burials in these areas is consistent with the more completely excavated areas. In particular, burial orientation supports the proposed mortuary and plaza zones in this ring.

Finally, one of the most intriguing findings in the structure analysis were serval burial concentrations that may be associated with (or in) structures. All of these were located in the proposed burial zone. If these are structures, the type is unique to this zone. In fact, the tightly concentrated band of burials observed in the western half of Ring 1 may appear as such precisely because the individuals were being buried inside some sort of structure, or in relation to an architectural feature that is no longer identifiable.

Conclusions

In conclusion, the burden of evidence strongly supports a circular layout for Rings 1 and 2. The data at hand also indicate that the northern portion of Ring 1 overlaps with the southern portion of Ring 2, as Hanson originally suggested (1966:16). There is also
strong evidence that Rings 1 and 2 are each organized internally as a series of concentric functional zones much. In the sense that these communities were organized in concentric zones they compare well to other known Fort Ancient circular communities. Both rings exhibit a central plaza area, bordered by a mortuary zone, and finally a ring of residential structures.

There are several important unresolved issues with this model. The first is that few residential structures have been documented outside of the overlap area which leaves us with little information about this zone that is not complicated by overlapping and cross-cutting features. While a circular pattern of structures appears to be represented by structures documented by the very little information has been gathered about this zone through much of the rest of the site. Second, there is a large quantity of utilitarian artifacts concentrated in the mortuary zone which suggest that it may not have functioned solely as a mortuary space. The presence of pottery, lithic and bone tools, as well as many pit features throughout this zone suggests it was also used to dispose of domestic refuse, or was used for domestic activities. Third, burial patterns in both rings (but especially in Ring 1) appear to have been oriented alongside or within an architectural feature. These burial patterns compare well to structures containing burials at the contemporaneous Buffalo site. This notion is supported by the presence of large pits that tend to be associated with Structures 1-8, which are clearly structures. However the lack of outer post lines associated with these burial concentrations leaves this issue unresolved.

A final unresolved issue is that multiple overlapping components are obscuring the layout of the Ring 2. A concentration of Middle Fort Ancient diagnostics is present.
in the southern half of Ring 2, while at least one late Woodland component appears to
located in the northern portion of Ring 2. The presence of intact Middle Fort Ancient
deposits below the Late Fort Ancient deposits in the southern portion of Ring 2 (in Unit
10/12), and disturbed and intact woodland deposits below the Late Fort Ancient deposits
in the north half of Ring 2 (in Unit 20) both support this idea. Even though the spatial
overlap of these earlier components complicated the analysis of Ring 2, the data at hand
are quite clear that this is a circular community comparable to Ring 1.

A productive approach to gathering more information about the domestic zone of
Rings 1 and 2 would be to place one or more trenches in the least studied sections of each
ring. Ideally these should extend from the recently excavated units, or attempt to
intersect the WPA trenches. For example, Bohanna indicates it is “highly likely” a
residential structure is located in the vicinity of WPA expansion area I. Given that the
location of the WPA grid is now fairly well established on the current grid, it should not
be difficult to identify area I and place a trench to intersect it. Another productive
approach would be to invest more in geophysical techniques. The electromagnetic data
collected for the present study could be processed further in an attempt to resolve
anomalies that could reveal the location of residential structures in the domestic zone.
Alternatively, a higher resolution magnetic, or a GPR surveys could be a productive
means to achieve this goal. Examining and confirming the presence of houses outside of
the overlap area in each ring should be the main priority in future evaluation of the model
presented here.

A final weakness of the present model is that this study invested relatively little
time in parsing out the stratigraphy of the overlap area. It was decided that building a
relative chronology based on artifact distributions and radiocarbon dates would be an equally or more secure method. At least three suggestions can be made for future development of this aspect of the stratigraphic relationship of the Rings 1 and 2. First, one could examine the WPA profiles which cut across the overlap area. Second, analysis of these profiles could be used to identify artifacts samples from upper and lower deposits in the area associated with each ring and compare the frequency distribution of artifact types and attributes from these samples to see if they are consistent with the proposed sequence. Third, radiocarbon dates should be secured from the three strata in the overlap area documented in Unit 9 and Trench 1. The stratigraphy of this area supports the sequence proposed here, but absolute dating and broader aerial exposure of the deposits represented by these strata would be a useful means of evaluating this. In the following two chapters, relative and absolute measures are used to examine the chronological relationship of Rings 1 and 2.
Figure 4-1: Idealized models of Madisonville Horizon Fort Ancient village layouts showing structures (rectangles), burials (black ovals) and plaza areas (gray). See Chapter 2 for examples at known sites.
Figure 4.2: Hardin Site locality aerial images from 1995 (left) and 2012 (right). Image on left from U.S. Geological Survey (2016). Image on right from U.S. Department of Agriculture (2016).
Figure 4-3: Aerial images of Hardin Site locality with possible midden ring stains circled on the 2012 image.
Figure 4-4: Late Fort Ancient Buffalo Site, Kanawha County, WV. Excavation map (left) and aerial photo (right) of overlapping ring villages. Sources: Image on left courtesy WV Geological and Economic Survey, Image right courtesy Robert Maslowski. Both images used with permission.
Figure 4-5: 2005 aerial image of the Hardin Site locality. 
Figure 4-6: The Hardin Site. Image on left is a digital elevation model (DEM), 1 meter contour. Image courtesy Carl Sheilds and Kentucky Geography Network (2011). Image on right is a modified 1995 aerial photo where purple and red represent darker soil color and higher elevation, blue and green represent lower elevation and lighter soil color. Image courtesy Arlis Johnson.
Figure 4-7: Haridn Site. Showing 2012 aerial photograph with midden Rings 1 and 2 marked.
Figure 4-8: Hardin Site. Basemap: modified 1995 aerial photo. The outline of Rings 1 and 2 from 2012 aerial photo superimposed over composite. Possible plaza areas of Rings 3 and 4 are based on composite.
Figure 4-9: Late Prehistoric surface diagnostics (x’s) and surface-mapped midden stain (solid line) boundary on 2004 aerial.
Figure 4-10: Overlay of 2011 site boundary, aerial photo and WPA excavation map.
Figure 4.11: Adjusted boundary (solid line) of Ring 1 and Ring 2 based on magnetic gradient map. Original midden boundary (dashed line) based on 2011 survey shown for comparison.
Figure 4-12: Location of Ring 4 from the aerial/DEM composite, which does not appear on magnetic gradient map.
Figure 4-13: Location of collections that may relate to Ring 5.
Figure 4-14: Overlay of magnetic gradient map and WPA excavation map.
Figure 4-15: Location of 2013 excavation areas that encountered WPA expansion areas A and B.
Figure 4-16: Detail of Units 5-7 (2013) and WPA expansion Area A. Figure (left) courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 4-17: Close-up of WPA expansion Area B, Unit 9 and Trench 1. Showing one model of where Trench 1 it is thought to encounter WPA expansion Area B. Figure courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 4-18: Overlay of WPA excavation map onto Ring 1 and Ring 2 identified by current project.
Figure 4.19: Modified boundaries of Ring 1 and Ring 2 accounting for orientation and arcs of structures in overlap area.
Figure 4-20: Distribution of all features excavated by the WPA. Includes pits, burials, fired areas, and refuse piles. Features are represented by center points and are not scaled to feature size.
Figure 4-21: Comparison of WPA features to boundaries of Ring 1 and Ring 2. Highlighting burial arcs with red and areas adjacent to proposed plazas lacking features with arrows.
Table 4-1: Burial contexts identified during 2011-2013 fieldwork.

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Context Name</th>
<th>Context type</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>Feature 1</td>
<td>looted burial pit</td>
<td>Looted pit with elongated shape. Contained numerous fragmented human remains</td>
</tr>
<tr>
<td>3&amp;4</td>
<td>Feature 2</td>
<td>looted burial pit</td>
<td>Looted pit of unknown shape. Contained numerous fragmented human remains</td>
</tr>
<tr>
<td>10 &amp; 12</td>
<td>Feature 4</td>
<td>possible looted burial pit</td>
<td>Looted pit with elongated shape. Contained few fragmented human remains</td>
</tr>
<tr>
<td>11</td>
<td>Feature 8 / Burial 1</td>
<td>Intact burial pit feature</td>
<td>Intact burial</td>
</tr>
<tr>
<td>20</td>
<td>Feature 9 / Burial 2</td>
<td>Intact burial pit feature</td>
<td>Intact burial</td>
</tr>
<tr>
<td>20</td>
<td>Feature 10 / Burial 3</td>
<td>Intact burial pit feature</td>
<td>Intact burial</td>
</tr>
<tr>
<td>22*</td>
<td>plowzone</td>
<td>Unknown / Plow disturbed</td>
<td>Possible human bone?</td>
</tr>
</tbody>
</table>

*not included in count
Figure 4-22: Distribution of all burials excavated by WPA. Burials in flexed position shown in red.
Table 4-2: Distribution of mortuary contexts by burial position and proportion disturbed by subsequent mortuary activity.

<table>
<thead>
<tr>
<th>BURIAL POSITION</th>
<th>RING 2</th>
<th></th>
<th>RING 1</th>
<th></th>
<th>OVERLAP</th>
<th></th>
<th>AVERAGE DEPTH FOR POSITION (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Extended</td>
<td>83</td>
<td>53.9%</td>
<td>63</td>
<td>64.9%</td>
<td>44</td>
<td>47.8%</td>
<td>1.79</td>
</tr>
<tr>
<td>partially flexed</td>
<td>24</td>
<td>15.6%</td>
<td>7</td>
<td>7.2%</td>
<td>19</td>
<td>20.7%</td>
<td>2.05</td>
</tr>
<tr>
<td>Flexed</td>
<td>10</td>
<td>6.5%</td>
<td>4</td>
<td>4.1%</td>
<td>15</td>
<td>16.3%</td>
<td>2.13</td>
</tr>
<tr>
<td>disturbed by plowing</td>
<td>5</td>
<td>3.2%</td>
<td>1</td>
<td>1.0%</td>
<td>3</td>
<td>3.3%</td>
<td>0.72</td>
</tr>
<tr>
<td>disturbed by prehistoric activity</td>
<td>24</td>
<td>15.6%</td>
<td>20</td>
<td>20.6%</td>
<td>9</td>
<td>9.8%</td>
<td>1.86</td>
</tr>
<tr>
<td>poor condition/decomposed</td>
<td>8</td>
<td>5.2%</td>
<td>2</td>
<td>2.1%</td>
<td>2</td>
<td>2.2%</td>
<td>1.68</td>
</tr>
<tr>
<td>grand Total</td>
<td>154</td>
<td>97</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Hanson classified burials using multiple criteria including burial position. The classification presented in this table is based on burial position only. In cases when there is correspondence between the positions recognized here and those recognized by Hanson’s a superscript note is provided.

2 This burial position corresponds to the position of burials in Hanson’s “single extended pit” and “double extended pit” burial type.

3 This burial position corresponds to the position of burials in Hanson’s “single partially flexed pit” burial type.

4 This burial position corresponds to the position of burials in Hanson’s “single fully flexed pit” burial type.

5 This burial position corresponds to the position of burials in Hanson’s “single bone pit” and “double bone pit” burial types.
Figure 4-23: Distribution of all middle Fort Ancient diagnostic artifacts and flexed burials (black circles) alongside all non-feature shell tempered ceramic sherds from depths 1.6-2.5 feet (red circles). For ceramics, dot size scaled to sherd frequency (not density).
Figure 4.24: Distribution of all middle Fort Ancient diagnostic artifacts and flexed burials (black circles) relative to modified 1995 aerial photo. Limit of concentration demarcated by dashed line. Circle in center represents speculative location of clear area.
Figure 4-25: Distribution of burials excluding flexed position. Includes WPA and 2013 excavation data.
Figure 4-26: Proposed burial zones in Ring 1 and Ring 2. Showing distinction between mortuary contexts documented by excavation (red) and those suggested by soil coring (blue) in recent fieldwork.
Figure 4-27: Comparison of WPA house distribution to proposed burial zones. Also showing possible extent of proposed plaza areas (blue arrows) based on burial patterning.
Table 4-3: Type and frequency of features excavated by WPA.

<table>
<thead>
<tr>
<th>Feature Type</th>
<th>WPA Frequency</th>
<th>2011-2013 Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post holes</td>
<td>1900+</td>
<td>≤100</td>
</tr>
<tr>
<td>Mortuary</td>
<td>335</td>
<td>13</td>
</tr>
<tr>
<td>Pits</td>
<td>203</td>
<td>3</td>
</tr>
<tr>
<td>Fired Areas</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Refuse Contexts</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Burned Botanicals</td>
<td>7</td>
<td>many</td>
</tr>
<tr>
<td>Rock Piles</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>House Floor</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 4-28: Excavated fired areas (red) and possible fired areas documented by soil core program (orange).
Figure 4-29: Comparison of all fired areas to proposed spatial zones.
Table 4-4: Average dimensions for each pit type.

<table>
<thead>
<tr>
<th>Pit Type</th>
<th>n</th>
<th>Area* (sq.ft.)</th>
<th>Vertical Thickness (ft.)</th>
<th>Thickness /Area (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>86</td>
<td>6.66</td>
<td>1.27</td>
<td>0.30</td>
</tr>
<tr>
<td>Complex</td>
<td>87</td>
<td>13.51</td>
<td>1.55</td>
<td>0.39</td>
</tr>
<tr>
<td>Basin</td>
<td>23</td>
<td>14.45</td>
<td>0.82</td>
<td>0.07</td>
</tr>
</tbody>
</table>

*calculated as max width x max length
Figure 4-30: Distribution of simple pits.
Figure 4-31: Distribution of complex pits.
Figure 4-32: Distribution of simple and complex pits to structures and proposed spatial zones.
Figure 4.33: Distribution of refuse contexts (red) and basins (blue).
Table 4-5: Basic attributes of Houses 1-8 originally described by Hanson (1966)

<table>
<thead>
<tr>
<th>House #</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Area* (sq. m)</th>
<th>Internal trash pits</th>
<th>central fire hearth</th>
<th>Interior burials</th>
<th>Re-built?</th>
<th>Interior Partition / extension?</th>
<th>Door opens at</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17.5</td>
<td>8.4</td>
<td>147</td>
<td>0</td>
<td>Yes</td>
<td>No</td>
<td>yes</td>
<td>?</td>
<td>End</td>
</tr>
<tr>
<td>2</td>
<td>&gt;12</td>
<td>7.6</td>
<td>&gt;91.2</td>
<td>0</td>
<td>Yes</td>
<td>Yes*</td>
<td>Yes</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>3</td>
<td>16.8</td>
<td>6.4</td>
<td>107.5</td>
<td>0</td>
<td>No</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes</td>
<td>End?</td>
</tr>
<tr>
<td>4</td>
<td>20.3</td>
<td>8.3</td>
<td>168.5</td>
<td>0</td>
<td>?</td>
<td>Yes*</td>
<td>Yes</td>
<td>End</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>21.7</td>
<td>9.2</td>
<td>199.6</td>
<td>0</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>End</td>
</tr>
<tr>
<td>6</td>
<td>15.7</td>
<td>7.5</td>
<td>117.8</td>
<td>1</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Maybe</td>
<td>?</td>
</tr>
<tr>
<td>7</td>
<td>17.5</td>
<td>9.1</td>
<td>159.2</td>
<td>0</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>End</td>
</tr>
</tbody>
</table>

*calculated as max width x max length
Figure 4-34: Illustration of Houses 5 and 7. Note that the northeast corner of House 7 was obliterated by House 6 (not shown). Adapted from original maps curated at the William S. Webb Museum of Anthropology, University of Kentucky.
Figure 4-35: Illustration of House 7, showing architectural features. Adapted from original maps curated at the William S. Webb Museum of Anthropology, University of Kentucky.
Figure 4-36: Illustration of Houses 5 and 7. Showing location of entry ways. Adapted from original maps curated at the William S. Webb Museum of Anthropology, University of Kentucky.
Figure 4-37: Illustration of post pattern from House 4. Highlighting post pattern interpreted as an interior partition or evidence of an extension.
Figure 4-38: Illustration of post pattern from House 4. Highlighting small circular post pattern (red arrows).
Figure 4-39: Ancillary feature / porticoe on Structure 7 at Burning Spring Branch Site, West Virginia. Adapted from Pullins et al. 2008: Figure 7-16.
Figure 4-40: Illustration of post pattern from Houses 2 and 3 located in WPA expansion Area B. The red two-way arrows show location of what Hanson (1966:9) believed was a passage.
Figure 4-41: Illustration of post pattern from Houses 5-7 located in WPA expansion Area C. Red dashed line indicates proposed southeast and northeast wall sections from House 6, later destroyed by occupation of House 7.
Figure 4-42: Location of all possible structures examined in the present study.
Table 4-6: Attributes of possible structures examined in the present study.

<table>
<thead>
<tr>
<th>Name</th>
<th>Area</th>
<th>Data Quality</th>
<th>Post holes?</th>
<th>Features?</th>
<th>Other data</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS B-1</td>
<td>Area B</td>
<td>Level 2</td>
<td>Short line</td>
<td>Hearth, pit</td>
<td>Structure basin</td>
</tr>
<tr>
<td>PS B-2</td>
<td>Area B</td>
<td>Level 3</td>
<td>Short line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS I-1</td>
<td>Area I</td>
<td>Level 2</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td>Burial alignment</td>
</tr>
<tr>
<td>PS I-2</td>
<td>Area I</td>
<td>Level 2</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td>Burial alignment</td>
</tr>
<tr>
<td>PS I-3</td>
<td>N. of Area I</td>
<td>Level 2</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td>Burial alignment</td>
</tr>
<tr>
<td>PS I-4</td>
<td>Area I</td>
<td>Level 3</td>
<td>Short line</td>
<td>Burials</td>
<td></td>
</tr>
<tr>
<td>PS I-5</td>
<td>S. of Area I</td>
<td>Level 3</td>
<td>Scatter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS D-1</td>
<td>Area D</td>
<td>Level 1</td>
<td>Outline</td>
<td>Hearth, pits</td>
<td></td>
</tr>
<tr>
<td>PS D-2</td>
<td>Area D</td>
<td>Level 2</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td>Burial alignment</td>
</tr>
<tr>
<td>PS D-3</td>
<td>Area D</td>
<td>Level 3</td>
<td>Doorway?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS D-4</td>
<td>Area D</td>
<td>Level 3</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td>Structure basin?</td>
</tr>
<tr>
<td>PS DD-1</td>
<td>Area DD</td>
<td>Level 3</td>
<td>Scatter</td>
<td>Pits, burials</td>
<td></td>
</tr>
<tr>
<td>PS U12</td>
<td>Unit 10/12</td>
<td>Level 3</td>
<td>Short Line</td>
<td>Hearth</td>
<td></td>
</tr>
<tr>
<td>PS 67R60</td>
<td>n/a</td>
<td>Level 3</td>
<td>Scatter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS U3-4</td>
<td>Units 3-4</td>
<td>Level 3</td>
<td>Short Line</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4-43: Location of post holes 16-1 and 16-2 located on north edge of the basin defining Possible Structure B-1. Base map (on grid paper) courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 4-44: Red arrows highlighting distance between centerline of House 2 and post holes to the north and south. Base map (on grid paper) courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 4-45: Conjectural outline of Possible Structure B-2.

- 4 post holes documented in WPA trench section
- 305 unexcavated
- 305 excavated

2013 Features:
- Post holes
Figure 4-46: Features located in WPA expansion Area I. Gray features are burials, brown features are pits.
Figure 4-47: Features located in WPA expansion Area I. Red lines highlight axes of linear burial concentrations.
Figure 4-48: Proposed structures suggested by burial and feature patterns in WPA expansion Area I.
Figure 4-49: Burial pattern in house type B at Buffalo Site, WV compared to burial pattern in WPA expansion Area I at Hardin Site (lower left). Images from Buffalo show the arrangement of burials inside two Type B houses (after Hanson 1975: Figures 17 and 20). Note that post hole patterns were not illustrated in the Buffalo site report, which is why they are not present in this adaptation.
Figure 4-50: Pattern of post holes, pits and thermal feature in WPA expansion Area D indicating Possible Structure D-1 (dashed). Base map (on grid paper) courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure 4-51: Conjectural outline of Possible Structure in vicinity of Units 10/12.

- 3 post holes documented in WPA trench section
- Unit 10: excavated
- Unit 12: excavated
- 2013 Features:
  - post holes
  - fired area
  - ash pit
- Middle Fort: Ancient features
- Unexcavated area
- Scale: 2 m
- Orientation: N
Figure 4-52: Location of Houses 1-8 and all “possible structures” examined in the present study.
Figure 4-53: Location of Houses 1-8 and all “possible structures” relative to proposed spatial zones.

<table>
<thead>
<tr>
<th>I</th>
<th>Domestic zone</th>
<th>II</th>
<th>Mortuary Zone</th>
<th>III</th>
<th>Plaza Zone</th>
</tr>
</thead>
</table>

- possible structure defined by burial concentration
- burials

Legend:
- Red squares: Possible structures defined by burial concentration
- Grey squares: Burials
Figure 4-54: Distribution of structures, “possible structures” and burials relative to proposed spatial zones.

<table>
<thead>
<tr>
<th>I</th>
<th>Domestic zone</th>
<th>II</th>
<th>Mortuary Zone</th>
<th>III</th>
<th>Plaza Zone</th>
</tr>
</thead>
</table>

- **I Domestic zone**
- **II Mortuary Zone**
- **III Plaza Zone**

- **burials**
Chapter 5
Ceramic Analysis

Goals

This chapter compares pottery samples from Ring 1 and Ring 2 to evaluate their chronological position. This chapter begins with a detailed description of Late Fort Ancient Madisonville ceramic series. While it seems somewhat superfluous, it is considered important because synthesis of Late Fort Ancient ceramic data is currently lacking in the literature, and because this information can be used by the reader to make an independent evaluation of the data presented later in the chapter. The second part of the chapter is a description of the sample contexts and an evaluation of possible sampling biases. This is followed by a typological description of the sample, and then a comparison and analysis of chronologically sensitive variables. Finally, I conclude by using this information to compare Ring 1 and Ring 2 and interpret their relative chronological position.

Late Fort Ancient Ceramic Types

Typological Classification

The majority of pottery analyzed for this study can be classified as Madisonville Series (after Griffin 1943; Turnbow and Henderson 1992). However, a significant quantity of pre-Madisonville Series pottery is intermixed in the late Fort Ancient contexts included in this study. Intermixed pottery includes shell tempered wares consistent with Fox Farm Cordmarked and Lee’s Plain types which date the Middle Fort Ancient Period (A.D. 1200-1400, after Henderson and Turnbow 1987), and rock tempered wares
consistent with Newtown Series which dates to the Middle/Late Woodland approximately A.D. 300-800 in Kentucky (McMichael 1984; Pollack and Henderson 2000; Applegate 2008:482). These types were recognized during analysis and separated for future study. As discussed in Chapter 6, the presence of Middle Fort Ancient pottery at the Hardin Site has already been recognized (Henderson et al. 1992:263; Henderson 2008:828-829). They will not be given further consideration in this chapter because they are not relevant to the current study; however, the spatial distribution of non-Madisonville Series ceramics is touched on briefly in the site structure chapter.

**Madisonville Series Ceramics**

Madisonville Series assemblages are the most recent Fort Ancient pottery, and date circa A.D. 1400-1680/1750. The series was first defined by Griffin (1943) based on his analysis of collections from the Madisonville site. Major subsequent modifications to these descriptions have only been made by Turnbow and Henderson (1992) based on a sample from five sites in northern/northeastern Kentucky: Thompson, Fox Farm, Snag Creek, Augusta, and Loughlin. These changes will be discussed under the appropriate sub-headings in the following type descriptions. Other analyses of Madisonville Series pottery that emphasize temporal trends include Drooker (1997), Riggs (1998), and LaMarre (1999). Riggs’ (1998) dissertation examined a sample of Madisonville Series pottery from the Madisonville and Sand Ridge sites in southeastern Ohio and identified some diachronic trends in attribute frequencies (below). Drooker (1997:173-202) and LaMarre (1999) have also identified possible diachronic trends within the Madisonville Series at the Madisonville and Buffalo sites, respectively. An important characteristic of
Madisonville Series pottery is its homogeneity throughout the Fort Ancient region relative to earlier Fort Ancient pottery. In fact, only the Madisonville Series has been defined for Post-A.D. 1400 pottery assemblages in the region, while over half a dozen series have been defined for the 1200-1400 period in the same area (e.g., Buam, Anderson, Fuert, Fox Farm, Philo, New River; Griffin 1943; Gartley 1976; Johnson 1978; Turnbow and Henderson 1992).

Madisonville Series - Plain and Cordmarked Types

Madisonville Plain and Madisonville Cordmarked are the two primary types represented by the Madisonville Series. The only difference between these types is surface finish. Therefore, the description of attributes that occur within these two types will be combined with the exception of exterior surface treatment.

Exterior surface treatment on Madisonville Cordmarked and Madisonville Plain sherds is generally distinguished based on the presence or absence of patterned cordage impressions. However, there are two issues that complicate this otherwise straightforward distinction. The first is that some vessels have a smoothed neck while the remainder of the vessel is cordmarked. Since most pottery assemblages consist of fragmentary specimens there is no way to determine if “plain”-surfaced neck sherds derive from a vessel with a plain or cordmarked body. Inevitably, if it is assumed that plain-surfaced necks derive from vessels with plain surfaced bodies, the percentage of cordmarked vessels will be under-represented if necks, rims, and body sherds are combined. Griffin dealt with this issue by placing only complete vessels with entirely smoothed surfaces into the Madisonville Plain type.
Vessels with plain necks and cordmarked bodies can be identified on sherds exhibiting the neck-body juncture because cordmarking typically begins in this area. For example, Turnbow and Henderson (1992:316) report examples from the Fox Farm, Snag Creek, Augusta and Thompson Sites in Kentucky. However, it still cannot be determined how many plain neck sherds lacking a portion of the neck-body juncture had cordmarked bodies. Spencer’s analysis of surface treatment from 9 Fort Ancient components indicates that the relative proportion of plain and cordmarked are very different for each category of vessel fragment. For this reason, it is probably the most useful to make comparisons of surface treatment within each class of vessel fragment (e.g., rim, neck, body). This approach is adopted in the present study.

The second general issue with distinguishing Plain versus Cordmarked types is that Madisonville Series pottery represents a continuum from completely plain to completely cordmarked rather than two distinct categories. Most detailed analyses of Madisonville pottery report two or three sub-types of plain and cordmarked sherds. For example, Turnbow and Henderson (1992:316, Table A-4) use three sub-types to document varying levels of smoothing: distinct, smoothed-over, and obliterated. The criteria for these distinctions are not described or illustrated, which makes it nearly impossible to compare to assemblages reported by other analysts.

Several diachronic studies of multiple Late Fort Ancient sites (Dunnell 1972:Figure 21; Riggs 1998:Tables 3.10 and 3.11), as well as seriation of type frequencies at individual sites (Hanson et al. 1964:Table 8; Hanson 1966:107-111, Table 2, Figure 47; Hanson 1975:91-94, Table2; Hemmings 1977:6.17) indicate plain surface treatment increases through time. Tables 5-1 and 5-2 compile surface treatment data
available for both early and late Late Fort Ancient sites. Not surprisingly, the averages for each sub-Horizon reveal an overall increase in the relative proportion of plain surfaced ceramics (though an increase is not universal).

Hanson (1975:94) suggested the gradual adoption of smooth surface treatment during the Fort Ancient period suggest an influence from eastern Tennessee ceramic traditions where plain surfaces predominate. The high percentage of plain surface treatment at the relatively earlier Bluestone Phase Fort Ancient sites – which border Appalachian Mississippian territory – support Hanson’s idea (e.g., Applegarth et al. 1978:46-57, Table 7; Fuerst et al. 2010). (Graybill 1981:Table 7).

While the overall trend is an increase in plain surface treatment, there is substantial variation within the Fort Ancient region. In central Kentucky Fort Ancient potters preferred plain-surfaced ceramics throughout the Late Fort Ancient Period, while northern Kentucky potters preferred cordmarked ceramics (Henderson and Pollack 1996:180). Nevertheless, plain surfaces increase through time in both areas. In the eastern Fort ancient area, diachronic trends in surface treatment are complicated by the use of a third surface treatment – corncob impressing (see Spencer 2006). As with plain and cordmarked surface treatments, the popularity of corncob impressing varied widely in the eastern Fort Ancient area during the Late Fort Ancient Period. At some sites it is the predominant surface treatment, at others, it is absent altogether. Some archaeologists have suggested it marks the presence of Siouan residents in this area (e.g., Spencer 2006; Maslowski 2011). If this is true, then the variable presence of corncob impressing is an indication Siouan residents were not welcome in all Fort Ancient communities.
Cordage attributes typically reported in the literature include twist direction, distinctiveness of impressions, and orientation of cordage impressions relative to the vertical axis of the vessel. Of these, only twist direction has been regularly quantified (Maslowski 2011:8-10). A comparison of well-dated sites used in Maslowski’s cordage twist study with other site level data suggests the following temporal trend for sites in or very near to main trunk of the Ohio River: Z-Twist predominates from A.D. 1200-1400 (Middle Fort Ancient), S-Twist from A.D. 1400-1550 (early Late Fort Ancient), and Z-Twist again from A.D. 1550-1680/1750 (late Late Fort Ancient) (Turnbow and Henderson 1992:132, Table A-4; see also, Henderson 1992a; Maslowski 1996, 2011; Pollack and Henderson 1996:172; LaMarre 1999). Interestingly, sites further from the Ohio River appear to be more conservative over time (see also, Carmean 2010:159-163).

In West Virginia, Fort Ancient sites away from the Ohio River tend to have predominantly Z-twist cordmarking regardless of age (Maslowski 1996:Map 5.1). In central Kentucky, S-Twist cordmarking predominates regardless of a site’s age (Fassler 1987; Turnbow 1988; Pollack 1989; Sharp and Pollack 1992; Turnbow and Henderson 1992:133; Carmean 2010:Table 4.27, Appendix F). The combination of Z-twist cordmarking and corcob-impressed surface treatment found at some West Virginia Fort Ancient sites is typical for non-Fort Ancient sites in Virginia, and suggests interaction between the two areas may have influenced Fort Ancient pottery style (Spencer 2006; Fuerst et al. 2010; Maslowski 2011:50).

Orientation of cordmarking is usually vertical on jars (Griffin 1943:133). Overlapping cordmarking in multiple directions is more common on bowls but remains
uncommon even on that form. Overlapping cordage impressions that crisscross are
typical for jar and bowl basal sherds (e.g., Hemmings 1977:6.11).

Cordage impressions are typically very distinct on Madisonville Series pottery
(Griffin 1943:133). Turnbow and Henderson report 65% of 1353 Madisonville
cordmarked sherds exhibit clear and sharp cordmark impressions (1992:316). They also
provide metric data to demonstrate the relative fineness of cordmarking on Madisonville
Series pottery relative to earlier Fox Farm Series pottery. In their sample, Fox Farm
Cordmarked sherds averaged 2-3 cords per centimeter and ranged from 1-6, while
Madisonville Cordmarked sherds averaged 3-4 cords per centimeter and ranged form 1-9

Interior surface treatment is typically described at the assemblage level but not
reported quantitatively. Most jars are smoothed on the interior of the body and well
smoothed on the interior of the neck and rim (Griffin 1943:134; Turnbow and Henderson
1992:316, 320). Often, the original surface of the neck and rim interior is not visible due
to the accumulation of black soot and/or cooking residue (Griffin 1943:133).

Paste texture is typically fine in texture but varies to medium. Both Griffin
(1943:133) and Turnbow and Henderson (1992:317) observe that most specimens tend
toward fine paste, with texture becoming coarser with increasing vessel size. Over 70%
of vessels in Griffin’s sample exhibited Mohs scale hardnesses of 2-2.5, with slightly
more of the remainder being slightly softer. David Pollack (personal communication,
2014) has observed that later pottery may be more well-fired and as such hardness should
increase, but few studies since Griffin have documented Mohs scale hardness for
Madisonville Series pottery (but see Brose 1982:28).
Temper is exclusively fired and then crushed mussel shell. The shell is usually finely crushed such that only a few laminar sheets of the platy structure occur in each temper particle. In Griffin’s description color varies widely from “light tans with reddish admixture to dark reddish and chocolate browns and various shades of gray” (1943:133). Smoke-blackened interiors and exteriors are common.

Vessel Morphology

Fort Ancient vessel morphology has been described using several sets of terminology, not always consistent with each other. This section describes the terminology that will be used in this report, and deals with some issues of terminology in the literature. In general Madisonville Series ceramics have been characterized as relatively homogenous (Griffin 1943:133; Hemmings 1977:6-1; Henderson 1992a; Glowacki et al. 1993:3). This is the case for vessel forms which consist of jars, bowls and pans in varying proportions at sites in the Fort Ancient region (see Table 5-3 and Table 5-4). In the following, I will use jars to examine how terminology is used to describe vessel morphology. Fort Ancient jars nearly always have a composite or inflected silhouette and a spherical, ellipsoid, or ovaloid body shape (Figure 5-1; Rice 2005:218-219, Figures 7.5 and 7.6). Due to the fragmentary nature of most Fort Ancient ceramic assemblages, descriptions of overall vessel contour require comparison of rim, neck, shoulder, and body sherds to complete vessels or large partial fragments.

Rims hold the most information about overall vessel contour (Rice 2005:222) and they are often classified into a series of types based on their form and orientation. Rim form describes the contour of the vessel wall between the most restricted part of the neck
(if present) and the lip (edge of the rim). Rim orientation usually describes whether the vessel has a restricted or unrestricted orifice. So for example a jar with a direct rim form (i.e., straight contour) can be slanting inward creating a restricted orifice or it can be slanting outward creating an unrestricted orifice. Griffin (1943), and subsequently others (e.g., Turnbow and Henderson 1992:Figure A-3; Pullins et al. 2008:582, Table 8-46) have combined rim form and rim orientation attributes into the single category. The limited variability within most Fort Ancient ceramic vessel forms (jar, bowl, pan) is probably the reason for this. For example, in the present study only two rim forms were observed among jars (Figure 5-2): direct (straight contour) and excurvate (excurving contour). Direct rim forms exhibited three orientations: vertical (unrestricted orifice), out-slanting (unrestricted orifice), and in-slanting (restricted orifice). Excurvate rim forms exhibited two orientations: slightly flared and very flared (see e.g., Appendix F, Figure F-1).

The rim orientations defined here compare fairly well to the rim classification scheme published by Turnbow and Henderson (1992:Figure A-3), with the main difference being that rim form and orientation are explicitly separated here, while they Turnbow and Henderson use the term “orientation” to describe both attributes at once. The flared and very flared rim orientation categories defined here are identical to Turnbow and Henderson’s “slightly flared” and “flared” categories, respectively (1992: Figure A-3). The vertical and out-slanting rim orientation categories defined here would both fall into Turnbow and Henderson’s “vertical, direct” category (1992: Figure A-3, top right). Finally, the in-slanting rim orientation category defined here is equivalent to Turnbow and Henderson’s “slightly incurvate” category (1992: Figure A-3, top center).
As currently defined, the Madisonville Series includes jar and bowl forms. Pan forms usually occur on Late Fort Ancient sites in association with Madisonville Series ceramics, but are classified under the companion Todd Series for historical reasons discussed below. Figure 5-1 shows these forms and how they compare to earlier forms typical for Fort Ancient (from Turnbow and Henderson 1992:Figure X-1). More specialized and rarely occurring conjoined, pedestaled, and effigy vessel forms have also been attributed to the Madisonville series (James Griffin 1943:135-137; John Griffin 1945; Drooker 1997:81-82; Figures 4-12 and 4-15). These forms are not considered trade items because, aside from selected attributes, they are entirely consistent with the Madisonville Series (Griffin 1943; Drooker 2002:77). In his original type definition, Griffin included only jars in the Madisonville Series because few bowls and pans were represented (1943:131-2). Bowls and Pans were more common in the sample he analyzed from Fox Farm, so Griffin included these in the Fox Farm Series. However, subsequent research has demonstrated that both bowls and pans are commonly found in assemblages characterized as Madisonville Series (Turnbow and Henderson 1992; Drooker 1997; LaMarre 1999; Henderson 2008). In addition, the bowls and pans Griffin analyzed from Fox Farm were probably associated with a Madisonville Series assemblage. With the information available at the time, he unable to recognize Fox Farm contained at least two Fort Ancient Components.

Subsequent research at the site (Turnbow and Henderson 1992) documented the site’s stratigraphy and produced absolute dates demonstrating the earlier component is associated with a Fox Farm Series assemblage, while the later is associated with a Madisonville Series assemblage that produced the bowls and pans in Griffin’s analysis.
Recognizing the bowls and pans were stratigraphically associated with Madisonville Series pottery, Turnbow and Henderson began to include bowls in the Madisonville Series, and developed the Todd Series for pans (1992:315-327). It should be noted that bowls are occasionally identified in Fox Farm Series assemblages in very low frequencies but are classified as Lees Plain (e.g., Turnbow and Henderson 1992:313-314). Lees Plain is a companion series designation created by Turnbow and Henderson for plain surfaced sherds that are otherwise identical to the Fox Farm Cordmarked type. The Fox Farm Plain type name could not be used for this purpose because it had already been used by Griffin to describe a small group of ceramics he thought to be trade vessels (1943:178; Turnbow and Henderson 1992:313).

Late Fort Ancient ceramic assemblages typically consist primarily of jars, followed by bowls and pans. The distribution of vessel forms by site and sub-horizon is presented in Tables 5-3 and 5-4. While jars represent about 75% of assemblages throughout the Late Fort Ancient Period, the relative proportion of bowls and jars flips from early to late sub-horizons. Even when the large samples from Buckner 2 and Buffalo are taken out of the comparisons, the trend remains. Looking at individual sites, these patterns tend to hold true with the exception of several early Late Fort Ancient sites. It may be that the adoption of bowls and pans during the early Late Fort Ancient was not consistent across space. In general, however, pans are more popular during the early Late Fort Ancient and bowls during the late Late Fort Ancient. Griffin identified 141 pans and 92 bowls at Fox Farm (1943:167-171), which may relate to the early Late Fort Ancient component.
There is a relative and absolute decrease in the proportion of pans at late Late Fort Ancient components (Table 5-4), and it has been suggested that the pan form is abandoned altogether toward the end of this Period (Turnbow 1991; Glowacki et al. 1993:7). This suggestion is supported by the complete lack of pans at the Thompson, Neale’s Landing, Howard, and Morrison sites (Prufer and Andors 1975:199-203; Turnbow and Henderson 1992:120; Pollack and Schlarb 2009:57). Importantly, two of these sites (Howard, Neale’s Landing) are very late contact period sites and the other two (Thompson, Morrison) have been identified with historically documented native villages from the early 1700s (see references above). Some materials at Thompson are associated with the historically documented Lower Shawnee Town village (Henderson and Pollack 1992), Neale’s Landing produced an iron trade axe that may date as late as the 1670s (Hemmings 1977:12.2-12.6, Figures 12.1-12.3), and Howard produced a gunflint (Pollack and Schlarb 2009:34-35, Figure 5.11) suggesting a terminus post quem occupation of at least mid-17th century. It has been proposed that the lack of pans at these very late components may be the result of economic changes relating to colonial exchange (Turnbow and Henderson 1992:121).

Madisonville Series Jars

Madisonville Series jars are ovaloid to spherical / globular. Globular jars may become more frequent through time (Drooker 1997:174, Table 6-8). Rim form is typically semi-flared to flared. Semi-flared appears to be more common in early Late Fort Ancient components (e.g., Griffin 1943:182 (Buckner); Applegarth et al. 1978:50 (Barkers Bottom); Turnbow and Henderson 1992:Table X-7 (Snag Creek and Upper Fox...
Farm components), and flared more common in late Late Fort Ancient components (Turnbow and Henderson 1992:Table X-7 (Upper Thompson Component); Riggs 1998:254-264, Table 3.6). It should be noted that ceramic assemblages from the late Late Fort Ancient components at the Howard (Pollack and Schlarb 2009:57) and Augusta (Turnbow and Henderson 1992:Table X-7) sites are not consistent with this pattern of rim shape, but this could be due to small sample sizes (n=19 and n=22, respectively).

Jar rim profile shape (e.g., thickened, tapered, etc.) has also been documented for many Madisonville Series assemblages (e.g., Turnbow and Henderson 1992:315-323; Riggs 1998:Table 3.7). Direct (i.e., parallel interior / exterior walls) rims are most common, followed by thickened, tapered (to the interior or exterior), and thinned profiles. Riggs found an increase in direct rim profiles from early to later Madisonville Series assemblages (1998:261). Comparison of other sites shows a relatively larger proportion of direct profile shapes in later assemblages (e.g., compare early Late Fort Ancient 15Ms1 to the late Late Fort Ancient 15Gp27 in Turnbow and Henderson 1992: Figures A-36 and A-37; see also Henderson 1992b:Figure 2; LaMarre 1999:Table 4.3; Pullins et al. 2008:Figure 8-36; but cf. Henderson and Pollack 1996). These calculations do not take into account rim profiles thickened by rim folds or strips, which are discussed below under decoration.

Jar lip shape is typically rounded, less often flat-rounded, and occasionally narrow or pointed. Riggs’s study sample suggests an increase from early and late Late Fort Ancient assemblages in rounded and flat-rounded and a coinciding decrease in the proportion of narrow or pointed lips during the late Late Fort Ancient Period (1998:Table
3.8). This trend is not consistently supported by the same studies discussed above for rim form.

Thickness of lip, rim, and body sherds appears to decrease over time with early Late Fort Ancient assemblages measuring 6.1mm and late Late Fort Ancient assemblages measuring 5.9mm in Riggs’s (1998:Table 3.19) sample. Turnbow and Henderson (1992:Table A-5) do not report rim thickness measurements for jars and bowls separately but their data show lower values for later Late Fort Ancient assemblages in their study (with the exception of one site). Other studies that report jar rim thickness for individual sites indicate a range of 5.8-7.3mm for early Late Fort Ancient (Petersburg :Henderson 1993; Johnson :Hockensmith 1984:87; Burning Spring Branch :Pullins et al. 2008:803, Table 9-22) and a range of 6.0-6.3mm for late Late Fort Ancient jar rims (LaMarre 1999 (Buffalo); Pollack and Schlarb 2009 (Howard)). Thickness trends for lip and body sherds follow the same general trend as rim sherds.

Similar to thickness, orifice diameter also decreases over time in Riggs’s study sample from 21cm in the early Late Fort Ancient sample to 20cm in the late Late Fort Ancient sample (1998:Table 3.18). Studies from individual sites that have reported rim orifice diameter values indicate a range of 22.0-26.1cm for early Late Fort Ancient components ([Fox Farm] Griffin 1943:171; [New Field] Henderson and Pollack 1996:172; [Burning Spring Branch] Pullins et al. 2008:797) and 7.1-23.4 cm for late Late Fort Ancient components ([Madisonville Site] Griffin 1943:Table III; [Goolman] Turnbow and Jobe 1984:28; [Howard] Pollack and Schlarb 2009:57). A recent analysis of ceramics from the Madisonville site found that 82% of rim diameters were less than 18cm (Krieg and Purtill 2013; note: this statistic includes as many as 8 bowls).
Madisonville Series Bowls

Because of they typically represent a low proportion of Madisonville Series assemblages (Tables 5-3 and 5-4), and few such assemblages have received detailed analysis, less quantitative data are available for diachronic comparison. LaMarre’s (1999) identification of 657 bowls (more than all other sites combined) at the Buffalo site provides the most detailed information on bowl variation in a Madisonville Series assemblage. Madisonville Series bowls are typically deep-hemispherical forms characterized by rims with have a vertical orientation and a direct profile shape. Deep hemispherical forms occasionally exhibit a slightly incurvate or excursurate/flared profile shape (e.g., Turnbow and Henderson 1992:122; Henderson 1993:29; LaMarre 1999:66; but cf. Griffin 1943:132, 169-171). Interestingly, over 90% of bowl rims in Griffin’s Fox Farm sample (n=92) had an incurving profile shape (1943:171). Lip shape is predominantly rounded (>90%) or flat-rounded (<10%) for early Late Fort Ancient components ([Fox Farm] Griffin 1943:171; [Burning Spring Branch], and predominantly flat-rounded (Buffalo, 46.3%) or rounded (Buffalo, 43%) for late Late Fort Ancient components (LaMarre 1999:62).

Bowl decoration may be temporally significant. Rim strips may be more common on bowls from early Late Fort Ancient sites, while transverse fingernail notching is the predominant form of decoration in late Late Fort Ancient assemblages (LaMarre 1999:132). For example, Griffin does not mention transverse lip notching as a common technique of bowl decoration for the 92 rims in his sample from Fox Farm, but goes into detail about and illustrates at least seven examples of rim strips (1943:171, Plate CIII,
Figures 5,6,7,10,12,13,14). Likewise, at the early Late Fort Ancient Period New Field and Petersburg sites 25% and 7.7% of bowls have notched rim strips (Henderson and Pollack 1996). The lower percentage of strips at Petersburg may be a reflection that it is transitional between early and late Late Fort Ancient. Clearly late Late Fort Ancient components at the Augusta and Buffalo sites have 13.4% / 26.6% notched rims compared to only 1% / 1.4% for added rim strips (Hale 1981: Table 33; LaMarre 1999: Table 4.12). This is not surprising considering this diachronic shift in preference also occurs for jars (see decoration, below).

Metric data for bowls are also relatively uncommon. Average bowl diameter data from individual sites indicate a range of 17.0-20.7cm for early Late Fort Ancient ([Fox Farm] Griffin 1943:169; [New Field] Henderson and Pollack 1996:172; [Burning Spring Branch] Pullins et al. 2008:797) and 13.9-19.3cm for late Late Fort Ancient ([Madisonville, Hahn, Turpin] Griffin 1943:Table 1; [Howard] Pollack and Schlarb 2009:57) components. Bowl rim thickness averages 5.0mm at the probable early Late Fort Ancient Fox Farm component (Griffin 1943:171), and 6.5-7.4mm at late Late Fort Ancient components ([Madisonville Site] Griffin 1943:171; [Buffalo] LaMarre 1999:Table 4.6). From the few sites that have both bowls and jars, it seems that bowls have a slightly smaller average orifice diameter and slightly thinner rims than jars.

Specialized Madisonville Series Vessel Forms

Griffin (1943:135-8; see also Mayer-Oakes 1955:168) recognized at least two specialized vessel forms that occur at more than one Late Fort Ancient site: conjoined or compound vessels and pedestaled vessels. He also recognized jars with effigy handles
and appendages as specialized forms (1943:135-136), but these are actually normal jar forms with specialized appendages so they will be discussed under that section. The only complete examples of conjoined vessels recovered from a Fort Ancient component are from the Madisonville site (Griffin 1943:Plate LXVI - Figure 5, Plate LXIX - Figure 1; Drooker 1997:81, Figure 4-12). They consist of a jar form stacked on top of another jar form with a clay strip (or the rim of the lower vessel) applied over the joined area. Drooker also illustrates a bowl form (1998: Photos 1113-1115) from the Madisonville Site. An example of a possible conjoined bowl form was identified during the present study in the Hardin WPA collections.

Griffin also recognized a pedestaled or stemmed vessel form at the Madisonville site (1943:137, 1945; Drooker 1997:82, Figure 4-15). It consists of a Madisonville Series jar form supported by a cylindrical pedestal attached to its base. One complete and one example without the base were recovered from the Madisonville site. The form has not been identified with certainty at any other Fort Ancient sites, though a possible example from the Augusta site may be suggested by the following description: “one bowl, which exhibits a large molded hole in the flat bottom of the vessel, must have served as something like a colander” (Turnbow and Jobe 1992:95). Could this be the top of a stemmed/pedestaled vessel, with the hole in the base representing where a pedestal had once been molded? Pedestaled vessels more common at Iroquoian sites (Latta 1987, 1990; Ramsden and Fitzgerald 1990); but also occurs at Susquehannock (Kent 1984:Figure 105) and Monongahela (Lapham and Johnson 2002:100) sites in the northeast. A single example has also been identified at a protohistoric Caddoan site in east Texas (Perttula 1992).
The suggestion that the general form was copied from Catholic chalices used in communion has stimulated some debate over its original inspiration in Native pottery traditions (Griffin 1945; Latta 1987, 1990; Ramsden and Fitzgerald 1990; see also Drooker 1997:82, 317-318). The plausibility of the idea is supported by the presence of this form only on protohistoric sites all of which were minimally aware of European colonization and could have been apprised of the idea through long-distance exchange contacts (Latta 1990:164). Whatever the origin, it appears that only the idea of the form is traveling since known examples exhibit attributes that are otherwise completely local.

A final ceramic form nearly as rare as pedestaled vessels are cylindrical shaped ceramic objects often referred to as “pestles” (e.g., Hanson 1966:103), though some forms with wider bases have been referred to as “trowels” (Mayer-Oakes 1955:Plate 101b). This functional name and interpretation was based on Hanson’s observation that nearly all specimens from Hardin were “chipped and broken, showing heavy abuse” (Hanson 1966:103). This however, has never been supported by any contextual or other evidence such as ethnographic analogy. In fact the morphology of the Hardin and other reasonably complete Fort Ancient ceramic cylindrical objects does not match that of ceramic trowels recently examined at the Late Prehistoric Mississippian Angel site in southeastern Indiana (McGill 2013).

A more well-supported interpretation of these items is pedestals (“briquetage”) used to hold large pans over a heat source to evaporate brine into salt (Figure 7; I. Brown 1980:83-84; Fig.14; Turnbow and Jobe 1992:96). Their battered condition is consistent with salt production since these implements are often damaged or destroyed after a single use because they become fused together with “green slag”, a byproduct of brine
evaporation (I. Brown 1980:68). In fact, not one of the items from the Hardin assemblage was complete, though one was refitted by Hanson. Other contextual information bolsters the notion salt was produced at the Hardin site, a subject returned to below.

Similar cylindrical ceramic objects have almost exclusively been documented at a handful of protohistoric Fort Ancient sites, where salt pans were also recovered. These sites include: Clover (Mayer-Oakes 1955: Plate 101b, Plate 108a-b), Buffalo (McMichael 1963), Hardin (Hanson 1966:103), and Augusta (Hale 1981:158; Turnbow and Jobe 1992:96). An example from Waterworks (Brown 1980:Figure 17i; Drooker 1997: Table 4-2) and four possible fragments from the transitional early/late Late Fort Ancient Petersburg site (Henderson 1993:35) may be the earliest evidence of this form. There may also be two examples from an unidentified Late Fort Ancient component at Blain Village, referred to as a “clay cylinder” in the site report (Prufer and Shane 1970:Plate XIII, C). The items however, unlike any of those recovered from late contexts, are grit tempered and were associated with middle Fort Ancient diagnostics, suggesting that they may simply be isomorphic with those clearly associated with late contexts. However the presence of a protohistoric component at Blain is suggested by both diagnostics and radiocarbon dates (Prufer and Shane 1970:Table31).

Analysis by the present study (below) indicates the cylindrical objects recovered from the site have morphological diversity indicating several possible functions, one of which may compares to the pedestaled form at Madisonville (above), the other to the salt processing hardware discussed by Brown (1980).
Madisonville Series Appendages

As currently defined, Madisonville Series appendages include strap handles, lugs, nodes, and effigy appendages. The specialized pedestaled vessel bases discussed above could also be considered an appendage. In addition, added clay strips on and below the lip are technically appendages, but in Fort Ancient pottery analysis they are considered under decoration and they will be treated as such in this study. In fact, Griffin’s type description of Madisonville Series pottery included all appendages as a type of decoration, which simply illustrates the historical contingency of this classification. No formal diachronic assessments have been made for Madisonville Series appendages, so most information about their temporally sensitive attributes (within the Late Fort Ancient) comes from impressionistic comparisons between individual sites. Griffin (1943:134) and subsequent researchers (e.g., David Pollack, Personal Communication 2014) have noted that handles are one of the most distinguishing characteristics of Fort Ancient pottery when compared to nearby Mississippian tradition pottery series. Handles on Madisonville Series vessels occur exclusively on jars.

Handles are relatively thin compared to those in earlier Fort Ancient ceramic series, typically approaching a bi-planar profile, though some are slightly bi-convex or plano-convex (see, e.g., Turnbow and Henderson 1992:Figure A-45). There is some suggestion that handled become thinner throughout the Late Fort Ancient Period (Turnbow and Henderson 1992:123). Handles at the early Late Fort Ancient Petersburg and New Field sites both have a width to thickness ratio of 1.0:4.3mm (Henderson 1993:29; Henderson and Pollack 1996:172).
Most handles have sides that converge toward the base (i.e., are triangular), though parallel-sided examples make up a significant proportion of Madisonville Series assemblages. The percentage of triangular handles may increase over time in the assemblage from the series type site from 48% to 71% (Griffin 1943:139; Drooker 1997:Table 6-8). This finding is supported by sites in northern/northeastern Kentucky (Turnbow and Henderson 1992:123), but data from other sites in other regions with at least ten handles do not consistently support this finding (compare: Henderson 1993:29; LaMarre 1999:81; Pullins et al. 2008:598. See also, Riggs 1998: Table 3.17). Handles are typically molded onto the rim just below the lip and then again onto the shoulder or shoulder/neck junction (e.g., Madisonville Site, Griffin 1943:134; Pollack and Schlarb 2009:59). Vessels with two sets of opposing handles may become more common later (e.g., Hale 1981:129; Griffin 1943:134; Drooker 1997:Table 6-8).

A rare variety of strap handle is bifurcated where it joins the vessel at or below the lip. Sometimes these are referred to as strap handles with triangular “cut-outs”. This variety has only been documented in the late Late Fort Ancient components at Goolman (Turnbow and Jobe 1984:28, Figure 3a), Madisonville (Griffin 1943:139-140, Plate LXXIV:Fig.12, Cowan 1987:Figure 14), Larkin (Griffin 1943:180, Plate XCIV:Fig.13), and Hardin (Hanson 1966:Figure 39C). Probable Late Fort Ancient Period components at the Lucasville Site in Ross County, Ohio (James Morton, personal communication 2014) and the Johnston-Turpin Farm Site near the better known early Fort Ancient Turpin Site (Comstock and Cook 2014).

Several examples of Madisonville Series-like pots with cut-out strap handles have been recovered from protohistoric contexts outside the mid-Ohio Valley, including the
Seneca Dann site (Drooker 1997:104, Figure 4-19), the Saltville area in western Virginia (Wedel 1990:Figure 1), and the early Upper Sauratown site in North Carolina (Ward and Davis 2001:134-137; Glanville 2008:Figure 2). It is noteworthy that all of these areas exhibit independent evidence of interaction with Fort Ancient region.

Both jars and bowls with effigy appendages have been documented, though they are more common on jars and only occur in late Late Fort Ancient components (Drooker 1997:81, 317-335). Examples have been recovered from at least a dozen sites spread throughout the Fort Ancient region (Drooker 1997:81, Figure 8-41). These late effigy forms tend to take the shape of animals often interpreted as lizards, though other animals are clearly represented (e.g., Griffin 1943:135-137; Drooker 1997:Figure 4-13; Spencer 2006:Figure 30). They take two forms. The more common variety consists of an animal effigy in the place of strap handles, with fore-limbs attached at the lip and the lower body, legs, and tail attached or appliqued onto the shoulder or base of the neck (Griffin 1943:135-137; Drooker 1997:325). The animals appear to be peering into the vessel while crawling over the rim (Drooker 1997:81), which contrasts with earlier effigy forms consisting primarily of a zoomorphic head looking away from the vessel interior. The southernmost Fort Ancient example may be from an undocumented site in the Red River Gorge in Eastern Kentucky known locally as “Ash Cave”. The specimen occurs on a large rim sherd with a flared rim and notched rim fold. It is the more common variety which takes the place of a strap handle. The tail exhibits notching and is appliqued to the shoulder of the vessel.

Lugs are typically found on bowls (perhaps in place of handles), are molded over the lip and generally project horizontally from the vessel rim in tab form (Turnbow and
Henderson 1992:Table X-8, Figure A-41). Griffin noted that almost 1/3 of the 97 bowls in his sample from Fox Farm had this type of appendage (1943:170).

Decoration

In general, decoration tends to occur on the lips and rims of Madisonville Series vessels. Punctuation, notching, incising, trailing, weak castellations, rim-folds, and rim-strips (applied clay strips) are common forms of decoration. Also present, but rare, are incised “slashes” and nodes, including paired nodes below the lip (e.g., Griffin 1943:135, 140; Drooker 1997:319; Riggs 1998:Table 3.13; LaMarre 1999:Table 4.13). Transverse notching on part or all of both jar and bowl lips is common.

In general earlier Late Fort Ancient assemblages tend to have more trailing and incising on necks (e.g., Capitol View:Henderson 1992b; New Field:Henderson and Pollack 1996) and, in some regions, appears to give way over time to lip notching (Turnbow and Henderson 1992:125-126; Riggs 1998:Table 3.16). In fact, neck decoration is rare in some late Late Fort Ancient assemblages such as Buffalo (10%, n=753; LaMarre 1999:Table 4.10; but cfc. Howard Site:Pollack and Schlarb 2009:57-59; Madisonville Site: Krieg and Purtill 2013). At the better-known Madisonville site, incising and trailing on necks is relatively common in domestic contexts (39%) but lacking altogether in mortuary contexts (Drooker 1997:175). This does not necessarily imply a functional reason, however, since the Buffalo assemblage was primarily domestic and neck decoration represented only 10% of the assemblage (LaMarre 1999). Since these sites are mostly contemporaneous, but very distant from each other, the difference may speak to cultural rather than chronological distance.
Incising, almost exclusively located on necks and rims, tends to be deep and narrow; while trailing tends to be wide and shallow (Henderson and Pollack 1996:Table 1). Trailing may become wider and shallower over time and increase in frequency at the expense of incising (e.g., compare Pollack and Schlarb 2009:57 to Henderson and Pollack 1996:Table 1; David Pollack, personal communication 2014). Motifs consist primarily of chevrons and curvilinear and rectilinear guilloche designs (Turnbow and Henderson 1992:127; Henderson and Pollack 1996:172). In published reported, percentages of rectilinear and curvilinear designs vary considerably at any given sub-Horizon (e.g., Griffin 1943:140; Pollack and Schlarb 2009).

Punctation on Madisonville Series ceramics typically occurs in horizontal rows on or below jar lips, at the base of the neck, or on the shoulder (Griffin 1943, Plate LXX:Figure 1, Plate LXXIII:Figures 3,6; Glowacki et al. 1993:6; LaMarre 1999:Table 4.13). This appears to be accomplished by pressing the blunt end of the finger tip into the wet clay. This is probably a variant of the more common lip notching which is done primarily with the fingernail (Glowacki et al. 1993:6). Griffin noted that it commonly occurs on shoulders of Madisonville Grooved Paddled jars serving as a border between plain surfaced neck and a paddle malleated body surface (1943:141,349, Plate LX:Figure 4, Plate LXIII:Figure 1, Plate LXVII:Figure 5).

Rim folds and rim-strips are also common decorative techniques on Madisonville Series ceramics. Turnbow and Henderson indicate that rim-strips predate but remain present in the Madisonville Series, while folds are unique to it (1992:126). Both types of rim modification can be decorated with notches, punctations, and cordmarking. Folds (usually on jars) and strips (usually on bowls) decorated by notching and punctuation
appear to be more common in earlier Late Fort Ancient assemblages (e.g., Henderson and Pollack 1996), while later assemblages tend to have primarily rim folds and are unmodified (Griffin 1943:140; Turnbow and Henderson 1992:126, Tables X-13, X-14; Riggs 1998:Table 3.7; LaMarre 1999:131). In the late Late Fort Ancient Buffalo and type site assemblages, rim folds are twice as common as strips and are rarely decorated (Griffin 1943:140; Glowacki et al. 1993; LaMarre 1999:Table 4.13). It should also be noted that while rim strips are not uncommon on bowls, folds are relatively rare (e.g., LaMarre 1999:131-132).

Weak single castellations are the final form of rim modification found in Madisonville Series assemblages, and only occur on Jars. Additionally, this form of modification has only been reported for three late Late Fort Ancient sites in West Virginia (Buffalo, Rolf Lee, Clover; Griffin 1943:Plate CXXIV, Figure 1; Graybill 1981:Table 11; LaMarre 1999:Figure 4.13). However, examples may be illustrated from Late Fort Ancient components at Fox Farm (Griffin 1943:Plate CVIII, Figure 4), Campbell Island (Griffin 1943:Plate XCI, Figure 3), and the Madisonville Site (Griffin 1943:Plate LXXIV, Figure 8).

Madisonville Series - Grooved Paddled Type

The Madisonville Grooved Paddled type was first defined by Griffin and has not been modified, though an additional type of paddled surfaced ceramics have been identified at the Neale’s Landing Fort Ancient site (Griffin 1943:141; Hemmings 1977:6.4; Turnbow and Henderson 1992:323). The Grooved Paddled type is identical to Madisonville Cordmarked and Plain types with the exception of surface treatment.
Griffin described it as “distinctive parallel grooves on the body produced by…a grooved paddle, which has been dragged across the unfired, moist clay” (1943:141,349). He described the impressions being either vertical or horizontal typically restricted to the body below a smoothed rim. The final distinguishing feature was the presence of a row of punctations bordering the smoothed neck/rim and the paddled body surface.

Henderson and Turnbow note that this type has only been identified in protohistoric (post-A.D. 1550) assemblages (1992:323), a pattern that continues to hold. A curious note about the type definition is that Griffin did not explicitly describe the cross-sectional shape of the paddle marks. When comparing Madisonville Grooved Paddled to Wellsburg Simple Stamped, Mayer-Oakes (1955:203-204) indicates the “the surface was roughened by paddling with a wooden paddle which had been grooved by carving, or wrapped with strips of thong”. These two different methods would produce two different kinds of impressions; one with a square or rectangular cross-section, one with a u-shaped cross section. The lack of specificity in both Griffin and Mayer-Oakes appears to have cascaded into a third type definition for paddled surface treatment by Hemmings (1977, see also below).

Paddled-surfaced ceramics comprised such a large proportion of the Neale’s Landing assemblage (38.5% of 2,847 sherds) that two types were distinguished by Hemmings (1977:6.4). Madisonville Grooved Paddled as defined by Griffin comprised 2.6% of the assemblage, which is comparable to its representation on other protohistoric sites. A second variety of paddled ceramics, Neale’s Landing Paddled, represented 35.9% of the assemblage. According to Hemmings (1977:6.4), the surface finish consists of “exterior, broad, shallow, irregular, closely spaced grooves, almost invariably vertical
to [the] rim. in most cases the corrugated impressions are attributable to a narrow paddle or paddle edge, but in all cases there is smoothing or finger wiping largely obliterating the details of the lands and grooves. It is possible that some impressions were produced by [a] coarse cord-wrapped paddle. The majority of impressions, however, were probably produced by simple paddle malleation and cover the entire vessel surface.

Depth of impressions vary, as does smoothing...”. In an attempt to clarify this somewhat ambiguous description, Hemmings adds that what distinguishes the Neale’s Landing type from the Madisonville type were “heavy, irregular, vertical corrugation carried to the rim…but not [from] a carved or thong-wrapped paddle, extensive smoothing over the surface...” and a vertical to slightly in-slanting rim orientation and a straight profile shape (1977:6.10-6.11).

Based on this description, Neale’s Landing Grooved Paddled could potentially encompass at least two methods of creating surface impressions: a cordmarked paddle or narrow paddle or paddle edge, neither of which are from a carved or thong-wrapped paddle but always involving some level of smoothing. Apparently, Hemmings had taken Mayer-Oakes’s description into account when defining Neale’s Landing Paddled and decided to exclude carved or thong-wrapped paddles as the implement used. Once again, we are still left without enough detail to determine what the grooved impressions should look like. Unfortunately, none of Hemmings’s, Griffin’s, or Mayer-Oakes’s images of grooved paddled sherds of any type are clear enough to confidently distinguish the several types of paddling.

Despite this lack of clarity, Hemmings goes on to suggest (1977:6.8-6.10) some sherds Griffin attributed to Madisonville Grooved Paddled probably conform to the
Neale’s Landing Paddled type. Specifically, the vessels illustrated by Griffin in Plate LXVI (Figure 6), Plate LXX (Figure 2), and Plate CXXVI (Figures 5-6) (Griffin 1943). These three vessels illustrated by Griffin exhibit at least two types of grooved impressions. More importantly, one vessel (Plate LXX, Figure 2) illustrates a very flared rim and lacks impressions to the rim, both of which are inconsistent with Hemmings’s definition. Griffin’s Plate LXVI (Figure 6) appears to illustrate a vessel more typical of Neale’s Landing than Madisonville Grooved Paddled; the vessel has slightly in-slanting rim orientation with a straight profile, and impressions to the rim that appear somewhat smoothed over (Baker 1988:48). The Neale’s Landing type has also been identified at the protohistoric Fort Ancient Buffalo and Cullison sites (LaMarre 1999:96-97, see also, Baker 1988:48), though the specific attributes used for these identifications remain unclear considering the ambiguities and inconsistencies presented here.

The most consistent attribute that seems to be able to distinguish these types are other attributes of the ceramic series from which they originate. Griffin’s type definition and most images illustrate Madisonville Grooved Paddled on vessels with a flared profile shape and paddling is restricted to the bodies of smoothed necked jars on which the neck is often divided from the body with a row of punctuations. Two complete vessels with grooved paddled exterior from the protohistoric / early historic Bentley Site in northeastern Kentucky are consistent with this pattern; and, without the paddle markings, would otherwise by normal Madisonville Series jars. On the other hand, a vertical to in-slanting jar orientation and surface treatment to the lip are more consistent with Neale’s Landing jars (Hemmings 1977:6.8-6.10; Baker 1988:48). The problem remaining is the need to identify types based on sherds which only exhibit the impressions. In the present
study, paddled type will not be stated since these type definitions cannot be resolved with the assemblage at hand; rather all sherds with impressions that fit one of the paddled types will be called “paddle impressed” and variation in cross-sectional shape will be described.

Perhaps the most important aspect of paddled ceramics is that they only occur on late Late Fort Ancient (i.e., protohistoric) and early historic sites (Turnbow and Henderson 1992:323; Table X). The post-A.D. 1500 increase in this type among eastern Fort Ancient settlements has been interpreted as resulting from intensified contact with tribal groups to the east and north whose ceramic traditions include a history of simple stamping (Baker 1988). In fact, most sites where this type has been identified are located in the eastern part of the Fort Ancient area. Both population displacement and intensified interaction have been proposed to explain the appearance of northern and eastern ceramic types at protohistoric Fort Ancient sites.

Madisonville Series - Net Impressed Type

Madisonville Net Impressed is a rare surface treatment on jars otherwise conform to the Madisonville Series (Griffin 1943:141, Plate LXII:Figure 8, Plate LXXVII:Figure 10). Griffin notes that the type surface treatment is identical to that on the earlier Fox Farm Series Net Impressed jars (1943:177, Plate CXIII:Figures 8,10). A few examples of net impressed pans have also been identified (e.g., LaMarre 1999:96, 134).
**Todd Series Ceramics**

The Todd Series is in many ways a replacement for Griffin’s Fox Farm Salt Pan type (1943:131, 167-169, 345; Turnbow and Henderson 1992:325-327). Griffin placed pans in the Fox Farm Series because they were abundant in his sample from Fox Farm and rare at Madisonville (Turnbow and Henderson 1992:323). Turnbow and Henderson later placed pans in the more appropriate Todd Series because pans consistently occur alongside Madisonville rather than the earlier Fox Farm Series types. Their presence in Griffin’s Fox Farm assemblage was due to unrecognized mixing of several components (see above; Turnbow and Henderson 1992:310-312). Two primary varieties, Fox Farm and Augusta have been defined; the latter appears only at Protohistoric Fort Ancient sites (Turnbow and Henderson 1992:325-327). Because they occur almost exclusively in post-A.D. 1400 (i.e., Late Fort Ancient ) assemblages, they are considered temporally sensitive time markers (Turnbow and Henderson 1992:326).

While they occur almost exclusively alongside Madisonville Series ceramics, Todd Series vessels are distinct in several ways that warrant a unique type. Like Madisonville Series ceramics, Todd vessels are exclusively shell tempered. However, the similarity largely ends here. First, Todd series ceramics are pan forms, though some examples with less outslanting walls could be considered shallow bowls. Unlike the Madisonville or earlier shell-tempered series, shell temper in Todd sherds is not finely crushed, temper fragments vary in size and is not oriented parallel to the vessel wall. Unsmoothed or poorly smoothed exterior surfaces are typical. Decoration is rare and limited for the most part to nodes on rim exterior and lip notching (Griffin 1943:168) but appears to be restricted to Todd Plain var. Augusta (below).
Surface treatment includes fabric impressing, a variant Turnbow and Henderson identify as fabric impressed (1992:327). Leaf impressions, cordmarking, and net-impressing have also been identified on a few specimens from protohistoric sites (e.g., Hanson 1966:Figure 36B; LaMarre 1999:96). Several sherds from early and late Late Fort Ancient sites have also been identified as fabric impressed (Turnbow and Henderson 1992:327). Vessel interiors are almost always very well smoothed, but not burnished (Griffin 1943:168). The combination of unfinished bodies and their large size suggests pans were formed by pressing clay into a shallow pit (Griffin 1943:169; see also, I. Brown 1980).

Todd Plain, var. Fox Farm.

The predecessor to this type was originally described by Griffin based on his analysis of 141 examples from Fox Farm (1943:131, 167-169). However, he lumped the Todd Plain var. Fox Farm sherds into his more general Fox Farm Salt Pan type. Subsequent researchers followed this method until Turnbow and Henderson split Griffin’s Fox Farm Salt Pan type into Todd Plain var. Fox Farm and Todd Plain var. Augusta (1992:325-327). Todd Plain var. Fox Farm is distinguished by rims that are unfinished on the exterior. This form tends to have thickened, irregular rims that varied from 5-20mm in thickness and 50cm in diameter in Griffin’s sample from Fox Farm. Turnbow and Henderson’s sample had a similar thickness range with a mean of 9.1mm (1992:326). Griffin also noted the vessel contour varies from plate-like with the rim oriented more toward horizontal, to shallow bowl-like with the rim recurving and approaching a vertical orientation (1943:168). Decoration has not been identified on any

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examples from unmixed contexts (Griffin 1943:168; Turnbow and Henderson 1992:326; LaMarre 1999:133). Todd Plain var. Fox Farm is the only pan variety found in early Late Fort Ancient components, but continues to be produced through the late Late Fort Ancient Period.

Todd Plain, var. Augusta

This type was originally defined to distinguish pans with a poorly-smoothed to smoothed exterior rim zone, which does not occur on var. Fox Farm (Turnbow and Henderson 1992:326-327). While var. Fox Farm pans occur on both early and late Late Fort Ancient sites, var. August is restricted to the latter. Though he lumped both varieties into the now obsolete Fox Farm Salt Pan type, Griffin recognized a “smoothed rim band” on 3 of 13 pan rims from the late Late Fort Ancient type site (1943:131). Hanson also recognized a “smooth rim” variety in the Hardin Site assemblage (1966:81, Figure 36C) though he lumped it into Fox Farm Salt Pan Type for lack of an alternative at the time. This variety may tend toward shallow bowls in some assemblages and lacks the thickened, irregular lips on var. Fox Farm (Turnbow and Henderson 1992:326). Turnbow and Henderson’s sample had a mean thickness of 9.7mm (1992:326). About 1/3 of this type is typically decorated with either notches on the lip or punctations on the exterior rim below the lip (e.g., Griffin 1943:131; LaMarre 1999:133-134, Figure 4.12).

Todd Plain, var. Unspecified

This variety was created to subsume body sherds lacking the diagnostic criteria necessary to place them in a variety. Several varieties of pan rims inconsistent with
either Fox Farm or Augusta variety have been identified at the protohistoric Buffalo site (LaMarre 1999:134-135). These included forms with sharply everted and flared rim profiles, one example with a net-impressed rim and body, three examples with cordmarked bodies and rims, and several other attribute combinations not previously identified. Nonetheless, LaMarre notes that most of these unique combinations appear on vessels that would otherwise fit into the Todd Plain var. Augusta and probably represent a local manifestation of the more generalized type (1999:135).

The Late Fort Ancient Ceramic Assemblage at the Hardin Site

Introduction

The spatial and chronological data presented above suggests the presence of at least two Late Fort Ancient components at the Hardin Site. However, the same information does not clearly distinguish whether the two midden rings represent sequential but continuous use of the site, or abandonment and reoccupation. In the sequential but continuous model, diachronic indicators are not expected to represent a gap in occupation and the midden rings may not represent clearly defined spatial boundaries. In the abandonment and reoccupation model, a gap in occupation should be reflected in relative or absolute measures and the midden rings are expected to exhibit unambiguous spatial boundaries. Ceramic attributes tend to change more rapidly than other forms of material culture and can therefore provide relatively sensitive chronological information. Samples of pottery from the two rings are compared to identify their relative chronological relationship.
A major challenge of this study was that a relatively limited number of studies have attempted such a comparison using pottery assemblages from Late Fort Ancient components (e.g., Henderson and Turnbow; Riggs 1998; see below). However, this work was stimulated by recent studies in northern Kentucky (Raymer 2008) and southeastern Ohio (Carskadden and Morton 2000) which confirm that detailed ceramic attribute analysis can establish a more refined relative chronology than lithic type frequencies or radiocarbon dates. Both studies successfully identified chronological separation among multiple components assigned to the same Fort Ancient sub-period. Raymer’s study was especially useful in laying out specific expectations for sequential versus non-sequential occupations. Sequential occupations are characterized by ceramic attributes exhibiting a few percent or less in relative proportion (statistically insignificant), while non-sequential occupations should exhibit much greater difference in relative proportion (statistically significant).

**Background**

The pottery assemblage from the 1939 excavations was mostly analyzed in the early 1960s by Lee Hanson (1966). Unfortunately, there are two reasons why Hanson’s original analysis cannot be used here. First, Hanson was aware the site represented several components, but was not aware they were spatially segregated so his sample represents a ceramics from at least four separate occupations. In the present study, an attempt is made to parse out the different types associated with the two midden rings to use this information to assess their relative chronological position.
The second problem with Hanson’s analysis is that combined ceramic types that were not known at the time to derive from chronologically distinct ceramic series. For example, Hanson combined Madisonville Cordmarked and Fox Farm Cordmarked types into a single type: Madisonville-Fox Farm Cordmarked (1966:77). These types represent temporally earlier (Fox Farm, ca. 1200-1400) and later (Madisonville, ca. 1400-1750) ceramic series. Combining them obscured diachronic trends in his occupational sequence. Interestingly, Hanson’s seriation comparing ceramics from four arbitrary levels at the site allowed him to make several correct observations about change over time. For example, he observed that u-shaped lug handles only occurred in the lower levels of the site. This is consistent with the current understanding that these are diagnostic of the Middle Fort Ancient Period. So even though Hanson’s analysis cannot be used as a replacement for re-analysis, some of his observations remain useful and they are incorporated here where appropriate. Moreover, even with knowledge of the modern ceramic typology, distinguishing Madisonville Cordmarked and Fox Farm Cordmarked types may continue to be a problem in the Hardin assemblage.

**Sampling and Methods**

*Sampling*

A very large sample of pottery from the Hardin Site is available for study (Table 5-5). Two sub-samples, one from WPA excavations and one from recent excavations, comprise the total sample. Sampling was stratified by village and was non-random. The sub-samples from both projects were derived from units placed strategically throughout the site and cannot be considered randomly placed. 1939 units were placed in areas of
highest surface density. 2013 units were placed where geophysical anomalies and or subsurface deposits were intact. In addition, selecting contexts for analysis was not random. The initial sample for this study was only from feature contexts. However, this amounted to only several hundred sherds from each village, so additional samples of pottery were added from midden (general) contexts. In order to maximize efficiency in the lab, midden contexts were selected based on size, with the largest selected first. In this section the size and nature of the two sub-samples will be described. Potential biases are examined to assess the degree to which non-random sampling may influence the final analysis.

The 1939 WPA fieldwork collected and catalogued pottery by context (e.g., unit, level, feature). Today the pottery from each context is stored in an individual bag marked with the number and associated provenience information. For the present study, the entire WPA ceramic collection was sorted into basic morphological groups (rim, body, appendage; see below) and entered into a Microsoft Access database. The total number of pottery sherds in the database is 52,376 (Table 5-5). This finding is somewhat surprising considering Hanson’s estimate of the pottery assemblage was 31,250 sherds (Hanson 1966:74-117). There is a discrepancy of 21,126 sherds between the earlier sample approximation and the present tabulation. Even considering that the earlier total was an approximation, the discrepancy is too large to ignore.

Several possibilities may account for the discrepancy between Hanson’s total sherd count and my own:a) How Hanson tabulated sherd counts; b) Fragmentation of sherds due to “box wear” since Hanson conducted his analysis. How Hanson tabulated the assemblage seems most likely. Hanson’s figures of pottery indicate that many had
been refitted during his analysis (e.g., Hanson 1966:Figures 27-31). During analysis, I observed many mended or re-fitted vessel fragments, and many sherds that had once been refitted and glued back together but are once again fragmented. Many sherds still have old glue adhering to their margins (from Hanson’s work). Since this observation is retrospective, the percentage of sherds that had been refitted cannot even be roughly quantified. Nonetheless, this observation suggests Hanson’s sample size figure may have counted refitted specimens as one individual sherd. In this scenario, the many sherds Hanson had refitted and glued back together have subsequently fallen back into the original fragments recovered by the WPA and each have been counted as an individual resulting in a massively inflated sherd count relative to Hanson’s.

Fragmentation due to “box wear” is another possibility as to why the present sherd count is much higher than Hanson’s. I believe this has had less influence than differences in sherd tabulation, and can be ruled out as the primary cause of the discrepancy between the present sherd count and Hanson’s. If Hanson’s estimated 31,250 sherds fragmented into 52,376 sherds from “box wear”, the breakage rate would be 67.6%. The collection has been re-boxed at least once since Hanson conducted his analysis, and moved at least twice, which might have resulted in some breakage. However, it seems unlikely that even the most careless handling would have broken 2 of 3 sherds. Moreover, the sherds in their present condition are typically not very crumbly suggesting that a high rate of accidental breakage is unlikely.

In sum, the present sherd count of 52,376 is much higher than the estimate of 31,250 based on Hanson’s figures. I interpret this discrepancy as a result of Hanson refitting many sherds and counting the mended items as one, while in the present study
all sherds were counted as one without any attempt at refitting. The partial vessels shown in Hanson’s figures (e.g., 1966:Figures 27-31) are largely fragmented back into their original numbers in the collection. Hanson’s analysis and refitting took place over 50 years ago, and it is apparent the adhesive he used has degraded and the refitted sherds and vessel segments have largely fragmented back to their original size. It is likely that during several moves of the collections facility, a minimal amount of incidental damage to the collection may also have increased the sherd count by a small percentage.

In the catalog generated by the present study 4,545 unique proveniences are represented in the 1939 collections. Bohannan’s field notes and catalog indicate that one lot number was given to each 6 inch level in each 5x5 foot square or each feature context. If 1.1 acres (9,580 – 5x5’ squares) were excavated to a depth of 2 feet (4 – 6” levels), then a range of 9580 proveniences could be represented if each square produced pottery from only one level, to 38,320 proveniences if each square produced pottery from all 4 levels. The presence of only 4,545 unique proveniences indicates the number of levels was uneven over the site, and of those excavated, not all produced pottery. Using a sherd count of 52,382 we arrive at an average of 11.5 sherds per 5x5’ six-inch level.

Adjusted to square meters this would be 5 sherds per 1x1(m) x 15(cm) level. A total of 24,857 ceramic objects were recovered from the 2011-2013 fieldwork (Table 5-6). In the 50 square meters investigated in 2012-2013 an estimated 67 ten centimeter levels were excavated. Adjusted to the 15cm levels excavated in 1939, this would be 44.7 levels. The 24,857 sherds would then result in 556 sherds per 15cm level. Comparing the 2013 (556 sherds/lvl) and 1939 (11.5 sherds/lvl) densities results in a ratio of 48:1.
Basic recovery techniques explain the large discrepancy in sherd density between the two collections. Shovel skimming and hand sorting soil in 1939 apparently resulted in recovery of only larger or more interesting pottery artifacts. Several WPA catalog cards indicate deposits were “screened”, but there is no indication in other archival documents this method was used systematically or extensively. To contrast, all soil was sifted through ¼” wire mesh screen during the 2011-2013 project. All pottery artifacts greater than 1/4” are included in the total count. Speculatively, if the 1939 project used the same sampling methods they would have produced as many as 2.2 million sherds! Potential sources of bias that may result from these different collection methods are assessed after I describe my analytical methods.

Analytical Methods

Ceramic collections from the 1939 and 2011-2013 field projects were analyzed separately due to where they are being curated, but the same methods were used for both. To begin my analysis ceramic sherds from each collection were sorted into temper groups and morphological groups based on the portion of the ceramic vessel they represent. The following nominal categories were used: body sherd, rim sherd, appendage sherd, decorated sherd, ground/shaped sherd, sherd disk, “pedestal” fragment, and other/miscellaneous. The “decorated sherd” category was later dropped since some types of decoration require closer attention than was possible during sorting.

A total of 75,626 shell tempered ceramics and 1,607 rock/other tempered ceramics were sorted (Tables 5-7 and 5-8). Once the entire assemblage from the 1939 and 2011-2013 projects were sorted, a sub-sample of 1,689 sherds were selected for
detailed analysis (Table 5-9). A total of 20 variables were selected for analysis (see below); some have well-established chronological significance, others have possible chronological significance. For this portion of the study only rim sherds, decorated body sherds, and appendages were included. Undecorated body sherds were not included because they provide relatively less chronological information.

**Biases**

This section examines potential bias from differences in field collection techniques by comparing the distribution sherd types (rim, body, neck, etc.) in each collection (Rice 2005:289). Tables 5-7 through 5-14 report the distribution of various attributes by sample origin (either 1939 or 2013). Some are referred to specifically, while others are presented solely to allow the reader to independently assess sampling bias. Table 5-7 shows that proportion of rims and appendages versus body sherds is very different for each collection. The relatively large proportion of rims and appendages in the 1939 collections is statistically significant ($X^2=2542.3$, df=1, p<0.001). This is likely a consequence of the numerous tiny body sherds recovered from the 2013 contexts.

Collection of all sherd fragments >1/4” during the 2013 excavations is almost certainly inflating the body sherd count (see above). Fortunately, a bias in the representation of body sherds is not necessarily an issue since the forthcoming comparison is based primarily on rims and appendages. The only body sherds included where decorated. It would be important for future studies examining undecorated body sherds to determine a minimum sherd size criterion before combining the two collections.
This section examines bias in sherd type within the sub-samples from each collection. Table 5-9 shows the final analytical sample, divided into 2013 and 1939 sub-samples for comparison. The sample reflects only contexts clearly away from the overlap area of the midden rings. The sample from the 1939 collections is almost twice that from the 2013 collections. All diagnostics were used from the 2013 collections, so the sub-sample size could not be increased. The total 1939 collection was so large that only ten percent of the rims (659/6435) were included, while about half of the rims from the 2013 collections were used (360/697). The relatively large unused proportion of 2013 collections was from excavations in the overlap zone (Units 5-7, 9, 13-19). Many of the unused contexts from the 1939 collections were also from the overlap zone, but many were not and represent additional samples that could be used for further study. The relative proportions sherd types are almost identical, which was not the case when the entire collections were compared (see above). This indicates the difference in proportion of body sherds between the collections did not have an influence on distribution of rims and appendages in the samples derived from them. This is probably because only decorated body sherds were included in the sub-samples.

The distribution of five attributes (or attribute states) in each sub-sample was compared to identify potential biases (Table 5-10, Table 5-11, Table 5-12, and Table 5-13). The attributes assessed are vessel form, jar orifice diameter, jar lip shape, jar rim form (orientation), and jar rim profile shape. In the following I will describe general trends and use the tables for specific examples of potential bias.
Bias from Sample Size

It is important to examine whether the relatively large sub-sample from the 1939 collections introduces bias. The representation of each attribute in the 1939 sub-sample is often 2 or 3 times the 2013 sub-sample. The relatively small 2013 sub-sample is not necessarily a problem, though in some cases the number of specimens representing each attribute state is often less than ten. For example, when comparing vessel form (Table 5-10), only one pan sherd is represented by Ring 1 in the 2013 collection. If the 2013 collection were used alone, it would appear that pans only represent 1.6% of vessels in Ring 1. However, the much larger 1939 sample indicates that pans represent over 14% of vessel forms. In this case, the proportion of pans is significantly different between the sub-samples ($X^2=6.59$, df=1, p=0.04). The sub-samples for Ring 2 were larger and the difference in the proportion of pans was not significant ($X^2=2.81$, df=1, p=0.24).

Though there was a significant difference in the representation of pans in each sub-sample for Ring 1, it does not appear to bias the combined sub-samples. When the 1939 and 2013 sub-samples are combined the proportion of pans drops from 14.2% to 12.6%. However, combining the sub-samples for Ring 2 resulted in a greater drop (19.7% to 16.7%) even though there were more pans in each sub-sample for that village. This suggests that combining the sub-samples has a general overall effect that does not appear to bias the representation of specific attribute states (in this case vessel form) even when one (here, pans) is significantly under-represented in the smaller sub-sample.

This examination of vessel form distribution is instructive because it exposes a common problem. In almost every case where the representation of an attribute state differs markedly (and probably statistically) between sub-samples, there are less than ten
sherds represented in one or both sub-samples). However, as the above case also points out, it did not result in a unique bias in the final combined sample. There were no other cases where a variable state was represented by less than ten specimens ONLY in the 2013 sub-sample. Where a variable state was represented by less than ten sherds in both sub-samples it was considered rare and could not be used to make meaningful comparisons.

Bias from Sherd Size

There is often assumed to be a potential bias resulting from analyzing small sherds. Some researchers avoid using small rim sherds because they cannot be oriented as accurately, and it can be difficult to distinguish the vessel form represented (e.g., Turnbow and Henderson 1992:295). A minimum sherd size criterion was not used in the present study for several reasons. First, the assumption that small sherds result in bias has never been demonstrated for a Fort Ancient pottery sample; or at least the evidence has not been published by researchers operating under this assumption. Second, maximizing sample size from the 2013 collections was a priority. Finally, excluding smaller rims may inadvertently bias the sample toward larger vessels or vessel forms (Rice 2005:290-293). Nonetheless, the potential for this bias should still be considered given that many small sherds were collected in 2013.

Though it has not been demonstrated in a published Fort Ancient ceramic study, there is good common sense reason that small rim sherds could be misleading. For example, when there is little of the rim represented below the lip of a small rim sherd, the specimen could potentially represent a small jar or a large bowl. In the 2013 sub-sample
of vessel forms (Table 5-10) the relatively high proportion of jars appears to be at the expense of bowls and pans, which might suggest mis-classification is biasing the distribution of vessel forms. The 2013 sub-sample thus may be biased by either sample size or small sherd size; though this bias does not appear to influence the combined sample in a meaningful way. Even if this bias did influence the combined sample, it would not affect the present study since there is no widely recognized temporal significance to the proportion of vessel forms.

Sample size and sherd size may also bias rim diameter measurements in the 2013 sub-sample (Table 5-11). Average rim diameter measurements are smaller for both villages in the 2013 sub-sample relative to the 1939 sample. However, the trend is the same regardless of which sub-sample is used: jars have larger orifice diameters in Ring 2 relative to Ring 2. As might be suggested by the distribution of vessel forms (Table 5-10), average rim diameter for jars suggests the 2013 sub-sample exhibits smaller rim sherds.

Thus far, I largely explored how sample size and sherd size can bias synchronic patterns of attributes and attribute states. More important for the present study are chronological biases that could result if the sub-samples exhibit reverse patterns. All tables (4-10 to 4-14) were examined to identify this potential bias. Attribute-states were given consideration only if represented by at least ten sherds in both villages AND both sub-samples. There was only one example – lip shape - where a between-village trend differs between sub-samples (4-12). In this case the proportion of rounded lips is greater in Ring 2 in the 1939 sample and the inverse in the 2013 sample. There is no obvious reason why this might be the case. Sherd size should not affect lip shape since this
portion of rims rarely fragmented. This exposes the possibility that other unrecognized biases or factors might be at play. For example, the 2013 excavations placed specifically to target areas of the site not examined by the 1939 excavations. These areas may represent contexts not accurately represented by the 1939 excavations.

The observation that there is only one case were a between-village trend differed between sub-samples is important. It indicates that even when sub-samples exhibit differences in the proportion of a given variable state, its relative proportion between villages is nearly always the same in both sub-samples. That is, both sub-samples usually tell us the same thing about the distribution of an attribute state even where there are differences in the sub-samples.

Bias from Context

As suggested above, another possible bias could result from combining different kinds of contexts (e.g., structure interior, house lot, community dump; see Arnold 1991; Pool 1997). One concern with the Hardin assemblage is that a substantial proportion of the 1939 sub-sample from Ring 2 (11.2%) is represented by Feature 19, a large community trash dump on the river bank. To examine whether the village samples are being disproportionately influenced by different contexts, they were split into midden (domestic) and trash dump (community) contexts for comparison. Dump contexts represent about 10% more of Ring 2 sample for both attributes (Tables 5-15 and 5-16).

This difference is significant for jar rim profile shape ($X^2=6.61$, df=1, $p=0.01$) and for jar rim orientation ($X^2=5.77$, df=1, $p=0.01$). This might suggest that comparison of attribute state distributions between villages should be conducted separately for dump.
and midden contexts. However, splitting each village sample by context not only decreases the sample sizes being compared, it also doubles the amount of comparisons that have to be made. A more practical solution was to make inter-village comparisons by context only when contexts exhibit significant differences in proportion (per Chi-square or T-test).

Statistical evaluation of proportional differences indicates that even when they appear to be great, the difference was rarely significant. For example, Table 5-15 indicates dump contexts in Ring 2 exhibit nearly twice as many bowls as midden contexts. A somewhat opposite pattern can be observed for pans (in the same village). Despite these apparent proportional differences by context, they were not significant ($X^2=1.54$, df=4, $p=0.14$). So even though dump contexts represent a significantly greater proportion of Ring 2 sample (see above), this difference did not result in a significant difference in the proportion of vessel forms when contexts are compared. This justifies combining the samples from both contexts for this attribute. Significance tests were used to evaluate proportional differences between contexts for the attribute comparison section at the end of this chapter. Significance tests were not performed in cases were splitting village samples resulted in attribute states represented by less than ten sherds.

**Overall Distribution of Ceramic Types in the Hardin Assemblage**

A total of 2,256 sherds were analyzed for this study (Table 5-17). Many of the important attributes used for chronological assessment have previously been illustrated by Hanson (1966). Additional images are provided in Appendix F as a supplement to those already published by Hanson, and to illustrate specific ceramic types and attributes.
that are significant to the present study, or may have broader comparative value. A total of 567 sherds were removed from the initial sample because they were determined to be from temporally mixed or indeterminate contexts. These contained ceramics with attributes or attribute combinations diagnostic of both the Late Fort Ancient Period (ca. A.D. 1400-1750) and the earlier middle Fort Ancient Period (ca. A.D. 1200-1400). Over 97% of mixed contexts were located in Ring 2. This and other evidence indicate that Ring 2 contains two temporally distinct but spatially overlapping Fort Ancient components (see Chapter 4). Because the primary goal of ceramic analysis in this project was to clarify the temporal relationship between the Late Fort Ancient components in Ring 1 and Ring 2, it was especially important to remove these temporally mixed contexts.

Removal of mixed contexts resulted in a final sample of 1,689 sherds (Table 5-18). These sherds are from unmixed contexts in discrete areas of the site where no overlap of two components is evident. About 65% of the sample derives from the 1939 collections and the remainder from 2013 collections. The total sample is split almost even between the two village areas, though there about a 10% difference in the proportion of each represented by midden and refuse dump contexts. I have already assessed the degree to which each collection may be biased due to differences in sampling, context, and field methods (this chapter, above). Because midden and dump contexts represent a significantly different proportion of each village sample, I present them separately in the following tables for the reader to examine, though comparisons are made for each village as a whole. This was done for two reasons. First, statistical analysis indicates that even though midden and dump contexts represent a different
proportion of each sample, this difference rarely influenced the combined sample. The few cases where this difference was relevant are highlighted.

Madisonville series comprises the vast majority of the sample from both village areas. The remainder consists of Todd series, which are pans. As this study is primarily concerned with relative frequencies of attributes rather than types, the typological data are presented here in brief for comparative purposes.

**Madisonville Series Ceramics**

Madisonville Series comprises nearly all of both Ring 2 (93.5%) and Ring 1 (92.5%) village assemblages (Table 5-18). Breaking the sample down by surface treatment and sherd type reveals slightly more meaningful differences (Tables 5-19 to 5-21). There is a slightly lower percent of Madisonville Plain in Ring 2 (rims:70.2%, necks:63.6%, strap handles:65.9%) compared to Ring 1 (74.3%, 73.3%, 73.1% respectively). The high proportion of Madisonville Plain in both samples compares favorably to previously documented Madisonville Series assemblages from late (post-A.D. 1500) Late Fort Ancient components.

**Cordage Twist**

Cordage twist was predominantly z-twist for both villages (Table 5-22), though it was almost ten percent higher in the Ring 2 assemblage (73% vs. 64.3%). Overall, both assemblages are consistent with late Late Fort Ancient components where z-twist tends to predominate (see above). Cordage attributes other than twist direction were not recorded for this study, though as a whole the site’s assemblage has predominantly distinct cordage
impressions occurring in regularly spaced rows of relatively fine (narrow) cords characteristic of Madisonville Series pottery. In mixed contexts, rims representing Middle Fort Ancient shell tempered ceramic types were often easily distinguished by wider cordage impressions occurring in irregularly spaced rows. They also exhibited stray cordage impressions crossing over regular rows, a feature rarely observed on Madisonville Series sherds. It should be noted however, that differences in cordmarking between these two pottery series are relative since no absolute measures (e.g., a minimum number of cordage impressions per unit of width) have been proposed (but see Turnbow and Henderson 1992 for proposed criteria).

Other Surface Treatments

There is a very low proportion of rim sherds with impressed surfaces other than cordmarking (Table 5-19, Table 5-20, and Table 5-21). They represent an insignificant proportion of the Ring 2 (4%, n=32) and Ring 1 (3.2%, n=29) samples. Of these, only one notable impression type was distinguished: paddle impressed. Both the Ring 2 (4 body, 1 neck, 1 rim) and Ring 1 (3 body, 1 rim) village samples exhibited sherds with paddle-like impressions consistent with published descriptions and images of Madisonville Grooved Paddled (e.g., Griffin 1943:141,349; Hemmings 1977:6.4; Turnbow and Henderson 1992:323; Drooker 1997). At least two types of Grooved “paddle” impressions are present in the Hardin assemblage. Three body sherds from each village have impressions with a square or rectangular cross-section (see e.g., Appendix F, Figure F-2). Sherds with this type of impression are all very thin and similar in appearance to those illustrated from the very late Late Fort Ancient / early Historic Period.
Morrison Village Site in southeastern Ohio (Prufer and Andors 1975:200, Plate 7B). They are also similar to the early-to-mid-18th century Bentley Site located only a few kilometers downstream from Hardin (Pollack and Henderson 1984:Figure 3B).

Second and perhaps third types can be suggested by other grooved-paddle like impressions identified in the present study sample which show more u-shaped cross-sections. The grooved paddled sherds illustrated in Hanson’s figures also show either u-shaped or other impressions (Hanson 1966:Figure 38c), but do not exhibit square/rectangular cross sections. Hanson identified the sherds he illustrated as Madisonville Grooved Paddled, but these were later identified by Hemmings as Neale’s Landing Paddled. Neither identification was based on clear criteria (see above). Grooved paddled impressions with a u-shaped cross section were also identified at the Bentley Site (Pollack and Henderson 1984:Figure 3A). The important recognition here is that at least two types of paddle impressing are present at Hardin; those with a u-shaped cross-section (see Hanson 1966: Figure 38D, left of two examples) and those with a square/rectangular cross-section (Appendix F).

While no Madisonville Net-Impressed sherds were identified in the sample, Hanson identified several sherds (1966:85, Figure 38d). The remaining sherds with impressed designs from each village appear to represent a variety of fabric or other unidentified materials. A notable example is a group of sherds and a partial vessel with what Hanson described as “the impression of a plaited basket…[with] a simple over-two under-two weave”. This surface treatment is not illustrated by Hanson but images of three sherds are provided in Appendix F (Figure F-2). No comparable examples of this surface impression could be found in the literature with which the author is familiar.
When examined by context of recovery, patterns of surface treatment by midden ring are relatively informative (Tables 5-19 to 5-21). As discussed above, the feature contexts from both village areas are primarily represented by large trash dumps near the river bank, while midden contexts are typically associated with residential / domestic areas of the site. For rim sherds (bowls and jars combined), Madisonville Plain is about 5% higher in Ring 2 midden contexts and 5% lower in Ring 1 midden contexts compared to dump contexts. For jar neck sherds, Madisonville Plain is more common in midden contexts for both samples, but especially in Ring 2 where it is more than 20% higher.

Plain necks are often thought to serve as decorative fields on jars. If this is the case, the higher proportion of plain necks in midden contexts indicates this field may have been more important in the domestic areas associated with midden contexts.

Paste

Exterior surface colors were predominantly brown or tan (Table 5-23). Other colors include tan, orange, gray, black, and red, in general order of proportion of the assemblage represented. This distribution is consistent with Madisonville Series assemblages. Paste texture was indirectly gauged by observing temper particle size. Particle size was characterized by nominal categories indicating how well the shell temper was crushed (Table 5-24). The Ring 1 sample exhibited a higher proportion of medium sized temper particles and lower proportion of fine particles. The inverse pattern in the Ring 2 sample indicates a somewhat finer texture. This method of temper assessment was not ideal since it was based on visual evaluation without a standard
measurement guide. This pattern should be considered tentative until replicable methods are used to evaluate the pattern indicated here.

Vessel Form

Jars and Bowls are the only two vessel forms defined for the Madisonville Series. Hanson illustrates both jars and bowls from the WPA collections (1966: Chapter 5), and supplementary images of jar forms and attributes are provided in Appendix F. The Todd Series was defined for pans which are discussed below. Hanson illustrates examples from the Hardin WPA collections, and additional examples are provided in Appendix F.

Jars are the predominant form in both village samples (67%), and their distribution is the same in both dump and midden contexts (Table 5-10). Bowls, on the other hand, are slightly more common in the Ring 1 sample (20.8%) than the Ring 2 sample (16.4%), and are more common in midden contexts in both samples. This finding is typical and suggests bowls have a more domestic function (Jobe and Turnbow 1992; Pollack and Jobe 1992; Henderson 1993; Pollack and Schlarb 2009:69-70).

Jar rim and neck thickness for both samples (Table 5-25) is consistent with other Madisonville Series assemblages (see above). Compared to each other, Jars have slightly thicker rims and necks, and larger orifice diameters in the Ring 2 sample (avg.=6.55mm, 6.04mm, 22.44cm) compared to the Ring 1 sample (avg.=6.21mm, 5.97mm, 22.18cm).

To control for vessel size, a ratio of orifice diameter to rim thickness was calculated (Table 5-25). The Ring 2 sample rims are still thicker relative to orifice diameter (Ring 2 = 0.27mm thickness for every 1cm in diameter, vs. 0.24mm).
Jar rim orientation, lip shape and rim profile shape in both samples were also consistent with other Madisonville Series assemblages. Jar rim orientation (Table 5-16) was predominantly flared (79-83%) with most of the remainder vertically (11-15%) oriented in both assemblages. When broken down into sub-types, there are 8% more very flared rims and 4% less slightly flared and vertical rims in the Ring 2 sample. Jar lip shape (4-26) was predominantly round (74-75%) and less often flat-round (17-18%) or beveled to a point (6-8%). Differences between samples were minimal. Rim profile shape (Table 5-27) was predominantly direct (67-78%) followed by thickened (10-12%), tapered (5-11%), or modified with a rim strip (3-6%) or rim fold (4-5%). The Ring 2 sample had 11% less direct profile shapes and 6% more tapered rims.

Decoration

Only 311 instances of decoration were recorded in the total sample (Table 5-28); 116 from the Ring 1, 195 from the south. Decoration occurred almost exclusively on rim and neck areas of jars, and rims of bowls. Decoration occurred on 38.2% of all vessels from the Ring 2 sample and 39% of all vessels from the Ring 1 sample. By vessel form 41-42% of jars were decorated and 47-58% of bowls. An 11% higher proportion of bowls decorated in the Ring 2 assemblage is notable, though bowls were not included in the temporal comparison. Additional comparison of decoration by type and vessel form is presented in Table 5-29). Examples of trailing (Figure F-8) and incising (Figure F-9) are provided in Appendix F. Hanson also illustrates examples of trailing (1966: Figure 43) and incising (1966:Figure 42B, center). Decoration on bodies was extremely rare in both samples (Ring 2=10, Ring 1=4). Body sherds were not typically included in this
analysis, but over 100,000 sherds were sorted and decorated sherds were removed for analysis if identified. The near absence of body decoration is typical of Madisonville Series assemblages.

Appendages

Appendages in the two samples are consistent with Madisonville Series assemblages elsewhere (Table 5-30). Though over 90% of handles from both village samples were strap handles, most were too fragmentary to identify to a particular type. Those that could be identified to a type were either triangular (17-23%) or parallel-sided (12-14%) strap handles; producing a 1.9:1.0 ratio of triangular:parallel strap handles in Ring 2 and 1.3:1.0 ratio in Ring 1. Appendage scars on jar rim and neck sherds indicate that strap handles are the only handle type identified on jars and that they only occur on jars. In both samples, handles were molded onto the upper rim below the lip in most cases, and rarely onto and over the lip. Strap handles with “cut-out” centers were identified only in the Ring 1 assemblage (n=2) and in the overlap area (n=1). This is a rarely occurring form that has only been identified at a few protohistoric sites (discussed above). One example from the WPA collectinos is illustrated in Hanson 1966 (Figure 39), which this same example and two others are illustrated in Appendix F.

Animal effigy appendages are another rare protohistoric diagnostic. One was identified in each village sample while two additional examples may be tentatively assigned to Ring 2. Horizontal tab lugs were rare (Ring 2: n=1, Ring 1: n=4), and were the only appendage type associated with bowls in either assemblage. These appendages were molded onto and extended horizontally from the lip.
Decoration on appendages was limited to 8 examples, all from the Ring 1 sample (Table 5-28). This included 2 incised lines, 2 trailed lines, 2 notched, and 2 examples of a three weak castellations above the handle on the rim.

Specialized Ceramic Forms

At least three specialized ceramic forms were documented in the village samples. These are a possible conjoined bowl rim and two types of ceramic cylindrical objects (e.g., Hanson 1966:103, Figure 45). The possible conjoined bowl rim sherd is from the Ring 1 sample and exhibits attributes typical for Madisonville Plain type. As indicated above, this is consistent with other examples, which also appear to be made locally. This sherd was shown in Hanson (1966:Figure 46G), who speculated that it was a pottery manufacturing tool. However, reexamination of the sherd suggest it represents a section of the lip and rim where two probable bowl forms were conjoined by molding the exterior vessel walls together along the rim area. Several views of the sherd are provided in Appendix F to illustrate how it may represent a conjoined vessel (see also Hanson 1966: Figure 46G). Though the sherd is a relatively small section of a vessel, it compares generally to examples from the Madisonville Site (Drooker 1998:Photos 1113-1115) and a late prehistoric site in Tennessee (Griffin 1943:Plate CXXVIII, Figure 1).

The other specialized ceramic form identified in this analysis is thick, solid cylindrical shaped object with flattened flaring ends. These have been identified as pestles (Hanson 1966:103), salt pan pedestals (Brown 1980), and pottery trowels (Mayer-Oakes 1955). Given the morphological variation present in the assemblage in the WPA collections, it appeared that several functionally distinct classes of objects could be
represented. Therefore, a detailed attribute analysis was conducted in an attempt to identify variation within the assemblage. In total 56 specimens were included in the analysis; 51 from the WPA collections (including the 42 identified by Hanson), and 5 recovered during 2013 fieldwork. Several examples were also recently observed (but not analyzed) by the author at the Southern Ohio Museum Center in Portsmouth, Ohio. The items were marked “Tanner’s Field”, which is a local name for the field in which the site lies. Analysis of the WPA and 2013 samples included recording base surface shape (concave, flat, etc.), basal diameter, shaft diameter, height, paste and surface treatment characteristics, and any other unique attributes (Table 5-31).

In total nearly equal numbers of cylindrical objects have been identified in both village samples (Ring 2=17, Ring 1=15). The remaining specimens recovered from the overlap area between the villages. All specimens were fragmentary, though one was refitted by Hanson (1966:Figure 45, left side). Most of the objects were plain-surfaced and had a base diameter : shaft ratio of 1.4 or less, meaning they were only slightly flared toward the base. This variant will be referred to here as Group 1 and is illustrated in Appendix F (Figure F-3). The only complete Group 1 cylinder, refitted by Hanson, exhibits these characteristics and is flared and flattened on both ends of the shaft. This specimen, along with other Group 1 cylinders, exhibits a slight lean when the intact end is set on a flat surface. If this refitted specimen is representative, then it may be suggested that all Group 1 cylinders may have had two flared and flattened distal ends.

The characteristics of Group 1 cylinders (Table 5-31), especially the leaning profile and fragmentary condition suggests most of the Group 1 specimens may be consistent with Ian Brown’s expectations for salt processing hardware (1980:60-76), or at
least that they functioned as pedestals designed to hold up pans over a fire. Ian Brown considers the cylinders as a group to be good candidates for salt processing hardware, and even illustrates one in his monograph on the archaeology of salt making (1980:83, Figure 17g). The only problem with this idea is that no saline spring is known in the direct vicinity of the site, though salt can be extracted from other matrices that are more suitable for transport (e.g., Brown 1980:9). The location of the site within the center of one of the most saline-rich regions of eastern North America lends additional plausibility to the idea. Nevertheless, the function of Todd Series ceramic forms requires further evaluation, perhaps by chemical analysis of absorbed residues (e.g., Horiuchi et al. 2011).

An additional observation is relevant to the interpretation of Group 1 cylinders (Table 5-31). Of the five specimens that had a sufficiently complete basal margin, all exhibited a cylindrical hole in the center of the base, 2.9-4.3cm deep and 1.3-2.0cm in diameter. Initially this was interpreted as an effort to thin the shaft walls to prevent cracking or explosion as water escapes the clay during drying and early stage firing (Rice 2005:96-97, 102-104). However, distinct nodes were identified on the exterior of two pan body sherds. At first this seemed to be the result of random variation in pan exterior surface form since it is thought they were shaped by pressing in shallow, expediently excavated pits (Turnbow and Henderson 1992:325). However, if pans were indeed propped up during firing with pedestals it makes sense the pedestals would have a means of holding the vessel in place, especially if they pedestals are leaning slightly. A slightly leaning pedestal would also have the advantage of being situated further from the fire underneath the pan. The two nodes identified on pan body sherds average 0.4cm high by 1.9cm in diameter. An attempt to situate the pan sherds with nodes onto pedestal bases
with depressions was successful. Despite these provocative and consistent observations, the low numbers of specimens suggests the inferred scenario remains plausible but weak until it can be more systematically evaluated. Without a larger sample, the consistency of the argument alone cannot increase its plausibility over random variation in exterior surface of pans.

Group 2 cylinders (Table 5-31) represent the remaining 6 of 19 specimens (Ring 2=1, Ring 1=3) for which base and shaft diameter could be measured. Examples are illustrated in Appendix F (Figures F-4 and F-5). This type was not illustrated by Hanson (1966). Type 2 cylinders had a ratio of 1.6 :1.0 or greater, suggesting some functional variation requiring a wider base. Those with enough of a base and shaft to stand on end do not exhibit a “leaning” vertical orientation as do the preceding group. Of the three specimens with a sufficiently complete basal margin, none exhibited a cylindrical hole in the center as in Group 1. The most morphologically similar items found in the published literature are the pedestaled vessels from the Madisonville Site (Griffin 1943:137; Drooker 1997:Figure 4-15). Without recovering a portion of a vessel with a stem attached, this interpretation remains speculative, though plausible.

Examples of pedestaled vessels appear to exhibit a basal diameter measuring at least twice that of the shaft. Moreover, both Hardin and Madisonville are largely contemporaneous, the distribution of pedestaled vessels is restricted to sites on or near to the Ohio River, and there is much evidence the Hardin community had exchange relations to the northeast where the vessel form is most common (though still rare). The possibility that several of the cylindrical items in the Hardin assemblage are fragments of
pedestaled vessels is plausible, but cannot be confirmed until a portion of a pedestal / vessel base attachment site is identified from Hardin.

Discussion of Madisonville Series Type Distribution

Overall both midden ring samples exhibit attributes very consistent with published type descriptions of Madisonville Series ceramics. The working model is that Ring 2 represents a later component, so the higher percentage of Madisonville Cordmarked in the Ring 2 sample somewhat surprising considering late Late Fort Ancient sites tend to have a higher percentage of Plain types relative to early Late Fort Ancient components. Several possibilities may explain this finding. These include the possibility that Ring 2 is not later than Ring 1, an increase in plain surfaced ceramics is not universal throughout the Fort Ancient region, and mixing of earlier ceramic series in the Ring 2 assemblage. According to Table 5-2 several late Late Fort Ancient components in the eastern Fort Ancient area have a higher percentage of Cordmarked relative to Plain types, suggesting an increase in plain surface treatment is not universal in the Fort Ancient region. This preference for surface treatment regardless of time may relate to an east-west difference among Fort Ancient groups (compare Tables 5-1 and 5-2).

The higher percentage of cordmarked ceramics in Ring 2 may also be the result of component mixing. An effort has been made to remove mixed contexts from the Ring 2 sample, by eliminating contexts with Middle Fort Ancient ceramic types. However, since non-diagnostic Fox Farm and Madisonville cordmarked ceramics cannot always be distinguished some mixed contexts may be biasing the Ring 2 sample, artificially
increasing the proportion of cordmarked sherds. Hanson and other researchers have also experienced difficulty of parsing Madisonville from Fox Farm Cordmarked sherds, and their solution was to combine cordmarked ceramics from the two series. Turnbow and Henderson (1992:311) have observed that cordmarking on Madisonville Series assemblages is more refined in its execution than that from Fox Farm Series, but I was not comfortable making this distinction due to my relative lack of experience with Fort Ancient ceramics.

Moreover, making this distinction had relatively little utility since surface treatment is not as chronologically sensitive as other attributes discussed below. The percent of plain surfaced ceramics ranges from 66-70% for all sherd types in the Ring 2 sample, and 73-75% in the Ring 1 sample. This percentage of Madisonville Plain is higher than any individual eastern Fort Ancient component and all but two western Fort Ancient components regardless of sub-period (Table 5-1 and 5-2).

**Todd Series Ceramics**

Primary Analysis

Todd Series ceramics are pans. Examples of var. Fox Farm are illustrated in Hanson (1966: Figure 35) and in Appendix F (Figure F-11. Examples of var. Augusta are illustrated in Hanson 1966 (Figure 36C) and in Appendix F (Figure F-10). As a proportion of ceramic series they represent just 7% of the ceramic sample from either village (Table 5-18). As a proportion of vessel forms (Table 5-15), Todd Series represents 16.7% of vessels in the Ring 2 sample and 12.6% of vessels in the Ring 1 sample. The series does not exhibit substantive differences by context. There is a
slightly higher representation of Todd Series in Ring 2 dump contexts is probably because more of the Ring 2 sample as a whole was from dump contexts (see Table 5-15).

The most substantial difference between villages is the inverse proportion of Todd Plain varieties (Table 5-32). In Ring 1 var. Augusta is the predominant type (57.1%) and var. Fox Farm is secondary (25.4%). In Ring 2 var. Fox Farm predominates (44.9%) and var. Augusta is secondary (40.8%). Unidentified types exhibit a similar distribution.

Decoration was present on less than 10% of pans in both village samples (Table 5-28). No examples of net impressed or fabric impressed rims were present.

One rim had a cordmarked exterior surface (Ring 2). Most decoration consisted of lip notching (6 of 9). One instance of lip notching was recorded on a Todd Plain, var. Fox Farm rim. This finding is unusual since decoration is not found on this type (Turnbow and Henderson 1992). The presence of rim folds on many var. Fox Farm rims is notable for two reasons. First, it has only been identified at the contemporaneous Buffalo site (LaMarre 1999:135). Second, while it is considered a form of decoration on jars and bowls, this is clearly not the case with its presence on Todd Plain, var. Fox Farm. In many cases rim folds on var. Fox Farm rims appear to be an attempt to press down or rudimentarily smooth the extruded lips that often distinguish this form.

Expanded Todd Series Analysis

Since such little published work has discussed Todd Series ceramics since they were defined over 20 years ago (Turnbow and Henderson 1999; but see LaMarre 1999), additional consideration was given to variation within the series in the Hardin assemblage. Two other motivations for additional consideration of Todd Series here.
First, there appears to be two Late Fort Ancient components at the Hardin site and
diachronic variation, if present, could provide useful information about the evolution of
the series. This section includes an additional sample of Todd series not included in the
sample described in the preceding sections. This supplemental sample is derived from
the contexts that were already analyzed but removed because they contained middle Fort
Ancient diagnostics. Since Todd Series is exclusive to the Late Fort Ancient Period,
including sherds from these contexts specifically for this analysis (but not in other
sections) was warranted. Note that these additional sherds are only considered in this
section so as to not skew other sections in this chapter by including some, but not all
sherds from mixed contexts.

The inclusion of previously removed mixed contexts increased the total sample of
Todd Series from 112 to 138 sherds (Table 5-33). Most of the additional sherds were
from Ring 2 since most mixed contexts were from this part of the site. With the
expanded sample Todd Plain var. Augusta predominates in both assemblages, though
Ring 1 still exhibits a higher proportion of var. Augusta and a relatively lower proportion
of var. Fox Farm.

One notable change resulting from this analysis was the absolute decrease of var.
Fox Farm in the Ring 2 sample from 40.4 to 20.0%. This was the result of a re-analysis
of the entire Todd Series assemblage after the additional sherds were added. Upon re-
analysis it was observed that many of the sherds originally assigned to var. Fox Farm
exhibited some characteristics that were inconsistent with the type definition. Initially
these inconsistencies were overlooked due to the small sample size of the original
assemblage and it was decided that “lumping” was more appropriate at the time.
However, with the larger assemblage a clear pattern emerged of sherds exhibiting characteristics of both Todd Plain varieties.

In the expanded analysis of Todd Series ceramics, sherds exhibiting attributes of both var. Fox Farm and var. Augusta represent 21.3% of Ring 2 and 3.2% of the Ring 1 samples (Table 5-33). These could not be assigned to either type. All but one have unfinished exterior rim surfaces which is consistent with var. Fox Farm. However, unlike var. Fox Farm, none of these have extruded lips and most lack thickened rim profile shapes. They compare favorably to var. Augusta in that most have direct rim profile shapes and rounded or flat-rounded lips. These indeterminate varieties were distributed fairly evenly between dump and midden contexts in Ring 2, but were rare in Ring 1. This unusual combination of attributes typically associated with either var. Fox Farm OR var. Augusta could potentially suggest a transitional type. However, functional and or cultural reasons are equally plausible without further examination.

A substantial proportion of pan rims in the expanded sample were missing a portion of their rim exterior surface or lip and could not even be placed in the “unidentified type” category described above. These accounted for 13.3% of the Ring 2 and 23.8% of the Ring 1 samples. With the exception of two specimens from Ring 2, all of these were recovered from midden contexts. This may suggest differences in the nature of trash placed in general midden versus dump contexts.

The distribution of Todd Plain is unexpected since Todd Plain, var. Augusta has only been identified in late Late Fort Ancient (post-A.D. 1550) components. This finding is consistent with patterns in the Madisonville Series types discussed above in suggesting both village date to the protohistoric period. One notable observation about the Ring 2
assemblage is the presence of several attribute combinations that do not fit into presently defined Todd Series types. In fact, a much larger proportion of the Todd Series sample from Ring 2 consisted of undefined varieties.

**McAfee Series Ceramics**

Only a few McAfee Series rims were identified in each of the village samples (Table 5-18). This series has been identified in Fort Ancient components dating ca. A.D. 1000-1500, but not later. The low frequency of this type in both samples is not surprising.

**Temporally Sensitive Attribute Comparison**

**Introduction**

Sixteen total variables call Temporally Sensitive Attributes (hereafter TSAs) were selected for further analysis with the goal of identifying assemblage level differences between village samples (Table 5-34). The variables selected were identified by comparison of previously studied assemblages as having some level of chronological significance. Temporal sensitivity has not been demonstrated equally well for all variables. Many of them have only been suggested to have temporal sensitivity, while others exhibit more widely accepted temporal patterns. As a starting point, I will compare the village samples for the first 6 variables, which were identified by Riggs (1998) through statistical analysis to have the greatest temporal sensitivity. I will then present and compare the remaining 10.

The distribution of 6 additional jar attributes, 1 pan attribute and 6 bowl attributes was also explored (Table 5-35). Chronological significance has been suggested for these,
but relevant data are either lacking or exhibit inconsistent patterning. Riggs (1998:172-191) analyzed samples of Madisonville Series pottery from the Sand Ridge and Madisonville sites in southeastern Ohio as part of a larger study of diachronic change in pottery attributes. He found the following variables to be the most temporally sensitive: (TSA-1) rim orientation/“vessel form”, (TSA-2) lip shape, (TSA-3) upper vessel (rim/neck) surface treatment, (TSA-4) lip decoration, and (TSA-5) lip surface finish (Riggs 1998:177-178; Table 3.4). Temper was also found to be temporally sensitive, but 100% of the Madisonville Series pottery assemblage at Hardin is exclusively shell tempered, so this attribute is not included in the comparisons below. Also, Riggs study included only jars since other vessel forms at the sites in his sample had relatively low frequencies.

**Temporally Sensitive Attribute Comparison**

TSA –1: Jar Rim Orientation

Riggs (1998:261) found the most significant temporal change in Madisonville Series jar attributes was an increase in flared rim jars to the exclusion of all other rim orientations. The Ring 2 sample has a relatively higher proportion of very flared jar rims and a lower proportion of slightly flared and direct to slightly in- and out-slanting jar rim orientations compared to the Ring 1 sample (Table 5-16). The difference between these three groups has very limited significance ($X^2 = 2.81$, df=2, p=0.25). However, when the proportion of very flared jars is compared to all other types the difference is moderately significant ($X^2 = 1.01$, df=1, p=0.10). Thus we can be moderately confident (75-90%) that
the differences observed between the samples is a result of real difference between the populations from which they were drawn rather than to the vagaries of sampling.

TSA –2: Jar Lip Shape

Riggs (1998:262) found an increase over time in rounded and flat-rounded lips and a decrease in other types (flat, tapered, pointed). The Ring 2 sample has a higher proportion of flat-round and round lips and a lower proportion of other types relative to the Ring 1 sample (Table 5-26), but the difference is not significant ($X^2=0.20$, $df=1$, $p=0.65$). It should be noted that there were significant difference in the proportion of lip shape types in midden versus dump contexts, but this did not influence the village comparison.

TSA –3: Jar Rim/Neck Surface Treatment

Riggs (1998:262) found an increase over time in smoothed upper vessel (rim/neck) jar surface treatment and a decrease in cordmarked-smoothed and tooled-smoothed surface treatments. In this study jar neck and rim surface treatment was coded separately. The Ring 2 sample has a relatively lower proportion of smoothed necks and rims, and a high proportion of cordmarked-smoothed necks and rims (Tables 5-19 and 5-20). The relatively low proportion of tooled-smoothing in the Ring 2 sample is somewhat contradictory, but its frequency in both villages is so low this difference cannot be evaluated statistically. The difference in the proportion of smoothing relative to all other types is moderately significant for rims ($X^2=2.09$, $df=1$, $p=0.15$), and not very
significant for necks ($X^2=0.90$, df=1, $p=0.28$). Comparison of other proportions was not significant ($p>0.30$).

TSA – 4: Jar Lip Decoration

Riggs (1998:263) found an increase in lip decoration, particularly notching, to be an important indicator of relatively later Madisonville Series assemblages. The Ring 2 sample has a lower proportion of notched jar lips (Table 5-29), but the difference is not significant ($X^2=0.35$, df=1, $p=0.56$).

TSA – 5: Jar Lip Surface Treatment

Riggs (1998:262) found an increase in the proportion of plain/smoothed jar lips over time. The Ring 2 sample exhibited 100% plain/smoothed lips compared to 99.4% in Ring 1. While technically the Ring 2 sample exhibits a relatively later distribution, the difference is less than 1%.

**Evaluation of Hardin Samples Based on Riggs’s TSA’s**

Comparison of the villages based on Riggs’s five most temporally sensitive attributes did not convincingly establish a difference. The Ring 2 sample appeared to be relatively later based on three of the attributes (TSA-1, TSA-2, TSA-5), and Ring 1 later based on the other three attributes (TSA-3a, TSA-3b, TSA-4). The only variable that exhibited moderate statistical significance was from Ring 2 (TSA-1, $p<0.10$). One variable from Ring 1 exhibited very limited significance (TSA-3b, $p=0.14$). However, TSA-3b (jar rim surface treatment) is a somewhat ambiguous temporal indicator since
plain surface treatment decreases over time in some areas of West Virginia (Table 5-3 and 5-4). This would mean that the only attribute with a statistically significant difference suggests Ring 2 represents a later occupation. Additional attribute comparisons are made below.

**Other Chronologically Sensitive Attributes**

A total of 10 additional temporally sensitive attributes were explored (CS1 to CS10, Table 5-34). The temporal sensitivity of these attributes has not been established by the same statistical methods, but a temporal trend in their distribution has been consistently observed among a greater sample of sites (see above, type descriptions).

**CS1 - Metric Attributes – Jar Orifice Diameter**

Data from previous research indicates the average jar orifice diameter decreases over time through the Late Fort Ancient Period (see above). Table 5-25 indicates that Ring 1 has somewhat smaller average orifice diameters, but this difference is not at all significant (t=0.99, df=234, p >0.2). To assess the relationship between rim diameter and thickness I use a ratio of thickness/diameter was calculated (Table 5-25). This ratio is smaller for Ring 1 indicating that not only is the average jar orifice slightly smaller but also that rims are thinner relative to orifice diameter.

**CS2 - Vessel Morphology – Vessel Forms**

Previous research indicates that later Madisonville Series assemblages tend to have fewer pans relative to bowls (see Tables 5-1 and 5-2). Table 5-15 indicates that
regardless of context the percentage of pans is lower in the Ring 1 assemblage. While bowls and pans are equally likely to occur in Ring 2, bowls outnumber pans by 1.6 to 1 in the Ring 1 sample. This difference is very significant ($X^2=4.37$, df=1, $p=0.04$).

CS3 - Surface Treatment - Grooved Paddled

Previous research indicates Madisonville and other Grooved Paddled types occur exclusively in late Late Fort Ancient (protohistoric) components. This surface treatment exhibited a very low frequency in both village samples in (Ring 2: n=6; Ring 1: n=3). Its relative proportion cannot be quantified since it occurred primarily on body sherds, which were not analyzed for surface treatment. Even if a complete analysis of body sherds had been conducted, the frequency of this surface treatment is so low it would not result in a meaningful quantitative comparison.

CS4 - Surface Treatment – Cordage Twist

Patterns of cordmark twist direction are stable through time outside of the main trench of the Ohio River. Z-twist predominates in West Virginia, while S-Twist predominates in central Kentucky. To contrast, twist direction changes through time at sites located near the Ohio River, (either in or adjacent to the Ohio River floodplain), and at sites located in the lower reaches of its tributaries (see Tables 5-1 and 5-2; Henderson and Turnbow 1992). In these areas before A.D. 1400 Z-Twist predominates, from 1400-1550 S-Twist predominates, and after 1550 Z-Twist once again predominates. At the Hardin site Z-Twist predominates in both assemblages, but more so in the Ring 2 sample. The difference between the two village samples is moderately significant ($X^2=2.34$, df=1,
p=0.13), though we cannot be very confident (87%) this difference is not due to the vagaries of sampling.

CS5 - Decoration – Type of Rim Band

Available data indicate rim folds increase through time at the expense of rim strips (see above). Thus it is expected that later Madisonville Series assemblages will have a relatively higher proportion of rim folds than rim strips. Table 5-27 indicates the Ring 1 sample has a slightly higher proportion of folds to strips, but this difference is not significant at all ($X^2=0.07$, df=1, p=0.79).

CS6 - Decoration – Type (Jar)

Several studies, including Riggs (1998) indicate the frequency of lip notching increases through time at the expense of all other types of decoration. Neck decoration in the form of incising or trailing appears to drop out almost completely in Riggs’ later sample, though some very late sites in central Kentucky appear to exhibit at least some incising or trailing (see above). Thus, later Madisonville Series assemblages should be expected to have a relatively higher ratio of lip notching to incised / trailed designs on necks. Table 5-29 indicates the Ring 1 sample has a slightly higher proportion of lip notching relative to neck incising/trailing, but this difference is not at all significant ($X^2=0.58$, df=1, p=0.45). The only other apparent difference between the assemblages is the proportion of incising on necks, which is almost absent in the Ring 2 sample. The proportion of neck incising relative to other types of decoration is the only type that
exhibits a significant difference between the samples, with Ring 1 exhibiting relatively more incising ($X^2=4.03, df=1, p=0.045$).

CS7 - Appendages – Animal Effigy Appendages

Animal effigy appendages tend to derive from late Late Fort Ancient components (see above). At least 6 examples of animal effigy appendages were observed in the Hardin Site WPA collections by the author, three of which are described by Hanson (1966:95). One (Hanson 1966: Figure 41B) compares well to examples from Madisonville (Griffin 1943:Plate LXIX-2) and Feurt (Griffin 1943:Plate XXIII-19) where the effigy takes the form a handle with the mid-section of the body rising off of the vessel. Examples where the entire animal is applied to the vessel body are also present (Hanson 1966:Figure 41C-D). Only one example can be associated with each ring.

CS8 - Appendages – Cut-Out Strap Handles

Cut-out strap handles have only been recovered from a few very late Late Fort Ancient components (see above). The two examples of cut-out strap handles that could be confidently associated with a village area were both from Ring 1.

CS9 - Appendages – Strap Handle Frequency

Griffin and others have observed that strap handle frequency increases through the Late Fort Ancient Period because jars shift from one set of opposing handles to two sets (see above). The ratio of strap handles to jar rims in the Ring 2 sample (0.60 :1.00) is higher than that for Ring 1 (0.46 :1.00).
CS10 - Specialized Forms - Cylinder / Pestle Objects

A variety of cylindrical shaped objects with expanding bases have been found at the Hardin site, and compare well to specimens recovered at a handful of other protohistoric Fort Ancient sites (see above). Type 1 cylinders (slightly expanding bases) and Type 2 cylinders (dramatically expanding bases) have been identified in both village assemblages. Combining both types, Ring 2 has 16 examples, Ring 1 has 15 examples, and the overlap area has 24 examples. When these frequencies are calculated against sample size (Ring 1=16/771, 2.1%; Ring 1=15/912, 1.6%), the Ring 2 sample has a slightly higher proportion, but the difference is not at all significant (X²=0.43, df=1, p=0.51). For specimens with measurable shafts and bases, Ring 1 had relatively more Type 1 cylinders (which may represent pan supports) while Ring 2 had relatively more Type 2 cylinders (which may represent pedestaled vessel bases). Since both types are diagnostic to the protohistoric, there does not appear to be any chronological significance to this observation.

Summary and Discussion

A total of 16 temporally sensitive attributes have been identified and compared between the village samples. Ten were identified here, 6 were identified by Riggs (1998, above). Of these, only 12 had sample sizes sufficient for statistical analysis (Table 5-34). Analysis consisted of identifying a significant difference in proportion (Chi-square) or mean (T-test). One attribute exhibited a very significant difference (CS6 – type of jar decoration; p<0.05) and one exhibited a moderate difference (TSA1 – jar rim orientation;
p<0.1) between the two village samples. These both indicated a later occupation in Ring 2. Four attributes exhibited a difference of limited significance (p<0.15). Of these, an equal number suggested a later occupation in each village. The remaining 6 attributes exhibited no statistically significant difference.

Five of the items compared (not all by statistical evaluation) have only been recovered from protohistoric components: the pan form Todd Plain, var. Augusta, cylindrical objects, grooved paddled surface treatment, animal effigy appendages, and cut-out strap handles. Of these an equal number occur on each village. Even though ceramic evidence at hand suggests a later occupation in Ring 2 it is notable that less than 10% of the 12 attributes compared exhibited a significant difference. The identification of exclusively protohistoric diagnostics in both village samples is also notable. These findings may suggest the components were somewhat close in time and both from the protohistoric period (A.D. 1550-1680). If Fort Ancient villages were abandoned only a decade or two before reoccupation the two village samples could easily relate to two entirely separate protohistoric occupations (see Raymer 2008; 2010).

Alternatively, it is also possible the locality was not abandoned and that the village moved less than a hundred meters to the north. Such a scenario has been documented for Amazonian horticulturalists (Heckenberger 2005:Figure 9.4). While this scenario falls within the parameters of a village micro-move (<1km-10km; Henderson 1998:Chapter 6), relocation of distances less than 1km does not seem likely given the technological limitations and requirements of swidden horticulturalists. As indicated by previous Fort Ancient research and comparison to ethnographic analogues, it is expected that deforestation and depletion of soil fertility within a settlement catchment typically
requires a community to move at least several kilometers (Henderson 1998; Raymer 2008, 2010). In fact, Henderson’s study of 19 middle Fort Ancient village components found only one example where a village moved less than 2.5km (1998:399). These alternative scenarios will be returned to in subsequent chapters.

Conclusions

Statistical comparison of temporally sensitive attributes found that only 2 of 12 exhibit moderate or very significant differences between the villages. Both indicated the Ring 2 sample represents a later occupation. While not conclusive in any way, the weak arrow pointing toward a later occupation in the Ring 2 area is strengthened by the fact that such a trend was identified even though there appears to be some mixing from a Middle Fort Ancient component in that part of the site (see Chapter 4).

A somewhat unexpected but important result of this ceramic comparison is the identification of protohistoric ceramic diagnostics in Ring 1. In fact, although the statistical comparison clearly indicates Ring 2 represents a later occupation, the frequency and diversity of 16\textsuperscript{th}-17\textsuperscript{th} century ceramic diagnostics (e.g., lizard effigy handles, cylinders, cut-out strap handles) recovered from Ring 1 opens up the possibility that both villages were protohistoric. This is an unexpected finding because the radiocarbon dates acquired prior to the ceramic analysis indicated a 15\textsuperscript{th} century date for Ring 1. In the next chapter, the relative chronological position of Rings 1 and 2 indicated by the ceramic analysis are evaluated by comparison to other relative chronological markers and to a series of radiocarbon dates.

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Table 5-1: Madisonville Series: surface treatment documented at early Late Fort Ancient components (A.D. 1400-1550).

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<th>EARLY LATE FORT ANCIENT COMPONENTS</th>
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* These are the largest two assemblages and both are Woodside Phase villages (eastern Fort Ancient).
Table 5-1 (continued):

References for Table 5-1
1. Turnbow and Henderson 1992: Table A-2; see also Turnbow 1992b
2. Henderson and Pollack 1996: Table 1
3. Henderson 1993
4. Turnbow and Henderson 1992: Table A-2; see also Pollack and Jobe 1992
5. Spencer 2006:20-23, Table 14
6. Dunnell et al. 1971; note that an earlier report (Hanson et al. 1964: Table 8) gives a very different distribution
7. Moxley and Bloemaker 1985; Pullin 2008:802
8. Spencer 2006
Table 5-2: Madisonville Series: surface treatment documented at late Late Fort Ancient components (A.D. 1550-1680).

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Table 5-2 (continued):

References for Table 4-2
1. Hale 1981
2. Turnbow and Henderson 1992: Table A-2
3. Turnbow and Henderson 1992: Table A-2
4. Glowacki, Turnbow, and Fields 1993
5. Spencer 2006:32-37, Table 22
6. Pollack and Schlarb 2009
7. Hemmings 1977: 6-17 notes that plain increases over time in seriation
8. Shaffer 2014: Table 2
9. Spencer 2006:27, Table 16
10. Spencer 2006: 29, Table 19
11. Spencer 2006:39, Table 25
12. Spencer 2006:42-46, Table 28
Table 5-3: Madisonville Series: vessel form documented at early Late Fort Ancient components (A.D. 1400-1550). Table adapted from Turnbow and Henderson 1992: Table X-5; Pollack et al. 2002.

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<td>31.1</td>
<td>5</td>
<td>11.1</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>496</td>
<td>70.0</td>
<td>86</td>
<td>12.1</td>
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<td>17.9</td>
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</table>
Table 5-4: Madisonville Series: vessel form documented at late Late Fort Ancient components (A.D. 1550-1680).

<table>
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<tr>
<th>LATE LATE FORT ANCIENT COMPONENTS</th>
<th>VESSEL FORMS</th>
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<th></th>
<th>TOTAL</th>
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<td>SITE NAME</td>
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<td>%</td>
<td>BOWLS</td>
<td>%</td>
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<tr>
<td>1</td>
<td>Augusta (1981)</td>
<td>260</td>
<td>66.8</td>
<td>97</td>
<td>24.9</td>
</tr>
<tr>
<td>2</td>
<td>Augusta</td>
<td>37</td>
<td>50.7</td>
<td>30</td>
<td>41.1</td>
</tr>
<tr>
<td>3</td>
<td>Larkin</td>
<td>43</td>
<td>63.3</td>
<td>15</td>
<td>22.1</td>
</tr>
<tr>
<td>4</td>
<td>Thompson</td>
<td>5</td>
<td>55.6</td>
<td>4</td>
<td>44.4</td>
</tr>
<tr>
<td>5</td>
<td>Madisonville (1)</td>
<td>124</td>
<td>85.1</td>
<td>17</td>
<td>11.8</td>
</tr>
<tr>
<td>6</td>
<td>Madisonville (2)</td>
<td>151</td>
<td>93.8</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Buffalo</td>
<td>1238</td>
<td>62.5</td>
<td>657</td>
<td>33.2</td>
</tr>
<tr>
<td>8</td>
<td>Howard</td>
<td>29</td>
<td>96.6</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>9</td>
<td>Neale's Landing</td>
<td>30</td>
<td>90.9</td>
<td>3</td>
<td>9.1</td>
</tr>
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<td>ALL SITES</td>
<td>1917</td>
<td>66.4</td>
<td>832</td>
<td>28.8</td>
</tr>
</tbody>
</table>
Table 5-4 (continued):

References for Table 5-4
1. Hale 1981
2. Pollack et al. 2002
3. Pollack et al. 2002
4. Turnbow and Henderson 1992: Table A-2
5. Glowacki, Turnbow, and Fields 1993; see also Griffin 1943:131-132
6. Krieg and Purtill 2013
7. LaMarre 1999
8. Pollack and Schlarb 2009
Figure 5-1: Fort Ancient vessel form profiles and their temporal distribution. Adapted from Turnbow and Henderson 1987, 1992: Figure X-1.
Figure 5-2: Jar rim form and rim orientation scheme. Illustration style (but not form or orientation scheme) adapted from Turnbow and Henderson 1992: Figure A-3.

<table>
<thead>
<tr>
<th>RIM FORMS</th>
<th>DIRECT FORMS</th>
<th>EXCURVATE FORMS</th>
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</thead>
<tbody>
<tr>
<td>IN-SLANTING</td>
<td>VERTICAL</td>
<td>OUT-SLANTING</td>
</tr>
<tr>
<td>SLIGHTLY FLARED</td>
<td>VERY FLARED</td>
<td></td>
</tr>
</tbody>
</table>
Table 5-5: All pottery in WPA collections from Hardin Site

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<thead>
<tr>
<th>SHERD TYPE</th>
<th>TEMPER</th>
<th>SHELL</th>
<th>ROCK*</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BODY</td>
<td></td>
<td>41980</td>
<td>164</td>
<td>42144</td>
</tr>
<tr>
<td>RIM</td>
<td></td>
<td>6435</td>
<td>12</td>
<td>6447</td>
</tr>
<tr>
<td>APPENDAGE</td>
<td></td>
<td>2182</td>
<td>1</td>
<td>2183</td>
</tr>
<tr>
<td>DECORATED**</td>
<td></td>
<td>[683]</td>
<td>[2]</td>
<td>[685]</td>
</tr>
<tr>
<td>GROUND/SHAPED**</td>
<td></td>
<td>[464]</td>
<td>[0]</td>
<td>[464]</td>
</tr>
<tr>
<td>DISK (BODY)</td>
<td></td>
<td>365</td>
<td>0</td>
<td>365</td>
</tr>
<tr>
<td>&quot;PESTLE“/CYLINDER</td>
<td></td>
<td>47</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td>41</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>52197</td>
<td>179</td>
<td>52376</td>
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</table>

*The vast majority are limestone tempered; but this category also includes an unquantified proportion of sherds with chert, sandstone, or grog temper

**ALREADY COUNTED IN RIM/BODY/APPENDAGE
Table 5-6: All pottery from 2011-2013 collections from Hardin Site

<table>
<thead>
<tr>
<th>SHERD TYPE</th>
<th>TEMPER</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SHELL</td>
<td>ROCK*</td>
<td>TOTAL</td>
</tr>
<tr>
<td>BODY</td>
<td>22479</td>
<td>1401</td>
<td>23880</td>
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<tr>
<td>RIM</td>
<td>697</td>
<td>25</td>
<td>722</td>
</tr>
<tr>
<td>APPENDAGE</td>
<td>165</td>
<td>1</td>
<td>166</td>
</tr>
<tr>
<td>DECORATED**</td>
<td>[28]</td>
<td>[19]</td>
<td>[47]</td>
</tr>
<tr>
<td>GROUND/SHAPED</td>
<td>46</td>
<td>0</td>
<td>46</td>
</tr>
<tr>
<td>DISK (BODY)**</td>
<td>[12]</td>
<td>[0]</td>
<td>[12]</td>
</tr>
<tr>
<td>&quot;PESTLE&quot;</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23429</td>
<td>1428</td>
<td>24857</td>
</tr>
</tbody>
</table>

*The vast majority are limestone tempered; but this category also includes an unquantified proportion of sherds with chert, sandstone, or grog temper

**ALREADY COUNTED IN RIM/BODY/APPENDAGE
### Table 5-7: All shell tempered pottery from Hardin Site

<table>
<thead>
<tr>
<th>SHERD TYPE</th>
<th>1939 COLLECTION</th>
<th>2013 COLLECTION</th>
<th>COMBINED TOTAL</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>BODY</td>
<td>41980</td>
<td>80.4</td>
<td>22479</td>
</tr>
<tr>
<td>RIM</td>
<td>6435</td>
<td>12.3</td>
<td>697</td>
</tr>
<tr>
<td>APPENDAGE</td>
<td>2182</td>
<td>4.2</td>
<td>165</td>
</tr>
<tr>
<td>DECORATED*</td>
<td>[683]</td>
<td>1.3</td>
<td>[28]</td>
</tr>
<tr>
<td>GROUND/SHAPED</td>
<td>464</td>
<td>0.1</td>
<td>46</td>
</tr>
<tr>
<td>SHERD DISK *</td>
<td>[365]</td>
<td>0.1</td>
<td>[12]</td>
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<tr>
<td>&quot;PESTLE&quot;/CYLINDER</td>
<td>47</td>
<td>0</td>
<td>4</td>
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<tr>
<td>OTHER / MISC.</td>
<td>41</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>52197</td>
<td>100</td>
<td>23429</td>
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</table>
Table 5-8: All rock/other* tempered pottery from Hardin Site

<table>
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<th>SHERD TYPE</th>
<th>1939 COLLECTION</th>
<th>2013 COLLECTION</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>BODY</td>
<td>164</td>
<td>91.6</td>
<td>1401</td>
</tr>
<tr>
<td>RIM</td>
<td>12</td>
<td>6.7</td>
<td>25</td>
</tr>
<tr>
<td>APPENDAGE</td>
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<td>0.06</td>
<td>1</td>
</tr>
<tr>
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<td>2</td>
<td>1.1</td>
<td>19</td>
</tr>
<tr>
<td>OTHER / MISC.</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>179</td>
<td></td>
<td>1428</td>
</tr>
</tbody>
</table>

*The vast majority are limestone tempered; but this category also includes an unquantified proportion of sherds with chert, sandstone, or grog temper.

**ALREADY COUNTED IN RIM/BODY/APPENDAGE
Table 5-9: Total ceramic sample selected for analysis.

<table>
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<th>SHERD TYPE</th>
<th>WPA sub-sample</th>
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<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>BODY</td>
<td>179</td>
<td>16.3</td>
<td>98</td>
</tr>
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<td>RIM</td>
<td>636</td>
<td>57.9</td>
<td>354</td>
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<td>APPENDAGE</td>
<td>214</td>
<td>19.5</td>
<td>120</td>
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<tr>
<td>GROUND/SHAPE**</td>
<td>[52]</td>
<td>0</td>
<td>[28]</td>
</tr>
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<td>SHERD DISK**</td>
<td>[49]</td>
<td>0</td>
<td>[16]</td>
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<td>&quot;PEDESTAL&quot; FRAG.</td>
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<td>4.3</td>
<td>4</td>
</tr>
<tr>
<td>OTHER / MISC.</td>
<td>22</td>
<td>2</td>
<td>15</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>1098</td>
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<td>591</td>
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</table>

*already counted in rim/body/appendage
Table 5-10: Distribution of vessel forms by ring location and collection origin (1939 or 2013).

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<tr>
<th></th>
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<th>1939 COLLECTIONS</th>
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<td></td>
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<td>BOWLS</td>
<td>PANS</td>
<td></td>
<td></td>
<td>JARS</td>
<td>BOWLS</td>
<td>PANS</td>
<td></td>
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<td>n</td>
<td>% (of row total)</td>
<td>n</td>
<td>% (of row total)</td>
<td>n</td>
<td>% (of row total)</td>
<td>n</td>
<td>% (of row total)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RING 2</td>
<td>82</td>
<td>71.3</td>
<td>19</td>
<td>16.5</td>
<td>14</td>
<td>12.2</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>51</td>
<td>81</td>
<td>11</td>
<td>17.5</td>
<td>1</td>
<td>1.6</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>133</td>
<td>74.7</td>
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<td>16.9</td>
<td>15</td>
<td>8.4</td>
<td>178</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td>RING 2</td>
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<td>29</td>
<td>16.3</td>
<td>35</td>
<td>19.7</td>
<td>178</td>
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<td></td>
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<td>268</td>
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<td>15.8</td>
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</table>
Table 5-11: Average rim diameter for jars by ring and collection origin.

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<th>VILLAGE</th>
<th>1939 AVG DIA</th>
<th>2013 AVG DIA</th>
<th>DIFFERENCE IN AVG DIA</th>
<th>1939 &amp; 2013 COMBINED</th>
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</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>23.8</td>
<td>19.9</td>
<td>16.4%</td>
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<tr>
<td>RING 1</td>
<td>22.5</td>
<td>16.9</td>
<td>25.0%</td>
<td>22.1</td>
</tr>
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</table>
Table 5-12: Jar rim lip shape by ring and collection origin.

<table>
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<tr>
<th>Year/Village</th>
<th>FLAT</th>
<th>FLAT-ROUND</th>
<th>ROUND</th>
<th>TAPERED TO ROUND LIP</th>
<th>POINTED</th>
<th>BEVELED TO INT OR EXT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1939 RING 2</td>
<td>1 n</td>
<td>23 21.1</td>
<td>72 66.1</td>
<td>6 5.5</td>
<td>2 1.8</td>
<td>5 4.6</td>
<td>109</td>
</tr>
<tr>
<td>1939 RING 1</td>
<td>4 1.6</td>
<td>42 17</td>
<td>181 73.3</td>
<td>2 0.8</td>
<td>0 0</td>
<td>18 7.3</td>
<td>247</td>
</tr>
<tr>
<td>2013 RING 2</td>
<td>2 2.9</td>
<td>10 14.4</td>
<td>54 78.3</td>
<td>0 0</td>
<td>0 0</td>
<td>3 4.3</td>
<td>69</td>
</tr>
<tr>
<td>2013 RING 1</td>
<td>2 4.2</td>
<td>7 14.6</td>
<td>37 77.1</td>
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<td>0 0</td>
<td>2 4.1</td>
<td>48</td>
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</table>
Table 5-13: Distribution of jar orientation* by ring location and collection origin (1939 or 2013).

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<tr>
<th></th>
<th>1939</th>
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<th></th>
<th></th>
<th></th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VERTICAL</td>
<td>IN-SLANTING</td>
<td>SLIGHTLY</td>
<td>VERY</td>
<td>OUT-SLANTING</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>RING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RING 2</td>
<td>10</td>
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<td>3</td>
<td>3</td>
<td>40</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>RING 1</td>
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<td>7</td>
<td>2.9</td>
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<td>41.7</td>
<td>88</td>
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</table>

<table>
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<tr>
<th></th>
<th>2013</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VERTICAL</td>
<td>IN-SLANTING</td>
<td>SLIGHT FLARE</td>
<td>VERY FLARE</td>
<td>OUT-SLANT</td>
<td>TOTAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>RING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RING 2</td>
<td>8</td>
<td>13.8</td>
<td>2</td>
<td>3.5</td>
<td>19</td>
<td>32.8</td>
<td>27</td>
</tr>
<tr>
<td>RING 1</td>
<td>3</td>
<td>7.3</td>
<td>1</td>
<td>2.4</td>
<td>15</td>
<td>36.7</td>
<td>17</td>
</tr>
</tbody>
</table>

*note that the slightly flared and very flared orientations are both excurving rim forms, while the vertical, out-slanting, and in-slanting orientations are all direct rim forms. See Chapter 5 for more detail.
Table 5-14: Jar rim profile shape by ring location and collection.

<table>
<thead>
<tr>
<th>Year</th>
<th>DIRECT</th>
<th>INTERIOR/EXTERIOR THICKENED</th>
<th>INTERIOR THICKENED</th>
<th>EXTERIOR THICKENED</th>
<th>RIM BAND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>2013</td>
<td>RING 2</td>
<td>39 65</td>
<td>2</td>
<td>3.3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>RING 1</td>
<td>32 82.1</td>
<td>4</td>
<td>10.3</td>
<td>0</td>
</tr>
<tr>
<td>1939</td>
<td>RING 2</td>
<td>71 68.3</td>
<td>10</td>
<td>9.6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>RING 1</td>
<td>185 73.7</td>
<td>13</td>
<td>5.2</td>
<td>4</td>
</tr>
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</table>
Table 5-15: Madisonville Series vessel forms by ring location and context type.

<table>
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<th>VILLAGE</th>
<th>CONTEXT TYPE</th>
<th>JAR</th>
<th>BOWL</th>
<th>PAN</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>RING 2</td>
<td>MIDDEN</td>
<td>144</td>
<td>66.7</td>
<td>39</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>DUMP</td>
<td>52</td>
<td>67.5</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
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<td>ALL</td>
<td>196</td>
<td>66.9</td>
<td>48</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIDDEN</td>
<td>257</td>
<td>66.1</td>
<td>82</td>
<td>21.1</td>
</tr>
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<td>DUMP</td>
<td>61</td>
<td>69.3</td>
<td>17</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>ALL</td>
<td>318</td>
<td>66.7</td>
<td>99</td>
<td>20.8</td>
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</tbody>
</table>
Table 5-16: Distribution of jar rim orientation by ring location and context type (1939 and 2013 collections).

<table>
<thead>
<tr>
<th>RING 2</th>
<th>DIRECT</th>
<th>IN-SLANTING</th>
<th>IN-CURVING</th>
<th>SLIGHTLY-FLARED</th>
<th>VERY-FLARED</th>
<th>OUTSLANTING</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTEXT TYPE</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>15</td>
<td>12.8</td>
<td>4</td>
<td>3.4</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>DUMP</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>2.3</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>ALL</td>
<td>18</td>
<td>11.3</td>
<td>5</td>
<td>3.1</td>
<td>0</td>
<td>0</td>
<td>59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RING 1</th>
<th>DIRECT</th>
<th>IN-SLANTING</th>
<th>IN-CURVING</th>
<th>SLIGHTLY-FLARED</th>
<th>VERY-FLARED</th>
<th>OUTSLANTING</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTEXT TYPE</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>34</td>
<td>14.5</td>
<td>6</td>
<td>2.6</td>
<td>0</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>DUMP</td>
<td>9</td>
<td>18.3</td>
<td>2</td>
<td>4.1</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>ALL</td>
<td>43</td>
<td>15.1</td>
<td>8</td>
<td>2.8</td>
<td>0</td>
<td>0</td>
<td>116</td>
</tr>
</tbody>
</table>
Table 5-17: Distribution of ceramic series by ring location.

<table>
<thead>
<tr>
<th>VILLAGE</th>
<th>MADISONVILLE SERIES</th>
<th>TOIDD SERIES</th>
<th>FOX FARM SERIES</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>RING 2</td>
<td>728</td>
<td>54.7</td>
<td>49</td>
<td>3.7</td>
</tr>
<tr>
<td>RING 1</td>
<td>849</td>
<td>91.7</td>
<td>63</td>
<td>6.8</td>
</tr>
<tr>
<td>TOTALS</td>
<td>1577</td>
<td>69.9</td>
<td>112</td>
<td>5</td>
</tr>
</tbody>
</table>

*A total of 7 sherds consistent with the McAfee Series (Turnbow and Henderson 1992) are reflected in the total, but were not included in the final sample.
Table 5-18: Distribution of ceramic series by ring location and context type.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>MADISONVILLE SERIES</th>
<th>TODD SERIES</th>
<th>MCAFEE SERIES</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUMP</td>
<td>174</td>
<td>16</td>
<td>0</td>
<td>190</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>547</td>
<td>33</td>
<td>1</td>
<td>581</td>
</tr>
<tr>
<td>ALL</td>
<td>721</td>
<td>50</td>
<td>1</td>
<td>771</td>
</tr>
<tr>
<td>DUMP</td>
<td>133</td>
<td>10</td>
<td>1</td>
<td>144</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>711</td>
<td>53</td>
<td>4</td>
<td>768</td>
</tr>
<tr>
<td>ALL</td>
<td>844</td>
<td>68</td>
<td>5</td>
<td>912</td>
</tr>
</tbody>
</table>
Table 5-19: Madisonville Series jar rims: surface treatment

<table>
<thead>
<tr>
<th>VILLAGE</th>
<th>CONTEXT TYPE</th>
<th>PLAIN n</th>
<th>PLAIN %</th>
<th>CORDMARKED * n</th>
<th>CORDMARKED * %</th>
<th>TOOLED-SMooth n</th>
<th>TOOLED-SMooth %</th>
<th>IMPRESSED n</th>
<th>IMPRESSED %</th>
<th>TOTAL n</th>
<th>TOTAL %</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>DUMP</td>
<td>32</td>
<td>68.1</td>
<td>12</td>
<td>25.5</td>
<td>1</td>
<td>2.1</td>
<td>2</td>
<td>4.3</td>
<td>47</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td>MIDDEN</td>
<td>95</td>
<td>73.1</td>
<td>28</td>
<td>21.5</td>
<td>1</td>
<td>0.8</td>
<td>3</td>
<td>2.3</td>
<td>130</td>
<td>73.4</td>
</tr>
<tr>
<td></td>
<td>ALL</td>
<td>127</td>
<td>71.8</td>
<td>40</td>
<td>22.6</td>
<td>2</td>
<td>1.1</td>
<td>5</td>
<td>2.8</td>
<td>177</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RING 1</td>
<td>DUMP</td>
<td>47</td>
<td>81</td>
<td>11</td>
<td>19</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>58</td>
<td>19.1</td>
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<tr>
<td></td>
<td>MIDDEN</td>
<td>189</td>
<td>76.8</td>
<td>50</td>
<td>20.3</td>
<td>6</td>
<td>2.4</td>
<td>1</td>
<td>0.4</td>
<td>246</td>
<td>80.9</td>
</tr>
<tr>
<td></td>
<td>ALL</td>
<td>236</td>
<td>77.6</td>
<td>61</td>
<td>20.1</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>0.3</td>
<td>304</td>
<td></td>
</tr>
</tbody>
</table>

*All cordmarked sherds exhibit some level of smoothing. Completely unsmoothed cordmarked sherds occurred almost exclusively in Middle Fort Ancient Contexts.*
All cordmarked sherds exhibit some level of smoothing. Completely unsmoothed cordmarked sherds occurred almost exclusively in Middle Fort Ancient Contexts.

| CONTEXT TYPE | RING 2 | | | RING 1 | | |
|----------------|---------|---------|---------|---------|---------|
|                | PLAIN   | CORDMARKED* | TOOLED-SMooth | IMPRESSED | TOTAL |
|                | n  | %  | n  | %  | n  | %  | n  | %  | n  | %  |
| DUMP           | 20 | 47.6 | 17 | 40.5 | 1 | 2.4 | 4 | 9.5 | 42 | 25.9 |
| MIDDEN         | 83 | 69.2 | 34 | 28.3 | 0 | 0.0 | 3 | 2.5 | 120 | 74.1 |
| ALL            | 103 | 63.6 | 51 | 31.5 | 1 | 0.6 | 7 | 4.3 | 162 | |

| CONTEXT TYPE | RING 2 | | | RING 1 | | |
|----------------|---------|---------|---------|---------|---------|
|                | PLAIN   | CORDMARKED* | TOOLED-SMooth | IMPRESSED | TOTAL |
|                | n  | %  | n  | %  | n  | %  | n  | %  | n  | %  |
| DUMP           | 41 | 68.3 | 19 | 31.7 | 0 | 0.0 | 0 | 0.0 | 60 | 18.6 |
| MIDDEN         | 195 | 74.4 | 63 | 24.1 | 3 | 1.1 | 1 | 0.4 | 262 | 81.4 |
| ALL            | 236 | 73.3 | 82 | 25.5 | 3 | 0.9 | 1 | 0.3 | 322 | |

Table 5-20: Madisonville Series jar necks: surface treatment.

*All cordmarked sherds exhibit some level of smoothing. Completely unsmoothed cordmarked sherds occurred almost exclusively in Middle Fort Ancient Contexts.
Table 5-21: Madisonville Series appendages: surface treatment.

<table>
<thead>
<tr>
<th>VILLAGE</th>
<th>PLAIN</th>
<th>%</th>
<th>CM</th>
<th>%</th>
<th>IMPRESSED</th>
<th>%</th>
<th>TOTAL</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>54</td>
<td>65.9</td>
<td>28</td>
<td>34.1</td>
<td>0</td>
<td>0</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>RING 1</td>
<td>84</td>
<td>73.1</td>
<td>29</td>
<td>25.2</td>
<td>2</td>
<td>1.7</td>
<td>115</td>
<td></td>
</tr>
</tbody>
</table>

*All cordmarked sherds exhibit some level of smoothing. Completely unsmoothed cordmarked sherds occurred almost exclusively in Middle Fort Ancient Contexts.*
Table 5-22: Madisonville Series: cordmarking twist direction (all vessel forms).

<table>
<thead>
<tr>
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<th>Z-TWIST</th>
<th>S-TWIST</th>
<th>Z- &amp; S- TWIST</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>RING 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>41</td>
<td>70.7</td>
<td>16</td>
<td>27.6</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>66</td>
<td>73.3</td>
<td>23</td>
<td>25.6</td>
</tr>
<tr>
<td>ALL</td>
<td>107</td>
<td>72.3</td>
<td>39</td>
<td>26.4</td>
</tr>
<tr>
<td><strong>RING 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>30</td>
<td>69.8</td>
<td>11</td>
<td>25.6</td>
</tr>
<tr>
<td>MIDDEN</td>
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<td>62.8</td>
<td>66</td>
<td>33.7</td>
</tr>
<tr>
<td>ALL</td>
<td>153</td>
<td>64</td>
<td>77</td>
<td>32.2</td>
</tr>
<tr>
<td>RING</td>
<td>CONTEXT</td>
<td>BLACK</td>
<td>%</td>
<td>GRAY</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>-------</td>
<td>----</td>
<td>------</td>
</tr>
<tr>
<td>RING 2</td>
<td>ALL</td>
<td>25</td>
<td>6</td>
<td>120</td>
</tr>
<tr>
<td>RING 1</td>
<td>ALL</td>
<td>26</td>
<td>5</td>
<td>121</td>
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</tbody>
</table>

Table 5-23: Madisonville Series: exterior surface color.
<table>
<thead>
<tr>
<th>RING</th>
<th>COARSE</th>
<th>MEDIUM</th>
<th>FINE</th>
<th>VERY FINE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>1</td>
<td>322</td>
<td>126</td>
<td>1</td>
<td>450</td>
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<tr>
<td>RING 1</td>
<td>1</td>
<td>483</td>
<td>138</td>
<td>3</td>
<td>627</td>
</tr>
</tbody>
</table>

Table 5-24: Madisonville Series: particle size of crushed shell temper
Table 5-25: Madisonville Series: jar neck thickness, rim thickness and rim orifice diameter.

<table>
<thead>
<tr>
<th>RING</th>
<th>NECK THICKNESS</th>
<th>RIM THICKNESS</th>
<th>RIM ORIFICE DIAMETER</th>
<th>RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>AVG</td>
<td>n</td>
<td>AVG</td>
</tr>
<tr>
<td>RING 2</td>
<td>177</td>
<td>6.04</td>
<td>166</td>
<td>6.37</td>
</tr>
<tr>
<td>RING 1</td>
<td>324</td>
<td>5.97</td>
<td>296</td>
<td>6.01</td>
</tr>
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</table>
Table 5-26: Madisonville Series: jar lip shape.

<table>
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<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th>TOTAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FLAT</td>
<td>FLAT-ROUND</td>
<td>ROUND</td>
<td>POINTED</td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>DUMP</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>25</td>
<td>33</td>
<td>68.8</td>
<td>3</td>
<td>6.3</td>
</tr>
<tr>
<td>MIDDEN</td>
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<td>2.3</td>
<td>21</td>
<td>16</td>
<td>100</td>
<td>76.3</td>
<td>7</td>
<td>5.3</td>
</tr>
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<td>ALL</td>
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<td>1.7</td>
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<td>18.4</td>
<td>133</td>
<td>74.3</td>
<td>10</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>RING 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>TOTAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FLAT</td>
<td>FLAT-ROUND</td>
<td>ROUND</td>
<td>POINTED</td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>DUMP</td>
<td>1</td>
<td>1.8</td>
<td>15</td>
<td>26.8</td>
<td>37</td>
<td>66.1</td>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>MIDDEN</td>
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<td>34</td>
<td>14.1</td>
<td>186</td>
<td>77.2</td>
<td>17</td>
<td>7.1</td>
</tr>
<tr>
<td>ALL</td>
<td>5</td>
<td>1.7</td>
<td>49</td>
<td>16.5</td>
<td>223</td>
<td>75.1</td>
<td>20</td>
<td>6.7</td>
</tr>
</tbody>
</table>
Table 5-27: Madisonville Series: jar rim profile shape.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>DIRECT</th>
<th>THICKENED</th>
<th>RIM STRIP</th>
<th>RIM FOLD</th>
<th>TAPERED</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>RING 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>36</td>
<td>78.3</td>
<td>4</td>
<td>8.7</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>74</td>
<td>62.7</td>
<td>16</td>
<td>13.6</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>ALL</td>
<td>110</td>
<td>67.1</td>
<td>20</td>
<td>12.2</td>
<td>9</td>
<td>5.5</td>
</tr>
<tr>
<td>RING 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>41</td>
<td>77.4</td>
<td>4</td>
<td>7.5</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>180</td>
<td>77.9</td>
<td>23</td>
<td>10</td>
<td>8</td>
<td>3.5</td>
</tr>
<tr>
<td>ALL</td>
<td>221</td>
<td>77.8</td>
<td>27</td>
<td>9.5</td>
<td>9</td>
<td>3.2</td>
</tr>
</tbody>
</table>

All percentages sum to 100%.
Table 5-28: Madisonville Series: proportion of decoration by vessel form.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>JAR DECO</th>
<th>% JARS</th>
<th>BOWL DECO</th>
<th>% BOWLS</th>
<th>PAN DECO</th>
<th>% PANS</th>
<th>BODY</th>
<th>APNDG *</th>
<th>MIN. NO DECORATED VESSELS</th>
<th>% OF VILLAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2 DUMP</td>
<td>22</td>
<td>42.3</td>
<td>6</td>
<td>66.7</td>
<td>1</td>
<td>6.3</td>
<td>3</td>
<td>0</td>
<td>30</td>
<td>25.9</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>59</td>
<td>41</td>
<td>22</td>
<td>56.4</td>
<td>2</td>
<td>6.1</td>
<td>8</td>
<td>0</td>
<td>86</td>
<td>74.1</td>
</tr>
<tr>
<td>ALL</td>
<td>81</td>
<td>41.3</td>
<td>28</td>
<td>58.3</td>
<td>3</td>
<td>6.1</td>
<td>10</td>
<td>0</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>RING 1 DUMP</td>
<td>23</td>
<td>37.7</td>
<td>10</td>
<td>58.8</td>
<td>3</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>18.5</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>112</td>
<td>43.6</td>
<td>36</td>
<td>43.9</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>159</td>
<td>81.5</td>
</tr>
<tr>
<td>ALL</td>
<td>135</td>
<td>42.4</td>
<td>46</td>
<td>46.5</td>
<td>5</td>
<td>8.3</td>
<td>4</td>
<td>0</td>
<td>195</td>
<td></td>
</tr>
</tbody>
</table>

*All 8 instances of decoration on appendages consisted of incised lines.

**Totals indicates minimum number of vessels (not instances) with at least one incidence of decoration.
Table 5-29: Madisonville Series: type and frequency of decoration by vessel form.

<table>
<thead>
<tr>
<th>JARS</th>
<th>CORD-MARK*</th>
<th>INCISING</th>
<th>TRAILING</th>
<th>NOTCHING</th>
<th>BURNISHING</th>
<th>CASTELLATION</th>
<th>NODE</th>
<th>RIM FOLD</th>
<th>RIM STRIP</th>
<th>UID</th>
<th>TOTAL</th>
<th>JAR FREQ</th>
<th>% JARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>4</td>
<td>2</td>
<td>17</td>
<td>24*</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>14</td>
<td>10</td>
<td>3</td>
<td>81</td>
<td>196</td>
<td>41.3</td>
</tr>
<tr>
<td>RING 1</td>
<td>4</td>
<td>13</td>
<td>19</td>
<td>54**</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>21</td>
<td>13</td>
<td>2</td>
<td>135</td>
<td>318</td>
<td>42.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BOWLS</th>
<th>CORD-MARK*</th>
<th>INCISING</th>
<th>TRAILING</th>
<th>NOTCHING</th>
<th>BURNISHING</th>
<th>CASTELLATION</th>
<th>NODE</th>
<th>RIM FOLD</th>
<th>RIM STRIP</th>
<th>UID</th>
<th>TOTAL</th>
<th>BOWL FRQ</th>
<th>% BOWLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>10.4</td>
<td>28</td>
<td>48</td>
<td>58.3</td>
</tr>
<tr>
<td>RING 1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>36</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>46</td>
<td>99</td>
<td>46.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PANS</th>
<th>CORD-MARK*</th>
<th>INCISING</th>
<th>TRAILING</th>
<th>NOTCHING</th>
<th>BURNISHING</th>
<th>CASTELLATION</th>
<th>NODE</th>
<th>RIM FOLD</th>
<th>RIM STRIP</th>
<th>UID</th>
<th>TOTAL</th>
<th>PAN FREQ</th>
<th>% PANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>49</td>
<td>8.2</td>
</tr>
<tr>
<td>RING 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>60</td>
<td>8.3</td>
</tr>
</tbody>
</table>

*Chi-square for proportion of lip notching based on 23/196 jars from the Ring 2 sample
**Chi-square for proportion of lip notching based on 43/318 jars from the Ring 1 sample
Table 5-30: Madisonville Series: type and frequency of appendages.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>UID</th>
<th>INDETERMINATE STRAP HANDLE</th>
<th>PARALLEL STRAP HANDLE</th>
<th>TRIANGULAR STRAP HANDLE</th>
<th>CUT-OUT STRAP HANDLE</th>
<th>LUG HANDLE</th>
<th>RIM-RIDER EFFIGY HANDLE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>RING 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>1</td>
<td>3</td>
<td>14</td>
<td>42.4</td>
<td>6</td>
<td>18.1</td>
<td>12</td>
<td>36.4</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>12</td>
<td>13.6</td>
<td>47</td>
<td>53.4</td>
<td>9</td>
<td>10.3</td>
<td>16</td>
<td>18.1</td>
</tr>
<tr>
<td>ALL</td>
<td>13</td>
<td>10.7</td>
<td>61</td>
<td>50.4</td>
<td>15</td>
<td>12.4</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>RING 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>1</td>
<td>5.6</td>
<td>8</td>
<td>44.4</td>
<td>4</td>
<td>22.2</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>1</td>
<td>0.7</td>
<td>85</td>
<td>62</td>
<td>17</td>
<td>12.4</td>
<td>24</td>
<td>17.5</td>
</tr>
<tr>
<td>ALL</td>
<td>2</td>
<td>1.3</td>
<td>93</td>
<td>60</td>
<td>21</td>
<td>13.5</td>
<td>27</td>
<td>17.4</td>
</tr>
</tbody>
</table>

**two of these are only tentatively assigned to the north village
Table 5-31: Madisonville Series: ceramic cylinder surface treatment and morpho-type distribution.

<table>
<thead>
<tr>
<th>CYLINDER TYPE</th>
<th>SURFACE TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TYPE 1*</td>
</tr>
<tr>
<td>RING</td>
<td>n</td>
</tr>
<tr>
<td>RING 2</td>
<td>4</td>
</tr>
<tr>
<td>RING 1</td>
<td>1</td>
</tr>
<tr>
<td>(OVERLAP AREA)</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>13</td>
</tr>
</tbody>
</table>

*defined by a base : shaft ratio of 1.1-1.4 : 1.0  **defined by a base : shaft ratio of 1.6-2.2 : 1.0
Table 5-32: Todd Series: distribution by ring location and context type.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>VAR. AUGUSTA</th>
<th>VAR. FOX FARM</th>
<th>UNIDENTIFIED TYPE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>RING 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>5</td>
<td>33.3</td>
<td>9</td>
<td>60</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>15</td>
<td>44.1</td>
<td>13</td>
<td>38.2</td>
</tr>
<tr>
<td>ALL</td>
<td>20</td>
<td>40.8</td>
<td>22</td>
<td>44.9</td>
</tr>
<tr>
<td>RING 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP</td>
<td>9</td>
<td>64.3</td>
<td>4</td>
<td>28.6</td>
</tr>
<tr>
<td>MIDDEN</td>
<td>27</td>
<td>55.1</td>
<td>12</td>
<td>24.5</td>
</tr>
<tr>
<td>ALL</td>
<td>36</td>
<td>57.1</td>
<td>16</td>
<td>25.4</td>
</tr>
</tbody>
</table>
Table 5-33: Todd Series expanded analysis: distribution of series with additional samples.

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>RING 2</th>
<th>VAR. AUGUSTA</th>
<th>n</th>
<th>%</th>
<th>VAR. FOX FARM</th>
<th>n</th>
<th>%</th>
<th>UNIDENTIFIED TYPE</th>
<th>n</th>
<th>%</th>
<th>UNANALYZABLE</th>
<th>n</th>
<th>%</th>
<th>TOTAL</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUMP</td>
<td></td>
<td>10</td>
<td>43.5</td>
<td>5</td>
<td>33.3</td>
<td>6</td>
<td>26.1</td>
<td>2</td>
<td>8.7</td>
<td>23</td>
<td>30.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIDDEN</td>
<td></td>
<td>24</td>
<td>46.2</td>
<td>10</td>
<td>66.6</td>
<td>10</td>
<td>19.2</td>
<td>8</td>
<td>15.4</td>
<td>52</td>
<td>69.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td></td>
<td>34</td>
<td>45.3</td>
<td>15</td>
<td>20</td>
<td>16</td>
<td>21.3</td>
<td>10</td>
<td>13.3</td>
<td>75</td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTEXT TYPE</th>
<th>RING 1</th>
<th>VAR. AUGUSTA</th>
<th>n</th>
<th>%</th>
<th>VAR. FOX FARM</th>
<th>n</th>
<th>%</th>
<th>UNIDENTIFIED TYPE</th>
<th>n</th>
<th>%</th>
<th>UNANALYZABLE</th>
<th>n</th>
<th>%</th>
<th>TOTAL</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUMP</td>
<td></td>
<td>9</td>
<td>75</td>
<td>2</td>
<td>16.7</td>
<td>1</td>
<td>8.3</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIDDEN</td>
<td></td>
<td>29</td>
<td>56.9</td>
<td>6</td>
<td>11.8</td>
<td>2</td>
<td>3.2</td>
<td>15</td>
<td>29.4</td>
<td>51</td>
<td>81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td></td>
<td>38</td>
<td>60.3</td>
<td>8</td>
<td>12.7</td>
<td>2</td>
<td>3.2</td>
<td>15</td>
<td>23.8</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5-34: Statistical comparison of temporally sensitive attributes. TSA1-5 after Riggs (1998). CS1-10 proposed here (see text).

<table>
<thead>
<tr>
<th>NAME</th>
<th>attribute</th>
<th>chronological significance</th>
<th>later component</th>
<th>value 1 t/p</th>
<th>Ring 2 (n)</th>
<th>Ring 1 (n)</th>
<th>sufficient sample</th>
<th>Significance Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSA1</td>
<td>Jar rim orientation</td>
<td>trend identified</td>
<td>RING 2</td>
<td>0.10</td>
<td>160</td>
<td>284</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>TSA2</td>
<td>Jar lip shape</td>
<td>uncertain</td>
<td>RING 2</td>
<td>&gt;0.20</td>
<td>179</td>
<td>297</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>TSA3(a)</td>
<td>Jar neck surface</td>
<td>uncertain</td>
<td>RING 1</td>
<td>&gt;0.20</td>
<td>162</td>
<td>322</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>TSA3(b)</td>
<td>Jar rim surface</td>
<td>uncertain</td>
<td>RING 1</td>
<td>0.14</td>
<td>177</td>
<td>304</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>TSA4</td>
<td>Jar lip decoration</td>
<td>trend identified</td>
<td>RING 1</td>
<td>&gt;0.20</td>
<td>196</td>
<td>318</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>TSA5</td>
<td>Jar lip surface treatment</td>
<td>uncertain</td>
<td>RING 2</td>
<td>&gt;0.20</td>
<td>196</td>
<td>318</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>CS1</td>
<td>Jar orifice diameter</td>
<td>trend identified</td>
<td>RING 1</td>
<td>&gt;0.20</td>
<td>82</td>
<td>159</td>
<td>Yes</td>
<td>T-test</td>
</tr>
<tr>
<td>CS2</td>
<td>Vessel form</td>
<td>trend identified</td>
<td>RING 1</td>
<td>0.13</td>
<td>293</td>
<td>477</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>CS3</td>
<td>Grooved paddled</td>
<td>trend identified</td>
<td>RING 2</td>
<td>na</td>
<td>6</td>
<td>4</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>CS4</td>
<td>Cordage twist</td>
<td>trend identified</td>
<td>RING 2</td>
<td>0.13</td>
<td>148</td>
<td>238</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>CS5</td>
<td>Type of rim band</td>
<td>trend identified</td>
<td>RING 1</td>
<td>&gt;0.20</td>
<td>24</td>
<td>34</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>CS6</td>
<td>Type jar decoration</td>
<td>trend identified</td>
<td>RING 2</td>
<td>0.05</td>
<td>81</td>
<td>135</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>CS7</td>
<td>Animal effigy appendages</td>
<td>trend identified</td>
<td>None</td>
<td>na</td>
<td>1</td>
<td>1</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>CS8</td>
<td>Cut out strap handles</td>
<td>trend identified</td>
<td>RING 1</td>
<td>na</td>
<td>0</td>
<td>2</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>CS9</td>
<td>Strap handle frequency</td>
<td>trend identified</td>
<td>RING 2</td>
<td>0.13</td>
<td>122</td>
<td>145</td>
<td>Yes</td>
<td>Chi-square</td>
</tr>
<tr>
<td>CS10</td>
<td>Cylindrical objects</td>
<td>trend identified</td>
<td>RING 2</td>
<td>na</td>
<td>16</td>
<td>15</td>
<td>No</td>
<td>None</td>
</tr>
</tbody>
</table>
Table 5-35: Statistical comparison of ceramic attributes with indeterminate temporal significance.

<table>
<thead>
<tr>
<th>NAME</th>
<th>attribute</th>
<th>CHRONOLOGICAL SIGNIFICANCE</th>
<th>later component</th>
<th>value 1 t/p</th>
<th>Ring 2 (n)</th>
<th>Ring 1 (n)</th>
<th>sufficient sample</th>
<th>Significance Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAR1</td>
<td>Jar rim thickness</td>
<td>uncertain</td>
<td>?</td>
<td>&gt; 0.005p &gt; 0.001</td>
<td>166</td>
<td>296</td>
<td>Yes</td>
<td>T-test</td>
</tr>
<tr>
<td>JAR2</td>
<td>Trailing / Incising Width</td>
<td>uncertain</td>
<td>?</td>
<td>NA</td>
<td>11/15</td>
<td>13/19</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>JAR3</td>
<td>strap handle type</td>
<td>uncertain</td>
<td>?</td>
<td>NA</td>
<td>11/15</td>
<td>13/19</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>JAR4</td>
<td>Handle metrics</td>
<td>uncertain</td>
<td>?</td>
<td>&gt; 0.2</td>
<td>71</td>
<td>106</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>JAR5</td>
<td>Tooled smoothed</td>
<td>uncertain</td>
<td>?</td>
<td>NA</td>
<td>3</td>
<td>11</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>JAR6</td>
<td>Jar rim profile shape</td>
<td>uncertain</td>
<td>?</td>
<td>0.003</td>
<td>164</td>
<td>284</td>
<td>Yes</td>
<td>chi-square</td>
</tr>
<tr>
<td>PAN1</td>
<td>Todd plain distribution</td>
<td>uncertain</td>
<td>?</td>
<td>0.004</td>
<td>49</td>
<td>63</td>
<td>Yes</td>
<td>chi-square</td>
</tr>
<tr>
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<td>0.12</td>
<td>42</td>
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<td>Bowl rim profile shape</td>
<td>uncertain</td>
<td>?</td>
<td>&gt; 0.2</td>
<td>44</td>
<td>94</td>
<td>Yes</td>
<td>chi-square</td>
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<td>Bowl lip shape</td>
<td>uncertain</td>
<td>?</td>
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<td>46</td>
<td>97</td>
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<td>99</td>
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<td>Bowl rim thickness</td>
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<td>&gt; 0.005p &gt; 0.001</td>
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<td>T-test</td>
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Chapter 6

Occupational History

Introduction

The ceramic comparison in Chapter 5 indicates Rings 1 and 2 at the Hardin Site both represent Late Fort Ancient occupations, but that Ring 2 is relatively later. This chapter evaluates the findings of the ceramic comparison by examining patterns of temporally sensitive metal, stone, and marine shell artifacts. Finally, patterns from these relative chronological markers are compared to a suite of 7 AMS radiocarbon dates (Ring 2=4, Ring 1=3) to make a final assessment of the relative chronological position of Ring 1 and Ring 2. This chapter begins with a brief overview of previous research on the occupational history of the site, and a short description of evidence for prehistoric components that predate the Late Fort Ancient Period.

Background

Previous Research

The site’s original occupational sequence was developed over 50 years ago (Hanson 1966:171-181). As described in Chapter 3, the sequence was more or less refuted by modern cross-dating techniques over 25 years ago and has subsequently been refined (see below). Recent work indicates the presence of multiple Fort Ancient components dating sometime between A.D. 1200-1650. The main deterrent in the development of a more detailed occupational history has probably been the large size of the site and collections. This is complicated by the fact that the bulk of the 1939 excavations were in the center of the site, which appears in Hanson’s site map as a
palimpsest of features, structures, and burials (1966:Figure 1; Chapter 8). Both Hanson (1966:16) and Holmes (1994:55) suggested that this area represents the overlap of multiple Fort Ancient components.

**The Present Study**

At the beginning of the present study two issues remained with the site’s occupational history: 1) the spatial patterning of temporally sensitive and diagnostic artifacts had not been used to determine the spatial extent of the Fort Ancient components, and 2) only a limited range of diagnostics have been used to develop the occupational sequence, and no systematic study has been conducted on temporally sensitive artifacts to validate or refine the proposed sequence. An initial attempt has been made by the present study to address both of these limitations.

Chapter 4 used patterns of diagnostic and temporally sensitive materials to examine the spatial extent of Fort Ancient components at the site, which indicated the presence of at least two Late Fort Ancient components and one Middle Fort Ancient component. This work also indicated that the center of the site represents the spatial overlap of the Late Fort Ancient components. Two measures were taken to develop the most accurate possible relative chronology of the two late components. First, contexts from the overlap area of the two components were avoided. Second, additional areas were sampled by the 2013 excavations to “fill in” areas not examined in 1939 to improve the spatial distribution of diagnostics.
General Occupational Sequence

Early Prehistoric Components

Because this portion of the occupational sequence is not relevant to the present study, it is only given cursory attention here for purposes of disseminating basic information about these components. Diagnostic artifacts indicate the presence of multiple Archaic and Woodland Period components. Artifacts indicating the earliest occupation of the site include Archaic Period projectile point types (Hanson 1966:Figure 50). For example the points in Figures 50-f and 50-g (Hanson 1966) compare well to types from the Terminal Archaic Barbed, and Large Side-Notched or Brewerton Clusters. All of these clusters date within the Archaic Period (Justice 1987:60-71, 119-123, 179-183). Hanson himself recognized a Woodland Occupation represented by Watson Cordmarked and Watson Plain pottery types (1966:81, 85, Figure 38).

Late Woodland and probably early Fort Ancient components are also represented at the site. A Late Woodland component is indicated by Lowe Cluster flared-base projectile points illustrated in Figure 50c (Hanson 1966). Limestone and other rock tempered ceramics were also recovered from nearly every 2012-2013 excavation unit. Among the rock tempered ceramics in most units were sherds exhibiting angular shoulders that appear to be consistent with Newtown Series angular shoulders. A radiocarbon determination from one unit associated with this pottery dates to the 7th – 8th century (Chapter 3), which would be expected for Newtown Series pottery which dates to the early Late Woodland elsewhere. Terminal Woodland and Early Fort Ancient components are also represented at the site. This is indicated by limestone and possibly...
other rock tempered sherds from Unit 22, which were associated with a radiocarbon determination dating to the 11th-12th century (Chapter 3).

**Late Prehistoric Components**

Late Prehistoric occupation at the Hardin Site is represented by several Fort Ancient components. The earliest appears to date to the terminal Late Woodland (ca. A.D. 800-1000) or Early Fort Ancient (A.D. 1200-1400) Period (discussed above). A Middle Fort Ancient (A.D. 1200-1400) component at the site was first recognized by Turnbow and Henderson (1987) based on the presence of U-shaped lug handles, Type 2 and 5 fine triangular points, and chipped stone disks (see also Henderson 2008:829). The wide distribution of these Middle Fort Ancient diagnostics examined in Chapter 4 confirms Turnbow and Henderson’s identification and provides a useful baseline to more fully examine this component at the site.

**Previous Fort Ancient Sequence**

Although Hanson recognized the possibility of multiple Fort Ancient components, he treated them as a single episode in his temporal analysis (1966:171-181). Hanson proposed a maximum date range of A.D. 1450-1680 for the Fort Ancient occupation of the site. His beginning date of 1500+50 A.D. was based on the only radiocarbon date from a Fort Ancient site in eastern Kentucky at the time, which was A.D. 1485+125 (Slone Site, Pike County, Kentucky; after Hanson et al. 1964:160). His terminal date of 1675+5 was based the position that Fort Ancient represented the Shawnee who were believed to have vacated the Ohio Valley between 1670 and 1680 (Hanson 1966:174;
after Griffin 1943; Swanton 1952:99,227; see also Chapters 1 and 2). Hanson also argued that the site was occupied “for a relatively short period” (1966:173). He based this position on a midden thickness of 2 feet, and minimal change in type frequencies between the earliest and latest strata compared in his pottery seriation.

Twenty years later Henderson et al. used new information to suggest a narrower date range (1986:137-8, 201,210), but kept it within Hanson’s estimate. They adjusted the early range to sometime after A.D. 1525. This observation was based on the high ratio of brass to copper at Hardin compared to the nearby Buffalo Site, which was estimated to date A.D. 1525-1640 (Graybill 1981:126). They adjusted the terminal range to sometime in the early 1600s based on looted collections from the site which included several iron objects and a blue glass trade bead comparable to Kidd and Kidd’s (1970) type WIb5.

In 1987 Henderson and Turnbow published the results of a chronology building effort in north/northeastern Kentucky. This project proposed a series of Fort Ancient phases for the area (see Chapter 2), the latest of which was the Montour Phase (A.D. 1550-1750). They argued that ceramic attributes in the Hardin Site assemblage (see also Henderson et al. 1990:323-324) were consistent with both the Manion (A.D. 1200-1400) and Montour (A.D. 1550-1750) Phases (see also Henderson 1992a:263; 2008:829). This implied early portion of the later Hardin site occupation was around A.D. 1550. This was consistent with Henderson et al.’s proposal a year earlier that the early portion of the occupation was sometime after A.D. 1525 (Henderson et al. 1986:137-138, 201, 210).

Holmes (1994:95) used metal, marine shell, and other items associated with burials to propose a date range of A.D. 1525-1650 for the late occupation of Hardin.
Like Henderson and Turnbow (1987) Holmes also recognized a Middle Fort Ancient occupation (1994:89-91). A unique contribution of Holmes’s assessment was the use of recently developed protohistoric chronological sequences in the southeast which were based on radiocarbon dates, protohistoric/historic trade goods, and native diagnostics (e.g., Smith 1987). Marine shell gorgets, brass and copper ornaments, and the glass bead and iron objects reported by Henderson et al. (1986) were central to Holmes’s assessment (see Holmes 1994:Table 6.1). His beginning range is similar to previous estimates, while his terminal range of 1650 was somewhat later than previous estimates suggesting the early 1600s. Importantly, like Hanson, Holmes cited the presence of overlapping longhouse structures in the center of the site as evidence the Late Fort Ancient occupation was “not a brief single episode” (1994:55-56, 96).

Finally, the most recent assessment of the Fort Ancient occupation was conducted by Drooker who proposed a range of A.D. 1550-1625 (1997:Fig.3.8, Tables 3.2, 4.9, 4.18). Like Holmes, Drooker’s estimate was based on comparison of diagnostic metal, glass, and marine shell trade goods reported from Hardin to contact period chronologies developed in other regions. Her assessment was more comprehensive in its inclusion of diagnostic materials, and compared them to multiple regional chronological sequences. While Drooker's study is the most comprehensive to date, the occupation span she and others have proposed is hindered by the presence of two Late Fort Ancient components, and by the inclusion of artifacts reported by looters. Nevertheless, her analysis provides a comprehensive source of background information that was used extensively by the present study; without it the current effort would probably not be as thorough.
Discussion

Drooker’s (1997) analysis is the last attempt to refine the occupation span of the Late Fort Ancient component(s) at Hardin. The A.D. 1550-1625 span continues to be used in the literature (e.g., Drooker and Cowan 2001; Henderson 2008:834). Following Raymer's observation that historically-documented swidden horticulturalists typically move their villages every few decades (2008: Chapter 2), it is likely this 75 time span represents more than one episode of occupation of the Hardin Site.

A second problem is the use of looted items in the current occupation span suggested for Hardin. While gathering information for their contact period volume, Henderson et al. (1986:8) report the provenience of looted items occasionally switched between multiple sites in the study area when collectors were asked about the same items on separate occasions. For the most part, the date range indicated by professionally documented diagnostics (see below) is consistent with looted items used by most researchers, which obviates the need to use them.

Late Fort Ancient Components Examined in this Study

In this section assemblages of chronologically sensitive (or diagnostic) lithic, ceramic, marine shell, and metal artifacts are compared between the Ring 2 and Ring 1 areas. These comparisons are summarized are then compared to AMS radiocarbon determinations from the site.
Summary of Ceramic Attribute Patterns

In Chapter 5 the relative proportion of temporally sensitive ceramic attributes was compared between Ring 2 and Ring 1. This assessment compared the distribution of 16 attributes between the two villages (Table 5-34). Only 2 of the 12 which had sample sizes sufficient for statistical comparison (Chi-Square, T-test) exhibited differences that were moderately (p<0.1) or highly (p <0.05) significant. Both of these indicated a later occupation in the Ring 2 area. Of the other ten attributes compared, 4 exhibited differences of limited significance (p<0.15). Two from each village indicated a later occupation. The final 6 attributes exhibited differences of even less significance. A notable result of this analysis was how few attributes exhibited a strong difference between the villages. This may be taken to suggest that their temporal separation is not great (see Chapters 5 and 6).

Aside from pointing a weak arrow toward Ring 2 as the later occupation, the ceramic comparison also documented that numerous late Late Fort Ancient diagnostic ceramic diagnostics in both villages that are thought to occur only in late Late Fort Ancient components (e.g., lizard effigy handles, ceramic cylinders, Todd Plain, var. Augusta).

Summary of Lithic Type Distributions

A complete analysis of lithic type distributions is presented in the next chapter, which was placed subsequent to this chapter only to keep it in sequence with Chapters 8 and 9, which also pertain to lithic analysis. The lithic data presented in this chapter pertains only to chronology, and is presented only in summary form here. For more details, including tables, figures, and attribute descriptions, please refer to the next
chapter and to Appendix G. Triangular projectile points and uniface and biface endscrapers are the most common lithic artifacts used for relative chronology in Fort Ancient archaeology (after Railey 1992). Other lithic types provide chronological information and were recovered from Rings 1 and 2, but the study sample did not contain enough to be useful here. The projectile point type frequencies from Rings 1 and 2 is consistent with the pattern expected for a late Late Fort Ancient occupation. This is indicated by the proportion of Type 5s and 6s in both villages, which both fall squarely in the range documented for this period. When comparing the two village areas to each other, the relatively higher proportion Type 6 and lower proportion of Type 2 and 5 points in Ring 2 indicate is represents a later occupation than Ring 1.

Endscrapers are also temporally sensitive. Uniface endscrapers tend to be present at early Late Fort Ancient components (A.D. 1400-1550) while both these and biface endscrapers are recovered from late Late Fort Ancient components (A.D. 1550-1750). The presence of both endscraper types at Rings 1 and 2 suggests they both represent late Late Fort Ancient components. Both rings also exhibit a much higher proportion of biface relative to uniface endscrapers (ratio > 3:1), though the temporal significance of this ratio is uncertain. It is notable that the relative chronological information from the lithic assemblage is consistent with the ceramic data in that it indicates both rings represent late Late Fort Ancient components but that Ring 2 is later.

**Marine Shell Gorget Patterns**

A comprehensive list of large marine shell gorgets excavated from the Hardin Site and their context information has not been published, so this information is provided in
Table 6-1. Illustrations or photographs have been published of many of these by Hanson (1966) and Holmes (1994). Appendix H provides photographs of many of the gorgets used in this analysis, including several which have not been published. Photographs of two engraved gorget fragments recovered in 2013 but not included in the analysis are also included in Appendix H (Figure H-1). Table 6-1 has a callout for each of the gorgets illustrated in Appendix H, as well as for those illustrated by Hanson. This present analysis does not include small format geometric gorgets, whose temporal significance has not been determined in the Fort Ancient area. These consist primarily of small rectangular, square and diamond-shaped types which are described by Hanson (1966:155-165).

Fifteen large marine shell gorgets recovered from the Hardin site by the WPA were used in the present study. Several fragments of engraved (probably large) marine shell gorgets were also recovered from the 2013 project but are not considered here because they are too fragmentary to assign to a particular type. The gorgets included in the present study were classified using the stylistic typology proposed by Brain and Phillips (1996). Temporal affiliations were assigned primarily based on the chronological scheme devised by Hally (2007).

Of the 15 considered for the present study, only 8 can be assigned relative dates and to either of the two rings. Two Mask Genre gorgets, one McBee Style and one Buffalo Style were recovered from the overlap area in 1939. The McBee Style gorget is shown in Hanson’s monograph (1966: Figure 63b) while the other is shown in Appendix G for reference. Sources used for the temporal assignments are provided for each gorget in Table 6-1. Since more burials were excavated in Ring 2, the distribution of these types
is compared as a proportion of the total number of burials for each village. This indicates that a slightly larger proportion of the Ring 2 burials were interred with gorgets dated at or after A.D. 1550 (Ring 2=4.7%, Ring 1=4.3%). If the additional untyped Rattlesnake genre gorget from Ring 2 is included, the proportion for that village increases slightly more. Unfortunately, its recovery from a plowzone context (WPA excavations, 0.0-0.5’ depth) precludes further assessment of its context. However, its presence in the plowzone might suggest it is from a relatively shallow (i.e., later) burial context.

Interestingly, a drawing by Charles Bohannan’s wife Dorothy depicts a fragmentary rattlesnake gorget from the collection of the Hardin family (after whom the site was named). The illustration should be considered fairly representative of the artifact on which it was based. A number of other artifact illustrations by Dorothy Bohannan curated with the site archives at the Webb Museum are very detailed and compare well to professional artifact illustrations. This illustration is notable because the missing portion could plausibly be represented by the fragmentary Rattlesnake genre gorget from Ring 2 (Appendix H, Figure H-5). Portions of several engraved elements and a drilled suspension hole are present on both specimens and the breakage pattern on both is remarkably similar. The engraving style on both specimens is also relatively unrefined compared to the other two Rattlesnake genre gorgets from the site, and compared to most Carters Quarter and Citico Style gorgets (e.g., Brain and Phillips 1996: 91-102). Assuming it is an accurate representation, the lack of fenestration would suggest the item in the drawing is more similar to a Citico style gorget, but the relatively un-refined engraving seems unusual for this style at least compared to examples in Brain and Phillips (1996) and Hally (2007).
Two other untyped gorgets originally described and illustrated by Holmes (1994:161-164, Figure 7.18 and Figure 7.19) deserve mention here and images of them are included in Appendix H for comparison. The first was interred with Burial 264 along with a Mask Genre, Buffalo Style gorget (shown in Appendix H, Figure H-8). The untyped gorget with Burial 264 has a cruciform element in the center surrounded by several concentric bands (Figure H-8). The bands are filled with a series of designs including sunburst elements and chevrons, the latter of which compare generally to elements found on Rattlesnake Genre gorgets. The presence of two sets of suspension holes, cross-cutting engraved elements, and engraving on the reverse side indicates this item was recycled.

Another untyped gorget was recovered with Burial 225 (Figure H-12; see also Holmes 1994: Figure 7.18 for a line drawing). This gorget exhibits a zoomorphic image that Holmes interpreted as a “stylized duck”. This gorget, like the untyped example from Burial 264 also exhibits drilled dots, and two sets of suspension holes. Another unusual attribute to this specimen is a rectangular design element interrupting the zoomorphic image suggesting, like the multiple sets of suspension holes, that this was recycled and may have had a different image at one time. As Holmes points out, the design elements on these two gorgets are typical of the eastern Fort Ancient region (Holmes 1994: 161; see also Henderson 2008: 805). Evidence of recycling has also been documented in other parts of the Fort Ancient region (e.g., Hoffman 1999: Figure 54).

Since 100% of typed gorgets from both components were in circulation after A.D. 1550, it might be more meaningful to compare the distribution of types available after A.D. 1650. This comparison reveals a slightly higher proportion of later gorget types in
the Ring 1 (2 of 3, 66.6%) relative to Ring 2 (3 of 5, 60.0%). One final measure would be to look at the representation of Rattlesnake genre gorgets. Many reviews of late Prehistoric gorgets indicate that this genre includes four styles – Lick Creek, Brakebill, Carter’s Quarter, and Citico – that represent the chronological evolution of a single style (Brain and Phillips 1996:83-106; Hally 2007:196, 210-211; Muller 2007:32; Rodning 2012:37). For example, at the Little Egypt site, all four types occur, but only Citico style occurs in the terminal occupation dated to A.D. 1425-1550 (Hally 2007:197). Following this model then, the presence of the earlier Carter’s Quarter style in Ring 1, and the later Citico Style in Ring 2 would imply the Ring 2 was occupied relatively later.

The interpretation of relative chronology based on this assemblage, like many other datasets, is complicated by overlap of chronologically sensitive types. Both contained very late type gorgets all of which were accessible after A.D. 1400 and into the contact period. The proportion of late style gorgets that tend to post-date 1550 is slightly greater in Ring 1, but the overall sample size is so small this difference is not meaningful. A comparison of Rattlesnake genre gorgets is probably more meaningful. The relatively earlier Carter’s Quarter style only occurs in Ring 1 while the relatively later Citico style only occurs in the Ring 2.

**Metal Artifact Patterns**

**Overall Distribution**

Several aspects of the metal assemblage that have chronological significance are examined in this section. Examples of most type of metal ornaments recovered from the Hardin Site are illustrated by Hanson (1966: Figure 67). A cone, a sheet (bead blank?),
and a sheet metal ornament are shown in Appendix I since Hanson did not illustrate them. A column in Table 6-2 provides a figure callout for each type of metal artifact. The total metal assemblage by ring location and type is presented in Table 6-2. While not temporally indicative in itself, the total quantity of metal is just over three times greater in Ring 1.

A major factor in this distribution is that 102 of 147 (69.4%) of the metal artifacts from Ring 1 were from Burial 144. Burial 18 from Ring 1 had the second most metal from Ring 1, including a sheet copper ornament behind the cranium (Appendix I, Figure I-1). In its current state, the sheet is fragmented into many pieces but close examination of the item indicates it may have come from a container of some kind because one edge of the sheet has a rolled lip that in profile has a “J” shape. This use of sheet copper as a head ornament compares well to an example from the intrusive Oneota component at the Oliver Phase Taylor Village in central Indiana (McCullough 2014:18). Though this probably does not bias the comparison since one burial in Ring 2 also makes up a large proportion of its assemblage (Burial 241, n=22 or 45.8%). Just based on this comparison alone, it would appear that Ring 1 may represent a later occupation if it is assumed absolute quantity of trade goods alone is the most temporally meaningful statistic.

It is more likely that the distribution of metal by context is more temporally sensitive. A higher proportion of contexts with trade goods would be expected at a later component since access to metal will result in a greater distribution throughout a habitation site over time. Ring 2 has a slightly higher proportion of burials with metal (Table 6-3), even though they tend to have fewer items each and a less diverse range of items than those in Ring 1 (Table 6-4). In Ring 2, only one out of seven burials had more
than one type of object, while in Ring 1 only one out of five burials had less than two types. Despite these differences, the village areas have the same number of metal artifact types (6). Interestingly, only three of the nine types present at the site are present at both villages, while the other six are only present at one village. This may have some temporal significance in itself even if neither village has a more diverse assemblage.

Protohistoric research in other regions indicates the distribution of metal by context may be temporally meaningful. With the exception of the Madisonville Site, earlier protohistoric components tend to contain metal objects only as finished adornments in burial contexts. Over time European trade goods increased in number and availability, which resulted in Native manufacture of ornaments and use of them for purposes other than burial adornment (Drooker 1996:172). Patterns of metal by type (Table 6-2) and context (Table 6-5) are informative. In Ring 2 metal occurs in a greater number of contexts (N=11, S=5), a greater proportion of its assemblage is from midden contexts (N=6.3%, S=0.7%), and metal was more often discarded in midden contexts (N=36.4%, S=20.0%). In addition, unfinished metal objects have only been recovered from this part of the site. The one unfinished item from Ring 2 is a square sheet of metal that has clearly been worked into a flat shape, possibly for the manufacture of a bead or tube. Based on patterns from other protohistoric sites, these observations about the Hardin Site indicate a later component in Ring 2.

The final and perhaps most important aspect of the metal assemblage is the distribution of chronologically sensitive types. The majority of the assemblage from both village areas is comprised of items common in the northeast and southeast between 1570-1630 (Table 6-2). Most of the chronological information for this assessment was
derived from Drooker and has probably not changed substantively (see Drooker 2001:Figure 3.8, Tables 3.2,4.9).

Only two metal artifact types suggest occupations later than A.D. 1630. The first are brass and copper clips, which occur in both villages (Ring 2: n=4, 8.3%; Ring 1: n=16, 10.9%). In published northeastern chronologies clips occur primarily from 1600-1630, while in Marvin Smith’s (1987) southeastern sequence they occur in the 1630-1670 period (see Table 6-2; Drooker 1996, 1997). Since most estimates tend to place the terminal range of the Hardin occupation range in the early 1600s, it would seem that the earlier range is most plausible. In addition, Drooker argues that clips recovered from Fort Ancient sites also have terminal occupation spans in the early 1600s, and that the form of clips at these sites is “large” relative to those used to define Smith’s 1630-1670 assemblage (1997:160). However, average measurements of the Hardin examples (L=1.21, W=1.34) are one third the size of published averages for Madisonville (L=3.72, W=3.03), which would seem to place them in a relatively smaller category. The lack of published measurements for those used to define Smith’s 1630-1670 assemblage make it impossible to determine whether the Hardin examples compare better to the northeastern or southeastern examples.

Coils manufactured from thin hollow tubes are the second metal artifact type from Hardin that may post-date 1630, and are only present in Ring 2. Coils made from thin tubes are present in northeastern assemblages dating A.D. 1580-1630, and southeastern assemblages dating 1630-1670. Both chronological spans are plausible since Fort Ancient people had trade relations in both regions. However, since the burden of
diagnostics aside from coils and clips predate 1630, it seems more likely they date to this period.

Other Possible Data

Other metal artifact types that have reportedly been looted from the Hardin Site include barred pendants, earrings, salamanders, and iron celts (Henderson et al. 1986:137, Fig. 33). Of these only the iron celts may represent post-A.D. 1630/40 occupations, but have also been recovered from pre-A.D. 1630 contexts (Drooker 1997: Table 3.2). Given that they cannot be associated with either village and have already been reported elsewhere (Henderson et al. 1986; Drooker 1997: Table 4.9) they add little to the present analysis.

Additional metal artifacts reportedly from the site were observed by the author in a large donated collection recently put on display at the Southern Ohio Museum in Portsmouth, Ohio. Among a variety of metal were numerous sheet metal (brass? copper?) effigies depicting zoomorphic figures. According to Waselkov (1989:124), these date A.D. 1630-1700, which is later in the 17th century than most of the metal assemblage at Hardin. If they are in fact from Hardin, they would probably represent the absolute terminal period of occupation at the site. Further study of the items and more information about their provenience is certainly warranted given the rarity of this type of metal artifact in the Fort Ancient area.
Chemical Sourcing Data

A small sample of items (n=14) from Hardin has been subjected to PIXE chemical analysis by Dr. David Robertson and Holly Gersch (n.d.) when they were affiliated with the University of Kentucky in the 1990s. Their analysis determined that 13 of 14 items contained trace elements present in European-sourced metals while one was native copper (Appendix I, Table I-1). Of these eight were from Ring 1, three were from Ring 2, and three have catalogue references that have been lost. The only Native copper item was from Ring 1, which might suggest a somewhat earlier assemblage from that village.

It is noteworthy that the findings of the PIXE analysis confirm Hanson’s finding that both brass and copper are present (1966:165-169; see also discussion in Drooker 1997:154-155, 294). This study also provides information about variation within the copper and brass categories. For example chemical data indicates two types of brass and two types of copper (Appendix __ Table 1). This information will be important in the future for examining the possible sources of European metals acquired by this community over time.

Drooker indicates that 4/13 (30.8%) of NAA analyzed items were native copper (1996:148), while the one Native copper item at Hardin represents just under 6% of the sample. Taken at face value, the larger proportion of Native copper at Madisonville would suggest a relatively earlier assemblage compared to either the Ring 1 or Ring 2 assemblages. However, Drooker indicates some of copper from Madisonville might derive from prehistoric components (1997:154-155). This may be right, since based on other chronological markers Hardin and Madisonville are more or less contemporary,
which would suggest that differences (in the proportion of brass/copper) between them may be related to differences in source (Drooker 1997:294). For example, Drooker’s research indicates that Madisonville likely acquired more material from the early Great Lakes fur trade, while Hardin has long term connections to the east coast and southeast where European traders tended to carry more brass relative to copper (1997:294).

**Glass Artifacts**

No glass beads or other artifacts of glass have been professionally recovered from the Hardin Site. However, Henderson et al. (1986:138) have described a blue glass bead and several “tubular” glass beads from burial contexts reported by looters. They indicate the blue bead was comparable to type W1b5 in the Kidd and Kidd bead typology (1970). Drooker (1997:Fig.3.8, Table 4.9) provides a range of 1600-1630 for the European artifacts likely from Hardin discussed in Henderson et al. (1986:138). Although the provenience of these materials is questionable, the date range proposed for them is consistent with professionally documented artifacts and AMS radiocarbon dates. All intact deposits recovered by the 2013 were screened through 1/4” and 1/16” mesh with the intention of recovering possible glass beads and small metal scrap fragments. The few 1/16” size grade samples processed to date have not produced glass beads.

**Absolute Chronology**

A total of 7 AMS radiocarbon assays have been conducted for this project (Table 6-6). Four determinations were acquired from Ring 2 and three from Ring 1. One date from each village appears to relate to pre-15\textsuperscript{th} century occupations at the site. There were
limestone/rock tempered ceramics in nearly every 2012-2013 excavation unit, including those which produced the early dates. It follows that these early dates probably relate to stratigraphic mixing as a result of later aboriginal activity at the site such as excavation of deep pits and post holes. The dates from Ring 1 indicate an occupation restricted to the 15th century. Two of the three later dates from Ring 2 indicate a protohistoric occupation. The third date from Ring 2 was from the 15th century.

While there appears to be some overlap the occupation spans of the village areas (as indicated by relative chronological measures) the overall picture is the same: a later occupation in Ring 2. The lack of protohistoric dates from Ring 1 is somewhat surprising considering other chronological measures indicated the presence of a protohistoric occupation. Given the few dates currently in hand we cannot be entirely sure that they accurately represent the relative chronological position of the village areas even if they are generally consistent with relative chronological measures.

Summary
A total of 19 different patterns of diagnostic or temporally sensitive artifacts have been compared between Ring 2 and Ring 1 (Table 6-7). Of these, 13 (68.4%) indicate a relatively later component in Ring 2 and 6 (31.6%) a later component in Ring 1. The AMS dates also indicate a later component in Ring 2, which independently supports this finding. While the burden of evidence indicates Ring 2 represents a later occupation, the finding that attributes suggest the opposite trend should not be overlooked. Several scenarios are suggested to explain this pattern:
1) In this scenario, some aspect of the comparisons such as sampling bias or the accuracy of the measures is influencing the results such that the observed patterns are not actually representative of the site’s occupational history. In this scenario the findings are considered too contradictory to make any conclusions.

2) In this scenario, the relative sequence indicated by the comparisons is assumed to be correct. Ring 1 was occupied first in the 1400s and Ring 2 was occupied sometime in the late 1500s – early 1600s and the use of these two areas was separated temporally by an occupation hiatus. The presence of 16\textsuperscript{th} -17\textsuperscript{th} century diagnostics in Ring 1 is the result of re-use of this part of the site for either special purposes or a limited residential function during the occupation of Ring 2. This is supported by the fact that none of the radiocarbon dates from Ring 1 date past A.D. 1475 (at 2 sigma).

3) In this scenario, the relative sequence indicated by the comparisons is assumed to be correct. The presence of 16\textsuperscript{th} -17\textsuperscript{th} century diagnostics in both villages indicates they both date to this time, but the presence of 16\textsuperscript{th} -17\textsuperscript{th} century radiocarbon dates only from Ring 2 indicates it is relatively later. The 15\textsuperscript{th} century radiocarbon dates represent the early part of the Ring 1 occupation. The limited proportional differences in many 16\textsuperscript{th} -17\textsuperscript{th} century diagnostics indicates either direct movement of the settlement from Ring 1 to Ring 2 without an occupation hiatus, or an occupation hiatus that was so short material culture differences will not be sufficient to detect it. In this scenario, Ring 1 was first
occupied in the 15th century and gradually abandoned over a number of years or decades as residential areas were moved to Ring 2. Residential occupation in Ring 1 ceased sometime in the last quarter of the 15th century but the area continued to be used for special purposes while residential occupation was focused on Ring 2. Continued special purpose use of this part of the site may have made it an ideal place to also dispose of refuse from habitation areas in Ring 2, which accounts for the presence of the many late Late Fort Ancient diagnostics recovered from Ring 1.

Discussion

At this time, none of the above scenarios can be ruled out with absolute certainty. The first scenario seems highly unlikely considering the amount of data that have been used in this analysis. While scenarios 2 and 3 cannot be evaluated at this time we can say with a high level of confidence that the earliest late Fort Ancient use of the site occurred in Ring 1 in the first decades of the 15th century and the latest use of the site was sometime in the early-mid-17th century and was most concentrated in Ring 2. This can be argued on the basis of at least three lines of evidence. First, the majority of measures in every data class indicate a later occupation in Ring 2. In addition, the 2 most robust assemblages used (projectile points (n=480), 6 ceramic attributes (avg. n= 427) both indicated a later component in Ring 2. Second, the latest diagnostics only occur in Ring 2. For example, Rattlesnake genre gorgets are present in both areas, but the relatively later Citico style occurs only in Ring 2, while the relatively earlier Carter’s Quarter style
only occurs in Ring 1. Similar trends were found in the metal assemblage (see above). And third, the AMS radiocarbon dates support this relative sequence.

**Conclusions**

The data indicate Ring 1 was first occupied during the early 15th century and continued to be used in some fashion into the early 17th century, while Ring 2 was occupied exclusively during the late Late Fort Ancient (A.D. 1550-1750). The nature of post-15th century occupation in Ring 1 appears to be special purpose or limited in function based on the type of late diagnostics present and lack of radiocarbon dates post-dating 1475. The data currently cannot clarify whether an occupation hiatus occurred between the use of the two rings, or if Ring 1 was gradually abandoned as residences were moved to Ring 2.

For the purposes of the study, evaluating these alternative models is not critical. Establishing the relative chronological position of the villages is the most important contribution of this chapter because it allows for diachronic comparison of hide processing trends. A much larger portion of time and effort were spent on this part of the project than originally expected. However, this was deemed absolutely necessary because without establishing the relative chronology of the two village areas, diachronic comparison of hide processing trends would not be possible. The fact that 14th-17th century use is represented in Ring 1 complicates the comparison, but does not preclude it. This issue is addressed in the next chapter.

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Table 6-1: Large marine shell gorgets from Hardin Site.

<table>
<thead>
<tr>
<th>RING</th>
<th>CONTEXT</th>
<th>WPA Grid Location N E</th>
<th>DATE *</th>
<th>TYPE</th>
<th>FIGURE CITATION</th>
<th>REFERENCES FOR DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BURIAL 290</td>
<td>6 43</td>
<td>1400-1600</td>
<td>MASK GENRE, BUFFALO STYLE</td>
<td>Hanson 1966: Figure 66; this study: Appendix H, Figure H-6</td>
<td>Abel 2005:5; Sullivan 2007:101-103, Fig.5.10; Drooker 2001:61c2</td>
<td></td>
</tr>
<tr>
<td>BURIAL 310</td>
<td>28 26</td>
<td>1425-1700</td>
<td>RATTLESNAKE GENRE, CITIGO STYLE</td>
<td>Hanson 1966: Figure 64; Holmes 1994: Figure 7.14; this study: Appendix H, Figure H-3</td>
<td>Rodning 2012:44-45; Muller 2007:32, Fig.2.11; Hally 2007: Fig.10.3</td>
<td></td>
</tr>
<tr>
<td>BURIAL 264</td>
<td>21 29</td>
<td>??</td>
<td>CRUCIFORM GENRE (?)**</td>
<td>Holmes 1994: Figure 7.19; this study: Appendix H, Figure H-11</td>
<td>Brain and Phillips 1996</td>
<td></td>
</tr>
<tr>
<td>BURIAL 264</td>
<td>21 29</td>
<td>1400-1600</td>
<td>MASK GENRE, BUFFALO STYLE</td>
<td>Holmes 1994: Figure 7.9; this study: Appendix H, Figure H-8</td>
<td>Abel 2005:5; Sullivan 2007:101-103, Fig.5.10; Drooker 2001:61c2</td>
<td></td>
</tr>
<tr>
<td>BURIAL 286</td>
<td>7 45</td>
<td>??</td>
<td>RATTLESNAKE GENRE, TYPE(?)</td>
<td>this study: Appendix H, Figure H-4 and Figure H-5</td>
<td>Rodning 2012:44-45; Muller 2007:32, Fig.2.11; Hally 2007: Fig.10.3</td>
<td></td>
</tr>
<tr>
<td>BURIAL 311</td>
<td>27 26</td>
<td>1500-1700</td>
<td>MASK GENRE, MCBEE STYLE</td>
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<td>Brain and Phillips (1996) and Hally (2007:197) indicate that Chickamauga are relatively earlier than Mcbee</td>
<td></td>
</tr>
<tr>
<td>BURIAL 225</td>
<td>17 23</td>
<td>??</td>
<td>&quot;DUCK/CRANE&quot;</td>
<td>Holmes 1994: Figure 7.18; this study Appendix H, Figure H-12</td>
<td>Hanson 1966:161; Holmes 1994:161-164</td>
<td></td>
</tr>
<tr>
<td>BURIAL 223</td>
<td>19 23</td>
<td>1500-1700</td>
<td>MASK GENRE, CHICKAMAUGA STYLE</td>
<td>none</td>
<td>Brain and Phillips (1996) and Hally (2007:197) indicate that Chickamauga are relatively earlier than Mcbee</td>
<td></td>
</tr>
<tr>
<td>RING CONTEXT</td>
<td>WPA Grid Location</td>
<td>DATE*</td>
<td>TYPE</td>
<td>FIGURE CITATION</td>
<td>REFERENCES FOR DATE</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>------------------</td>
<td>-------</td>
<td>------</td>
<td>-----------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>BURIAL 107</td>
<td>N 21 -57.5 E</td>
<td>1400-1650</td>
<td>Rattlesnake Genre, Carters Quarter Style</td>
<td>this study: Appendix H, Figure H-2</td>
<td>Rodning 2012:44-45; Muller 2007:32, Fig.2.11; Hally 2007:Fig.10.3</td>
<td></td>
</tr>
<tr>
<td>BURIAL 111</td>
<td>N 65 -40 E</td>
<td>1500-1700</td>
<td>Mask Genre, Chickamauga Style</td>
<td>This study: Appendix H, Figure H-9</td>
<td>Brain and Phillips (1996) and Hally (2007:197) indicate that Chickamauga are relatively earlier than McBee</td>
<td></td>
</tr>
<tr>
<td>BURIAL 95</td>
<td>N 67 -16 E</td>
<td>??</td>
<td>Plain Genre</td>
<td>Hanson 1966: Figure 63A</td>
<td>Brain and Phillips 1996</td>
<td></td>
</tr>
<tr>
<td>BURIAL 133</td>
<td>N 62 -43 E</td>
<td>1500-1700</td>
<td>Mask Genre, McBee Style</td>
<td>Hanson 1966: Figure 63B</td>
<td>Brain and Phillips (1996) and Hally (2007:197) note Chickamauga is relatively earlier than McBee</td>
<td></td>
</tr>
<tr>
<td>OVERLAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BURIAL 208</td>
<td>N 20 -19 E</td>
<td>1500-1700</td>
<td>Mask Genre, McBee Style</td>
<td>Hanson 1966: Figure 63B</td>
<td>Brain and Phillips (1996) and Hally (2007:197) note Chickamauga is relatively earlier than McBee</td>
<td></td>
</tr>
<tr>
<td>BURIAL 227</td>
<td>N 22 -7 E</td>
<td>1400-1600</td>
<td>Mask Genre, Buffalo Style</td>
<td>this study: Appendix H, Figure H-7</td>
<td>Abel 2005:5; Sullivan 2007:101-103, Fig.5.10; Drooker 2001:61c2</td>
<td></td>
</tr>
</tbody>
</table>

*Dates triangulated from multiple sources and are meant to represent relative chronological position.

**This gorget exhibits attributes consistent primarily with Cruciform and Triskele genres as defined by Brain and Phillips 1996. However, some attributes invoke later Rattlesnake genre; Holmes was the first person to illustrate this (1966: Figure 65).

***Hanson (1966:161) reports four “large” mask gorgets and five “small” mask gorgets. All but one large mask are accounted for here. The remaining “large” mask gorget has not been identified in collections or in the catalogue cards for the collections.
Table 6-2: Distribution of metal artifacts at the Hardin Site.

<table>
<thead>
<tr>
<th>Metal Artifact Type</th>
<th>RING 2</th>
<th>RING 1</th>
<th>Age Range</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>BEAD</td>
<td>31</td>
<td>64.6</td>
<td>118</td>
<td>81.0</td>
</tr>
<tr>
<td>CLIP</td>
<td>4</td>
<td>8.3</td>
<td>16</td>
<td>10.9</td>
</tr>
<tr>
<td>TUBE</td>
<td>3</td>
<td>6.3</td>
<td>7</td>
<td>4.8</td>
</tr>
<tr>
<td>tube bracelet</td>
<td>2</td>
<td>4.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>COIL</td>
<td>7</td>
<td>14.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bead Blank</td>
<td>1</td>
<td>2.1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CONE</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>UID object</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>PENDANT</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Flat Bracelet</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>TOTALS</td>
<td>48</td>
<td>65.4</td>
<td>147</td>
<td></td>
</tr>
<tr>
<td>DIVERSITY</td>
<td>6</td>
<td>6.0</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Table 6-3: Proportion of burials* with metal.

<table>
<thead>
<tr>
<th></th>
<th>RING 2</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burials</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>WITH</td>
<td>7</td>
<td>6.5</td>
</tr>
<tr>
<td>WITHOUT</td>
<td>100</td>
<td>93.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>107</td>
<td></td>
</tr>
</tbody>
</table>

*Includes only burials in extended and semi-flexed position because these are most likely to represent Late Fort Ancient occupations.
Table 6-4: Distribution of metal by ring location and individual burial context

<table>
<thead>
<tr>
<th>Ring 2</th>
<th>N</th>
<th>%</th>
<th>Diversity of Types</th>
<th>Description of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUR212</td>
<td>2</td>
<td>4.1</td>
<td>1</td>
<td>beads</td>
</tr>
<tr>
<td>BUR215</td>
<td>4</td>
<td>8.3</td>
<td>1</td>
<td>clips</td>
</tr>
<tr>
<td>BUR218</td>
<td>7</td>
<td>14.6</td>
<td>1</td>
<td>coils</td>
</tr>
<tr>
<td>BUR241</td>
<td>22</td>
<td>45.8</td>
<td>2</td>
<td>beads (20), tubes (2)</td>
</tr>
<tr>
<td>BUR244</td>
<td>4</td>
<td>8.3</td>
<td>1</td>
<td>beads</td>
</tr>
<tr>
<td>BUR292</td>
<td>2</td>
<td>4.2</td>
<td>1</td>
<td>bracelets</td>
</tr>
<tr>
<td>BUR310</td>
<td>3</td>
<td>6.3</td>
<td>1</td>
<td>beads</td>
</tr>
<tr>
<td>FEA19</td>
<td>1</td>
<td>2.1</td>
<td>1</td>
<td>tube</td>
</tr>
<tr>
<td>Midden</td>
<td>3</td>
<td>6.3</td>
<td>2</td>
<td>beads (2), sheet/bead blank (1) (3 contexts represented)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ring 1</th>
<th>freq</th>
<th>%</th>
<th>Diversity of Types</th>
<th>Description of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUR132</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>bead, headband</td>
</tr>
<tr>
<td>BUR144</td>
<td>102</td>
<td>69.4</td>
<td>5</td>
<td>beads (96), clip (1), pendant (1), tubes (4)</td>
</tr>
<tr>
<td>BUR18</td>
<td>26</td>
<td>17.7</td>
<td>6</td>
<td>bead (2), clip (15), cone (2), pendant (1), UID sheet (1), tube (3), flat bracelet (1)</td>
</tr>
<tr>
<td>BUR322</td>
<td>15</td>
<td>10.2</td>
<td>1</td>
<td>beads</td>
</tr>
<tr>
<td>Midden</td>
<td>1</td>
<td>0.7</td>
<td>1</td>
<td>Bead (one context represented)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>147</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6-5: Distribution of metal by general context type.

<table>
<thead>
<tr>
<th>Context Type</th>
<th>Ring 2</th>
<th></th>
<th>Ring 1</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>BURIAL</td>
<td>7</td>
<td>63.6</td>
<td>4</td>
<td>80.0</td>
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<tr>
<td>MIDDEN</td>
<td>4</td>
<td>36.4</td>
<td>1</td>
<td>20.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11</td>
<td>36.4</td>
<td>5</td>
<td>20.0</td>
</tr>
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</table>
Table 6-6: AMS radiocarbon determinations and calibrated calendric dates by ring location. Calibrations by Calib 7.0.

<table>
<thead>
<tr>
<th>RING</th>
<th>UNIT</th>
<th>DEPTH</th>
<th>ZONE / STR</th>
<th>DESCRI.</th>
<th>Sample Source</th>
<th>Sample Type</th>
<th>D-AMS #</th>
<th>C14 Age (BP)</th>
<th>1 sigma error</th>
<th>median</th>
<th>1 sigma</th>
<th>2 sigma</th>
<th>13C PER MIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING 2</td>
<td>3</td>
<td>35-40</td>
<td>ZIIC</td>
<td>MATRIX ADJ POST 9</td>
<td>flotation</td>
<td>carya sp. (shell)</td>
<td>D-AMS 001315</td>
<td>1271</td>
<td>26</td>
<td>723</td>
<td>688-767</td>
<td>669-774</td>
<td>-23.5</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>35+</td>
<td>ZII</td>
<td>POST 9 FILL</td>
<td>flotation</td>
<td>carya sp. (shell)</td>
<td>D-AMS 001314</td>
<td>347</td>
<td>23</td>
<td>1560</td>
<td>1486-1630</td>
<td>1464-1635</td>
<td>-13.9</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>44-58</td>
<td>FEA 5</td>
<td>Zone Z1A burned soil</td>
<td>flotation</td>
<td>zea mays (cob)</td>
<td>D-AMS 013553</td>
<td>451</td>
<td>23</td>
<td>1440</td>
<td>1433-1449</td>
<td>1421-1461</td>
<td>-9.4</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>40-50</td>
<td>STRII LVL2</td>
<td>midden</td>
<td>flotation</td>
<td>zea mays (cupule)</td>
<td>D-AMS 013554</td>
<td>375</td>
<td>23</td>
<td>1499</td>
<td>1455-1616</td>
<td>1448-1630</td>
<td>-4.9</td>
</tr>
<tr>
<td>RING 1</td>
<td>2</td>
<td>30+</td>
<td>ZII</td>
<td>POST 3 FILL</td>
<td>flotation</td>
<td>carya sp. (shell)</td>
<td>D-AMS 001316</td>
<td>448</td>
<td>28</td>
<td>1442</td>
<td>1431-1452</td>
<td>1417-1475</td>
<td>-14.5</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>32-42</td>
<td>STRII</td>
<td>NWC, midden</td>
<td>water screen</td>
<td>zea mays (cupule)</td>
<td>D-AMS 013877</td>
<td>471</td>
<td>24</td>
<td>1434</td>
<td>1427-1444</td>
<td>1416-1450</td>
<td>-9.9</td>
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Table 6-7: Summary of diagnostic /temporally sensitive artifact comparisons between ring location.

<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Measure of difference</th>
<th>Later Component</th>
<th>Sample N</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Ring 2</td>
<td>Ring 1</td>
</tr>
<tr>
<td>triangular projectile points</td>
<td>&gt; proportion Type 2 points</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion Type 5 points</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion Type 6 points</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>bipointed knives</td>
<td>&gt; proportion</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>marine shell gorgets</td>
<td>&gt;proportion burials w/late types</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;proportion post-A.D. 1600 types</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>later rattlesnake style</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>metal artifacts</td>
<td>&gt; absolute quantity</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion of burials w/metal</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion in midden contexts</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion represented by clips</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>presence of coils</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;proportion European-sourced metal</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>ceramic artifacts*</td>
<td>&lt;proportion incised jar necks (p=0.05)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; proportion flared jar rims (p=0.10)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;proportion plain jar rims (p=0.14)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;proportion bowls : pans (p=0.13)</td>
<td>x</td>
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<td></td>
<td>&gt;proportion Z-twist cordmarking (p=0.13)</td>
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<td>&gt;frequency of strap handles (p=0.13)**</td>
<td>x</td>
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<td>TOTALS</td>
<td>n</td>
<td>13</td>
<td>6</td>
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<td></td>
<td>%</td>
<td>68.4%</td>
<td>31.6%</td>
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*only showing comparisons resulting in significance of p <0.15
**scaled to jar rim frequency for that component
Chapter 7
Lithic Analysis

Goals

Lithic analysis was conducted for several purposes in this study. First, the dimensions and use-wear patterns of teardrop-shaped endscrapers were collected to provide the primary dataset used to evaluate the degree to which diachronic trends in hide processing are present. Second, the type frequency of triangular projectile points was used as a measure of relative dating the Ring 2 and Ring 1 areas (see last chapter). This chapter describes the frequency distribution of chipped stone artifacts and production debris for the two village areas, while the subsequent chapters (8 and 9) present the more detailed endscraper datasets.

Background

The lithic assemblage was subjected to typological classification in the early 1960s by Lee Hanson (1966). Unfortunately, as with the pottery assemblage, Hanson’s work could not be used in the present study because he did not divide the sample by midden ring. Furthermore, even though this could be done today using Hanson’s catalog cards, his classification scheme is too basic and outdated to be of much use for the purposes of the present study. For example, use of the current projectile point typology (Railey 1992) has made it possible to use this tool class for relative dating. In the following I first present the chipped stone dataset using a basic morphological classification scheme (after Andrefsky 2005:75-85, Figure 4.7).
Methods and Sampling

The lithic assemblage was classified based on morphological and technological criteria. Since morphology does not necessarily equate with function (Tringham et al. 1974; Keeley 1980; Yerkes 1987:114-190), this classification is primarily a means of organizing the assemblage for presentation. Evidence of function is only assessed for endscrapers in this study (see below). The first criterion of sorting was technological, and divided artifacts into biface and non-biface categories (after Andrefsky 2005:Figure 4.7). Bifaces are systematically chipped on both aspects of an objective piece, while non-bifaces are either not shaped, chipped only on one aspect (i.e., unifaces), or shaped by some other method (Andrefsky 2005:77-78). Both uniface and biface categories were then divided into unrefined and refined categories.

Unrefined items range from minimally reduced flake or cobble blanks, to minimally thinned bifaces, to well-thinned preforms with a nearly regular outline shape. Refined items are equivalent to “finished” bifaces in most commonly used classification schemes (e.g., Callahan 1979; Whittaker 1994:203; Andrefsky 2005:187-191). These are formal tools from either flake or cobble blanks that have been shaped into an ideal outline form by a terminal stage of systematic pressure - or soft hammer – flaking. Several subdivisions within the refined and unrefined categories were recognized (see below). Most types are commonly recognized in Fort Ancient lithic assemblages. Because the WPA excavations produced such a large tool assemblage, additional sub-types were observed that may provide a useful baseline for future comparison among sites.

All lithics from the 1939 project were included because they were all tools. Debitage was collected during the 1939 WPA excavations but later culled from the
museum. All lithics greater than ¼” collected in 2011-2013 fieldwork were included. A large number of lithics remain in less than ¼” artifact samples that have not been sorted.

**General Distribution of Lithic Types**

A total of 32,356 chipped stone artifacts made of chert raw material were classified for this study (Table 7-1). Just over 10% of the sample (n=3,326) was derived from the overlap zone of the two circular village areas. These artifacts were not included in further analysis due to their ambiguous temporal affiliation. The final sample excluding material from overlap area was 29,030 artifacts (Table 7-2).

Not including debitage, the 1939 and 2013 excavations each contribute half of the tool assemblage in the preliminary sample (Table 7-2). The 26,521 flakes in the assemblage are all from the 2013 excavations. Several other categories, biface fragments, uniface tools (mostly utilized or retouched flakes), and cores are also absent or nearly so in the 1939 sub-sample. It is likely these categories were not recovered in 1939 due to their fragmentary or unrefined condition. Debitage and tool fragments would have been very difficult to collect systematically since they did not screen. The near absence of these illustrates this sampling bias is systematic. For debitage and tool categories that are not represented in the 1939 sub-sample, patterns within and between villages are described as a proportion of the 2013 sub-sample.

Four categories of lithic artifacts in are only represented by the 2013 collections (Table 7-2: biface fragments, expedient flake tools, debitage, and cores). These were removed from the sample. The size of the lithic the assemblage without these four categories is shown in Table 7-3. It is dramatically smaller but consists almost entirely of
tools, which are the primary category of interest for the present study. Table 7-3 still has the total sample split by collection in order to examine proportional differences in each collection. Potential differences can be observed by comparing the frequency distribution of categories from each collection. The table shows that only two types exhibit a noticeable difference. Triangular projectile points represent about 15% more of the 2013 sample compared to the 1939 sample. Conversely, triangular blanks/preforms represent 10% more of the 1939 assemblage. Both of these differences are highly significant (triangular projectile points: p=0.0000001; triangular bifaces: $X^2=27.8$, p=0.0000001).

It is highly likely that triangular projectile points are underrepresented in the 1939 collections for two reasons. First, most of the 1939 specimens are complete or nearly complete, suggesting fragments were regularly left behind. To contrast, the 2013 collections include all specimens, broken or otherwise. Second, the 1939 collections represent materials from unit excavations only, while the 2013 collections include collections from systematic surface collections which focused almost exclusively on diagnostics. If the 102 triangular projectile points from surface collections are excluded from the 2013 sample, the difference in proportion of triangular projectile points and triangular blanks/preforms between the two collections drops to 6% and 7%, respectively (Table 7-4). The difference in the proportion is no longer significant for triangular projectile points ($X^2=3.52$, p=0.17), but remains significant for triangular blanks/preforms ($X^2=20.39$, p=0.00004).

The remaining difference between the sub-samples is at least partially due to the inclusion of more fragmentary projectile points in the 2013 collections. That there remains some differences in the proportion of tool categories is not unexpected since the
2013 excavations were less spatially representative. The 2013 excavations represent only 2 discrete loci in Ring 1 and 4 in Ring 2, so it is entirely likely that triangular blanks/preforms were simply not discarded in these contexts in numbers that represent the villages as a whole.

Even though there are differences in the proportion of categories between the collections, it is fairly consistent. For example the 1939 sample produced 6% (Ring 2) and 7% (Ring 1) fewer triangular projectile points than the 2013 sample. Given that this difference is nearly the same for both villages, combining the samples should not influence inter-village comparisons. To summarize, the four categories only collected in 2013 are analyzed only with reference to the 2013 sub-sample (Table 7-2). The remaining categories are analyzed as part of the final combined sample (Table 7-5). These two tables should be referred to for the following descriptions.

**Non-Biface Lithics**

Non-biface lithics are defined here as tools and debris lacking bifacial reduction or shaping.

**Non-Biface: Debris**

Chert Debitage consists of waste flakes produced by core, and biface reduction activities (Whittaker 1994:20). Debitage can be classified based on a variety of morphological or technological attributes depending on what the observer wishes to know. Most inform the analyst about the degree to which the assemblage represents different stages of lithic reduction, though they can also be informative about other
aspects of an assemblage such as the type of reduction strategy employed (Andrefsky 2005:118-142). A limited analysis of debitage (n=543) indicated that exactly half of all debitage exhibits at least a small amount of cortex. For cortex type 95% of cortex-bearing debitage exhibited water-worn cortex and 89% of all cores exhibiting cortex were small river pebbles. The high proportion of pebble cortex is consistent with other Fort Ancient sites that had local access to stream deposits (e.g., Pollack and Schlarb 2009:40-47).

**Non-Biface: Tools**

**Chert Hammerstones**

Hammerstones are implements used for hard hammer direct percussion technique of flint knapping (Whittaker 1994:85-87). Repeated blows from use result in crushing of the implement surface and a battered appearance. Only a few chert hammerstones have been recovered from either village, suggesting other non-chert stone, antler or other materials were used as percussors for flint knapping.

**Chert Cores**

Chert cores are objective materials form which flake blanks are detached (Whittaker 1991:14-21). Cores can be bifacial, in which they are included in the biface blank - general biface category due to the inability to separate early stage bifaces from bifaces that are used as cores.

All but 9 cores in the sample are from the 2013 sub-sample; therefore trends relating to this artifact category will be described only for this sub-sample. Cores represent 23% of
the Ring 2 sample and 16% of the Ring 1 sample, which a significant difference
\(X^2=8.03, p=0.018\).

Approximately 90% of cores from both villages were small pebbles exhibiting
water-worn cortex, and were probably acquired locally from gravel bars along the Ohio
River. Almost all cores exhibiting tabular cortex were locally available Upper Newman
chert types. One core from a tabular source from Ring 2 was nonlocal chert (Kanahwa),
and two cores from Ring 1 were from nonlocal chert types (Upper Mercer and
unidentified). This evidence of local raw material acquisition is typical for Fort Ancient
(e.g., Sharp 1988:204-208; Cooper 2005; Pullin et al. 2008; Pollack and Schlarb
2009:42), and for other late prehistoric sedentary groups in eastern North America (Parry

Only 10% of cores from either village were reduced to the point they lacked
cortex. Only one core in this category from each village was made of nonlocal chert, the
remainder from locally available Upper Newman chert. Only Ring 1 had cores in this
category made of higher grade Upper Newman chert, often called “Paoli” (e.g., Pollack
and Schlarb 2009:41), though only a few were present.

Finally, several trimming or platform rejuvenation flakes were also observed in the
assemblage. They are identical to the specimen identified at the Fort Ancient Blain
Village (Prufre and Shane 1970:106, Figure 15, E; Yerkes 1987:123).

Uniface Tools

Uniface tools are objective pieces made on flake blanks that have been reduced to
the point they may or may not exhibit attributes of the original flake (after Andrefsky
I recognize two sub-varieties: unrefined (informal) and refined (formal) uniface tools.

Unrefined (Informal) Unifaces

Expedient flake tools consist of utilized and retouched flakes. These are expedient tools produced from flakes derived chert debris piles or expeditiously detached from a core and lack evidence of extensive damage or wear. Both utilized and retouched flakes were identified in this assemblage, though no attempt was made to parse the two types. It should also be noted that these were separated from the flake assemblage without magnification, so it is quite possible that minimally utilized flakes are underrepresented. Typically, utilized flakes exhibit a regular pattern of edge wear (e.g., rounding, polish) or damage (micro-flake removal) indicative of enough contact with another material to alter the flake (Tringham et al. 1974:192).

Retouch, on the other hand, is intended to re-sharpen the working edge, or to strengthen the edge by increasing the edge angle (Tringham et al. 1974:181). Retouched flakes exhibit a margin intentionally modified by regular pressure flaking, though some use damage can result in patterned wear difficult to distinguish from light retouch. A 10x hand lens was used to distinguish these informal flake tools from incidentally damaged flakes by a regular pattern of damage or wear. Flakes damaged by non-use related sources (e.g., trampling) typically exhibit randomly distributed flake scars of varying sizes and orientations (Tringham et al. 1974:192; Keeley 1980:24-35).

Expedient flake tools represent 22% of the Ring 2 sample and 16% of the Ring 1 sample. While it was not quantified, the vast majority of retouch and utilization damage
tended to occur on the dorsal aspect of one margin in the Hardin assemblage. Less frequently, more than one margin is modified and the location of retouch may occur on either aspect of the tool. The difference in proportion of expedient flake tools is significant ($X^2=6.16, p=0.05$), and is almost identical to the difference in proportion of cores between villages.

The relative proportion of expedient flake tools should be re-evaluated in the future by a more intensive debitage analysis using a minimum of 10x magnification during sorting. Even this however, can be misleading about the proportion of an assemblage that has been utilized since minimally used flakes may or may not exhibit damage observable at this magnification (Keeley 1980).

**Refined / Formal Unifaces**

Uniface endscrapers

Uniface endscrapers are the only tool in the refined uniface category. Like expedient flake tools, they are made from flake blanks. However, they a distinguished by a regular outline shape and morphology achieved by systematic soft hammer or pressure flaking. These tools are produced on thick flake blanks, are characterized by a tear-drop shape with the bit located distally and haft element located proximally. On unifacial specimens, the dorsal surface of the distal end and margins are retouched to produce a high bit edge angle and regular lateral margins conducive to hafting (Johnson 1997; Cobb 2000:87-88). Many specimens also exhibit a characteristic recurved profile toward the bit end. Such a feature could have been intentionally produced by overshot flake
detachment from a core (Whittaker 1994:19; Andrefsky 1998:86; Evans 2014:345-346), but this idea requires experimental verification.

Formal uniface endscrapers are a widely recognized formal tool type that occurs throughout much of eastern North America beginning in the 16th century (Johnson 1997, 2003; Cobb 2000:86-92; see above). Before this time the tool type is largely restricted to upper Mississippian components in the Oneota culture area and the eastern plains (Cobb 2000:88-89; Evans et al. 2014:342). It is thought the type was designed to process bison hides. They are larger and thicker than those of game animals further east, and may have necessitated a specialized implement.

Uniface endscrapers appear the middle and lower Ohio Valley beginning in the 15th century (Railey 1992:141-144), at least several generations before they appear in other parts of eastern North America. Most 15th century Fort Ancient and Caborn Welborn lithic assemblages contain this tool type. Their relatively early appearance in this region has not been investigated, though both groups were in contact with the Oneota groups on the eastern plains dating back several hundred years (Drooker 1997; Emerson and Emerson 2014:325-326).

In fact, some scholars recently suggested the possibility that the Fisher Phase sites in the upper Midwest, while bearing many similarities to their Oneota neighbors, have a unique developmental trajectory that may be tied to Fort Ancient (Jackson 2014:29-30). Whatever the antiquity of Fort Ancient – eastern plains contact, the presence of this tool type, longhouse architecture, Oneota-like symbolism, and disk pipes indicate intensified Fort Ancient interaction with this region beginning in the 15th century (Drooker 1997:336-337, 2012; Davidson 2014).
So while Fort Ancient and Caborn Welborn adoption of formal endscrapers may have been stimulated by western contacts, the first appearance of this tool type in other regions sometime in the late-16th to early-17th century has been tied to the onset of the European trade in furs and hides (Brain 1988:279; Cobb 2000:86-92). Interestingly, Fort Ancient people start making bifacial endscrapers during this period, even though they had been making a uniface variety for over a century. In general, Mississippian sites dating to this time period in central and lower Mississippi River Valley and throughout most the southeast have only uniface endscrapers (e.g., Cobb 2000:87; Hally 2008:233-234), suggesting the bifacial variety was not widely adopted.

Uniface endscrapers make up 5% of the Ring 2 tool sample and 8% of the Ring 1 sample. While apparently not a great difference, it is significant ($X^2=6.60$, $p=0.01$, df=1). This difference may have temporal significance since this type tends to be associated with earlier Late Fort Ancient components, though it also occurs in later Late Fort Ancient assemblages.

**Biface Lithics**

**Unrefined Biface**

Unrefined items range from minimally reduced flake or cobble blanks, to minimally thinned bifaces, to well-thinned preforms with a nearly regular outline shape. These items fall into the early stages of most biface reduction sequences, such as stages 1-4 in Callahan’s or stages 0-3 in Whittaker’s sequence (e.g., Callahan 1979; Whittaker 1994:203; Andrefsky 2005:187-191). Unrefined triangular bifaces, with evidence of
retouch (code 50) and without (code 40), were recognized. The remainder were lumped into a single class (code 60).

Early Stage Bifaces

Early Stage Bifaces (code 60) make up a nearly equal proportion of Ring 2 (14%) and Ring 1 (12%) village assemblages. These bifaces are poorly thinned and often have an irregular outline.

Triangular Blanks and Preforms

Triangular blanks and preforms (code 40) make up and equal proportion of both village assemblages (15%). Like general early stage bifaces (code 60), this category of bifaces is usually poorly thinned (i.e., have a thick bi-convex cross-section), but were distinguished by a fairly regular outline shape. Because they have recognizable outline shapes, they are further along in the reduction sequence they represent stages 3-4 in Callahan’s sequence and 2-3 in Whittaker’s. Their triangular shape indicates they were preforms for triangular knives, projectile points, and possibly even bifacial endscrapers. The more well-thinned specimens would fit into Railey’s “Crude Triangular” type (1992:153-154, Figure XI-7:a-e). As Railey points out (1992:153), there is variability in the morphology of items included in this category by Fort Ancient researchers, so no attempt has been made to separate earlier stage triangular blanks and the relatively more refined preforms.
Hump-Backed Triangular Bifaces

Hump-backed triangular bifaces (code 50) make up just 3% of both village assemblages. These bifaces represent a later stage of triangular preforms, and are relatively more refined than triangular preforms. They are characterized by a thick protuberance ("stack") on one or both aspects resulting from repeated hinge terminations. They also tend to be asymmetrical with one lateral margin being longer than the other, resulting from retouch and or heavy utilization along only one margin. The longer margin becomes more excurvate as it is retouched, while the shorter unmodified margin remains relatively straight. Some have suggested they are failed triangular preforms that could not be thinned, but their ubiquity and quantity on many late prehistoric sites, especially protohistoric Fort Ancient, suggests the tool type may have been intentional (Railey 1992).

Hump-backed triangular bifaces were first recognized as a distinct type in Illinois (Blum and Liss 1961; Brown 1961), and in the lower Ohio Valley (Munson and Munson 1972:35). This type’s appearance among Fort Ancient, Monongahela, Huber, Langford, and Fisher components but not Lower Mississippian or Iroquoian indicate is distinguishes Upper Mississippian lithic assemblages (Evans et al. 2014:342) and may represent a proto-Algonkian diagnostic (Munson and Munson 1972:35; Railey 1992:154).

Refined Bifaces

Refined items are equivalent to “finished” bifaces in most classification schemes (e.g., Callahan 1979; Whittaker 1994:203; Andrefsky 2005:187-191). They exhibit a regular outline shape and a slightly bi-convex to flat cross-section produced by pressure
flaking. This category includes fine triangular knives, fine triangular projectile points, and biface endscrapers.

Fine Triangular Knives

Fine triangular knives (code 80) make up a similar proportion of Ring 2 (3.4%) and Ring 1 (4.3%) assemblages. These items have a generally triangular plan but repeated retouch along the blade margins has resulted in an observable shoulder separating a triangular blade from a square or rectangular haft element. They are well-thinned like fine triangular projectile points, but are typically larger. Some specimens exhibit alternate beveling from repeated episodes of retouch.

Fine Triangular Projectile Points

Fine triangular projectile points (codes 1-13, 98) represent 38.6% of the Ring 2 and 31.2% of the Ring 1 assemblage. The difference is highly significant ($X^2=9.59$, $p=0.008$). These items are very thin and have a triangular outline plan that varies into a dozen morphological types (see below). They are almost always thinned using bifacial pressure flaking. Some were more expediently shaped by retouching only part of the margin on both aspects of a thin flake blank.

Non-Triangular Refined Bifaces

Bi-Pointed Knives

Bi-pointed knives (code 80) represent nearly equal proportions of the Ring 2 (3.4%) and Ring 1 (4.3%) village samples. These items are well-thinned leaf-shaped
tools that exhibit extensive retouch from repeated use. Their bi-pointed shape suggests a specialized purpose, though no use-wear study has demonstrated this. The fact that they do not occur in Railey’s assemblage attests to their rarity, though he does observe that Fort Ancient lithic assemblages become increasingly diverse through time, especially after A.D. 1400 (Railey 1992:168). Similar to unifacial endscrapers, this type of knife first shows up at Fort Ancient sites around the 15th century (Cowan 1987:15; Drooker 1997:83), which supports Railey’s model of increasing assemblage diversity. This type also occurs in other parts of eastern North America around the 15th century (Evans et al. 2014:340).

Bifacial Endscrapers

Biface endscrapers (code 20.2) make up a similar proportion of Ring 2 (13.4%) and Ring 1 (16.2%) village assemblages. These items are similar in overall morphology to uniface endscrapers, but they have been modified on both aspects to shape the haft and blade elements. Detailed analysis of these items conducted for this study (below) suggests that these may be based on a bifacial reduction sequence in contrast to the thick, minimally modified, flake blanks use for uniface scrapers. Whereas on the uniface items distal recurve was probably achieved by detaching flake blanks by overshot flaking (see above), the same feature was probably achieved on bifacial specimens by detaching flakes from the distal or lateral bit margins. Hinge or, less commonly, step terminations from these flakes dive into the body of the tool creating a slight convexity and “hooked” bit with the same lateral profile as uniface scrapers. More description is provided in the subsequent section.
Bifacial scrapers are an important Fort Ancient time marker since they only occur at sites dating to the 16th century or later (Railey 1992). They are also an interesting cultural marker since Fort Ancient were the only group who regularly used bifacial technology to make endscrapers outside of the eastern plains. Not even Caborn Welborn people made biface endscrapers despite the fact they were closer to, and may have had more regular contact with, groups on the eastern plains.

Use-wear analysis of endscrapers from the Oneota-related Hoxie Farm site in northern Illinois indicates that longer, bifacial scrapers were more often used for processing soft materials (hides?) while shorter unifacial scrapers were more often used for processing hard materials (Evans et al. 2014:342-349. This possible functional difference is evaluated in the following use-wear chapter.

Perforators

Perforators (code 30), like many categories, represent nearly equal proportions of the Ring 2 (5.1%) and Ring 1 (6.0%) village assemblages. These items are characterized by bifacial shaping and retouch and a narrow bit element that varies in shape depending on the specific function.

Several drill (i.e., rotary perforators) types were distinguished from other perforators by the presence of an elongated, narrow bit with a biconvex, diamond or roughly circular profile shape. Two sub-types of drills were recognized: expanded-base triangular drills and spike drills (after Railey 1992:144). Triangular drills were made from either triangular biface blanks or were likely recycled from triangular projectile points or knives. They exhibit an expanding base that ranges from nearly rectangular to
triangular, to “T” and “Y” shaped. Railey suggests that the variety with a large rectangular to triangular expanding base may have been used for more heavy duty drilling (1992:144). The “T” and “Y” shaped drills, and the spike drills tend to exhibit more refined flaking and elongated cylindrical bits with a more rounded profile. The “T” and “Y” shaped drills are still presumable crafted from a triangular blank of some kind as suggested by a continuum of base shapes from broad rectangular to triangular hafts to those with “T” and “Y” shapes.

While the varieties based on a triangular blank occur throughout the Fort Ancient sequence, spike drills are restricted to the Late Fort Ancient Period, post-A.D. 1400. Recent microwear analysis of experimental and archaeological samples of this tool type indicates it was used for manufacturing stone pipes (Law de Lauriston et al. 2015). The archaeological assemblage was from a protohistoric site in Oklahoma, which may imply their presence in protohistoric components like Hardin relates to pipe manufacture. Spike drills are typically very refined with a nearly circular profile. The primary distinguishing features of these are their pencil-like shape and the absence of an obvious hafting element. The most difficult to assess are the more narrow cylindrical variety which lack obvious morphological characteristics identifying a base or haft element.

Typically the widest aspect of the tool is in the center, which is typically only slightly wider than either distal or proximal ends. The working end of this variety can usually be distinguished from the haft end by the type of wear they exhibit (Railey 1992:144). The less cylindrical variety have a wider proximal end with haft element comprising about 1/3 of its length and the bit comprising the remainder. The haft element is typically shaped like an elongated upside-down triangle or pyramid with a flat
top. The lateral margins of the base are never parallel. Very narrow triangular drills can look somewhat like spike drills, but their hafts can always be distinguished by a square to rectangular shape with parallel lateral margins. The limited difference between very narrow triangular drills and spike drills with trianguloid- and pyramidal- shaped haft elements may suggest that even the latter originate from triangular preforms with their ultimate shape determined by differences in resharpening technique or hafting type.

Other Perforators are informal tools that vary widely in form, and appear to be crafted expediently from flake preforms, or are recycled from broken biface tools. Some may have been hafted, but most were crafted from amorphous flakes suggesting they were hand-held. Moreover the wide range of bit morphology suggests design for a wide range of desired bore diameters and materials. Microwear analysis of comparable items by Keeley (1980:Figures B-8 and B-9) indicates they were used for boring or reaming dry hide. He calls them awls.

In the sample, the proportion of non-rotary perforators, expanded-base drills, and spike drills is 44.0/ 24.0/ 36.0 % for Ring 2 and 58.5/ 19.5/ 22.0% for Ring 1. The apparently large proportional differences are not significant ($X^2=1.50$, df=4, p=0.29).

Early Prehistoric Projectile Points

A variety of early prehistoric, non-Fort Ancient projectile points (Code 99) were identified in the 1939 collections, and a few were collected during recent fieldwork. A total of 59 were recovered from the Ring 2 area and 33 from Ring 1. These were not considered in the analysis of each village assemblage because they were not relevant to
the present study, though classification would useful in establishing long-term use patterns of the Hardin Site locality.

Miscellaneous Biface Tools

Miscellaneous biface tools (code 97) represent nearly equal proportions of the Ring 2 (2.0%) and Ring 1 (1.9%) village assemblages. These items are well-thinned and typically exhibit evidence of retouch from repeated use. They represent irregular biface tools that could not be placed in a specific tool type category, and fragments of unidentified tool types broken during use or re-sharpening.

**Comparison of Fine Triangular Projectile Points between Ring 1 and Ring 2**

**Background**

The distribution of triangular projectile point types is widely used in Fort Ancient archaeology for relative chronology (e.g., Graybill 1981; Railey 1992; Drooker 1997:213; Drooker and Cowan 2001). This section compares the distribution of triangular projectile point types between the two village areas to build a relative chronology of the two components (see Chapter 6). A brief overview of the history of triangular projectile point classification in Fort Ancient research is presented first.

Variation in the shape of Fort Ancient triangular projectile point bases has long been recognized as chronologically significant (Graybill 1981). Graybill made one of the first large scale efforts to use base shape to seriate Fort Ancient components using triangular projectile points. He divided points into convex, straight, and concave bases, and found that the relative proportion of this attribute corresponded to radiocarbon dates
and other chronologically sensitive artifact types at a series of West Virginia Fort Ancient sites. Subsequently, Railey (1992) expanded on this division, defining 7 types. Minor, but meaningful, modifications have been made over the last two decades (Henderson and Pollack 1996:182-183; Henderson 1998:137-141; Miller 2001; Miller and Sanford 2010; Henderson and Gray 2000). Even with these additions, it seems likely that at least some spatial or temporal variation is not being recognized by the typology throughout the large areas of Kentucky, West Virginia, and southern Ohio in which it is currently being employed. Figure 7-1 shows the outline shape of the most temporally sensitive Fort Ancient projectile point types, as well as other types proposed here (after Henderson 1998:Fig.2.4; Henderson and Gray 2000; this study). Table 7-6 provides a description of the types, including recent modifications and the three extra types used in the present study.

Several attempts have been made to dismiss the validity of specific types (e.g., Carmean 2009, 2010), or to collapse the types into fewer categories (Bradbury and Richmond 2004; Bradbury et al. 2011; Cook and Comstock 2014), but these observations have not been incorporated into subsequent use of the typology. Moreover such critiques are misplaced in suggesting Railey intended his types to be diagnostic rather than temporally sensitive. When used to evaluate the relative age of a component by comparing the frequency distribution of types at the assemblage level, the typology is strongly predictive (Pollack et al. 2014:60). In fact, despite critiques, Railey’s typology has consistently predicted the relative age of components and has been repeatedly validated by radiocarbon determinations (Pollack et al. 2014). It is telling that the typology continues to be widely employed, even by some who have specifically criticized
it (e.g., Cooper 2005:170; Comstock and Cook 2015:104). Considering the relatively small sample of projectile points (n=151) used by Railey to build the typology, its persistence and utility are impressive. If anything, they represent the predictive power of the types, and the quality of Railey’s original research.

To date, the most comprehensive comparison of projectile point assemblages was recently conducted by Pollack et al. (2012) using 24 components represented by at least 15 projectile points each (Figure 7-2). The result (Table 7-7) indicates Type 2 predominates at Early Fort Ancient (A.D. 1000-1200) and Middle Fort Ancient (A.D. 1200-1400) sites, Type 5 predominates at early Late Fort Ancient (A.D. 1400-1550), and Type 6 predominates at late Late Fort Ancient / late Late Fort Ancient components. These findings are consistent with Railey’s original typology (1992), but also indicate that the proportion of type 5 peaks between A.D. 1400-1500. Railey’s original description for Type 5 indicated that it’s frequency peaks after A.D. 1400 (1992:161-163), but he did not recognize that it was the predominant type for the 1400-1550 period (probably due to the paucity of sites dated to this time in 1992). The relatively late popularity of Type 6 is supported by Pollack et al.’s comparison, and is validated by its predominance in post-A.D. 1550 Fort Ancient components in West Virginia (Graybill 1981:Table 20; Railey 1992:163-165). The validity of the typology for recognizing late components in West Virginia is important due to the proximity of Hardin to the area.

**Type Distribution in Ring 1 and Ring 2**

The distribution of types in the current study sample is shown in Table 7-8. A combination of the 1939 and 2013 datasets from the Hardin Site results in a total sample
of 679 triangular projectile points, one of the largest projectile point assemblages available for any Fort Ancient site. Railey’s typology was used for classification, though a few additional types (11, 12, 13) were recognized here (see Table 7-6 for type descriptions). The three additional types were recognized and given numbers purely for the purposes of examining intra-site distribution of variants that are not systematically recognized elsewhere. It was hoped that the recognition of additional variation would have temporal significance. Type 11 exhibits the same morphology as Type 4 (excurvate lateral margins, straight base) but are longer than 25mm, Type 12 is equivalent to Nodena, Elliptical (Justice 1987:230-232), and Type 13 is equivalent to Nodena, Banks Variety (Justice 1987:230-232)

Given that most assemblages are much smaller than that available for the present study, it is not a surprise that Types 12 and 13 are either not recognized in Fort Ancient assemblages and placed in an unidentified or unassigned category, or are referred to as Nodena varieties. Type 11 on the other hand seems to represent a classificatory problem present in Fort Ancient lithics. It appears that what is referred to here as Type 11, is often lumped into Type 5. This can be seen in images of “Type 5” which depict straight-based points with excurvate lateral margins (e.g., Henderson 1992a:Fig.19L,S; Pollack and Schlarb 2009:Fig.5.2). Examples can even be seen in Railey’s original description (1992:Fig.XI-11). Those lumped into Type 5 exhibit straight distal-lateral margins, but then converge toward the base. Technically, the portion of the lateral margin that recures toward the base on the cited examples and Type 5’s and on Type 11 here could be considered the haft element, which may be why these examples are included in the Type 5 category by some researchers.
Alternatively, such examples could represent arrow points that originally had straight lateral margins but the distal portion was resharpened while the item remained hafted resulting in two different margin profiles. Whatever the case, lateral margins are not explicitly divided into blade and haft areas by Railey or others. If these areas of the margin are being used to include specimens with excurvate lateral margins in Type 5 category, this logic should be explicitly recognized to avoid classificatory slippage, and promote inter-assemblage comparison.

Type 11 points represent only a small proportion of the Hardin assemblage (see below), which may indicate their fate has little impact on resulting type distributions. However, the degree to which this is the case in all assemblages is not known. The problem then, is one of classificatory ambiguity that undoubtedly results in some researchers placing ambiguous specimens in an “untyped” category while others place them in Type 5 category. This exposes a need for a standard method of determining “straight” versus “excurvate” lateral margins. In the present study, a ruler edge or flat surface was used to distinguish the two. Straight-based specimens with lateral margins that converge toward the base were placed in the Type 11 category.

The higher proportion of Type 6s and the lower proportion of Type 2s in Ring 2 suggest that it is relatively later, though the difference in proportion is not significant ($X^2=1.31$, $p=0.254$, df=1). The relative proportion of Type 5s is not informative since it is nearly identical in both village areas. It is notable that the distribution of Types 11-13 is nearly identical in both village samples.

Table 7-9 shows the distribution of only Types 2-6, which allows for a direct comparison of the Ring 1 and Ring 2 samples to the 24 Kentucky sites included in
Pollack et al.’s (2012) recent study (see Table 7-7). The proportion of Types 5 and 6 in both village areas falls squarely within the ranges documented for late Late Fort Ancient components in Pollack et al.’s (2012) study.

Other Observations

During the course of analysis the large size of the assemblage permitted the distinction of some potentially important variation within Type 6 projectile points. Two variants were repeatedly observed during analysis, both of which are consistent with the original definition of Railey’s Type 6: concave base / excurvate lateral margins and concave base / straight lateral margins (1992:163). These variants have already been observed in the unpublished analysis of the Bentley (Lower Shawnee Town) Site triangular projectile point assemblage (Henderson and Gray 2000). The Bentley Site is the latest Fort Ancient component in Kentucky and dates the early historic period, ca. A.D. 1740s-1750s (Pollack and Henderson 1983). Henderson and Gray identified what they believed to be an unusual number of Type 6s with straight lateral margins in the assemblage. They designated these specimens with the Type 9 name, but have not published the results of their study.

Considering that both Hardin and Bentley represent very late Fort Ancient components (after A.D. 1550), it can be proposed that the strong representation of Type 6 and Type 9 may have chronological significance. However, since the relative proportion of the two has only been quantified for Hardin and Lower Shawnee Town, it is not currently possible to evaluate its significance. Furthermore, if Type 9 is accepted, the definition of Type 6 would have to be restricted only to concave-based specimens with
excurvate lateral margins and have their widest point at the mid-section. These modifications to Type 6 are shown in Table 7-6 by crossing out certain attributes for Type 6. These changes would only have to be recognized for assemblages where Type 9 is recognized.

At this point, several possibilities are equally plausible explanations for the presence of both Type 6 and Type 9 in some assemblages: 1) The presence of Type 6 and Type 9 is not chronologically meaningful beyond northeastern Kentucky (Hardin and Bentley are both in northeastern Kentucky only a few kilometers apart). It represents a local experimentation with the lateral margins of Type 6 points during the protohistoric period in the area; 2) The “ideal” concave-based triangular projectile point has straight lateral margins (i.e., Type 9), while those with excurvate lateral margins (Type 6) are the result of modification during re-sharpening or re-hafting. In this scenario, the distribution of the two variant represents how reduced the projectile point assemblage is. If this is true, then relatively more reduced assemblages should exhibit a proportion of Type 6 relative to Type 9; or 3) The proportion of Type 6 and Type 9 represents a chronologically meaningful change in attribute frequency.

**Summary and Discussion**

Overall the Ring 1 and Ring 2 assemblages are strikingly similar (Table 7-5). This is perhaps not surprising considering the same observation was made in comparing the ceramic assemblages. These differences also had temporal significance which was examined in Chapter 6. Possible functional differences will be examined here. Only
triangular projectile points and biface endscrapers exhibit proportional differences that had statistical significance (Table 7-5).

Looking at the assemblages as a whole, the relatively higher proportion of projectile points in the Ring 2 assemblage is countered by a slightly higher proportion of nearly every tool category in Ring 1. Since the main difference in proportion among these assemblages lies among projectile points and endscrapers, a ratio of categories to was calculated for each village and endscraper type (Table 7-10). Not surprisingly, all three ratios are much higher for Ring 1. The ratio of all endscrapers to projectile points is significantly higher in Ring 1 (0.64:1) sample relative to Ring 2 (0.42:1) sample ($X^2=8.42, p=0.004$).

The meaning of this difference is difficult to assess given the lack of research on Fort Ancient endscrapers. The proliferation of endscrapers on Oneota tradition sites has been taken as an indication of the intensity of bison hide processing. An endscraper to point index has been used to compare Oneota sites since the early 1960s (Hall 1962). If a higher ratios of endscrapers is taken as an indication of a greater focus on hide processing, then it would appear that more hide processing was taking place in that village. However, one problem with this inference is that morphological similarity of Fort Ancient and Oneota endscrapers does not mean they were functional equivalents, or that uniface and biface endscrapers were functionally equivalent.

Microwear study of uniface and biface endscrapers from the upper Mississippian Hoxie Farm site indicates that uniface endscrapers were used to process harder materials such as wood while biface endscrapers were used for processing soft materials such as hides (Evans et al. 2014:347-349). Even if these results cannot be applied directly to
interpret the function of Fort Ancient endscraper types, the ratio of both endscraper types is higher in Ring 1 though not significantly so for both types (see Table 7-5). This issue will be further explored after the metric and use-wear analysis data have been presented.

Conclusions

The purpose of this analysis was to use the distribution of diagnostic and temporally sensitive tool types to assess the relative chronological position of Ring 1 and Ring 2. Classification of the Hardin site lithic assemblage identified the expected range of tool forms and types expected for Late Fort Ancient occupations. Tool forms diagnostic of the late Late Fort Ancient (e.g., biface endscrapers) are present in abundance in both village areas. In addition, the type frequency of projectile points from both villages is consistent with other assemblages dating to the late Late Fort Ancient (see Table 7-7). The distribution of point types also indicates that the Ring 2 area is relatively later. This information will be used in Chapter 6 as one line of evidence in assessing the relative chronological position of the two villages.
Table 7-1: All chert artifacts classified from Hardin Site

<table>
<thead>
<tr>
<th>CONTEXT</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>contexts used in present study</td>
<td></td>
</tr>
<tr>
<td>Ring 2</td>
<td>23138</td>
</tr>
<tr>
<td>Ring 1</td>
<td>5892</td>
</tr>
<tr>
<td>contexts not used in present study</td>
<td></td>
</tr>
<tr>
<td>overlap area : general contexts</td>
<td>517</td>
</tr>
<tr>
<td>overlap area : Houses 1-3</td>
<td>2809</td>
</tr>
<tr>
<td>grand total</td>
<td>32356</td>
</tr>
</tbody>
</table>
Table 7-2: All chert artifacts included in the analytical sample.

<table>
<thead>
<tr>
<th>artifact Category</th>
<th>Code</th>
<th>1939 sub-sample</th>
<th>2013 sub-sample</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td>Total</td>
</tr>
<tr>
<td>triangular projectile points</td>
<td>1-13,</td>
<td>256</td>
<td>150</td>
<td>406</td>
</tr>
<tr>
<td></td>
<td>69,98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>scrapers</td>
<td>20</td>
<td>123</td>
<td>101</td>
<td>224</td>
</tr>
<tr>
<td>perforators</td>
<td>30</td>
<td>29</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>triangular blankets/preforms</td>
<td>40</td>
<td>125</td>
<td>83</td>
<td>208</td>
</tr>
<tr>
<td>hump-backed triangular biface</td>
<td>50</td>
<td>26</td>
<td>19</td>
<td>45</td>
</tr>
<tr>
<td>early stage biface</td>
<td>60</td>
<td>83</td>
<td>65</td>
<td>148</td>
</tr>
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<td>early stage biface fragment</td>
<td>60.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>bipointed knife</td>
<td>70</td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>bifacial knife</td>
<td>80</td>
<td>23</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>uniface tool</td>
<td>90</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>hammerstone</td>
<td>95</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>core</td>
<td>96</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>misc. biface tool</td>
<td>97</td>
<td>20</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>early prehist. projectile pt.</td>
<td>99</td>
<td>53</td>
<td>22</td>
<td>75</td>
</tr>
<tr>
<td>TOOL SUBTOTAL</td>
<td>-</td>
<td>753</td>
<td>511</td>
<td>1264</td>
</tr>
<tr>
<td>debitage</td>
<td>91</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>-</td>
<td>753</td>
<td>911</td>
<td>1264</td>
</tr>
</tbody>
</table>
Table 7-3: All chert artifacts excluding classes not present in the 1939 collections*

<table>
<thead>
<tr>
<th>artifact category</th>
<th>code</th>
<th>1939 sub-sample</th>
<th></th>
<th></th>
<th>2013 sub-sample</th>
<th></th>
<th></th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td>1939 TOTAL</td>
<td>RING 2</td>
<td>RING 1</td>
<td>2013 Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>triangular projectile points</td>
<td>1-13, 69, 98</td>
<td>256</td>
<td>36.9</td>
<td>150</td>
<td>3.1</td>
<td>406</td>
<td>34.5</td>
<td>168</td>
</tr>
<tr>
<td>endscrapers</td>
<td>20</td>
<td>123</td>
<td>17.7</td>
<td>101</td>
<td>20.9</td>
<td>224</td>
<td>19.0</td>
<td>63</td>
</tr>
<tr>
<td>perforators</td>
<td>30</td>
<td>29</td>
<td>4.2</td>
<td>23</td>
<td>4.8</td>
<td>52</td>
<td>4.4</td>
<td>21</td>
</tr>
<tr>
<td>triangular blanks/preforms</td>
<td>40</td>
<td>125</td>
<td>1.8</td>
<td>83</td>
<td>17.1</td>
<td>208</td>
<td>17.7</td>
<td>21</td>
</tr>
<tr>
<td>hump-backed triangular biface</td>
<td>50</td>
<td>26</td>
<td>3.7</td>
<td>19</td>
<td>3.9</td>
<td>45</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>early stage biface</td>
<td>60</td>
<td>83</td>
<td>1.2</td>
<td>65</td>
<td>13.4</td>
<td>148</td>
<td>12.6</td>
<td>55</td>
</tr>
<tr>
<td>bifacial knife</td>
<td>70</td>
<td>8</td>
<td>1.2</td>
<td>7</td>
<td>1.4</td>
<td>15</td>
<td>1.3</td>
<td>0</td>
</tr>
<tr>
<td>hammerstone</td>
<td>80</td>
<td>23</td>
<td>3.3</td>
<td>19</td>
<td>3.9</td>
<td>42</td>
<td>3.6</td>
<td>10</td>
</tr>
<tr>
<td>misc. biface tool</td>
<td>95</td>
<td>1</td>
<td>0.1</td>
<td>5</td>
<td>0.1</td>
<td>6</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>694</td>
<td>484</td>
<td>1178</td>
<td>338</td>
<td>222</td>
<td>559</td>
<td>1737</td>
</tr>
</tbody>
</table>

*excluding biface fragments, uniface tools, debitage, cores.
Table 7-4: All chert artifacts excluding classes not present in the 1939 collections*, and excluding 2011 surface collections**

<table>
<thead>
<tr>
<th>artifact Category</th>
<th>Code</th>
<th>1939 sub-sample</th>
<th>2013 sub-sample</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td>1939 TOTAL</td>
</tr>
<tr>
<td>triangular projectile points</td>
<td>1-13,69,98</td>
<td>256</td>
<td>150</td>
<td>406</td>
</tr>
<tr>
<td>uniface endscrapers</td>
<td>20.1</td>
<td>18</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>biface endscrapers</td>
<td>20.2</td>
<td>92</td>
<td>75</td>
<td>167</td>
</tr>
<tr>
<td>perforators</td>
<td>30</td>
<td>29</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>triangular blanks/preforms</td>
<td>40</td>
<td>125</td>
<td>83</td>
<td>208</td>
</tr>
<tr>
<td>hump-backed triangular biface</td>
<td>50</td>
<td>26</td>
<td>19</td>
<td>45</td>
</tr>
<tr>
<td>early stage biface</td>
<td>60</td>
<td>83</td>
<td>65</td>
<td>148</td>
</tr>
<tr>
<td>bipointed knife</td>
<td>70</td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>bifacial knife</td>
<td>80</td>
<td>23</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>hammerstone</td>
<td>95</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>misc. biface tool</td>
<td>97</td>
<td>20</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>TOTAL</td>
<td>681</td>
<td>476</td>
<td>1157</td>
<td>282</td>
</tr>
</tbody>
</table>
*excluding biface fragments, uniface tools, debitage, cores

**2011 Surface Collections: Type 1-13: 44 surface collected triangular projectile points from Ring 2, 43 from Ring 1, for a total of 87 removed from 2013 total; Type 20.2: removed 11 surface collected scrapers from the Ring 2 and 16 from the Ring 1 for a total of 27 from the entire 2013 sample; Type 40: took FS1006, 894, 872, 662, 649, 128 from early stage bifaces; Type 50: took FS1187 from early stage bifaces; fs503,687 from triangular bifaces
Table 7-5: Final combined sample. Excludes classes not present in the 1939 collections*, and excluding 2011 surface collections**

<table>
<thead>
<tr>
<th>Lithic Category</th>
<th>Code</th>
<th>RING 2</th>
<th>RING 1</th>
<th>Chi-Square: difference of proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>triangular projectile points</td>
<td>1 to 13, 69, 98</td>
<td>380</td>
<td>38.6%</td>
<td>212</td>
</tr>
<tr>
<td>uniface endscrapers</td>
<td>20.1</td>
<td>39</td>
<td>4.0%</td>
<td>31</td>
</tr>
<tr>
<td>biface endscrapers</td>
<td>20.2</td>
<td>120</td>
<td>12.2%</td>
<td>104</td>
</tr>
<tr>
<td>perforators</td>
<td>30</td>
<td>50</td>
<td>5.1%</td>
<td>41</td>
</tr>
<tr>
<td>triangular blanks/preforms</td>
<td>40</td>
<td>146</td>
<td>14.8%</td>
<td>105</td>
</tr>
<tr>
<td>hump-backed triangular biface</td>
<td>50</td>
<td>28</td>
<td>2.8%</td>
<td>20</td>
</tr>
<tr>
<td>early stage biface</td>
<td>60</td>
<td>138</td>
<td>14.0%</td>
<td>83</td>
</tr>
<tr>
<td>bipointed knife</td>
<td>70</td>
<td>8</td>
<td>0.8%</td>
<td>7</td>
</tr>
<tr>
<td>bifacial knife</td>
<td>80</td>
<td>33</td>
<td>3.4%</td>
<td>29</td>
</tr>
<tr>
<td>hammerstone</td>
<td>95</td>
<td>1</td>
<td>0.1%</td>
<td>5</td>
</tr>
<tr>
<td>miscellaneous biface tool</td>
<td>97</td>
<td>20</td>
<td>2.0%</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>963</td>
<td></td>
<td>650</td>
</tr>
</tbody>
</table>

*excluding biface fragments, uniface tools, debitage, cores

**2011 Surface Collections: Type 1-13: 44 surface collected triangular projectile points from Ring 2, 43 from Ring 1, for a total of 87 removed from 2013 total; Type 20.2: removed 11 surface collected scrapers from the Ring 2 and 16 from the Ring 1 for a total of 27 from the entire 2013 sample; Type 40: took FS1006,894,872,662,649,128 from early stage bifaces; Type 50: took FS1187 from early stage bifaces; FS503,687 from triangular bifaces
Figure 7-1: Morphological types used to classify Fort Ancient fine triangular projectile points*

*Type 9 after Henderson and Gray 2000 and this study, Types 11, 12, 13 after this study. See Table 7-6 for descriptions.
### Table 7-6: Attributes of currently recognized Fort Ancient triangular point types, including three additional types used in this study.

<table>
<thead>
<tr>
<th>Type</th>
<th>Type Name</th>
<th>Basal Margin</th>
<th>Lateral Margins</th>
<th>Widest @ Base</th>
<th>Base/Corner Shape</th>
<th>Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small Tri-Incurvate</td>
<td>concave</td>
<td>concave</td>
<td>base</td>
<td>expanding/sharp</td>
<td>&lt;45 deg</td>
</tr>
<tr>
<td>2</td>
<td>Flared Base</td>
<td>convex to straight</td>
<td>basally expanding</td>
<td>base</td>
<td>expanding/sharp</td>
<td>&lt;90 deg</td>
</tr>
<tr>
<td>2.1</td>
<td>Eared Flared Base</td>
<td>concave</td>
<td>base</td>
<td>expanding/sharp</td>
<td>&lt;90 deg</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Coarsely Serrated</td>
<td>straight to convex</td>
<td>straight, nearly parallel</td>
<td>varies</td>
<td>varies/sharp</td>
<td>varies</td>
</tr>
<tr>
<td>3.1</td>
<td>Finely Serrated</td>
<td>straight?</td>
<td>straight to excrurate</td>
<td>base?</td>
<td>expanding/sharp</td>
<td>&lt;90 deg</td>
</tr>
<tr>
<td>4</td>
<td>Short, Exc r vate</td>
<td>usually convex to straight</td>
<td>straight to excrurate</td>
<td>base</td>
<td>direct/sharp-round</td>
<td>≤90 deg</td>
</tr>
<tr>
<td>5</td>
<td>Straight Sided</td>
<td>straight to slightly convex</td>
<td>straight to v. slightly convex</td>
<td>base</td>
<td>direct/sharp-round</td>
<td>≤90 deg</td>
</tr>
<tr>
<td>6*</td>
<td>Concave Base</td>
<td>concave</td>
<td>excrurate to straight</td>
<td>medial or base</td>
<td>convergent/sharp-round</td>
<td>varies</td>
</tr>
<tr>
<td>7</td>
<td>Thick, Wide Base</td>
<td>straight?</td>
<td>straight to excrurate</td>
<td>base</td>
<td>convergent/sharp-round</td>
<td>varies</td>
</tr>
<tr>
<td>8</td>
<td>Long, Concave Base</td>
<td>concave</td>
<td>excrurate to straight</td>
<td>base</td>
<td>convergent/sharp-round</td>
<td>varies</td>
</tr>
<tr>
<td>9*</td>
<td>Concave Base, Straight Sided</td>
<td>concave</td>
<td>straight</td>
<td>base</td>
<td>expanding/sharp</td>
<td>≤90 deg</td>
</tr>
<tr>
<td>11</td>
<td>Long, Exc r v ate</td>
<td>straight</td>
<td>excrurate</td>
<td>base</td>
<td>direct/sharp-round</td>
<td>≥90 deg</td>
</tr>
<tr>
<td>12</td>
<td>Nodena, Elliptical</td>
<td>pointed</td>
<td>excrurate</td>
<td>medial</td>
<td>convergent/ N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>13</td>
<td>Nodena, Banks Var.</td>
<td>straight</td>
<td>excrurate</td>
<td>medial</td>
<td>contracting/sharp-round</td>
<td>&gt;90 deg</td>
</tr>
<tr>
<td>Type</td>
<td>Citation</td>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Railey 1992: 156, Figure XI-7f-h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Railey 1992: 156, Figure XI-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Henderson 1998:140</td>
<td>Miller and Sanford 2010 recognize a serrated Type 2 variant which they refer to as Type 2/3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Railey 1992: 158, Figure XI-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Henderson 1998:140</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Railey 1992: 158-161, Figure XI-10</td>
<td>See also Carmean 2009 for discussion.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Railey 1992: 161-163, Figure XI-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Railey 1992: 163-165, Figure XI-12</td>
<td>See comments for Type 9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Railey 1992: 165, Figure XI-7i-j</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Henderson and Pollack 1996:182, Figure 7f-g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Henderson and Gray 2000</td>
<td>Henderson and Gray 2000 distinguished straight-sided (Type 9) from excurvate-sided concave base points (Type 6), but this research has not been published.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>here</td>
<td>The plan shape of this type is identical to excurvate-sided Type 4, but is longer than 25mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Perino 1966; Justice 1987:230-232, Figure 50a-b</td>
<td>These match the plan shape of Nodena Elliptical, but tend to be thicker and might actually be small endscrapers. This idea should be examined by microwear analysis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Perino 1966; Justice 1987: 230-232, Figure 50d-e</td>
<td>This have the same plan shape as Type 6 with the exception of a straight base.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note that when attributes were not provided for a given type by the references cited, they were devised for this table based on illustrations of types provided in the reference, or based on the author’s experience. Type 10 is not included here because it is the same as Type 9. I independently identified this type at Hardin before I was aware of Henderson and Gray 2000.*
Figure 7-2: Fort Ancient sites used in Pollack et al.’s comparison of fine triangular projectile points. Also location of Hardin Site (adapted from Pollack et al. 2012:Fig.2)

SITES:
Table 7-7: Pollack et al.’s comparison of fine triangular projectile points
(adapted from Pollack et al. 2012: Table 1)

<table>
<thead>
<tr>
<th>Site Name</th>
<th>n</th>
<th>Type 2</th>
<th>Type 2.1</th>
<th>Type 3</th>
<th>Type 3.1</th>
<th>Type 4</th>
<th>Type 5</th>
<th>Type 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Fort Ancient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elk Fork(^1)</td>
<td>32</td>
<td>65.6%</td>
<td>6.3%</td>
<td>6.3%</td>
<td>6.3%</td>
<td>15.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Run(^2)</td>
<td>42</td>
<td>50.0%</td>
<td>2.4%</td>
<td>2.4%</td>
<td>45.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muir(^3)</td>
<td>46</td>
<td>45.7%</td>
<td>23.9%</td>
<td>17.4%</td>
<td>13.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Late Early / Early Middle Fort Ancient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedinger(^4)</td>
<td>69</td>
<td>68.1%</td>
<td>2.9%</td>
<td>26.1%</td>
<td>2.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cox(^5)</td>
<td>17</td>
<td>70.6%</td>
<td></td>
<td></td>
<td>29.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Branch Creek(^6)</td>
<td>29</td>
<td>58.6%</td>
<td></td>
<td></td>
<td>34.5%</td>
<td>6.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentuckiana Farm(^7)</td>
<td>36</td>
<td>30.6%</td>
<td>25.0%</td>
<td>8.3%</td>
<td>2.8%</td>
<td>5.6%</td>
<td>27.8%</td>
<td></td>
</tr>
<tr>
<td>Van Meter(^8)</td>
<td>20</td>
<td>65.0%</td>
<td></td>
<td></td>
<td></td>
<td>30.0%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Middle Fort Ancient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guilfoil(^9)</td>
<td>18</td>
<td>50.0%</td>
<td>16.7%</td>
<td></td>
<td></td>
<td></td>
<td>33.3%</td>
<td></td>
</tr>
<tr>
<td>Broaddus(^10)</td>
<td>94</td>
<td>42.6%</td>
<td>10.6%</td>
<td>3.2%</td>
<td>43.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenney(^4)</td>
<td>65</td>
<td>66.2%</td>
<td>4.6%</td>
<td>1.5%</td>
<td>26.2%</td>
<td>1.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singer(^9)</td>
<td>26</td>
<td>34.6%</td>
<td>11.5%</td>
<td>19.2%</td>
<td>7.7%</td>
<td>26.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpenter Farm(^11)</td>
<td>17</td>
<td>17.6%</td>
<td>17.6%</td>
<td></td>
<td></td>
<td></td>
<td>64.7%</td>
<td></td>
</tr>
<tr>
<td>Fox Farm(^12)</td>
<td>55</td>
<td>23.6%</td>
<td>41.8%</td>
<td>7.3%</td>
<td>27.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florence Hr(^22)</td>
<td>17</td>
<td>23.5%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>5.9%</td>
<td>29.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Early Late Fort Ancient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capitol View(^13)</td>
<td>65</td>
<td>7.7%</td>
<td>1.5%</td>
<td>7.7%</td>
<td>70.8%</td>
<td>13%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet Lick Knob(^14)</td>
<td>59</td>
<td>5.8%</td>
<td>1.8%</td>
<td>5.8%</td>
<td>1.8%</td>
<td>6.8%</td>
<td>78.0%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Fox Farm(^12)</td>
<td>40</td>
<td>7.5%</td>
<td>12.5%</td>
<td>17.5%</td>
<td>32.5%</td>
<td>30.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Field(^15)</td>
<td>85</td>
<td>1.2%</td>
<td>9.4%</td>
<td>68.2%</td>
<td>21.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petersburg(^16)</td>
<td>26</td>
<td>15.4%</td>
<td>3.8%</td>
<td>15.4%</td>
<td>61.5%</td>
<td>3.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Late Late Fort Ancient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augusta(^12)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>15.0%</td>
<td>40.0%</td>
<td>45.0%</td>
<td></td>
</tr>
<tr>
<td>Goolman(^17)</td>
<td>107</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24.3%</td>
<td>75.7%</td>
</tr>
<tr>
<td>Larkin(^18)</td>
<td>55</td>
<td>3.9%</td>
<td>3.9%</td>
<td>11.8%</td>
<td>23.5%</td>
<td>56.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bentley(^19)</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32.7%</td>
<td>17.3%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

\(^1\) Cooper 2005; \(^2\) Henderson 1998b; \(^3\) Henderson 2006; \(^4\) Raymer 2008; 
\(^5\) Raymer 2011; \(^6\) Pope 2005; \(^7\) Picklesimer and Miller 2010; \(^8\) Raymer et al. 2012; 
\(^9\) Henderson 1998e; \(^10\) Carman 2010; \(^11\) Pollack and Hockensmith 1992; 
\(^12\) Railey 1992, Pollack and Henderson 2012; \(^13\) Henderson 1998a; 
\(^14\) Steve Ahler, personal communication 2011; \(^15\) Updike 1996; \(^16\) Flood 1993; 
\(^17\) Henderson 1998d; \(^18\) Stokes 1996; \(^19\) Henderson and Gray 2000
Table 7-8: Triangular projectile point type frequencies by ring location.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RING 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.5%</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>9.0%</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.2%</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>6.8%</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>92</td>
<td>21.7%</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>65</td>
<td>15.3%</td>
<td>44</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>0.5%</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>84</td>
<td>19.6%</td>
<td>36</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>1.2%</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
<td>4.2%</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>4.2%</td>
<td>11</td>
</tr>
<tr>
<td>UID</td>
<td>39</td>
<td>9.2%</td>
<td>28</td>
</tr>
<tr>
<td>TOTAL</td>
<td>424</td>
<td>1</td>
<td>255</td>
</tr>
</tbody>
</table>
Table 7-9: Triangular projectile point type frequency by ring location. Showing only Types 2-6 allowing for direct comparison to the 24 sites in Pollack et al. 2012.

<table>
<thead>
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<th>type</th>
<th>RING 2</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.7%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.3%</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>9.5%</td>
</tr>
<tr>
<td>5</td>
<td>92</td>
<td>30.3%</td>
</tr>
<tr>
<td>6*</td>
<td>180</td>
<td>59.2%</td>
</tr>
<tr>
<td></td>
<td>304</td>
<td>176</td>
</tr>
</tbody>
</table>

*Includes Type 6 and Type 9.
Table 7-10: Triangular projectile point and endscraper type frequencies and ratios by ring location.

<table>
<thead>
<tr>
<th>comparison type</th>
<th>category</th>
<th>RING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RING 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Frequency</td>
<td>triangular projectile points</td>
<td>380</td>
</tr>
<tr>
<td></td>
<td>uniface endscrapers</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>biface endscrapers</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>all endscrapers</td>
<td>159</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>comparison type</th>
<th>Category</th>
<th>RING</th>
<th>Chi-Square: Difference in Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td>Ratio</td>
<td>uniface endscrapers : projectile points</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>biface endscrapers : projectile points</td>
<td>0.32</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>all endscrapers : projectile points</td>
<td>0.42</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Chapter 8

Endscraper Microwear Study

Goals and Background

Microwear analysis is used in this study as one method of documenting endscraper morphology and use patterns. In particular it is hoped that microwear patterns will distinguish whether or not endscrapers were used for hide processing. This is important for both the present study and beyond since endscrapers are widely assumed to be hide processing tools, though this has not been widely demonstrated in eastern North America (but see Cobb and Pope 1998; Evans et al. 2014).

A variety of methods have been adopted to examine the relationship between tool morphology, function, and use-wear traces – micro-chipping, attrition, and polish (e.g., Odell et al. 1974; Hayden 1979; Keeley 1980; Ahler 1984). While no universal relationship have emerged, some tool functions are associated with a relatively predictable pattern of morphological and or use-wear attributes. The relationship between function and physical attributes has, in a limited number of cases, been ethnographically and or experimentally verified (e.g., Tringham et al. 1974; Seigel 1984; Shott and Weedman 2007). Building on this research, S. R. Ahler has defined at least 13 functional modes, or “kinetic states”, each of which is defined by six attribute categories (1984:427-428, Appendix F; 1988:496-517). These include micro-chippage or flake initiation and termination type, attrition type (e.g., rounding, crushing, striae), attrition orientation, distribution of micro-chippage scars, and edge angle. Because Ahler defined his kinetic states with a limited range of attribute categories due to time constraints
(1984:717), a few additional attributes were documented in the present study which could provide useful supplementary information.

Another consideration at the outset of the use-wear component of this study was that only endscrapers were included. Considering that this morphological tool type is almost universally associated with hide processing and less often wood or bone working activities (Cobb 2000), it would have been easy to assume the tools served one or several such purposes. However, greater certainty about scraper function was desired since this information was crucial to assessing the degree to which hide processing may have increased at the locality over time. Moreover, the detailed analysis that follows was deemed necessary to assess relative intensity of use in addition to function.

**Sampling**

The biface endscraper microwear sample was a random stratified sample (Table 8-1). The initial goal was to include 25 each uniface and biface scrapers from each village for a total of 100 items. Selecting samples was accomplished by generating an excel spreadsheet with all endscrapers, dividing it once by scraper type, and again by village. The result was four spreadsheets: Ring 2 uniface, Ring 2 biface, Ring 1 uniface, Ring 1 biface. Scrapers in each sheet were originally listed in descending order from lowest to highest catalog number. I then generated a new column and instructed excel to insert a random number sequence in the column. Finally, I resorted the spreadsheet descending from greatest to least based on the random number assigned to the scrapers and then selected the first 25 scrapers in this randomly generated sequence. In several cases additional tools were included because some of the original 25 were burned, or had
bits that were fragmentary or obscured by residue. The result was 29 biface scrapers from each village, 25 uniface scrapers from Ring 2, and 21 from Ring 1. All uniface scrapers that could be examined from Ring 1 were examined.

During the course of analysis it quickly became apparent that the original assignment of scrapers to either “unifacial” or “bifacial” was not based on strict enough criteria. Originally, scrapers were considered bifacial if any of the ventral aspect was shaped. Closer inspection of scrapers revealed several patterns. First, nearly all scrapers regardless of type have some level of shaping of the proximal lateral margins, probably for hafting (see below). Second, nearly all biface and most uniface scrapers have some level of ventral modification, but most of this was concentrated toward the proximal end where lateral modification was also the most pronounced. This association suggested that most bifacial modification was probably related to shaping the proximal end of the tool for hafting. Since some level of proximal shaping was common to nearly all scrapers it was decided a more meaningful criterion for distinguishing scraper type was the method by which the distal portion of the ventral surface (the “bit”) was shaped. Thus, scrapers were reclassified during analysis as “bifacial” only if the bit portion of the ventral surface was shaped, and “unifacial” if the bit shape was determined by the original flake blank. These morphological considerations are examined further in the subsequent metric analysis section. This brief discussion was to explain why some classificatory changes were made to scrapers during microwear analysis.
Methods

A National Model DC3-420\textsuperscript{TH} stereoscopic zoom microscope was used for microwear analysis. This microscope was equipped with a 20x eyepiece and a 1.5x objective lens for a maximum total magnification of 120x with a field size of 1.7mm. Each scraper was given a general examination at low magnification (15-30x) to assess the presence of general characteristics, condition, presence of residue that might obscure analysis. All three margins (bit/working edge, both lateral margins) were examined on the first five scrapers. This was to familiarize myself with the range of variation in use traces on each area. As part of this, both proximal lateral margins were examined in detail at the full range of magnification (0-120x). This information was to characterize this part of the tools and to assess whether the items were hafted. As discussed below in the results, nearly all uniface and biface specimens were very likely hafted. For this reason, after the pattern of use-traces for hafting was recognized, this part of the tool was given brief attention and marked only if hafting evidence was lacking. The vast majority of effort was focused on the bit/working edge.

The working edge of each specimen was examined to document the presence of wear traces resulting from damage and attrition during use. While some attributes can result from incidental damage or natural causes, but these have been identified by well-established by experimental programs (e.g., Tringham et al. 1974; Keeley 1980:15-83). Type of action, or kinetic category, and hardness of material being worked can generally be determined based on patterns of damage and attrition visible at low resolution (Andrefsky 2005:197-198). However, the specific type of material within each general density category (e.g., soft plants, hide, or flesh) cannot accurately be distinguished with
lower magnification microscopy. Moreover, the rate and type of wear is partially
determined by chert minerology, so it is often recommended that experimental studies on
locally available material are used to provide a baseline for interpretation (Andrefsky
2005:198).

Because this study did not make use of either high resolution microscopy or an
experimental program, the patterns observed can only be interpreted in the relative and
general sense. However, the results are still deemed informative because endscrapers
have been analyzed in a variety of contexts worldwide and are almost universally used
for hide processing and a limited range of other purposes. In addition, while
experimental data are not available to assess the effect of raw material variability, this
can be indirectly gaged with the present dataset because chert type was recorded.
Therefore microwear patterns can be explored by chert type to examine its influence.
Given the limitations of the study, an effort was made to maximize the amount of
information that could be collected about tool use with the methods at hand. A range of
detailed use-wear information was recorded. First, the general morphology of the
working edge was recorded (plan shape, working edge angle, presence/absence of
retouch). Second, the type of micro-chipping (initiation, termination) and its qualities
(orientation relative to working edge plane, aspect location, and distribution) were
recorded. And finally, the type(s) of wear traces (rounding, polish, grinding, crushing,
and striae) and their associated qualities (primary and secondary type and location, striae
orientation) were recorded.
Results

The results are described for each category of information below – morphology, micro-chipping, attrition – and then summarized to infer which “kintetic category” (Stanley Ahler 1979) or type of use-action (Andrefsky 2005:195) is best supported. These types of use are derived from experimental programs (e.g., Tringham et al. 1974; Keeley 1980; Andrefsky 2005:197-198) that provide generalizations about the relationship between material density, damage, and attrition that result from different materials and use-actions. As indicated above, these generalizations do not account for differences in raw material type. An attempt to overcome this issue is made by exploring these patterns for each material type.

Morphology

The plan shape of Fort Ancient scrapers (Figures 8-1 and 8-2) has been referred to by a variety of names such as “thumb nail” (Griffin 1943:162) and “teardrop” – shaped (Railey 1992:143). These descriptions converge around two aspects of the plan shape: a slightly-to-moderately excursive distal margin/bit area, with lateral margins that converge toward the proximal end. The proximal margins are typically straight to slightly excursive and, toward the proximal end, usually exhibit a notable inflection point after which they converge to either a point or a very narrow slightly excursive margin. Scrapers exhibiting margins that converge to a point at the proximal end invoke more of a long “teardrop” shape; while those converging to a narrow margin invoke more of a “thumbnail” shape. Keeley indicates scrapers with a convex distal plan shape are typical for hide scraping, while concave edges are typical for wood scraping (1980:111).
The longitudinal profile shape of endscrapers (Figures 8-1 and 8-2) is also distinctive as well as notably consistent. They typically exhibited a slightly concave ventral profile and a convex dorsal profile. Importantly, the concavity of the ventral profile appears to be created by recurve toward the distal end. On uniface specimens recurve was an aspect of the flake blank (Griffin 1943:122), while it was manufactured by shaping on biface specimens.

Edge Angle of Distal (Bit) Margin

The most frequent distal margin edge angle for both scraper types in both villages was between 60 and 90 degrees (Table 8-2). This is consistent with Keeley’s sample of scrapers identified for hide working at Clacton, which averaged greater than 70 degrees (1980:116). The second-most common edge angle range is 40 to 60 degrees for both biface samples, and unifaces from Ring 1. Unifaces from Ring 2 standout because they tend to have edge angles from 60 to 90 or > 90 degrees. Thus, in Ring 2 the two scraper types are more distinct with regard to this attribute. The pattern in Ring 2 is also more consistent with Railey’s generalization the biface scrapers tend to have a lower edge angle than uniface scrapers (1992:143).

Location of Use Traces

As a starting point for microwear analysis each tool was examined for the distribution of wear traces (Table 8-3). The majority of all use-traces (>70-90%) for both scraper types occurred on the dorsal (convex) aspect of the bit edge. For damage to accrue only on one aspect, the tool would have to be used in a one-way motion, with the
ventral aspect of the tool contacting the objective material and resulting in damage on the opposite (dorsal) aspect (Tringham et al. 1974). There were some differences between villages and scraper types, but they are not patterned.

**Type, Orientation and Distribution of Micro-Chippage**

Micro-chippage is a type of damage that occurs to the working edge of a tool during use. Micro-chips or flakes are detached from the working edge as a result of contact with an objective surface. Micro-chips vary in their initiation and termination type, distribution and size. Variables that determine micro-chippage patterns include the hardness of the objective material, the contact angle of the tool’s working edge, and the rate and direction of the tool’s movement (Keeley 1980:24-25). In this study, flake initiation type, flake termination type, distribution, and orientation of scars were recorded. Keeley indicates that the size (in mm.) and shape of scars is also informative (1980:24), but the magnification at which tools were inspected (<120x) and time limitations did not permit collection of this information.

**Flake Scar Initiations**

Flake scar initiations are determined by the type of contact and angle at which contact is made between the working edge of a tool and an objective surface. Bending initiations result from contact with a larger area of the working edge, usually with the tool’s working edge as an acute angle relative to the contact surface (Lawrence 1979:115). Point initiations are the result of force concentrated in a smaller area, such as
the very tip of the working edge, with the tool’s working edge contacting the objective surface at a higher angle (Lawrence 1979:115).

The initiation type for roughly half of all uniface scrapers was obscured by heavy wear on the bit working edge (Table 8-4). Both village uniface samples exhibited a mixture of point and bending initiations, lacking a consistent predominant type. For biface scrapers the predominant initiation type was point for both village samples, though a fair number were also too worn to identify. When looked at by village, the predominant initiation type differed for uniface (bending) and biface (point) scrapers in the Ring 2 sample, but was the same for both types (point) in Ring 1.

Flake Scar Terminations

Flake scar terminations provide clues about how a fracture propagated into a tool’s working edge (Lawrence 1979:115-117). Experimental studies indicate termination types tend to be associated with distinct types of applied force (e.g., Keeley 1980). Terminations in the microwear sample (Table 8-5) were predominantly step for uniface scrapers (Ring 2=51.7%, Ring 1=65.5%) and overwhelmingly step for biface scrapers (Ring 2=84.0%, Ring 1=85.7%). As was the case for scar initiations, there was greater difference in the type distribution of terminations between scraper types in Ring 2.

Orientation of Micro-Flake Scars

The orientation of micro-flake scars (Table 8-6) was typically perpendicular to slightly oblique for uniface scrapers (Ring 2=59%, Ring 1=72%). The same was true for
biface scrapers, though the trend was not as strong (Ring 2=52%, Ring 1=56%). For most micro-flakes to be oriented perpendicular or slightly oblique to the working edge, the tool working edge would have to be held roughly perpendicular or transverse to the direction in which the tool was moving. Again, the difference between uniface and bifaces with regard to this attribute is more marked for Ring 2 (16%) than the Ring 1(7%).

Distribution of Micro-Flake Scars

The distribution of micro-flake scars along the dorsal aspect of the bit (Table 8-7) was not highly concentrated into one category for unifaces, but was markedly so for bifaces, for which about 2/3 of all specimens exhibited an irregular pattern of scars. This suggests a clear difference between the two types for both villages. In many cases a series of overlapping flake scars were observed, beginning at the working edge and overlapping each other up the dorsal aspect of the bit resulting a in a stepped, jagged appearance in profile (Table 8-8). This was referred to as “bit edge stacking”. This appearance suggests each episode of use or resharpening left ever shorter step flakes. The majority of uniface scrapers (Ring 2=58.6%, Ring 1=72.4%), and an even higher proportion of biface scrapers (Ring 2=76.0%, Ring 1=81.0%) exhibited this pattern. Where step scars appear, the edges of the step termination were nearly always slightly-to-moderately rounded and exhibited some level of polish.
Type, Orientation, and Distribution of Attrition

Rounding and Striae

Rounding was the most common type of attrition and was observed on all unifaces, and all but one biface scraper (Table 8-9). Rounding was observed on over 50% of all uniface and biface scrapers at 15x magnification, and over 80% of all scrapers at 60x. Other patterns by village location or scraper type are very weak.

Striae were not strongly patterned by village and scraper type (Table 8-10). They were present on only 30-40% of uniface, and 40-50% of biface scrapers. In addition, when present, striae were usually first observed somewhere between 15 and 60x magnification.

Striae were always on the ventral aspect of the working or leading edge that came into contact with objective material. Striae were oriented either perpendicular or slightly oblique to the working edge (Table 8-11). This is consistent with the orientation of micro-flake scars, which exhibited the same orientation but located on the dorsal aspect of the working edge. The presence of striae opposite is an indication the point of contact was the ventral aspect. Repeated pressure exerted on the ventral aspect of the leading edge would have simultaneously resulted in striae on the ventral aspect, and driven micro-flakes off the opposite aspect of the working edge (Odell et al. 1974:189; Keeley 1980:21-25). Keeley indicates striae result “from contact, under pressure, between the flint of the tool and materials as hard as, or harder than, itself” (1980:23).

Occasionally striae would wrap slightly around the leading edge of heavily rounded bits, but never onto the dorsal aspect. This could be the result of at least two different processes. First, the leading edge could have been pressed into the material
being worked such that it was buried deeply enough for the ventral working edge and very bit edge to contact the objective material. Alternatively, straie wrapping around the bit edge from the ventral surface could result from holding the implement at an angle equal to or greater than 90 degrees sometimes, and holding it a less than 90 degrees at other times. Nonetheless, the material would still have to be harder than chert to leave striae. If the material worked was soft like hide, it is possible some abrasive like sand could have been used in the scraping process.

Striae were not common on hide or wood scrapers in Keeley’s (1980) experimental or archaeological assemblages, but they were present. Keeley indicates that when striae did occur on rounded working edges it was on hide scrapers. However, he does not indicate how this material, which is much softer than the chert tool, would have left striae (1980:50). In fact, he indicates that striae on archaeological examples “cannot be interpreted very precisely, nor can it be determined whether they are the result of use or handling during use” (1980:102).

Polish and Residue

Polish produced somewhat clear patterns by scraper type and village (Table 8-12). Some level of polish was observed on all uniface scrapers and over 90% of biface scrapers. Oddly enough, while some biface scrapers lack polish, the most common magnification range at which polish was first observed on bifaces was somewhat lower than for unifaces. This trend was very clear when comparing uniface and biface scrapers in the Ring 2 sample (0-15x :uniface=24.3%, biface=56.0%), and weaker but still present for the Ring 1 sample (0-15x :uniface=34.4%, biface=42.8%).
Haft Elements

Haft elements were examined for micro-wear patterns on a sample of ten biface endscrapers. The observed pattern on both scraper types is consistent with other microwear studies that have considered this part of the tool (e.g. Beyries 1988; Anderson-Gerfaud 1990). The pattern was so consistent that it was determined that further analysis would be redundant. An equal sample of uniface scrapers was considered but casual observation of these identified identical patterning and no further analysis was done. Dibble (1995:343) notes that hafted tool types usually exhibit the greatest amount of wear.

Summary and Discussion

This summary section condenses the use-trace information detailed above to describe overall patterns for each scraper type. A notable observation is that most use-trace patterns were generally similar for each type regardless of village. This summary thus describes scraper patterns by type first, and then notes any inter-village differences within each type, and between types. More detailed analysis of these differences is reserved for the discussion in the following chapter, when use-trace and metric data can be combined for a more holistic assessment and interpretation.

Comparison of Uniface Endscraper Patterns to Ahler’s (1984) Kinetic States

The overall pattern of uniface scrapers is very consistent with Ahler’s “scraping” kinetic mode. The tools have a very high edge angle (mostly 60-90 degrees), exhibit primarily bending initiations and a combination of termination types, and scar
orientations were primarily perpendicular but ranged to slightly oblique. Scar
distribution was the only attribute whose distribution was inconsistent with Ahler’s
criteria for “scraping” kinetics. However, given the majority of attribute distributions
match scraping very well, this finding does not discount my assignment since scar
distribution can vary quite widely depending on the hardness of the material being
scraped. For example Brink (1978) found that hide scraping leaves an irregular, non-
overlapping pattern, while wood scraping tended to leave a regular, overlapping
pattern. The presence of many uniface tools with point initiations is also not considered
completely aberrant for scraping since initiation type depends on the angle of the tool
when the working edge is in contact with the target material (Keeley 1980).

Comparison of Biface Endscraper Patterns to Ahler’s (1984) Kinetic States

The overall pattern of biface attributes is consistent with Ahler’s “burin” kinetics.
However, the morphology of these tools, and the pattern of several use-traces, is also
consistent with scraping kinetics – perhaps a variant of scraping not recognized in
Ahler’s scheme. Clearly, the morphology of these biface tools is that of a standard
scraper, though one important difference is that they were shaped by bifacial flaking.
The orientation of flake scars perpendicular to the working edge indicates these tools
were used in a transverse motion, like endscrapers typically are used. This means the
long axis of the working edge is perpendicular to the motion in which the tool was moved
during use. Use traces concentrated on the dorsal aspect of the bit indicate unidirectional
movement (Tringham et al. 1974:188). The presence of point initiations indicates the
tool was held such that the bit edge was oriented at a very high angle (nearly
perpendicular) to the material surface being worked. This angle of use is actually very similar to burins, which are “chisel like”, and “suitable for grooving or engraving bone or wood” (Ahler 1984:723; Whittaker 1994:120-121; Inzian et al. 1999:Figures 57-61). In addition, the high proportion of items with massive step scarring indicates these items were used under extremely high pressure to work a hard material.

To review then, at the assemblage level use-traces exhibited by these tools appear most similar to”burin” kinetics in Ahler’s scheme, but the morphology (a much wider working edge than a typical burin) and some attributes are more consistent with scraping. This combination suggests a specialized scraping tool for very hard materials (e.g., bone, see below). The point initiations with step terminations suggest they would have been held at a high angle perhaps to penetrate a very hard surface. But then the rounding and striae on the ventral and acute working edge areas suggest that after the point of the tool was used to penetrate a hard surface it was then adjusted to a more acute angle (more parallel to the surface being worked) to scrape away whatever material was being penetrated.

It was generally assumed at the outset that all scrapers were primarily used for hide processing activities, and perhaps a combination of secondary uses. However, overall the microwear data presented here suggest that uniface and biface scraper morphology is associated with a clear functional difference. In addition, the data indicate that there are differences in the degree to which the two morpho-types can be distinguished within each village. Patterns of use-traces on uniface and biface specimens are more clearly distinct from each other in Ring 2 than they are in Ring 1. Distribution of use-traces was distinct for tool types in Ring 1 as well, but the pattern was less clear.
Overall, patterning of use traces in both villages indicates the different scraper forms relate to real differences in use. This indicates scraper form may have become more specialized in Ring 2. It appears that while unifaces tend to exhibit patterns consistent with scraping hides, bifaces tend to exhibit a pattern of scraping or even whittling harder materials such as wood or bone. This next section discusses in more detail the distribution of use-traces and compares them to known patterns for different material types in an attempt to determine what type of material uniface and biface scrapers were used to scrape.

**Review and Interpretation**

**Uniface Endscrapers**

All unifaces exhibited rounding and polish. On most specimens (>55%) both of these use-traces were observed at magnifications between 0-30x. All specimens also exhibited micro-flake scars on the opposite (dorsal) aspect of the bit working edge. However, the degree of attrition by rounding was so high that micro-flake initiation type was not observable on nearly half of all uniface scrapers (45-48%) because the negative flake scar bulb had been worn off by rounding of the very edge. To contrast, striae were not present on the majority (60-70%) of uniface scrapers, and none were observed at 0x magnification. The magnification at which straie were observed did not have a strong tendency toward lower or higher magnification ranges.

On tools where micro-flake scar information could be collected initiation type was a mixture of bending and point initiations. Termination type was predominantly (52-66%) step terminations, but a mixture of hinge and feather terminations were also
observed in moderate numbers. So while termination type does exhibit a predominant trend (step), the mixture of initiation and termination types characterizes damage. The predominance of step terminations is matched by the large proportion (59-72%) of uniface scrapers with multiple, "stacked" hinge terminations resulting in a stepped profile. The mixed terminations are perhaps also consistent with a lack of strongly predominant scar distribution patterns. If regular and regular/overlapping scar pattern categories are combined they are only slightly more common than the combined proportion for irregular and irregular/overlapping.

While polish was present on all uniface scrapers, it was not observed on most (65-75%) at 0-15x magnification, though by 30x magnification it was present on just over half (55-58%). While the distribution of polish location was not specifically coded for, it can be said that when present on the ventral surface it was concentrated primarily near the very bit edge and if it extended proximally on the bit surface it was not as concentrated. Likewise, polish on arrises and above (proximal to) stacked dorsal flake scar terminations was concentrated on the most highly pedestaled areas. Polish was also occasionally observed on the haft area though no systematic effort was made to identify polish on areas other than the bit.

Rounding and polish, present on every specimen, were the most characteristic use-traces observed on uniface scrapers. Attrition by rounding was so intense that nearly half of all tools were so rounded that flake damage from the bit edge could not be identified as to type. Unfortunately this pattern is shared by wood and hide scrapers, and experimental work indicates that the most important distinction between the two is type of polish (see e.g., Keeley 1980). Unfortunately, the low magnification analysis used in
this study did not permit observation of polish type. However, the relative "smoothness" of polish was documented as either planar/smooth or pitted and only one specimen had planar/smooth polish. This type of polish is characteristic of hide scraping, dry hide in particular, and not wood scraping which tends to have highly reflective planar or smooth polish. The utility of this observation however is limited by the maximum magnification of analysis in this study, which was 120x. In addition, the surface contour generated by polish on unifaces does not clearly match published images of either wood or hide polish.

Other data collected are equally ambiguous. The (100%) proportion of the assemblage exhibiting polish is consistent with Keeley's (1980:51) finding for hide scrapers, while the relatively low proportion of striae on uniface scrapers is more consistent with Keeley's (1980:36) result for wood scrapers (36%) though the prevalence of striae on hide scrapers depends on what stage of hide processing and if an abrasive additive were used (Brink 1978; Siegel 1984). Finally, the high proportion of the assemblage exhibiting flake scar damage (100%) and the overlapping, continuous pattern of scars are more consistent with wood, which produces a higher rate of and more regular pattern of flake scars compared to hide scraping. This again is counter-balanced by the presence of polish leading up the bit edge onto the tool's spine in many cases, though this was not quantified. This polish distribution is consistent with hide scraping. The flexibility of hides compared to wood places relatively more of the tool's body in contact with the material. While the overall pattern documented in the present sample indicates that uniface scrapers were primarily for hide processing, the presence of use-traces unique to wood working is not surprising at all. Analysis of ethnographic and
archaeological scraper assemblages have demonstrated that endscrapers are typically multi-purpose (e.g., Brink 1978; Cobb and Pope 1998).

**Biface Endscrapers**

Nearly all biface scrapers had rounding and polish. Though only a few lack these use-traces, it is notable since 100% of all unifaces exhibited them. On over 75% of biface scrapers that exhibited rounding and polish, it was observed at magnifications at 30x or less - a much higher percent than uniface scrapers. While rounding and polish were observed on a larger proportion of bifaces than unifaces between 0-30x, a much lower proportion of bifaces had flake initiations obscured by rounding on the bit edge. This suggests that when present, rounding was typically observed at a lower magnification among biface scrapers, but that the attrition from rounding was not as great. The trend seems contradictory. While attrition from rounding may have been relatively less intensive for biface scrapers, attrition in the form of striae was more intensive, being present on almost half of all specimens (40-50%). Perhaps rounding was developing more quickly due to harder material being worked, while the high frequency of step scars is an indication the tools were constantly being resharpened as a result. Such a pattern might be expected for a tool requiring a sharp edge to scrape very hard material.

Patterns of micro-flakes from the bit edge of biface scrapers were markedly distinct from uniface scrapers. Biface scrapers exhibit a clear predominance in flake initiation category (point, 60-69%), flake termination category (step, 84-86%), and flake scar distribution type (irregular and irregular/overlapping, 85-88%). These unambiguous trends in damage contrast with the weak trends exhibited by uniface scrapers. Consistent
with the high proportion of step terminations is the predominance of stacked step scars up
the dorsal surface of the bit (76-81%).

Polish was observed on nearly all specimen. Compared to unifaces, a relatively
high proportion of bifaces exhibited polish at 0-15x magnification (44-56%) and at 0-30x
magnification (76-81%) when compared to unifaces. Biface scrapers also exhibited
polish on arrises and proximal to step scars on the dorsal aspect of the bit in the majority
of cases at 0-15x magnification. This proportion was higher than for uniface scrapers.
The most distinctive and prevalent use-trace on biface scrapers was intensive damage
from step flake scars present on over 80% of all specimens and was so intense on 3/4 of
these that scars were stacked. Independent experimemntal work has repeatedly found that
this is characteristic of bone working (Brink 1978:79-84,120; Keeley 1980:42-45). There
is some overlap with working dried wood, but the extent of damage clearly points toward
bone working in this case. Compared to unifaces, the relatively low proportion of bifaces
with attrition intensive enough to obscure flake intitiation type also points toward
working very hard material since repeated edge rejuvenation by flake detachment would
limit the degree to which attrition can build up (Brink 1978:]. Finally, the high
proportion of biface scrapers with irregular or irregular and overlapping terminations
(>85%) also characterizes bone working (Brink 1978:79-84).

Conclusions

Examination of a sample of uniface and biface endscrapers identified patterned
differences in use traces. Uniface endscrapers are characterized by intensive rounding,
polish, and high edge angles. These and other attribute patterns closely match Ahler’s
“scraping” kintetic state and they have tentatively been interpreted here as hide processing tools based on comparison to other microwear studies of endscrapers. Some wear traces indicate that these tools were probably ocassionally, but not primarily used for other purposes. The presence of abrasive tracks on many examples indicates that some type of abrasive material was probably employed during the use of these tools. Biface endscrapers exhited micro-wear patterns that distinguished them from uniface endscrapers. They are characterized by less intensive rounding, and a distinctive pattern of flake scar initiations, terminations, and distributions that are more consistent with Ahler’s “burin” kinetics. Burin use is characterized by use of tools for working hard materials at a higher angle relative to the contact surface.

Patterns of wear traces on biface endscrapers are consistent with tools documented in other studies used to work bone or hard wood. Like uniface scrapers, these also exhibit some overlap in wear traces with other kinetic categories indicating they too probably were used occasionally for purposes other than hard wood or bone scraping. These include rounding on contact edges and polish on dorsal flake scar arrises, both of which are more consistent with working softer materials. It is interesting to suggest that biface endscrapers were repurposed to work softer materials, but it is not possible to determine whether these apparently distinct use trace patterns represent simultaneous or sequential functions. What is certain is that wear patterns observed on discarded endscraper bits are those resulting from their last episode of use (Siegel 1985:93), which indicates that at least some biface endscrapers were used to work relatively soft materials before being discarded.
Given that biface endscrapers and bone beamers co-occur on several well-documented late Late Fort Ancient components (e.g., Madisonville, Hardin, Buffalo), evidence that biface endscrapers were primary hard wood or bone working tools can reasonably be used to hypothesize they were used to manufacture beamers. A low resolution (<60x) microscopic examination was conducted of two beamer fragments from the 2013 by Chris Moore at the University of Indianapolis. His analysis identified microtraces consistent with lithic shaving along the concave (working) surfaces of the items, suggesting a stone tool was used to shape the items. While these preliminary results from both the lithic and bone tool wear patterns are highly suggestive, more work needs to be done to evaluate this model. For example, only high resolution microscopy can answer this question by identifying specific polish types.

A preliminary comparison of archaeological complexes in the vicinity of the Fort Ancient area indicate beamers and bifacial endscrapers co-vary at components dating to the 16th and 17th century. These include Sandusky components (Northern Ohio) which have both beamers and bifacial endscrapers (Abel 2015:19). Components lacking both beamers and bifacial endscrapers include Whittlesey (northern Ohio; Brose 1994), and Caborn-Welborn (lower Ohio Valley; Cherl Munson, personal communication 2015). To the author’s knowledge, a possible relationship between bone beamers and biface endscrapers has not been suggested before, and so the idea is tentative and should be evaluated more thoroughly by analysis of biface endscrapers at other Fort Ancient sites, and perhaps by experimental replication of beamers.

Both types of Fort Ancient endscrapers are commonly assumed to have functioned primarily as hide processing tools with some overlapping secondary function
(e.g., Railey 1992:142). Though differences between the two have been noted (e.g., Railey 1992:142-144), no systematic study has been conducted to evaluate whether this difference has functional implications. Based on the present findings, this appears to be the case, at least at the Hardin Site. In addition, distinct chronological affiliation has long been recognized for these two types. If biface endscrapers are indeed a specialized tool for manufacturing bone beamers as has been hypothesized above, it follows that at some point in the 16th century a greater need arose for the use of beamers that required this innovation in lithic technology. In the following chapter, the differences found here are independently evaluated using metric data.
Table 8-1: Count of endscrapers included in the microwear sample

<table>
<thead>
<tr>
<th>Scraper Type</th>
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<tr>
<td></td>
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<td>RING 1</td>
<td>TOTAL</td>
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<td>29</td>
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</tr>
<tr>
<td>BIFACE</td>
<td>25</td>
<td>21</td>
<td>46</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
<td>50</td>
<td>104</td>
</tr>
</tbody>
</table>
Figure 8-1: Endscraper morphology: plan and profile shape. Example shown is a biface endscraper.

pattern of ventral shaping flakes
Figure 8-2: Endscraper morphology: profile shape.

- **Bifacial Endscraper**
  - (dorsal aspect)
  - (profile view)

- **Unifacial Endscraper**
  - (dorsal aspect)
  - (profile view)
Table 8-2: Endscraper morphology: distal margin (bit) edge angle.

<table>
<thead>
<tr>
<th>Edge angle (degrees)</th>
<th>UNIFACE ENDSCRAPERS</th>
<th>BIFACE ENDSCRAPERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>&lt;40</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>40-60</td>
<td>7</td>
<td>24.14%</td>
</tr>
<tr>
<td>60-90</td>
<td>12</td>
<td>41.38%</td>
</tr>
<tr>
<td>&gt;90</td>
<td>10</td>
<td>34.48%</td>
</tr>
<tr>
<td>29</td>
<td>100.00%</td>
<td>29</td>
</tr>
</tbody>
</table>
Table 8-3: Endscraper microwear micro-chippage: aspect of tool exhibiting damage

<table>
<thead>
<tr>
<th>Aspect exhibiting damage</th>
<th>UNIFACE ENDSRAPERS</th>
<th></th>
<th></th>
<th></th>
<th>BIFACE ENDSRAPERS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td>RING 2</td>
<td>RING 1</td>
<td></td>
<td>RING</td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td></td>
<td>freq</td>
<td>%</td>
<td>freq</td>
<td>%</td>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>dorsal</td>
<td>27</td>
<td>93.10%</td>
<td>24</td>
<td>82.76%</td>
<td>18</td>
<td>72.00%</td>
<td>19</td>
</tr>
<tr>
<td>ventral</td>
<td>0</td>
<td>0.00%</td>
<td>1</td>
<td>3.45%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>both-regular</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>both-irregular</td>
<td>2</td>
<td>6.90%</td>
<td>4</td>
<td>13.79%</td>
<td>7</td>
<td>28.00%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>100.00%</td>
<td>29</td>
<td>100.00%</td>
<td>25</td>
<td>100.00%</td>
<td>21</td>
</tr>
</tbody>
</table>
Table 8-4: Endscraper microwear micro-chippage: flake scar initiation type.

<table>
<thead>
<tr>
<th>Flake scar initiation type</th>
<th>UNFACE ENDSCRAPERS</th>
<th>BIFACE ENDSCRAPERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td>RING</td>
</tr>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>Point Initiation</td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>Bending Initiation</td>
<td>10</td>
<td>34.48%</td>
</tr>
<tr>
<td>UID</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>obscured by wear/damage</td>
<td>13</td>
<td>44.83%</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
Table 8-5: Endscraper microwear micro-chippage: flake scar termination type.

<table>
<thead>
<tr>
<th>flake scar termination type</th>
<th>UNIFACE ENDSCRAPERS</th>
<th>BIFACE ENDSCRAPERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Feather</td>
<td>3 10.34%</td>
<td>5 17.24%</td>
</tr>
<tr>
<td>Hinge</td>
<td>9 31.03%</td>
<td>5 17.24%</td>
</tr>
<tr>
<td>Step</td>
<td>15 51.72%</td>
<td>19 65.52%</td>
</tr>
<tr>
<td>Snap</td>
<td>2 6.90%</td>
<td>0 0.00%</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>total</td>
<td>29 100.00%</td>
<td>29 100.00%</td>
</tr>
</tbody>
</table>
Table 8-6: Endscraper microwear micro-chippage: Orientation of scars relative to working edge plane

<table>
<thead>
<tr>
<th>Orientation of scars</th>
<th>UNIFACE ENDSCRAPERS</th>
<th></th>
<th>BIFACE ENDSCRAPERS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td>RING 2 freq</td>
<td>RING 1 freq</td>
<td>RING 2 freq</td>
</tr>
<tr>
<td>perpendicular</td>
<td>freq</td>
<td>%</td>
<td>freq</td>
<td>%</td>
</tr>
<tr>
<td>slightly oblique</td>
<td>1    3.45%</td>
<td>0    0.00%</td>
<td>0    0.00%</td>
<td>0    0.00%</td>
</tr>
<tr>
<td>oblique</td>
<td>0    0.00%</td>
<td>0    0.00%</td>
<td>0    0.00%</td>
<td>0    0.00%</td>
</tr>
<tr>
<td>perpendicular-slightly oblique</td>
<td>21</td>
<td>72.41%</td>
<td>17</td>
<td>58.62%</td>
</tr>
<tr>
<td>perpendicular to oblique</td>
<td>0</td>
<td>0.00%</td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>obscured by wear/damage</td>
<td>3</td>
<td>10.34%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>100.00%</td>
<td>29</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
Table 8-7: Endscraper microwear micro-chippage: distribution of micro-flake scars along dorsal aspect of bit.

<table>
<thead>
<tr>
<th>UNIFACE ENDSNAPERS</th>
<th>RING</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>regular</td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>irregular</td>
<td>11</td>
<td>37.93%</td>
</tr>
<tr>
<td>regular / overlapping</td>
<td>8</td>
<td>27.59%</td>
</tr>
<tr>
<td>irregular / overlapping</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>N/A*</td>
<td>4</td>
<td>13.79%</td>
</tr>
<tr>
<td>29</td>
<td>100.00%</td>
<td>29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BIFACE ENDSNAPERS</th>
<th>RING</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>regular</td>
<td>1</td>
<td>4.00%</td>
</tr>
<tr>
<td>irregular</td>
<td>14</td>
<td>56.00%</td>
</tr>
<tr>
<td>regular / overlapping</td>
<td>2</td>
<td>8.00%</td>
</tr>
<tr>
<td>irregular / overlapping</td>
<td>8</td>
<td>32.00%</td>
</tr>
<tr>
<td>N/A*</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>25</td>
<td>100.00%</td>
<td>21</td>
</tr>
</tbody>
</table>

*dorsal aspect of bit lacks micro-flake scars
Table 8-8: Endscraper microwear micro-chippage: presence of “bit edge stacking”.

<table>
<thead>
<tr>
<th>“bit edge stacking” present?</th>
<th>UNIFACE ENDSRAPERS</th>
<th>RING</th>
<th>RING 2</th>
<th>freq</th>
<th>%</th>
<th>RING 1</th>
<th>freq</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td></td>
<td>RING</td>
<td></td>
<td>8</td>
<td>41.38%</td>
<td>8</td>
<td>27.59%</td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td></td>
<td>RING</td>
<td></td>
<td>17</td>
<td>58.62%</td>
<td>21</td>
<td>72.41%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>100.00%</td>
<td>29</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>“bit edge stacking” present?</th>
<th>BIFACE ENDSRAPERS</th>
<th>RING</th>
<th>RING 2</th>
<th>freq</th>
<th>%</th>
<th>RING 1</th>
<th>freq</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td></td>
<td>RING</td>
<td></td>
<td>6</td>
<td>24.00%</td>
<td>4</td>
<td>19.05%</td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td></td>
<td>RING</td>
<td></td>
<td>19</td>
<td>76.00%</td>
<td>17</td>
<td>80.95%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>100.00%</td>
<td>21</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>
Table 8-9: Endscraper microwear attrition: rounding.

<table>
<thead>
<tr>
<th>Magnification</th>
<th>UNIFACE ENDSCRAPERS</th>
<th>BIFACE ENDSCRAPERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td>RING 2</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>0x</td>
<td>6</td>
<td>20.69%</td>
</tr>
<tr>
<td>15x</td>
<td>14</td>
<td>48.28%</td>
</tr>
<tr>
<td>30x</td>
<td>4</td>
<td>13.79%</td>
</tr>
<tr>
<td>60x</td>
<td>2</td>
<td>6.90%</td>
</tr>
<tr>
<td>90x</td>
<td>2</td>
<td>6.90%</td>
</tr>
<tr>
<td>120x</td>
<td>1</td>
<td>3.45%</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

*magnification indicates the minimum level of magnification at which use trace was first observed.
**Table 8-10: Endscraper microwear attrition: striae**

| magnification * | **UNIFACE ENDSCRAPERS** | | **BIFACE ENDSCRAPERS** | |
|-----------------|--------------------------|--------------------------|--------------------------|
|                 | RING                     | RING 1                   | RING                     | |
| freq            | %                        | freq                     | %                        | |
| 0x              | 0                        | 0                        | 0                        | |
| 15x             | 4                        | 13.79%                   | 2                        | 6.90%                   |
| 30x             | 1                        | 3.45%                    | 3                        | 10.34%                  |
| 60x             | 0                        | 0.00%                    | 2                        | 6.90%                   |
| 90x             | 1                        | 3.45%                    | 2                        | 6.90%                   |
| 120x            | 2                        | 6.90%                    | 3                        | 10.34%                  |
| N/A**           | 21                       | 72.41%                   | 17                       | 58.62%                  |
|                 | 29                       | 100.00%                  | 29                       | 100.00%                 |
| 0               | 0                        | 0.00%                    | 0                        | 0.00%                   |
| 15              | 3                        | 12.00%                   | 0                        | 0.00%                   |
| 30              | 1                        | 4.00%                    | 6                        | 28.57%                  |
| 60              | 3                        | 12.00%                   | 0                        | 0.00%                   |
| 90              | 1                        | 4.00%                    | 2                        | 9.52%                   |
| 120             | 2                        | 8.00%                    | 2                        | 9.52%                   |
| 99              | 15                       | 60.00%                   | 11                       | 52.38%                  |
|                 | 25                       | 100.00%                  | 21                       | 100.00%                 |

* magnification indicates the minimum level of magnification at which use trace was first observed.

** use-trace not observed.
Table 8-11: Endscraper microwear attrition: straie orientation

<table>
<thead>
<tr>
<th>striae orientation</th>
<th>UNIFACE ENDSRAPERs</th>
<th>BIFACE ENDSRAPERs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td>RING</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>perpendicular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6.90%</td>
<td>5</td>
</tr>
<tr>
<td>slightly oblique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>13.79%</td>
<td>4</td>
</tr>
<tr>
<td>oblique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.45%</td>
<td>1</td>
</tr>
<tr>
<td>both</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.45%</td>
<td>1</td>
</tr>
<tr>
<td>N/A*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>72.41%</td>
<td>18</td>
</tr>
<tr>
<td>29</td>
<td>100.00%</td>
<td>29</td>
</tr>
</tbody>
</table>

*use-trace not observed.
# Table 8-12: Endscraper microwear polish

<table>
<thead>
<tr>
<th>Magnification</th>
<th>UNIFACE ENDSRAPERS</th>
<th>Magnification</th>
<th>BIFACE ENDSRAPERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING</td>
<td></td>
<td>RING</td>
</tr>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td>RING 2</td>
</tr>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
<td>%</td>
</tr>
<tr>
<td>0x</td>
<td>3</td>
<td>10.34%</td>
<td>1</td>
</tr>
<tr>
<td>15x</td>
<td>4</td>
<td>13.79%</td>
<td>9</td>
</tr>
<tr>
<td>30x</td>
<td>9</td>
<td>31.03%</td>
<td>7</td>
</tr>
<tr>
<td>60x</td>
<td>8</td>
<td>27.59%</td>
<td>6</td>
</tr>
<tr>
<td>90x</td>
<td>3</td>
<td>10.34%</td>
<td>3</td>
</tr>
<tr>
<td>120x</td>
<td>2</td>
<td>6.90%</td>
<td>3</td>
</tr>
<tr>
<td>29</td>
<td>100.00%</td>
<td>29</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Magnification</th>
<th>RING 2</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>freq</td>
<td>%</td>
<td>freq</td>
</tr>
<tr>
<td>0x</td>
<td>7</td>
<td>28.00%</td>
</tr>
<tr>
<td>15x</td>
<td>7</td>
<td>28.00%</td>
</tr>
<tr>
<td>30x</td>
<td>5</td>
<td>20.00%</td>
</tr>
<tr>
<td>60x</td>
<td>4</td>
<td>16.00%</td>
</tr>
<tr>
<td>90x</td>
<td>1</td>
<td>4.00%</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
<td>4.00%</td>
</tr>
<tr>
<td>25</td>
<td>100.00%</td>
<td>21</td>
</tr>
</tbody>
</table>

* magnification indicates the minimum level of magnification at which use trace was first observed.
Chapter 9
Endscraper Metric Study

Introduction

Because this study is concerned with examining the degree to which hide processing intensified over time, examining one of the most important and durable tools used in this activity provided a key dataset. Ideally the metric data collected on scrapers is intended to both independently evaluate the findings from the microwear analysis, and to provide new information about the relative intensity of endscraper use through time.

Analysis of endscraper use patterns involves documenting their “use-history”. The central concept in the study of tool use histories, is the Reduction Thesis, which states that tool retouch during use results in gradual reduction of the tool (Shott 2005; Shott and Nelson 2008:23). Various measures have explored overall assemblage reduction (Shott and Nelson 2008:35), while others examine specific tool types such as scrapers described below. To be clear, reduction is a process whereby relatively smaller pieces are detached from a larger objective piece. Retouch is the action of detaching or removing smaller pieces from objective pieces (Andrefsky 2008:4-8). Smaller pieces are detached from objective pieces in one of three basic processes: 1) pieces (“blanks”) are detached from cores to produce tools, 2) pieces are detached from blanks to produce tools, and 3) pieces are detached from tools to resharpen or maintain them. So cores, blanks, and finished tools all undergo reduction, but for different purposes (Shott and Nelson 2008:27). However, since many tools are not resharpened during use they do not undergo reduction after they are produced (Shott and Nelson 2008:27).
This study is concerned with the 3rd category of reduction: the degree to which finished tools are reduced as a result of resharpening. This will process will generally be referred to as endscraper reduction. Geometric, Allometric, and Volumetric indices have been used to assess endscraper reduction patterns. As is recognized by several researchers below, many indices that explore endscraper variability measure overall reduction. Degree of reduction may or may not relate directly to how much utility has been spent or remains, or how much they have been retouched by resharpening. Several experimental and ethnographic studies have examined this relationship (e.g., Kuhn 1990; Weedman 2000; Eren et al. 2005; Shott and Weedman 2007), but the rarity of such studies and their diverse objectives makes them more useful as guides for modeling expectations rather than strict interpretive road maps. Moreover, Shott and Weedman’s analysis of ethnographically documented scraper assemblage suggest evaluation of different types within a single assemblage may require independent reduction measures (2007:1031).

**Background**

**Geometric Indices of Reduction**

Geometric measures examine how cross-section shape changes as tools are reduced. Like allometric measures (below), these are essentially ratios of changing and unchanging tool dimensions. Unlike allometric measures, they examine only cross-section morphology. In cross-section the thickest part of the flake, usually along the dorsal spine, remains unchanging through the tool’s use-life while the angle and thicknesses of working edges gradually changes through use and resharpening. Kuhn’s
geometric index of uniface reduction (GIUR), or simply index of reduction (IR), is one of the first popular geometric measures of reduction intensity. It measures the ratio of a uniface tool’s thickness along the line of retouch scar terminations (“t”) to its maximum thickness (“T”). This ratio essentially measures the degree to which invasive retouch has progressed toward the centerline (thickest) part of the the flake blank. Not surprisingly, the ratio increases through successive resharpening events (Kuhn 1990:Table 1), if not simply because as additional flakes are detached they progress from the distal tool margin where it is thinnest and they gradually “bite” into the body of the tool toward its thickest portion at the spine (Eren and Sampson 2009).

Several researchers, including Kuhn, have observed a potential “flat flake” problem (Kuhn 1990:586; Dibble 1995). Kuhn’s measurement is ideal for flake tool blanks with a triangular cross section because the ratio of thickness at the flake retouch terminations gradually approaches the thickest dimension in the dorsal centerline. For flakes with a flat or trapezoidal cross-section (i.e., flat dorsal surface parallel or nearly parallel to flat ventral surface), the retouched edges (thickness measurement “t”) will approach the maximum flake thickness (measurement “T”) much faster and will thereby increase the IR value faster than tools with a triangular cross section (Dibble 1995:329; Hiscock and Clarkson 2005:1016-1017). This assumption however, has not always been supported by experiments specifically designed to address the problem (Hiscock and Clarkson 2005).

Several researchers (Hiscock and Clarkson 2005:1020, Table 3; Hiscock and Attenbrow 2005; Eren and Pendergast 2008) have found that, if used appropriately, Kuhn’s index is relatively highly correlated to mass lost when compared to other
measures, but only when a single margin was being measured (Hiscock and Clarkson 2005:1020, Table 3). However, this was not the case for tools with multiple utilized margins. When multiple margins are used, they can be utilized and retouched at different rates, which introduced unpredictable variability in resulting flake cross-section dimensions. In an attempt to deal with this issue, Hiscock and Attenbrow (2005) modified Kuhn’s index to account for variation in reduction and morphology of flake margins when multiple margins were used on a scraper. Despite these improvements, two independent experiments by Eren and colleagues (Eren et al. 2005; Eren and Pendergast 2008:73) did not support the assertion of Hiscock and colleagues that a modified Kuhn index of reduction is a “robust” predictor of progressive weight loss by retouch on a single margin – even if it is relatively better than alternative measures.

Finally, a more recent experimental evaluation, (Eren and Sampson 2009) replicated the findings of Kuhn, Hiscock and colleagues. Earlier experiments failed to replicate Hiscock and Clarkson’s (2005) due to differences in experimental design (Eren and Sampson 2009:1244; see also Eren and Pendergast 2008:71-73). They found that IR does in fact correlate with mass lost, but only during initial resharpening episodes of one edge. The relationship does not hold for more heavily resharpened tools. Low IR values (0.1-0.29) range only 2-3% in mass lost, while moderate values (0.40-0.59) range by 8%, and high values (0.6-0.99) range by 44% (Eren and Sampson 2009:1246). Low IR values do correlate with mass lost, but the relationship between IR and mass lost becomes increasingly weaker as IR increases (Eren and Sampson 2009:1247). This situation appears to reflect variation in where (one, two, or more margins) and how (invasiveness of retouch) mass is lost. One tool with extremely invasive retouch along one margin will
have less mass lost than a tool with the same IR value resulting from less invasive
retouch of a larger edge area (see also Eren et al. 2005:1198-1199; Nejman and Clarkson
2008:21-25, Fig.5).

In sum, the work of Eren and colleagues suggest that while the Index of
Invasiveness (II) and the Index of Reduction (IR) may measure mass lost in a general
way, they more appropriate as measures of edge exhaustion (on a single edge) and
retouch method (see Eren and Pendergast 2008:74-82). IR is most useful for evaluating
the exhaustion of a single margin or edge. For example, a single side scraper and a
double side scraper may have the same IR value of 0.8. The IR value achieved for a
double side scraper can be driven by one edge with an IR of 0.35 and one at 0.45, or 0.8
overall, while the same IR value can be driven by a single edge with an IR of 0.8. They
do not represent the same level of exhaustion (the single scraper is more exhausted) even
though they have the same IR value (2009:1247). Therefore, IR data should ideally be
collected on the same edge area, and assemblages should only be compared if the same
edge area is being considered.

_Volumetric Measures_

Over the past decade, Metin Eren and a host of colleagues, including Stephen
Kuhn, have made a strong case that volumetric measures are better predictors of mass
lost than geometric alternatives such as Kuhn’s (1990). As indicated above, Kuhn’s
index has turned out to be a better measure of edge exhaustion than mass lost.
Volumetric measures are good predictors of mass lost because they capture enough
information to model the three-dimensional area lost from reduction (Shott and Nelson

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Eren et al.’s (2005) measure was the only such measure considered here because alternative methods depend on platform attributes of the tool blank (e.g., Dibble and Pelcin 1995; Bradbury et al. 2008), which in most cases were not present in assemblage from the Hardin Site. While data were being collected for this study, a method using 3-d scanned images to estimate original flake volume came available, but has not been attempted for the Hardin assemblage (Morales et al. 2015).

Nonetheless, even the most accurate measures of mass lost do not necessarily gage use-life, curation process, or tool utility (Eren and Sampson 2009:1245). Like all measures, volumetric measures track only a single variable of overall reduction – mass lost – which is not informative about how mass is lost (resharpening location and technique). Nor does it necessarily tell us about the relationship between mass lost and reduced tool utility. Eren and Pendergast (2008) illustrate how ERP can be combined with other measures to answer specific questions about curation and utility.

**Allometric Measures**

Allometric measures are ratios of changing to unchanging dimensions during a tool’s use-life (Shott and Weedman 2007:1025). Examples of allometric measures include the ratio of flake thickness (unchanging) to surface area of uniface tools (Blades 2003), and bit width (relatively unchanging) to blade length on hafted Archaic endscrapers (Jefferies 1990). More recently, Shott and Weedman (2007:1025) have proposed a ratio of length x width (Area) to proximal thickness or “A/T” to measure scraper reduction. Ideally the measure evaluates whether discard length is a result of original blank dimensions or degree of reduction. To deal with this they scaled area to proximal
thickness, since (they assume) the haft element does not change and therefore represents original blank thickness.

Shott and Weedman found that A/T correlates significantly with other indirect volumetric measures developed for the study ($r=0.89$, $p<0.01$), which in turn correlated with direct volumetric measures (2007:1027-1028). Moreover, correlation between A/T and the indirect measure of volume decreased with each resharpening (first:$r=0.91$, second:$r=0.91$, third:$r=0.85$). So like the relationship between geometric measures and mass lost, allometric measures appear to correlate strongly at first with volume loss, but this relationship becomes weaker as resharpening episodes increase. As regards the present study A/T is not ideal since their measure was developed for ethnographically documented transverse scrapers with parallel haft margins. They warn that the measure would not be valid for scrapers with converging margins because they would not maintain a near constant width during their use life. A better area/thickness ratio for the purposes of the present study is simply length x width / maximum thickness (after Dibble 1984a 1984b, 1987 in Holdaway 1991:93).

Summary of all Reduction Measures

To summarize the above geometric indices do not predictably measure reduction (as mass lost) on uniface tools. This is because, as tools are resharpened, edge angle, scar invasiveness, and the amount of material lost vary unpredictably. We cannot rule out the degree to which method of resharpening, number of margins resharpened, flake cross-section, and the episode of resharpening being carried out determine change in geometric cross-sections (i.e., the “Frison Effect”, see Jelinek 1976; Dibble 1995). Moreover, for
transverse hafted endscrapers in particular, Shott and Nelson (2008:36) predict that their rectangular longitudinal cross-section will change little due to the concentration of retouch on the distal margin. And while this may reduce the utility of geometric measures, there appears to be a predictable allometric relationship between length, width, and thickness: as scrapers are increasingly reduced they will become shorter relative to width and thickness (Jefferies 1990; Blades 2003:151; Shott and Weedman 2007).

The issues identified above lead Shott and Nelson (2008:29, 36) to argue in favor of allometric and volumetric measures of reduction intensity. Allometric measures are useful because, as scrapers are resharpened, they lose length faster than they lose width, while geometric properties of the working edge do not always track predictably with reduction. Volumetric measures are also useful because they appear to track closely to mass lost, though few independent evaluations have been made of Eren et al.’s (2005, 2008) Estimated Reduction Percentage. Moreover, as Shott and Weedman’s (2007:1032) ethnographic study indicates, volumetric, and to a lesser degree allometric, measures correlate with overall reduction fairly well, but not necessarily to work accomplished. This is because reduction as a result of resharpening varies by individual preference for when to resharpen. Until more specific experimental data speak to this relationship, these measures stand as a best approximation.

**Methods**

A combination of volumetric and allometric measures will be used to examine transverse endscraper reduction in the Hardin assemblage. The above discussion indicates that volumetric measures most predictably track mass lost (overall reduction),
while allometric measures may be uniquely suited to measuring transverse scraper reduction. This is because for transverse scrapers resharpening is concentrated on the distal margin such that width and maximum thickness change little relative to length as number of resharpening episodes increases (Jefferies 1990; Blades 2003; Shott and Weedman 2007). If mass is lost at resharpening episodes accrue, a relationship is expected between the two variables in the Hardin assemblage. Mass lost will be measured volumetrically with Eren et al.’s (2005) Estimated Reduction Percentage. Retouch intensity will be measured with the allometric measure Area/Thickness (after Dibble 1984, 1987; Holdoway 1991:92-93; see below).

Nearly all of the morphometric data were collected with fairly simple set of measurements. Metric data were collected with Pittsburg Model 47257 digital hand calipers recorded to the hundredth of a millimeter. Artifact weights were collected with an AND model ED-120A digital scale recorded to the hundredth of a gram. The scale was calibrated with a standard 100 gram weight. The equipment used to collect volume measurements for the ERP and are described below.

Most of the morphometric data presented below are based on simple statistics that are either self-explanatory (e.g., the ratio of “length to width”) or are briefly described in the text if necessary. Other descriptive data were collected but not used in this study. Because they are fairly detailed, the methods for calculating the primary reduction measure, ERP, are described first.

Estimated Reduction Percentage (ERP) is a volumetric approach to estimating how much of a tool’s area has been lost by retouch (Figure 9-1). Calculating ERP is a three-step process (Eren et al. 2005:1192-1194). First, the 2-dimensional geometric area
missing from each retouched tool edge must be determined. This is derived from
geometric calculations based on three measurements: a, b, and D (Figure 9-2). The first
two measurements are the angle of the working edge (a) and the length of the retouch
scars extending up the dorsal surface of the tool (D). The third measurement is the edge
angle of the original flake blank (b), which was determined by extrapolating the ventral
and dorsal (spine) planes until they meet forming the edge angle of the original flake
blank (Figure 9-2). This was accomplished by holding the dorsal plane of the tool against
one leg of an open goniometer, closing the other leg until it touches the spine (dorsal
surface) of the tool. With its ventral surface flat on the bottom leg of the goniometer, the
tool is then either maneuvered away or toward the intersection of the goniometer legs
until the top leg is perpendicular to the angle of the spine plane (Figure 9-3). \n
Data points a, b, and D can then be used to determine the remaining
measurements (D1-D4, t and h) using basic principles of geometry (Eren et al.
2005:1192-1193, Figures 2-6):

\[
\begin{align*}
t &= (D)\sin(a) \\
D_1 &= \frac{t}{\sin(b)} \\
D_3 &= (D)\cos(a) \\
D_4 &= (t)\cot(b) \\
D_2 &= (t)\cot(b) - (D)\cos(a) = D_4 - D_3 \\
(* \text{ purposely out of order}) \\
h &= (\sin(b)) \times ((t)\cot(b) - (D)\cos(a)) \\
\end{align*}
\]
Once measurements D1-D4, h, and t have been collected, they can then be used to calculate the 2-dimensional area (A) of Triangle A (Figure 9-2 and Figure 9-4) using the formula (see Eren et al. 2005:1194, Fig.7):

\[
\text{Area (A)} = \frac{1}{2} \text{(base)} \times \text{(height)} = \frac{1}{2} (D_1) \times (h)
\]

Once area A has been calculated, we can use this to determine the 3-dimensional area (volume) of debitage removed from the tool by multiplying the 2-dimensional area A by the length of the retouched edge. If multiple edges have been retouched, V is calculated for each edge and the values are added together (Figure 9-5; after Eren et al. 2005:1194-1195, Fig.8).

Before ERP can be calculated, one more measurement must be taken, volume of the retouched piece. This was accomplished by Eren et al. (2005:1194-1195) by placing the retouched piece in a graduated cylinder and measuring the displaced volume. To get the most precise volume displacement measurement they recommend using digital calipers to measure the water level before and after placing the tool in the cylinder in place of using the graduated marks. Despite this effort to achieve greater precision, Eren et al. (2005:1198) still had trouble maintaining <5% error. Not surprisingly, I could not achieve consistent displacement measurements for the same tool using this method, so an easier and more replicable solution was devised. This study used an overflow canister, and a small beaker with 0.1ml graduations (Figure 9-6). The tool was placed in the overflow canister and the displaced water dripped from the canister into the empty beaker. The resulting volume was measured to the nearest 0.05ml, paying close attention
to the reticle location by viewing it horizontal to the eye. Using this method the volume of the retouched tools was recorded with +0.1ml accuracy.

With the retouched tool volume measurements in hand, the final ERP equation was calculated:

\[
\text{ERP} = \frac{V}{V + \text{Volume Retouched Tool}}
\]

After taking measurement on a small sample of scrapers, it was observed that most scrapers in the assemblage had one edge angle on the center of the working edge, and a different edge angle along the corners of the bit (Figure 9-5). In such cases one set of measurements was taken for the main / central bit area, and another near the corners. Each set of measurements was used to calculate a separate volume of estimated debitage (V) value. In such cases the two V – values were added together before calculating the ERP value. Once the data have been collected for ERP, they can be re-used to examine a variety of other indices, including Kuhn’s Index of Reduction (IR), and Shott and Weedman’s “area/thickness” ratio (A/T) can also be calculated.


\[
A/T = \frac{((\text{length @ discard}) \times (\text{width @ discard}))}{\text{max thickness}}
\]
Method for measuring reduction with Kuhn’s Index of Reduction (Kuhn 1990) where \( D \) and \( a \) are the same as above and \( T \) is maximum thickness of the spine of the scraper blade area:

\[
IR = \frac{(D)\sin(a)}{T}
\]

**Sampling**

It was originally proposed that only endscrapers identified as hideworking tools by microwear analysis would be subjected to metric analysis. However, microscopic and metric analyses were conducted in a single continuous episode of data collection so there was no opportunity to sub-divide the sample. As Chapter 8 indicates, microwear data indicate the uniface scrapers were probably hide processing tools, while the biface scrapers were used to work harder materials like bone or hard wood. The degree of rounding and polish on the biface scrapers suggests they may have secondarily been used for hide processing after they were too worn to work harder materials. Metric data were collected for both varieties. This will enable the examination of how functionally distinct but morphologically similar scrapers differ in patterns of use (as indicated by reduction indices). Furthermore, if major differences are identified between the uniface and biface scraper samples, it could provide independent support for the microwear analysis findings.

Metric and volumetric data were collected for a total of 61 uniface scrapers and 78 biface scrapers with about half of each type from each village (Table 9-1). Unfortunately, the uniface endscraper sample could not be increased since all of those available for study were analyzed.
Hardin Site Endscraper Metric Data

Uniface Endscraper Morphology and Use

The summary data are presented by type (Table 9-2) and by village (Table 9-3). To get a sense of the basic dimensions of scrapers, maximum length (L), width (W), and thickness (T) measurements were taken. Length and width were smaller on average in the Ring 2 sample (L=30.37mm, W=21.20mm) compared to Ring 1 (L=31.88mm, W=21.42mm). A comparison of average area (LxW=square mm) values is consistent with this difference (Ring 2=643.88mm, Ring 1=682.92mm). Thickness measurements held the opposite pattern in Ring 2 sample having a slightly higher average (Ring 2=7.88mm, Ring 1=7.86mm). This indicates that, at discard, uniface scrapers from the Ring 2 sample were shorter and thicker than those from the Ring 1 sample. However, these dimensions alone cannot distinguish whether discard length is a result of original blank dimensions or degree of reduction. The area : thickness ratio controls for original blank size by expressing remaining area relative to thickness. This calculation indicates that Ring 2 scrapers (A/T=81.71) have less area remaining relative to thickness compared to Ring 1 scrapers (A/T=86.89). In other words, if a scraper with the same area was taken from each village, the scraper from the Ring 2 would be thicker in absolute terms but would have less area per unit of thickness.

Average Estimated Reduction Percentage (ERP) values are presented by type in Table 9-2 and by village in Table 9-3. Descriptive statistics for ERP values are provided in Table 9-4. ERP values ranged from 0.61% to 75.39% for uniface endscrapers. Ring 2 has a higher average (23.63%) than Ring 1 (22.42%). The difference is not significant
(t=0.265, df=58, p>0.5). The small sample sizes (Ring 2: n=31, Ring 1: n=29) could potentially weaken the dataset, though the lack of outliers might suggest the sample is fairly representative. All uniface scrapers present in both museum and recent collections were included in the sample.

Index of Reduction (IR) measures the degree to which the re-sharpening of a working edge has invaded toward the thickest portion of the tool. In cases where tool edges were not uniform, two Index of Reduction (IR) values were calculated, one representing the less reduced edge portion (MIN) and one for the relatively more reduced edge portion (MAX). Accounting for this variation is important because it has been found that IR can vary greatly when different parts of a tool’s working edge are retouched at different rates or by different methods (Eren et al. 2005; Eren and Pendergast 2008). Therefore, if the distal bit working edge angle (equivalent to “DBEA” in Lerner 2000:127, Fig.4) varied more than ten degrees, two sets of measurements were collected. In cases where working edges were uniform, only one value was recorded and was placed under AVG.

Average Index of Reduction (IR) values are presented by type in Table 9-2 and by village in Table 9-3. Descriptive statistics for uniface endscraper IR values are provided in Table 9-5. The Ring 2 uniface scraper sample had higher IR averages for MAX (Ring 2=0.82; Ring 1=0.74) but lower for MIN (Ring 2=0.58, Ring 1=0.62). Neither of the inter-village differences were statistically significant. A potentially meaningful feature of the dataset is that range and standard deviation are almost always higher for MAX and lower for MIN values. This will be returned to in discussion.
**Biface Endscraper Morphology and Use**

The information presented for uniface scrapers above will now be presented for biface endscrapers. Biface endscraper morphometrics (Tables 9-2 and 9-3) length, width, and thickness were larger on average in the Ring 2 sample (L=33.70mm, W=21.07mm, T=8.71mm) compared to Ring 1 (L=32.80 mm, W=20.41mm, T=8.61mm). A comparison of average area (LxW=square mm) values is consistent with this difference (Ring 2=709.97mm, Ring 1=669.34 mm). When scaled to thickness (Length x Width / Thickness), area is still larger for biface scrapers from the Ring 2 sample (LxW/T=81.47) compared to Ring 1 (LxW/T=77.74mm). This indicates that, at discard, biface scrapers from the Ring 2 sample had more surface area both relative to thickness and absolutely. However, just as was the case with uniface scrapers, these dimensions alone cannot distinguish whether these dimensions are a result of original blank dimensions or degree of reduction.

Estimated Reduction Percentage (ERP) values (Tables 9-2 to 9-4) ranged from 2.3% to 64.11% for biface endscrapers. Ring 1 has a higher average (22.86%) than Ring 2 (21.69%). Though the number suggest a slightly more reduced assemblage in the Ring 1 sample, the difference is not significant (t= -0.340, df=77, p>0.5). One outlier value of 63.02% was removed from the Ring 2 sample decreasing the average by 1.1%.

As with uniface scrapers, MIN and MAX Index of Reduction (IR) values were collected for biface scrapers (Table 9-6). The bifacial endscraper IR data pattern similar to the uniface samples. Average IR values for the Ring 2 sample are higher for MAX (Ring 2=0.75, Ring 1=0.74) and AVG (Ring 2=0.64, Ring 1=0.63) and lower for MIN (Ring 2=0.54, Ring 1=0.55). None of the differences were statistically significant.
Range and standard deviation were higher in the Ring 2 sample for MIN and MAX. So while the Ring 2 sample exhibited the highest levels of exhaustion (MAX IR value), they also had relatively high ranges and standard deviations, which suggest that the degree to which any given tool is exhausted is more variable in this sample. Even though they were not as exaggerated, the Ring 1 sample also had a relatively high standard deviation and range indicating whatever behavior (retouch rate, discard preference) is driving this pattern for MAX values it is present in both villages, but is just more intensified in the Ring 2 sample.

**Summary and Discussion**

The goal of stone tool analysis was to evaluate the degree to which hide processing may have intensified in response to European colonial demand. Microwear analysis described above suggests uniface scrapers were most likely hide processing tools. Unfortunately, few known archaeological measures of stone tools are known to correlate strongly with direct measures of work. So we cannot directly equate the amount of wear represented on tools with the amount of work accomplished (i.e., hides processed). However, easily obtainable and objective tool attributes been shown to track mass lost, which, in turn, tracks closely to progressive tool resharpening during the course of a tool’s use life. The relationship of mass lost and resharpening intensity is somewhat ambiguous since decisions about when to resharpen, and method of resharpening can vary widely at the individual level. Averaging measures of reduction for all tools in an assemblage and comparing assemblages is assumed to ameliorate the ambiguity introduced by individual variation. Using multiple lines of evidence to bear on
the same issue can further strengthen a finding. In this study, two different measures of reduction were collected, Estimated Reduction Percentage and the Index of Reduction. The ERP has been experimentally shown to track mass lost as a result of resharpening. The IR on the other hand, has been shown to be a more useful gage of edge exhaustion. A variety of other measures of reduction were eliminated due to the lack of a platform and other characteristics commonly used to estimate reduction.

**Summary of Uniface Findings**

Estimated reduction percentage provided a baseline to begin evaluating how “used up” scrapers were in each assemblage. This measure of reduction indicated that uniface scrapers from Ring 2 (ERP=23.63%) were more reduced on average than those from Ring 1 (ERP=22.42%). This difference lacks statistical significance (t=0.265, df=58, p>0.5). However, a surprising finding is that despite the heavily damaged appearance of biface scrapers (excessive, overlapping step fractures, etc.; see last chapter), unifaces exhibited the highest ERP value of any sub-sample in this study. The Index of Reduction (IR) dataset supported this finding. Maximum IR values for the Ring 2 sample were notably higher than those from Ring 1, though once again the difference was not significant (t=1.149, df=63, p > 0.2).

Two other datasets also support these findings. First, Edge angle data (Table 8-2). The most common edge angle for uniface scrapers in both samples was 60-90 degrees. However, the second most common edge angle was >90 degrees for Ring 2 and 40-60 degrees for Ring 1. As scraper bits are retouched their edge angle gradually increases, so this variable indicates uniface scrapers were more heavily resharpened at discard than
those in Ring 1. However, if scraper bits were rejuvenated periodically due to extremely high edge angles, then this measurement may only be an indication of where a scraper bit was in the resharpening cycle. To the contrary, if scraper bits were resharpened only until the edge angle became too high and then tossed, this measurement is an indication of overall reduction (or at least tool exhaustion).

Second, in absolute terms Ring 2 scrapers were shorter, wider, and thicker than those from Ring 1. However, since thickness is largely determined by original blank size I scaled area to maximum thickness to control for original blank size (after Dibble 1987a, 1987b). This resulted in a ratio of 81.71 square mm per unit of thickness in the Ring 2 and 86.89 sq. mm per unit of thickness in Ring 1. The relatively smaller area remaining on uniface scrapers in Ring 2 is indirect (but independent) evidence that the assemblage is more reduced (after Holdaway 1991:93; Shott and Weedman 2007:1027-1028).

Microwear data distinguished uniface from biface scrapers in several ways. First, uniface scrapers exhibited rounding an polish without exception, while only 75% of biface scrapers exhibited this type of wear. In fact, on nearly half of uniface scrapers in both villages, rounding was so pronounced that the negative flake scar bulb had been removed by rounding and initiation type could not be determined. To contrast, the presence of striae was relatively uncommon on uniface scrapers (30-40%). Overall the use-traces exhibited by uniface scrapers was most consistent with hide scraping. However, the high proportion of unifaces exhibiting step scars in both village samples (Ring 2: 51.7%, Ring 1: 65.5%) is unusual for hide processing since this type of damage is simply not present on scrapers used on soft materials such as hide (Tringham et al. 1974:189; Keeley 1980:49-53).
At least two possibilities can account for such a pattern. First, since other use traces, as a whole, strongly indicate hide scraping, it may be deduced that the ubiquity of step scars is the result of resharpening. This explanation is supported by the observation of several specimen exhibiting partially rehsarpened bits which left a portion of the bit heavily rounded and or faceted while the remainder exhibited a relatively acute and sharp edge with little rounding. Alternatively, it is quite possible that the step scars are an indication these tools were multifunctional, being used for scraping hide and another much harder material. Bone and or antler scraping would be most likely candidates since step scars are the most distinctive type of damage resulting from working these materials (Tringham 1974:189; Keeley 1980:40-60). If in fact, however, biface scrapers were specialized for bone working (see below), it seems more likely the presence of step scars on uniface scrapers relates to resharpening. This issue is unlikely to be resolved without experimental replication, use, and microwear analysis.

**Summary of Biface Findings**

Estimated Reduction Percentage indicates biface scrapers in Ring 1 (ERP=22.86%) sample were more reduced than those from Ring 2 (ERP=21.69%), though the difference was not significant (t=-0.340). The Index of Reduction dataset was not consistent with this finding; the Ring 2 scrapers had higher average MAX IR values (0.749) compared to Ring 1 (0.736). The difference in avg for MAX IR is so small (0.013) between the samples that this inconsistency is outweighed by the burden of independent evidence from other data bearing on reduction. First, edge angle for both samples was most frequently between 60-90 degrees as was the case for uniface scrapers.
Bifaces are differentiated in that the second most common edge angle for both samples was 40-60 degrees. So while 60-90 degrees is the most common edge angle for both types, if edge angle was plotted on histogram the distribution of unifaces angles would be skewed higher and biface angles would be skewed lower. Second, as with uniface scrapers, the more reduced bifaces (according to ERP) in the Ring 1 sample also have smaller areas (LxW), and less area per unit of thickness.

*Endscraper Comparison and Interpretation*

Several general trends can be observed when comparing uniface and biface subsamples. Overall, the metric and microwear datasets both differentiated unifaces and bifaces, though the difference was not as great in the metric data. A potentially meaningful finding was that the distinction between uniface and biface endscrapers was relatively more consistent and greater in Ring 2. For example, several metric attributes exhibited relatively similar patterns for unifaces and bifaces in Ring 1 (e.g., edge angle, scar orientation, primary scar magnification, presence of resharpening, and polish magnification). It should be noted that some patterns were similar between unifaces and bifaces in Ring 2 also, but was not nearly as common. Similarities between these forms should not be overemphasized to make the point that they are relatively less distinct in the Ring 1 sample; they are still interpreted as functionally distinct tool types. Indices of reduction also distinguished uniface and biface endscrapers more clearly in Ring 2. Estimated reduction percentage exhibited greater difference (1.93%) between unifaces and bifaces in the Ring 2 relative to Ring 1 (0.44%), though neither difference was significant. The absolute greatest statistical difference among sub-samples was
between bifaces and unifaces in Ring 2 IR average values ($t=1.36$, $df=79$, $p>0.1$).

Even though we can only be about 80-90% confident this sample difference is representative of the population, it is somewhat telling since it is the greatest observed for any of measure of reduction. It is also meaningful for several other reasons. First, it is consistent with the microwear data, which indicated unifaces and bifaces are more distinct in Ring 2 than in the Ring 1. Second, it is consistent with both the IR and A/T reduction measures in suggesting that unifaces from the Ring 2 sample were the most reduced of all sub-samples.

The finding that unifaces are both relatively more reduced and more clearly distinguished from bifaces in Ring 2, brings up the question of specialization. If the two tool types were being more systematically dedicated to specific tasks in Ring 2 it would be expected that their use wear patterns would also become more distinct, which was the case. As with many of the trends observed in the metric and microwear data, limited sample size for unifaces limits the degree to which statistical significance can be achieved whether a difference is present or not. Further evaluation of this issue can only be resolved by increasing the sample size of unifaces, or evaluating other indicators of hide processing. The latter is attempted in Chapter 10.

**Endscraper Blank Shape and Retouch Potential**

As indicated above, the metric data bolster the microwear data patterns that indicate unifaces were hide processing tools and bifaces were hard wood and or bone processing tools. Eren and colleagues (Eren 2013; Andrews et al. 2015) recently found support for the notion that Clovis foragers used flatter, wider uniface blanks, which
would have afforded greater retouch potential. It just so happens that unifaces in the Hardin assemblage (both village samples) have wider flatter shapes compared to bifaces. According to Eren et al.’s model this would suggest they may have been designed to be resharpened to a greater degree. The emphasis on uniface width would maximize working edge contact with material being worked (i.e., hides). Likewise, the emphasis on thickness (relative to width) and the presence of two spines on biface endscrapers would have been important for these tools because they were being used to work harder materials and would therefore require greater axial strength.

Another notable observation with regard to retouch is that range and standard deviation were higher for the MAX IR values among both tool types and both villages. If MIN values represent edges that have had less resharpening, then the lower range and standard deviation for MIN values indicates there is less variability in resharpening scrapers during their early use, a finding consistent with controlled reduction experiments which have found that mass lost is predictable after the first resharpening episode, but becomes increasingly unpredictable after subsequent resharpening episodes (Kuhn 1990; Eren et al. 2005; Eren and Sampson 2009). The larger ranges and standard deviations in the AVG and MAX values support this suggestion by indicating that as scraper use-life accrues, individual preference influences retouch decisions to a greater degree. It could be that early in the retouch sequence technological or mechanical considerations limit personal choice, but then a threshold is reached where they are no longer the primary consideration.
Conclusions

The metric data achieved two goals. First, they collected metric information that was used to describe and evaluate differences in endscraper form suggested by the microwear data. This was successful in that the findings were indeed consistent with the microwear data. Uniface endscrapers exhibited thinner, wider blank profiles relative to the thicker more narrow biface endscraper blanks. The thinner uniface endscraper blanks would have been sufficient for scraping softer materials, but would not have been sufficient for scraper harder materials; while the thicker biface blanks with dual spines would have been necessary to scrape harder materials. Finally, the relatively lower edge angles on biface endscrapers would have been ideal for penetrating hard (bone or wood) material but not necessarily for processing softer materials they would be more likely to penetrate. Conversely, the higher edge angles on uniface scrapers would have been ideal for scraping soft material without puncturing it, but not for penetrating harder materials.

Aside from confirming the findings of the microwear study, the metric study also identified patterns of endscraper reduction that are important for assessing the degree to which hide processing intensified over time. Both metric data and measures of reduction exhibited more distinctive patterns between endscraper types in Ring 2. This was consistent with the microwear study. The consistency of this finding, along with the observation that uniface endscrapers were more intensively utilized in Ring 2 (i.e., later) brings up the possibility the tool types were becoming more functionally specialized as a result of production intensification. Tentatively, this appears to be the case. But as with the rest of the conclusions made here, this should be considered a hypothesis that requires additional independent measures and comparison to other similar Fort Ancient
or other eastern North American contexts where hide production is expected to have intensified. Further considering of these data is given in Chapter 10.
Figure 9-1: Endscraper metrics: example tool illustrating the 3-dimensional area calculated by Estimated Reduction Percentage (ERP). Triangles represent areas along working edge lost by retouch. Image from Eren et al. 2005: Figure 9.*

Figure 9-2: Endscraper metrics: measurements taken to calculate 2-dimensional area lost from working edge from retouch. Images and calculations: adapted from Eren et al. 2005: 1192-1194 and Figures 1-7.*
\( a \) = angle of the working / retouch edge

\( t = (D)\sin(a) \)

\( T = \text{bit thickness}^{**} \)

\( D = \text{retouch length} \)

\( D_1 = \frac{t}{\sin(b)} \)

\( D_3 = (D)\cos(a) \)

\( D_2^* = ((t)cot(b)) - ((D)\cos(a)) = D_4 - D_3 \)


** In Eren et al. 2005 “T” measures maximum tool thickness. For this study, “T” measures maximum bit thickness. This change was made because this study tracks reduction specifically of the bit area, which may not exhibit the thickest part of the tool.
Figure 9-3: Procedure used to estimate edge angle of original flake blank using goniometer. This is angle (b) in calculating Estimated Reduction Percentage (ERP). Refer to Figures 9-2 and 9-4.
Figure 9-4: Endscraper metrics: illustration of measurements $D_4$ and $h$ required to calculate Estimated Reduction Percentage (ERP). Images and calculations: adapted from Eren et al. 2005: 1192-1194 and Figures 1-7.*
Figure 9-4 (continued).

\[ D_4 = (t)\cot(b) \]

\[ h = (\sin(b)) \times ((t)\cot(b)) - ((D)\cos(a))) \]

*note: see Figure 7-2 for other measurements*
Figure 9-5: Endscraper metrics: accounting for multiple retouched edges when calculating Estimated Reduction Percentage (ERP). Image: adapted from Eren et al. 2005: Figure 8.*

\[ L_1 = \text{retouched working edge } \#1 \]
\[ L_2 = \text{retouched working edge } \#2 \]

Figure 9-6: Equipment used to measure endscraper volume displacement for calculating ERP (left). Also showing example of procedure used to measure endscraper volume. Overflow canister set on scale to provide a level surface and to elevate it above cylinder (B). Note: cylinder (D) shown on right to illustrate method, but scarper is submerged after canister is filled.

A - overflow canister
B - graduated cylinder (0.1ml increment)
C - scale used to provide level surface
D - cylinder used to pour water into overflow canister
E - plastic-coated wand for retrieving endscrapers from canister
Table 9-1: Endscraper metrics: sample used for metric study.

<table>
<thead>
<tr>
<th>Scraper Type</th>
<th>RING</th>
<th>RING 1</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td></td>
</tr>
<tr>
<td>UNIFACE</td>
<td>32</td>
<td>29</td>
<td>61</td>
</tr>
<tr>
<td>BIFACE</td>
<td>39</td>
<td>39</td>
<td>78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>71</td>
<td>68</td>
<td>139</td>
</tr>
</tbody>
</table>
Table 9-2: Endscraper metrics: Summary of endscraper metric data. Comparing average values for each type by ring.

<table>
<thead>
<tr>
<th>UNIFACE ENDSCRAPER</th>
<th>BIFACE ENDSCRAPER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>quantity or variable measured</strong></td>
<td><strong>RING</strong></td>
</tr>
<tr>
<td><strong>RING</strong></td>
<td><strong>RING 2</strong></td>
</tr>
<tr>
<td><strong>L</strong></td>
<td>30.37</td>
</tr>
<tr>
<td><strong>W</strong></td>
<td>21.20</td>
</tr>
<tr>
<td><strong>T</strong></td>
<td>7.88</td>
</tr>
<tr>
<td><strong>LxW</strong></td>
<td>643.88</td>
</tr>
<tr>
<td><strong>LxW/T</strong></td>
<td>81.73</td>
</tr>
<tr>
<td><strong>A/T</strong></td>
<td>115.32</td>
</tr>
<tr>
<td><strong>ERP</strong></td>
<td>0.24</td>
</tr>
<tr>
<td><strong>IR MIN</strong></td>
<td>0.58</td>
</tr>
<tr>
<td><strong>IR MAX</strong></td>
<td>0.82</td>
</tr>
</tbody>
</table>
Table 9-3: Endscraper metrics: Summary of endscraper data. Comparing uniface versus biface average values within each ring.

<table>
<thead>
<tr>
<th>RING 2</th>
<th>RING 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>quantity or variable measured</td>
<td>endscraper type</td>
</tr>
<tr>
<td></td>
<td>UNIFACE</td>
</tr>
<tr>
<td>L</td>
<td>30.37</td>
</tr>
<tr>
<td>W</td>
<td>21.20</td>
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<tr>
<td>T</td>
<td>7.88</td>
</tr>
<tr>
<td>LxW</td>
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<td>LxW/T</td>
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<td>A/T</td>
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<td>ERP</td>
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<tr>
<td>IR MIN</td>
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</tr>
<tr>
<td>IR MAX</td>
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Table 9-4: Endscraper metrics: Estimated Reduction Percentage (ERP) data. Descriptive Statistics.

<table>
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<tr>
<td>max</td>
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Table 9-5: Endscraper metrics: Index of Reduction (IR) data for Uniface Endscrapers. Descriptive Statistics.

<table>
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<tr>
<th>INDEX OF REDUCTION VALUES</th>
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<th>IR AVERAGE</th>
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</thead>
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<td>Median</td>
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<td>SD</td>
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<td>N</td>
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</table>

*removed one outlier
Table 9-6: Endscraper metrics: Index of Reduction (IR) data for Biface Endscrapers. Descriptive Statistics.

<table>
<thead>
<tr>
<th>INDEX OF REDUCTION VALUES</th>
<th>IR MINIMUM</th>
<th>IR MAXIMUM</th>
<th>IR AVERAGE</th>
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<td>RING 2</td>
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<td>25th %ile</td>
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<td>75th %ile</td>
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<tr>
<td>sd</td>
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<tr>
<td>n</td>
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*removed one outlier from MIN (1.13314601), original avg=0.55292, sd=0.210249
Chapter 10
Evidence of Hide Production and Non-local Exchange at The Hardin Site

Introduction

This chapter has two goals. First, it describes the material and spatial dimensions of the hide production system at Hardin and assesses whether hide production intensified over time. Second, it evaluates the relationship between production and exchange by examining and comparing the distribution of trade goods and hide processing tools. In particular, this section focuses on mortuary associations to assess the question of who may have processed hides, and who may have benefitted from the products of their exchange abroad.

Modeling the Hide Production Industry

This study employs a multi-dimensional framework (see Chapter 1) to assess diachronic trends in hide production. The first section of this chapter lays out the spatial and material dimensions of hide processing industry, and describes how they are expected to change as a result of production intensification. Specific archaeological correlates are proposed for each parameter of the production entity. In the second section data are presented to evaluate the expectations set out for each parameter. The final section reviews and discusses the findings to make a final assessment about the degree to which production may have intensified over time.

Historical and archaeological studies indicate Native people intensified production of hides in eastern North America to supply colonial markets (Chapters 2 and 3). Based on this observation, it was proposed that if the residents of the Hardin Village
locality intensified hide production to participate in the colonial exchange sphere(s) evidence of this could be documented by comparing pre-contact and post-contact components at the site. In Chapter 1 a review of relevant craft production literature was used to identify a framework for studying the spatial and material dimensions of the hide production industry at Hardin. This literature was useful because it supplies specific expectations for identifying production intensification. Likewise, literature on hide processing was used to identify the expected material correlates that are specific to this type of craft production (see Chapter 1 and Table 10-1). It also helped identify which dimensions could be addressed with the data available from the Hardin Site. For the present study it was decided that only context and intensity of production could be addressed with the data that were collected.

**Production Indicators**

This section presents the primary datasets used to examine diachronic trends in hide production. Production intensity will be measured in several ways. The general principle followed in measuring production intensity is that when a specific productive task is intensified, a relative increase is expected in the quantity of implements and production debris. Shifts in the size and location of production contexts may also be expected. Because most production in eastern North American societies took place in residential contexts, analysis of this parameter is limited at the Hardin Site; few residential areas were documented outside of the village overlap zone. With the exception of a few specific feature types, the spatial distribution of production contexts at the site can only be assessed indirectly (see next section). If more hide smoking pits were
present at the site, an increase in their number and/or location (i.e., away from residential areas) would be expected if production intensified.

Production implements include uniface endscrapers, biface endscrapers, bone beamers, and mussel shell scrapers. Uniface endscrapers have been identified as hide processing tools in many contexts through space and time (e.g., Keeley 1980; review in Cobb 2000:86-92; see also Chapter 7). Microwear analysis for the present study identified a probable hide processing function for uniface endscrapers at the Hardin Site (Chapters 8 and 9).

Biface endscrapers may also be related to hide production. Evidence gathered by this study indicates their primary function was working hard wood or bone, though use traces suggest they functioned secondarily as hide processing tools. In Chapter 9 it was hypothesized one function of biface endscrapers could be the manufacture of bone beamers. Descriptions of beamer manufacture indicate they were crafted by carving out the midsection of a deer metatarsal, though other animals were also used (Prufer and Shane 1970:134; VanderKolk 2009:41). Hanson illustrates several examples from Hardin (1966: Figure 59A) and an additional example is illustrated in Appendix J (Figure J-1, bottom). Beamers have been documented historically and archaeologically as hide processing tools – probably fleshing tools (see Lapham 2005; Baillargeon 2011). They occur throughout much of the Fort Ancient sequence but do not exceed about 10 percent of bone tool assemblages until the 16th century (Prufer and Shane 1970:134-135; Drooker 1997:72,75,83; Vanderkolk 2009:Fig. 6, Table 3).

Mussel shell scrapers are the final category of possible hide processing tools that will be considered. These are mussel shell implements that appear to have been held by
the thick hinge portion of the tool and used for scraping or scooping. Griffin interpreted
the function of mussel shell artifacts with some evidence of use variously as “spoons”,
“knives”, and “scrapers” (e.g., 1966:46, 52, 74). The common interpretation of these
items as spoons in the Fort Ancient literature is probably based on the fact they are
sometimes recovered from the inside of ceramic mortuary vessels (e.g. Griffin 1943: 96,
157). Only one example has been recorded at Hardin (WPA Burial #180), which was an
infant located in the overlap area. Though the shell implements interpreted here as hide
scrapers could have been used for a variety of purposes, hide processing is one function
that has been documented by archaeological and historical contexts in eastern North
America (Lapham 2005:94-99). In southwestern Virginia, for example, a dramatic
increase in the frequency of shell scrapers was associated with intensification of hide
processing during the contact period (Lapham 2005:99, Table 4.3).

Although the Hardin site mussel shell scrapers were not subjected to microwear
analysis, examination of their morphology and macroscopic (<10x magnification) wear
patterns reveals two types (Appendix K). Type 1 scrapers represent the 25 mussel shell
artifacts Hanson classified as spoons (e.g., Hanson 1966: Figure 63h). These have a
sinuous plan shape along the utilized margin and most have an unmodified hinge area
where they were presumably held during use (Appendix K, Figure K-1, Figure K-2, and
Figure K-3). A few larger examples appear to have been modified near the hinge with
notches, perhaps for hafting (Appendix K, Figure K-4). Most Type 1 shell scrapers
exhibit a working edge with rounded facets (e.g., Appendix K, Figure K-3), though a few
exhibit working edges that are more sharply faceted and exhibit small wear striae (e.g.,
Appendix K, Figure K-4). The three examples with possible hafting damage all have this wear pattern. Some examples show both types of wear.

It cannot be determined based on my brief examination whether the sharply faceted edges are the result of prehistoric use or from “bag wear”. The examples with this type of wear also exhibited whitish and sometimes powdery edges suggestive of recent breakage or wear, while those exhibiting a more rounded type of faceting were always patinated and most certainly represent prehistoric use. To be sure, the flat faceted wear cannot be ruled out as prehistoric since it is conceivably the result of a different kind of activity that was not conducive to preservation and left edges that are now prone to degradation. It should also be noted that Hanson indicates most of the mussel shell items he classified as spoons had “one edge ground flat”, but I did not make the same observation. However, it is not entirely certain what Hanson meant with regard to the wear he observed on working edges since the example depicted in his monograph does not show the working edge that accrued wear (1966:Figure 63h).

Type 2 shell scrapers represent the three mussel shell implements Hanson classified as scrapers (e.g., 1966: Figure 63d). These consist of cut and or worn sections of the thickest part of a mussel shell valve (Appendix K, Figure K-5). The hinge area has been removed (or worn) from both examples which could be found in the WPA collections at the Webb Museum. On one specimen, the hinge area and the margin opposite the hinge have both been removed (or worn) from use (Appendix K, Figure K-5, bottom; see also Hanson 1966: Figure 63D). On the other specimen the hinge is absent (Appendix K, Figure K-5, top). Compared to Type 1 shell scrapers these specimens are relatively short and very narrow, almost too small to have been useful as hand-held
implements. One plausible interpretation of these is debris from the manufacture of narrow triangular shell pendants found in some burials at the site. This possibility is suggested further the presence of unfinished versions of such pendants at the site.

It is notable that none of the shell scrapers in the Hardin collections exhibit notched working edges as to many examples from Lapham’s study from western Virginia. However, examples have been documented at other Fort Ancient site (e.g., Griffin 1966:43 [1943]). One interesting variant of Type 1 scrapers is an example with triangles engraved on the interior of the working margin (Appendix K, Figure K-4). This appears to be very similar to an example illustrated by Griffin from the Fullerton Field Site (1943:81, Plate XXVII-5), which is a very short distance downstream from Hardin in Greenup County, Kentucky.

Manufacturing debris other than discarded tools are difficult to assess with the available data. For hide processing, these would include the remains of fauna taken for their pelts or skins, evidence of butchery practices that minimize damaging the pelt/skin, and perishable materials such as scraps of skin, animal fur, and materials used to dye or preserve hides (Lapham 2005; Baillargeon 2011; Mould 2011). Of these, only faunal remains and perhaps some materials used to dye or preserve hides are non-perishable. Refuse disposal contexts were targeted in the 2013 excavations specifically to recover faunal materials, but the quantity recovered was not sufficient to evaluate the proportion of pelt/hide bearing mammals taken or butchery practices.

Hematite or red ochre (ground hematite) is one class of material present at Hardin that could have been used for curing or dying hide. A sample of fragments of raw and modified hematite was recovered by both the 1939 and 2013 excavations (Appendix L,
Figure L-1 and Figure L-2). Among the modified hematite objects are several celt-like or adze-like groundstone tools excavated in 1939 (Figure L-3) and a small bifacially chipped tool excavated in 2013. In addition numerous sherds with red-stained interiors, possibly representing red-ochre residue, were recovered by the 1939 excavations. Finally, several groundstone objects including several grinding slabs recovered from the site exhibit red pigment staining or residue. One is described and illustrated by Hanson (1966: 137, Figure 55) and one is illustrated in Appendix L (Figure L-4).

A substantial literature indicates Hematite is involved in hide processing in one or two different ways (Harris 2011:64; Ruth 2013: 223-226). Archaeological (e.g., Keeley 1980:170-172; Starnini and Voytek 1997:444) and historic contexts (e.g., see Ruth 2013:224) provide evidence red ochre was used as a pigment used to dye hides. For example, William Bartram observed red painted hides among the Creek in the 1770s (Waselkov and Braund 1995:144). Modified hematite fragments at Fort Ancient sites have typically been interpreted as pigment stones (e.g., Turnbow 1992a:177-178), though no specific hypotheses have been proposed to evaluate this interpretation. It is relevant that most, but not all sites from which hematite fragments have been recovered have protohistoric components (e.g., Griffin 1943: Table XIV; Turnbow 1992a:177-178).

In many archaeological contexts, red ochre is associated with both hide processing tools as well as hides themselves. Several microwear studies have identified red pigment on endscrapers interpreted as hide processing implements (Rosenfeld 1971:182; Keeley 1980:171). In fact Stanley Ahler (1979:322, Table VI) identified both red and yellow ochre staining on a class of endscrapers interpreted as hide processing tools, though he did not comment specifically about its possible source or function. Red
staining and residue identified on a sample of Paleolithic endscrapers has been chemically identified as ochre (Morales and Verges 2014:304-306).

Abraders have also been documented with red ochre staining (e.g., Dumont 1987:83-84; Starnini and Voytek 1997:444; Mayer et al. 2008). Abraders or “handstones” are a common tool used in softening (smoothing), one of the final hide processing stages (Richards 2004:108-122). Their use in this stage of hide processing is important because it follows the dressing/curing stage which involved soaking hides in a solution designed to preserve them (Richards 2004). If curing solutions included ochre (for dye or preservation) it could be expected that tools from later stages such as softening would be coated with it.

Evidence that hides were colored with red ochre comes from several prehistoric European contexts (e.g., Keeley 1980; Harris 2011). For example, Magdelenian house floors exhibit areas of red ochre staining, sometimes as patches and in other covering the entire floor (Keeley 1980:171). These patterns have been interpreted in two ways. First, as the result of ochre-impregnated hides repeatedly being used as floor coverings and or decaying on the structure floors. Second, it has been suggested ochre-stained interior floor areas were used for applying ochre to hides. As Keeley (1980:172) points out it is unlikely the cases where entire floors were stained with red ochre represent hide processing, a pattern that is more plausibly explained by using ochre-impregnated hides as floor coverings. Moreover, indoor areas do not typically meet the spatial requirements of hide processing. Cases where ochre stained areas occur outdoors are much more likely to represent contexts where red ochre was applied to hides.
A less common interpretation for the use of red ochre in hide processing is as a preservative or curing agent (Audouin and Plisson 1982; Ruth 2013:224-226; but cf Harris 2011:64). In particular, red ochre may have both a drying and anti-microbial properties (Ruth 2013:225-226), both of which assist with curing hides by keeping water out and preventing bacteria from breaking down the fiber structure of skins resulting in putrification (Thompson 2011:4-5). What this exposes is that the potential dying and preservative functions of ochre are not mutually exclusive. Whatever the specific function of hematite and red ochre, it is associated with either hides or hide processing in a variety of contexts separated by space and time. This does not demonstrate the association is necessarily true in the present case, but does make it plausible and worth investigation.

Discussion

When considered individually, the implements, raw materials, and production debris proposed here as indicators of hide processing would not make a very strong model. Some of the items used such as endscrapers and hematite are known to be multifunctional, and therefore were probably used for other tasks even if hide processing was their primary function. The strength of this study lies in the systematic examination of multiple indicators of the hide production system. In the future, it would be ideal to expand on and re-evaluate the findings of the present model by examining other indicators of production such animal exploitation patterns, butchery marks, changes in hunting practices, and by increasing the sample size of the artifact classes used here.
Measures of Production Intensification and Expectations

Intensification of production is evaluated here by comparing quantity of production tools and debris and tool utilization patterns, and tool standardization. If production intensified, the later village should exhibit greater quantities of production implements and debris, and greater tool utilization. Density is an ideal unit of comparison for quantity of production tools because it standardizes the quantity being compared to an unchanging background quantity (e.g., volume of sediment excavated), but differences in recovery techniques between the 1939 and 2013 excavations preclude this unit. Instead, the unit of comparison in most cases will be proportion of the recovered assemblages.

Measure #1a: Quantity of production tools (Santley et al. 1989:108-110; Santley and Kneebone 1993:41-42). It is expected that the later village will exhibit a relatively greater proportion of hide processing tools (beamers, uniface endscrapers, biface endscrapers).

Measure #1b: Quantity of production debris (Santley et al. 1989:108-110; Santley and Kneebone 1993:41-42). It is expected that the later village will exhibit a relatively greater proportion of production debris (hematite/ochre) if hide production intensified through time.

Measure #2: Tool utilization intensity. It is expected that the later village will exhibit a pattern of greater utilization intensity (at the assemblage level) compared to the earlier village if hide production intensified through time.
Measure #3: Improvements in production technology (Santley et al. 1989:108-110; Santley and Kneebone 1993:41-42). It is expected that new production tools will be present and/or extant production tools will exhibit relatively specialized form or use patterns in later village assemblage if production intensified through time.

Evaluation of Measures

Measure 1a: Quantity of Production Tools

Bone Beamers

The results for Measures 1a and 1b are shown in Table 10-2. Bone beamers are discussed first. Table 10-3 shows the entire sample of all bone tools from the Hardin Site. This table represents the assemblage after removing the burial and dump contexts, and eliminating tool manufacturing debris and ornamental/non-utilitarian items. These contexts and artifact types were removed to avoid biasing the final comparison.

According to the craft production model presented above, it is expected that bone beamers should represent a greater proportion of the bone tool assemblage from the later village if hide processing intensified over time. This expectation is not supported by the data. Beamers represent a notably higher proportion of the Ring 1 sample (Ring 2: 29.1%, Ring 1: 41.0%) though the difference is not highly significant ($X^2=3.68$, $p=0.06$, df=1).
Uniface Endscrapers

If hide processing intensified over time, uniface endscrapers are expected to represent a higher proportion of the later village stone tool assemblage. This prediction was not supported by the data. Uniface endscrapers represent a greater proportion of the Ring 1 sample (Ring 1 = 4.6%, Ring 2 = 4.0%), though the difference is not significant ($X^2 = 0.48$, $p = 0.45$, df = 1; Table 7-5).

Biface Endscrapers

If hide processing intensified over time, biface endscrapers are expected to represent a higher proportion in the later village. This prediction was not supported by the data. Uniface endscrapers represent a greater proportion of the Ring 1 sample (Ring 1 = 15.3%, Ring 2 = 12.2%), and the difference is significant ($X^2 = 4.06$, $p = 0.04$, df = 1; Table 7-5).

Mussel Shell Scrapers

If hide processing intensified over time, it is expected that mussel shell scrapers should exhibit a greater frequency during the later occupation of the site. This expectation was strongly supported by available data since shell scrapers were recovered almost exclusively from Ring 2 (Table 10-4). The only two Type 2 scrapers recovered were both from general midden contexts from the Ring 1. As indicated above, the identity of these as scrapers is somewhat tenuous since they are so small. The only Type 1 scraper from Ring 2 was recovered from the fill of Burials 95-96 and was considered by
Bohannan to be a “fortuitous association”. This indicates that all shell scrapers recovered from Ring 1 were from refuse contexts of some type.

The Ring 2 assemblage consists entirely of Type 1 scrapers, almost all of which were recovered from feature or burial contexts. The only Type 1 scraper recovered outside of a feature (CAT# S-84) was located adjacent to Activity Area 1 (see below) and adjacent to a thermal feature that produced another Type 1 scraper. This scraper was also unique because it was engraved with a series of triangles along the inside of the working edge.

**Measure 1b: Quantity of Production Debris**

Hematite/Ochre

The distribution of hematite artifacts and sherds with ochre residue is presented in Table 10-5. Two types of hematite artifacts were recovered from the Hardin site; raw fragments or pebbles and modified fragments. Modified fragments exhibit abrasive tracks or lines, smoothed areas, and sometimes polished areas. Some modified fragments have been abraded so heavily they exhibit one or more faceted surfaces. Fragments considered raw are either eroded or do not exhibit sufficient evidence of wear to evaluate whether or not they were used. Finally, sherds with red ochre stained interiors were counted for each village. These may represent sherds in which ochre was processed, or vessels in which a solution of red ochre could have been mixed with a curing solution (see above).

Because it was not possible to standardize the frequency of hematite or ochre-stained items as a proportion of an assemblage, its distribution is compared between
villages as the average number of fragments recovered per context (frequency hematite/frequency contexts). It is expected that hide processing debris will exhibit a higher average at the later village if production intensified over time. This prediction was largely supported by the data (Table 10-5). The average frequency per context of modified hematite fragments (Ring 2=3.33, Ring 1=2.00) and sherds with red ochre staining (Ring 2=1.14, Ring 1=1.07) exhibited higher averages in Ring 2. To contrast, the average frequency per context of raw hematite fragments was higher in Ring 1 (Ring 1=3.64, Ring 2=4.00), but this did not influence the overall average for all hematite artifact types which indicates a higher density/context in Ring 2. Overall artifact frequencies used for these comparisons were not great enough for evaluation by significance testing.

As mentioned above, ochre residue is also sometimes observed on groundstone implements. According to Hanson (1966:137) of the five grinding stones recovered by the WPA excavations at Hardin “one metate, and possibly two others, showed evidence of grinding paint pigment”. It is notable to observe that a majority of grinding stones recovered by the WPA appear to have been used to process pigment, though for the purposes of this study the total sample is too low to confidently make a statement about differences between Ring 1 and Ring 2 (unless they are all from one ring). Future research should seek to re-examine these specimens in the collections. In addition several grinding slab or metate fragments in the 2011-2013 collections exhibit red ochre residue, but their distribution on the site cannot be quantified until the groundstone tool assemblage has been analyzed.
Measure 2: Tool Utilization Intensity.

This section compares endscaper utilization patterns at the two villages by summarizing and further examining microwear and metric datasets (see Chapters 8 and 9). A suite of nine use-wear attributes (Table 10-6) and 4 metric attributes (Table 10-7) were used to examine endscaper utilization intensity. It is expected that endscrapers from the later village will exhibit greater utilization if hide production intensified through time. As discussed above, microwear analysis indicates uniface endscrapers were used primarily for hide processing, while bifacial endscrapers were used primarily for scraping bone or hard wood. At best, then, these tools were indirectly involved in the production process. While it cannot be said for certain if biface endscrapers were used to make beamers, intensity of use will be examined for them as part of this section.

Other classes of production tools could not be assessed to measure production intensity. Shell scraper use intensity cannot be compared between the rings since microwear study was not conducted on these tools, and because so few were recovered from Ring 1. All beamers from both village samples were utilized until they snapped in half. The three complete specimens recovered 1939 were not included in the sample because they were not found in the collections or were located in the village overlap. Two halves of an exhausted specimen were recovered in situ at the contact of Stratum II (late Fort Ancient) and Stratum III (middle Fort Ancient) in Unit 10 (Ring 2). The ambiguous position of the specimen precluded it from inclusion in the study sample.
Uniface Endscrapers – microwear data

Seven of the attributes recorded by the endscaper microwear study were used to measure stone tool use intensity (Table 10-6). The third set of columns in Table 10-6 marks the village in which each attribute exhibited greater intensity of wear. Overall, the Ring 2 sample showed greater intensity of use-wear (Ring 2=5, Ring 1=4). A chi-square test of significance was calculated for five of the nine attributes, but none exhibited a significant difference. For the other two attributes, the expected values were less than five for at least one cell making the test invalid (Drennan 2009:192). Though not as meaningful as a chi-square test, Table 10-6 shows the average difference between the villages for each attribute. This difference was nearly twice as great for the five attributes indicating more intensive tool use in the Ring 2 (15.28%) compared to those indicating more intensive tool use in Ring 1 (8.68%).

Uniface Endscrapers – metric data

Four measures of endscaper utilization were documented with metric data (Table 10-7). As with the microwear data, the first set of columns in Table 10-7 indicate the village in which each attribute exhibited greater wear. This is followed by the values achieved in each village, and then results of significance tests to evaluate the difference between villages. All four measures indicate greater intensity of use for uniface scrapers in the Ring 2 Sample. However, like the microwear data, no differences in use patterns between villages were found to be significant. The recurrent lack of strong difference between the villages is worth note (see discussion), but this is countered to some degree by the fact that both microwear and metric data consistently indicate greater utilization of
uniface scrapers from the Ring 2 sample. The four measures here can be divided into two
general groups: measures of retouch and edge exhaustion (IR, Angle of Working Edge),
and measures of overall reduction (ERP, A/T). Since both were higher in the Ring 2
sample it can be suggested that uniface scrapers in this village had undergone a greater
degree of reduction (i.e., cycles of resharpening), and that their edges exhibited a greater
degree of exhaustion (i.e., were at the end of a resharpening cycle) at the time of discard
relative to those in the Ring 1 sample.

Biface Endscrapers – Microwear Data

The same seven microwear attributes were compared for biface scrapers between
the villages to examine relative intensity of use (Table 10-6), with a nearly identical
result. Ring 2 showed greater intensity of use-wear for a greater number of attributes
(Ring 2=5, Ring 1=4). As with uniface scrapers, a chi-square test of significance was
calculated for five of the nine attributes, but none exhibited a significant difference. For
the other two attributes, the expected values were less than five for at least one cell
making the test invalid (Drennan 2009:192). Again, the average difference between the
villages was greater for the five attributes indicating more intensive tool use in Ring 2
(14.57 %) compared to those indicating more intensive tool use in Ring 1 (9.73%).

Biface Endscrapers – Metric Data

Again, the same metric attributes were compared for biface as for uniface scrapers
(Table 10-7). Unlike the pattern found for uniface scrapers, for which all four attributes
indicated greater use in Ring 2, the attribute patterns were split even for biface scrapers.
Angle of retouch/working edge and average Index of Reduction values indicated biface scrapers in Ring 2 has relatively exhausted edges that had been retouched to a steeper angle (on average) than those in Ring 1. Both measures of overall reduction (ERP, Area/Thickness) on the other hand indicate greater tool utilization in Ring 1. So while biface scrapers had undergone a greater degree of reduction (i.e., cycles of resharpening) in Ring 1, their working edges were not as exhausted when they were discarded.

Measure #3: Improvements in Production Technology

Several findings are suggestive that intensification of hide processing may have stimulated or necessitated investments in technology to accommodate an increase in production. Improvements in production technology include microwear evidence that biface endscrapers were likely used to work hard wood or bone. Given that this tool type appears only after A.D. 1550 at Fort Ancient sites, and that beamers proliferate at some sites, it can be hypothesized that biface scraper technology was adopted to manufacture greater numbers of beamers to accommodate an increase in hide processing. This hypothesis however currently stands on several unknowns that require further investigation (see Chapter 9). The presence of shell scrapers almost exclusively in Ring 2 may be another investment in new tool technology. This seems plausible considering shell scrapers were adopted for this reason by some southern Appalachian groups in the 16-17th century (Lapham 2002, 2005). A third development in tool technology is suggested by differences in metric and use-wear patterns between the Ring 2 and Ring 1 Village. In particular, uniface and biface endscrapers in were more distinguished in
morphological and use-wear attributes in Ring 2 than they were in Ring 1, which
suggests the tool types were becoming increasingly specialized for specific tasks.

Attributes of Production Context

At Fort Ancient village sites residential areas were the primary context of most
production activities (e.g., Hanson et al. 1964; Cook 2004; Pullins 2008). Like many
regions of eastern North America production was aimed at replacing household
inventories and was conducted within house lots or house areas. Consequently, most
activities were engrained in everyday activities, took place in generalized contexts, and
employed unspecialized tools. As a result, tools and debris from production activities are
typically cleared from their original place of use to prepare for subsequent activities in
the same space. If these are tossed in general middens or dumps they will be difficult to
quantify assuming they are mixed with refuse from other activities and from other
households (who may have different rates of production). Therefore, primary production
contexts unique to hide processing activities will probably be difficult to identify
throughout most of the Fort Ancient temporal sequence.

Expectations for the spatial and material patterning associated with hide
processing are presented in Table 10-1. Unfortunately, most cannot be effectively
evaluated by the present study due to the lack of broad horizontal exposure in areas
outside of the village overlap zone. In particular, there is a paucity of fully exposed
structures and associated activity areas. Nonetheless, plotting the distribution of tools
and debris related to hide processing provides baseline information about where some
stages may have taken place. These distributions are discussed with reference to the
spatial zones documented in each village (domestic, mortuary, plaza; see Chapter 4).

Reference is also made to structures, though many are in the overlap zone. Until detailed analysis of this part of the village has been conducted it can only be assumed the deposits located in it represent a combination of both components. The spatial analysis conducted in Chapter 4 provides enough confidence about site layout to use the spatial zones within each ring as a reference for the present section, but they should be considered a working model rather than a final interpretation. The complex and long term use of the site has resulted in some level of “fuzziness” regarding the internal layout of each village. Moreover, the degree to which parts of Ring 1 may have been re-used (or continued to be used) during the occupation of Ring 2 may influence artifact patterning in unrecognized ways.

Bone Beamers

The most obvious concentration of bone beamers is in the overlap area between the villages (Figure 10-1). This appears to be the result of refuse accumulation from both villages. The only concentration by village area appears to be in the domestic zone of Ring 1.

Uniface Endscrapers

Uniface endscrapers (Figure 10-2) appear to be more evenly distributed throughout the site compared to antler tine tips and bone beamers. In general they appear to be more concentrated in the mortuary zone of Ring 2 than in Ring 1, where their distribution is split between the mortuary and domestic zones.
Biface Endscrapers

Biface endscrapers (Figure 10-3) are more numerous and widely distributed than uniface endscrapers, beamers or antler tine tips. There does not appear to be a skew toward either mortuary or domestic zones. Not only are they present throughout the domestic zone, they occur in nearly every structure (and possible structure).

Shell Scrapers

Shell scrapers (Figure 10-4) are the final processing tool examined here. The low frequency and association with midden contexts in Ring 1 provides little information about the contexts in which they were used. To contrast, all but two contexts that produced shell scrapers in Ring 2 were adjacent to or near Activity Area 1. As indicated above, this indicates a strong association with this part of the site. Since the only scrapers recovered from outside this area were in burial contexts, it may be suggested that their use was restricted to areas such as AA-1, which is discussed in more detail below.

Hematite and Ochre Residue

Unmodified hematite fragments (Figure 10-5, blue diamonds) were recovered from every 2013 excavation area, but from none of the 1939 excavation areas. Considering the relatively small area exposed by the 2013 excavations, it seems safe to say unmodified hematite was either not collected in 1939 or was culled from collections. Based on such a small sample of excavation areas, little can be said except that this material occurs ubiquitously in 2013 units. The location of many units on the edge of the
mortuary zone makes it tempting to suggest a mortuary rather than hide processing function (see below). However, all four 2013 excavation areas in the domestic zone also produced raw hematite (two in the overlap area, one in Ring 1).

Modified hematite (Figure 10-5, blue crosses) exhibits a similar pattern to raw hematite. This is because all 2013 units produced modified hematite, but only a few fragments were recovered from the 1939 excavation areas. Finally, ceramic sherds with a fine red residue were identified and tabulated during initial sorting of the 1939 pottery collections. Their highest concentration is in the overlap area, in and near structures.

Other Aspects of Production Context

Santley et al.’s (1987) model predicts that the organization production and associated facilities will change to accommodate production intensification (see Chapter 1). However, since strong evidence for production intensification was not found by this study, potential differences in the organization of production observed in this section could relate to other factors unrelated to production intensification. There are several lines of evidence for changes in the organization of production from Ring 1 to Ring 2.

The first is line of evidence for diachronic change in the organization of production assumes either occupational history scenario #2 or #3 (see Chapter 6 summary section): that Ring 1 was used only for residential occupation in the 15th century and was later reused (or continued to be used) by the residents of the Ring 2 area for special purposes. Ethnoarchaeological and archaeological case studies in the Mesoamerican craft production literature (see above) indicate that when production intensifies beyond the capacity of residential areas production facilities are often moved to another location.
It follows that if Ring 1 were re-used for special purposes during the occupation of Ring 2, then the higher proportion of uniface endscrapers, biface endscrapers and bone beamers in Ring 2 may be an indication it was reused for these activities.

This could have had several functional advantages, the most important of which may have been more space to stretch hides during fleshing (using beamers), and graining or softening (using scrapers). Moving these activities outside of residential areas would also have been important to avoid interfering with other activities, and to reduce hindrance from refuse accumulation and the smell of flesh and bone from hide processing activities. If hides were smoked as part of the curing process, smudge pits would also be expected (Richards 2004:36-37; Harris 2011:61-62; see also above), though there is very little evidence of these at the site. If they were used, numerous smoking pits would potentially be a hindrance to residential activities. Lapham (2005) argues that the lack of smudge pits within settlements may suggest that smoking was done over domestic (interior) fires, outside of the settlement, or not at all.

A second possible change in the organization of production may be suggested by the presence of a specialized activity area (hereafter, AA-1) in the southeast portion of the Ring 2. AA-1 consists of a concentration of features, artifacts and cleared areas covering approximately 20 x 20 meters that was documented by WPA expansion area D (Figure 10-6). The first line of evidence AA-1 represents an activity area is the presence of four feature free areas each measuring 4-10 meters on a side. They are surrounded by a heavy concentration of pits, burials, and thermal features. Given the high density of features in the area, the presence of relatively large cleared areas is somewhat unusual. Ceramic densities were also relatively low in these areas. Two of the cleared areas have
two 5x5m excavation units that did not produce any pottery. However, many artifacts including hide processing tools were recovered from these cleared areas. This may indicate an attempt was made to keep some types of refuse from cluttering the area, which is expected for maintained or “clear areas” associated with specific craft production and other daily activities (Hayden and Cannon 1983; Arnold 1990).

The second and perhaps strongest line of evidence AA-1 may have functioned specifically for hide processing is finding that 26 of 32 Type 1 shell scrapers recovered from the site were from three thermal features, two pit features, one midden context, and one burial scattered in and around the periphery of AA-1. Feature 167, a small trash pit, contained 19 of the 32 shell scrapers, and was located immediately adjacent to one of the largest clear areas (Figure 10-6).

Feature 186, a possible smudge pit, was also documented near AA-1. The field notes for Feature 186 describe it as: “a shallow hole, 0.3’ deep, filled with charred corn cobs and pieces of charcoal. Above this, [was] a slightly larger pile of cobs”. The field excavator also noted the fortuitous association of a modified fragment of hematite just outside this feature on the ground. The function of this feature is not entirely certain, but it compares well to smudge pits, which Lapham describes as “small oval-shaped features filled with carbonized organic materials, typically corncobs” (Lapham 2005:99-101; see also Binford 1967, Richards 2004:127-135).

AA-1 also exhibited a high concentration of thermal features, which could have been involved in drying or smoking hides. Their location near AA-1 and concentrations of hide processing tools leaves open the possibility they are associated with an unrecognized hide smoking technique. Lapham notes that the paucity of hide smoking
features at the 3 protohistoric sites she studied in Virginia may indicate hide smoking
techniques changed to accommodate more hides at once (2005:100-101). Another
possibility is that AA-1 represents a typical clear area for residential activities, and it only
appears anomalous because no others have been exposed.

A final consideration is that AA-1 is in the proposed mortuary zone of Ring 2. There are numerous burials in the immediate vicinity of AA-1. Given that thermal
features occur above burials and are intruded on by them makes their association
somewhat ambiguous. Evidence of both mortuary and craft production activities within
this proposed mortuary zone suggest that either the area was repurposed for different
activities through time, or the mortuary zone needs to be re-conceptualized as a multi-
functional space. The fact that hide processing tools are present in both domestic and
mortuary zones in both rings suggest that either some part of the hide processing
sequence took place in the mortuary zone, or that tools and debris from hide processing
were discarded in there.

The concentration of different feature types near AA-1, and many examples of
overlapping and intrusive features suggest a long and complex use history for this area of
the site that would make it extremely difficult if not impossible to evaluate the suggested
alternative scenarios. For example burials, pits, and posts from possible structures (see
Chapter 4) overlap each other in several parts of WPA excavation block D near AA-1.
Burial associations (e.g., metal trade goods) and artifacts from in and around AA-1
(biface endscrapers) both date to the late Late Fort Ancient Period which would make it
impossible to tease apart the use history of the area using diagnostic material culture.

Whether the multiple functions suggested for this area are synchronic or
diachronic, the association of a variety of hide processing tools – including most of the shell scrapers recovered from the site – with a large clear area seem to suggest that at least part of the hide processing sequence took place within the proposed mortuary zone.

**Summary and Discussion**

Little conclusive information about the spatial organization of production can be gained from the present analysis. In general most tool distributions are split between residential and mortuary zones. No tool category exhibited a strong pattern by spatial zone in both village areas. Beamers are somewhat more concentrated in the residential zone of Ring 1, while uniface endscrapers and shell scrapers are fairly concentrated in the mortuary zone of Ring 2. The near absence of shell scrapers in Ring 1 is also notable.

A final observation from this comparison is that uniface and biface endscraper distributions were relatively more spatially discreet in Ring 2. Both microwear and metric analysis also suggested these two scraper types are more distinct in Ring 2. As discussed in Chapter 8 there is some overlap in use-traces between the scraper types though it is believed that uniface scrapers were primarily used for working softer materials while biface scrapers were for harder materials. Use traces were more clearly distinguished between scraper types for 11 of 14 microwear attributes in Ring 2, suggesting that the function of these tools was more discreet during that occupation than it was in Ring 1. This pattern is consistent with the finding that their spatial distribution was also more discreet.

Unfortunately, this analysis is limited by several factors. The first is that it is not known whether the observed distributions represent primary or secondary refuse.
Second, there currently is not enough data to quantify differences by spatial zone. Additional systematic surface collections would be a relatively efficient method of recovering larger samples of endscrapes, hematite artifacts, and possibly beamer fragments (which are more susceptible to destruction when exposed to surface conditions of plowed fields).

**Mortuary Analysis**

*Introduction*

The purpose of this section is to identify who may have processed hides, and to determine if there is any direct relationship between hide processing and access to marine shell and metal (i.e., non-local) trade goods. This is an attenuated mortuary analysis that focuses only on these selected aspects of the Hardin Site mortuary program. Will Holmes (1994) completed a thorough analysis of mortuary patterns at the site for his thesis project, but his data can only be used here in a general sense because he treated the entire burial population as a single unit of analysis. The main contribution of the present analysis then is a comparison of hide processing tool, and non-local trade good associations between Rings 1 and 2.

*Methods*

The first step of this analysis was a search of the William S. Webb Museum of Anthropology NAGPRA grave goods inventory from the Hardin Site. This inventory was provided as a spreadsheet that was sorted by grave good type to identify hide processing tools, metal, and marine shell associations. The same tool types used in the
above study of the hide production industry were considered here: bone beamers, uniface and biface endscrapers, hematite artifacts, and shell scrapers. One omission is pottery sherds with ochre residue. These are not identified in the NAGPRA inventory and including them would have required analysis of the entire ceramic assemblage associated with the burials. A list was generated of burials with relevant associations and these items were checked in the museum collections for accuracy. Since radiocarbon dates and artifacts from Ring 1 and Ring 2 indicate the presence of earlier Fort Ancient components, an attempt was also made to examine chronologically sensitive artifacts with each burial to ensure they represent Late Fort Ancient interments. Only one burial lacked diagnostic artifacts dating to the Late Fort Ancient Period (Burial 331), which is discussed below. Sex determinations and age estimates were taken from Appendix C of Audrey Garten’s 1997 M.A. thesis on treponematosis and tuberculosis at Hardin. Age was divided into subadults and adults (16+), also using Garten (1997).

Hide Processing Associations

Figure 10-7 and Table 10-8 show the location and distribution of burials associated with hide processing related artifacts (hereafter, HPAs). Regardless of ring location, women are unambiguously more likely to be associated with HPAs. The only associations with one of two males in Ring 1 and the only male in Ring 2 are hematite artifacts. The second male in Ring 1 may have been associated with an endscraper. However, this burial is disarticulated and commingled with the remains of an adult female and it is uncertain with which individual this item was interred. Given that hematite is not always related to hide processing, it can be argued that no males are
clearly associated with HPAs. In fact, of the six hematite burial associations only one co-occurred with another HPA. The association of hematite only with males and almost never with other HPAs may suggest that it was not used for hide processing at the site. Alternatively, assuming hematite is an HPA, its presence almost exclusively with males may suggest a division of labor in the hide processing sequence in which males only participated in the stage involving hematite. As discussed above, possibilities include pigmentation and or a preservative function.

Diachonric patterns of HPA associations are also informative. Overall, a larger proportion of the Ring 1 (17.1%) burial population was interred with an HPA compared to Ring 2 (10.3%). At the same time there was a marked increase in the female: male ratio of HPA associations from 2:1 to 5:1. The widening of a gender difference in HPA association during the occupation of Ring 2 clearly establishes a female role for hide processing at the Hardin Site. More interestingly perhaps, is a concurrent shift in the quantity and diversity of HPAs. Although more individuals from Ring 1 were buried with HPAs, only one may have had more than one type. This was Burial 118, an infant whose grave pit was later disturbed by two other separate burials (Burial 119 and 122).

To contrast, two of ten contexts from Ring 2 had three different types of HPAs, each with multiple shell scrapers, an endscraper, and another object. The observation that the only burials with shell scrapers also had endscrapers confirms Holmes’ finding of a weak correlation between the two in his burial analysis (Holmes 1994:151). It is notable that both of the females with shell scrapers had uniface endscrapers, which have been interpreted as likely hide processing tools. Even if the 7 individuals associated with HPAs in the overlap area are added to the analysis (for a total sample of 35 individuals),
these individuals still stand out as unique. In fact, data from the overlap area strengthen the female association with hide processing because one individual from this area was the only other burial on the site with shell scrapers aside from those in Ring 2, and it was also a female.

The quantity of HPA associations also increased through time. In Ring 1 the only individual buried with more than one HPA was a male with three hematite pebbles and one modified hematite object. To contrast, in Ring 2 four of ten contexts had more than one HPA, though two of these individuals were buried only with multiple fragments of hematite. The other two individuals from Ring 2 were buried with a variety of other types of HPAs.

Discussion

Whether grave goods represent personal possessions (i.e., represent “social personae” sensu Saxe 1970; Binford 1971) or interments placed with the dead as part of a socially or politically motivated mortuary ritual (see e.g., Pearson 1999:85-87) the patterns of HPAs documented here strongly suggests females were the primary group involved in hide processing activities, regardless of time period. This finding is also consistent with Nagy’s analysis of musculoskeletal markers in the Hardin Site population which indicated women buried with scrapers, awls and other tools exhibited stress patterns consistent with the utilitarian artifacts of their owners (2000:268). She concluded that this association may be an indication of occupational specialization (2000:280). The data presented here suggest that this may have been hide processing.
Male associations with HPAs contrasted strongly with females since hematite was the only clear HPA associated with men, and it was not common. It was suggested that if hematite is in fact related to hide processing, it may indicate men participated only in later stages of processing involving application of pigment/preservative solutions. An alternative interpretation is that hematite was used as a pigment or for other purposes.

For example, Holmes (1994:164-165) interpreted the association hematite artifacts and a cache of other items with Burial 331 as evidence this person was a shaman. It is also notable that this burial was the only one in this mortuary study lacking artifacts indicative of a specific Fort Ancient sub-period, though the orientation of this person’s grave pit was clearly toward the plaza of Ring 1 which may suggest it was Late Fort Ancient.

Whatever the chronological position of Burial 331, the contextual information available seems to suggest its grave associations may not be related to hide processing. If the associations with Burial 331 do represent a shaman, it should be noted that a similar artifact cache (including a hematite cone) was associated with Late Fort Ancient male burial in Ring 2 (2013, Burial #3). Hematite was also the only HPA with this male. It is notable that generally similar sex differences in HPAs were identified at the contemporaneous Madisonville Site (Drooker 1997: Table 7-10). Stone endscrapers were only associated with females, while “shell spoons” were twice as likely to be associated with females and the only red ochre artifact was recovered with a male. Drooker did not directly associate these items with hide processing, but it is notable that they compare well to the findings here.

There were several remarkable diachronic shifts in HPA associations from Ring 1 to Ring 2. The first is a 60% decrease in the proportion of mortuary contexts with HPAs.
The second is that the ratio of females: males with HPAs increases from 2:1 to 5:1. Given that fewer individuals were associated HPAs, magnification of female associations may have made it more important to them. To be sure, the ratio of female : subadult HPA associations shows the same pattern as the female:male ratio. In Ring 1 females were slightly less likely than subadults to be associated with an HPA (4 females, 5 subadults), while in Ring 2 they were slightly more likely to be associated with an HPA (6 females, 4 subadults). Even though neither of these comparisons indicates a strong increase in female representation, they both show the same pattern. This shift toward female HPA association is further confirmed by the fact that the only two burials from either ring with more than one type of HPA were both females from Ring 2.

In the first part of this chapter, a comparison of hide processing intensity between Ring 1 and Ring 2 suggested either a limited increase or no increase at all over time. This comparison seems consistent in that there is either no change in gender associations (women always processed hides), or their role in hide processing vis a vis men and subadults became more important. However, there is an increase in the quantity and diversity of HPAs associated with women over time, which may be an indication that it was becoming more important at least as a marker of social identity. The weak evidence for intensification of hide processing on the other hand, makes it difficult to interpret why hide processing may have been a more salient social identity marker in Ring 2. It is possible that the community experienced unusually cold or unpredictable climate during the occupation of Ring 2 as part of a temporal fluctuation related to the Little Ice Age (Fitzgerald 2001).


**Non-Local Trade Good Associations**

This section begins with a brief description of marine shell and metal artifacts associated with burials in Ring 1 and Ring 2 to provide a comparative background to those also containing HPAs. Regardless of time period, the majority of individuals interred with marine shell or metal artifacts were subadults. The disparity between subadults and all categories of adults (male, female, indeterminate) increases through time from 53.8% to 75% for marine shell trade goods and from 50.0% to 71.4% for metal trade goods. With the exception of one adult of indeterminate sex from Ring 2, all burials from the site associated with both marine shell and metal were with subadults. This pattern has already been observed for the burial population as a whole by both Hanson (1966:73) and Holmes (1994:144-148). What this study adds is the observation that this pattern increases over time with subadults receiving an even greater proportion of trade goods in Ring 2 compared to Ring 1.

Among adults, only men were associated with metal artifacts, but this was limited to one individual from each ring. As a proportion of all burials with metal, males dropped from 25 to 14.3% of burials associated with metal from Ring 1 and Ring 2. To contrast, subadults exhibit a 20% increase from Ring 1 to Ring 2. Adult male and female associations with marine shell show an inverse pattern when Ring 1 and Ring 2 are compared. Females are four times more likely than males to be associated with marine shell in Ring 1, but only half as likely in Ring 2. Since the overall number of adults to receive marine shell was low compared to subadults, a more meaningful observation is that the decrease for female associations (24.5%) was nearly matched by the increase for the subadult associations (21.2%).

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Burials associated with both metal and marine shell were almost exclusively subadults in both rings. The exception was one adult of indeterminate sex from Ring 2. This pattern is not surprising considering that both categories of trade goods were largely associated with subadults in both villages.

Discussion

The association of the majority of non-local trade goods with subadults in Rings 1 and 2 at Hardin appears to be somewhat common for protohistoric sites in eastern North America. Such a pattern has been observed in at least several regions including: western New York (Wray et al. 1991:172-176; Table 4-18), central Virginia (Gallavin 2003:42), western Virginia (Lapham 2005: Chapter 5), and central North Carolina (Ward and Davis 2001:124). Special mortuary treatment aimed at subadults could be interpreted as a social response to the increase in deaths among this age group (Saunders 1994; Lapham 2005; Warren 2014:51). Lapham for example has suggested that subadults were often interred with valuable non-local goods because they represented the continuation of family groups (2005:148). And while a similar scenario is plausible for the Hardin Site, the exact meaning of this pattern of mortuary associations will require a more extensive analysis of the Hardin burial population divided by Ring 1 and Ring 2. This was not attempted in the present study.

*Hide Processing and Non-Local Trade Good Associations*

There are no adult burials associated with both HPAs and metal trade goods and only a few burials were associated with both HPAs and marine shell. Table 10-9 and
Figure 10-8 show the location and distribution burials associated with both hide processing related artifacts and marine shell. None were present in Ring 1. The only male (Burial 3 from 2013) from Ring 2 with an HPA and marine shell was associated only with hematite and his other associations appear more consistent with shamanistic or other activity (see above). All remaining sexed adults from Ring 2 with both associations were female, and all three had an endscraper. Two of these three females were the only individuals associated with shell scrapers, and they also had the largest number (4) and greatest diversity (3) of hide processing tools of any individuals included in this study (including the overlap area). It is very interesting that the two females with the most hide processing equipment from Ring 2 also had marine shell, because as a group female associations with marine shell dropped from 30% in Ring 1 to 6 % in Ring 2. So of the few females in Ring 2 that had marine shell also had the most HPAs.

**Discussion and Conclusions of Mortuary Analysis**

The main goal of the mortuary study was to evaluate the relationship between hide production and exchange. As the final comparison shows, there are very few associations between the two. Though it would have been convenient, it is perhaps not surprising there is little evidence of a direct relationship between the two in mortuary contexts since there is no necessary relationship between social identity as expressed in mortuary practices and the products of one’s labor during life. Of course, this is precisely why the overall distribution of all associations of non-local trade goods was examined rather than just those co-occurring with hide processing tools. A strong pattern emerged where subadults were the most likely recipients of these trade goods, a trend that
increased over time. At the same time, the most likely producers of hides were women, who saw a drop in associations over time. Were females transferring an increasing part of their wealth to their dying children?

The relatively weak evidence of a relationship between hide production and exchange, and for intensification of hide processing were unexpected. Despite these trends, the mortuary analysis found an overall increase in the proportion of burials with non-local trade goods from 24.3% in Ring 1 to 36.5% in Ring 2. This elicits the question: if not hides, then what might have been produced to acquire nonlocal goods? Several possibilities may account for these apparently contrasting patterns. These are somewhat speculative, but could provide a useful starting point for future research. In addition, they are not necessarily mutually exclusive alternatives.

As discussed already, it is entirely possible that even if hide production increased during the occupation of Ring 2, it may simply be that Fort Ancient people did not produce hides with the intention of using them for exchange items. Fort Ancient people may have valued hides more than whatever could be offered in long distance exchanges. While it seems to be unlikely, it is also possible that hides produced by Fort Ancient people were not desired by intermediaries trading with colonial merchants.

Second, as discussed in Chapters 1 and 2, Fort Ancient people were ideally situated to produce and distribute a variety of desirable raw materials and goods. These may have been more suitable as resources that could be produced by Fort Ancient people for exchange. The mid-Ohio Valley contains a dense concentration of saline springs, and it also contains materials such as chert, hematite, cannel coal and pipestone. Likewise, the location of Fort Anciet people on the Ohio River and sandwiched between northern
tribal areas in the Great Lakes and northeast, and southern tribal and chiefdom areas of the Mississippi Valley and the southeast. This centralized geopolitical location may have made them important conveyors of information or expert guides.

Meyers recently argued that the relative paucity of cannel coal raw materials outside of certain parts of Appalachia may have made it an important trade material (2011:95-109, 227-235, 325-332). Cannel coal is also available in the vicinity of the Hardin Site and can be acquired as stream deposits from the Ohio River. Production residues are present in the 1939 and 2013 Hardin collections in the form of manufacturing debris (flakes, chunks, ground fragments), and preforms of “tooth” or “claw” pendants.

Pipestone was also locally available to the residents of Hardin and production debris very similar to those found for cannel coal are present in the 1939 and 2013 collections (see also Drooker 2012, 2015). There is a substantial sample of production debris (>100 items) including several pipe preforms, which is a strong indicator of local production (Davidson 2014a). Future examination of these various production residues could have great potential for understanding Fort Ancient exchange and regional interaction patterns and could be used to build on the findings presented here.

Finally, as we have discussed, the possibility that there may not be a direct relationship between production and exchange since regional exchange often involved exchanges of non-material goods, so it may simply be that items of non-local origin at Fort Ancient sites were acquired as part of social transactions for which Fort Ancient people did not produce goods.

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Table 10-1: Stages of hide processing and spatial/material correlates for each stage.

<table>
<thead>
<tr>
<th>Stage</th>
<th>activity</th>
<th>predicted location</th>
<th>Facilities</th>
<th>tools / materials involved</th>
<th>archaeological correlate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>skinning</td>
<td>outdoors</td>
<td>flat surface</td>
<td>bifacial knives, flake tools</td>
<td>microflakes, utilized flakes and fragments</td>
</tr>
<tr>
<td>2</td>
<td>butchering</td>
<td>outdoors</td>
<td>flat surface</td>
<td>bifacial knives, choppers</td>
<td>microflakes, biface tool fragments</td>
</tr>
<tr>
<td>3</td>
<td>beamer/scraper manufacture</td>
<td>indoor/outdoor</td>
<td>flat surface</td>
<td>hafted biface endscrapers</td>
<td>broken endscraper bits, biface tool fragments, microflakes</td>
</tr>
<tr>
<td>4</td>
<td>soaking (for fleshing/de-hairing)</td>
<td>indoor/outdoor</td>
<td>subsurface pits?</td>
<td>large vessels, clay pit (?)</td>
<td>empty pits</td>
</tr>
<tr>
<td>5</td>
<td>fleshing/beaming</td>
<td>outdoors</td>
<td>flat surface / stretching rack or beaming post</td>
<td>beamer or durable stone or bone scraper with wide blade/scraping surface</td>
<td>fragments of beamers, exhausted flat chipped stone disks, pottery disks, or bone scraper with wide bit; scatter of small stake molds in an outdoor area, uniface and biface knives for woodworking</td>
</tr>
<tr>
<td>6</td>
<td>dehairing</td>
<td>outdoors</td>
<td>flat surface / stretching rack</td>
<td>uniface endscrapers, few (exhausted?) biface endscrapers</td>
<td>exhausted endscrapers, broken endscrapers, microflakes, uniface and biface knives for woodworking</td>
</tr>
<tr>
<td>Stage</td>
<td>activity</td>
<td>predicted location</td>
<td>facilities involved</td>
<td>tools / materials involved</td>
<td>archaeological correlate</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>7</td>
<td>soaking (for tanning/dressing)</td>
<td>indoor/outdoor</td>
<td>flat surface with large vessel to soak hide or subsurface pit to soak hide or groundstone tools to split bones for marrow (or other source of dressing such as deer/animal brains), large vessels for soaking, or digging implement for pits; heavy duty chert bifaces or groundstone tools to split bones for marrow (or other source of dressing such as deer/animal brains), groundstone tools for grinding pigment from hematite</td>
<td>large vessel fragments or empty pits, large quantities of fragmentary faunal remains (for rendered fat) and/or faunal crania that have been split open (for brains); fragments of heavy duty splitting tools, ground ochre residue on vessels or grinding implements, exhausted fragments of hematite</td>
<td>?</td>
</tr>
<tr>
<td>8</td>
<td>wringing/drying hide</td>
<td>outdoors</td>
<td>durable post for attaching hide to wring out</td>
<td>exhausted scrapers or abraders</td>
<td>?</td>
</tr>
<tr>
<td>9</td>
<td>softening hide</td>
<td>indoor/outdoor</td>
<td>flat surface / stretching rack</td>
<td>wide-blade dull scraper or abrading stone</td>
<td>digging implement for pit construction, fuel for smoking pit</td>
</tr>
<tr>
<td>10</td>
<td>smoking hide</td>
<td>outdoors</td>
<td>small hearth or hide smoking pit</td>
<td>pits filled with some quantity of charcoal, corn cobs or other partially burned material and ash near base of pit. Possibly a series of small stake molds around orifice for smoking; broken digging implements</td>
<td></td>
</tr>
</tbody>
</table>

Table 10-1 (continued):
Table 10-2: Results of Measures #1a (Tool Quantity) and #1b (Debris Quantity) and comparison between Ring 1 and Ring 2.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Data Class</th>
<th>greater</th>
<th>proportion/density</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RING 2</td>
<td>RING 1</td>
<td>RING 2</td>
<td>RING 1</td>
</tr>
<tr>
<td>#1 Tool Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>proportion bone beamers</td>
<td>x</td>
<td>29.1</td>
<td>41</td>
<td>11.9</td>
</tr>
<tr>
<td>proportion unifacial endscrapers</td>
<td>x</td>
<td>4</td>
<td>4.6</td>
<td>0.6</td>
</tr>
<tr>
<td>proportion bifacial endscrapers</td>
<td>x</td>
<td>13.4</td>
<td>16.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Shell Scrapers</td>
<td></td>
<td>na</td>
<td>na</td>
<td>NA</td>
</tr>
<tr>
<td>#2 Debris Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw Hematite Density</td>
<td>x</td>
<td>3.64</td>
<td>4</td>
<td>NA</td>
</tr>
<tr>
<td>Modified Hematite Density</td>
<td>x</td>
<td>3.33</td>
<td>2</td>
<td>NA</td>
</tr>
<tr>
<td>Shards with red ocre adhering to interior</td>
<td>x</td>
<td>1.14</td>
<td>1.07</td>
<td>NA</td>
</tr>
<tr>
<td>TOTALS</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 10-3: Distribution of bone tools only. Representing both sub-samples combined from midden contexts only.

<table>
<thead>
<tr>
<th>Final Sample of Bone Tools*</th>
<th>Ring 2</th>
<th>Ring 1</th>
<th>TOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Pointed tip</td>
<td>6</td>
<td>3.0%</td>
<td>2</td>
</tr>
<tr>
<td>drift</td>
<td>27</td>
<td>13.3%</td>
<td>8</td>
</tr>
<tr>
<td>ANTLER SUBTOT</td>
<td>77</td>
<td>37.9%</td>
<td>16</td>
</tr>
<tr>
<td>awl</td>
<td>54</td>
<td>26.6%</td>
<td>20</td>
</tr>
<tr>
<td>beamer</td>
<td>59</td>
<td>29.1%</td>
<td>32</td>
</tr>
<tr>
<td>MISC</td>
<td>9</td>
<td>4.4%</td>
<td>8</td>
</tr>
<tr>
<td>pin</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>hook</td>
<td>1</td>
<td>0.5%</td>
<td>1</td>
</tr>
<tr>
<td>chisel</td>
<td>3</td>
<td>1.5%</td>
<td>1</td>
</tr>
<tr>
<td>BONE SUBTOTAL</td>
<td>126</td>
<td>62.1%</td>
<td>62</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>203</td>
<td></td>
<td>78</td>
</tr>
</tbody>
</table>

*after removal of burial and dump contexts, manufacturing debris and ornaments
Table 10-4: Description of all contexts at the Hardin Site that contain mussel shell scrapers.

<table>
<thead>
<tr>
<th>RING LOCATION</th>
<th>BURIAL</th>
<th>MIDDEN</th>
<th>THERMAL FEATURE</th>
<th>PIT FEATURE</th>
<th>ALL CONTEXTS*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># SCRAPERS</td>
<td># CONTEXTS</td>
<td># SCRAPERS</td>
<td># CONTEXTS</td>
<td># SCRAPERS</td>
</tr>
<tr>
<td>RING 1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RING 2</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>20</td>
</tr>
</tbody>
</table>

*Percent (%) in this case represents proportion of all shell scrapers from site since no other relative measure was possible.
Table 10-5: Distribution of hematite artifacts* and sherds with ochre residue.

<table>
<thead>
<tr>
<th>category</th>
<th>Hematite artifacts</th>
<th>Sherds w/ red ochre residue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>raw</td>
<td>modified</td>
</tr>
<tr>
<td>Ring</td>
<td>Ring 2</td>
<td>Ring 1</td>
</tr>
<tr>
<td>frequency</td>
<td>51</td>
<td>20</td>
</tr>
<tr>
<td># contexts</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Density/context</td>
<td>3.64</td>
<td>4</td>
</tr>
</tbody>
</table>

*Not including three hematite artifacts from 1939 collections: Lithic Catalog #2003 faceted hematite fragment (Ring 2, midden); Lithic Catalog #2060 small hematite celt, burned; a “hematite celt” (Ring 2, midden); Lithic Catalog #2118 small hematite celt or chisel (Ring 1, subadult Burial 119).

Including these three artifacts would change the density/context values to: Ring 2 = 3.52, Ring 1 = 2.9.
Table 10-6: Results of Measure #2: Tool Utilization Intensity measures from the microwear dataset.

<table>
<thead>
<tr>
<th>Uniface Endscrapers</th>
<th>Microwear data Category</th>
<th>more utilized: proportion</th>
<th>more utilized: proportion</th>
<th>difference</th>
<th>Chi-Square</th>
<th>Value</th>
<th>p=</th>
<th>df=</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ring 2</td>
<td>Ring 1</td>
<td>Ring 2</td>
<td>Ring 1</td>
<td>Ring 2</td>
<td>Ring 1</td>
<td></td>
</tr>
<tr>
<td>Proportion resharpened</td>
<td>X</td>
<td>17.2</td>
<td>3.5</td>
<td>13.7</td>
<td></td>
<td>INVALID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion scar initiations obscured by wear</td>
<td>X</td>
<td>44.8</td>
<td>48.2</td>
<td>3.4</td>
<td>0.07</td>
<td>0.79</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion scar orientation obscured by wear</td>
<td>X</td>
<td>10.3</td>
<td>0</td>
<td>10.3</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion rounding visible at 0-15x mag</td>
<td>X</td>
<td>74.1</td>
<td>58.2</td>
<td>15.5</td>
<td>0.67</td>
<td>0.41</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion polish visible at 0-15x mag</td>
<td>X</td>
<td>24.1</td>
<td>34.5</td>
<td>10.4</td>
<td>0.74</td>
<td>0.39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion exhibiting bit stacking</td>
<td>X</td>
<td>86.2</td>
<td>93.1</td>
<td>6.9</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion polish on bit stack visible at 15x mag</td>
<td>X</td>
<td>48</td>
<td>44.4</td>
<td>3.6</td>
<td>0.82</td>
<td>0.05</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion exhibiting striae</td>
<td>X</td>
<td>27.4</td>
<td>41.4</td>
<td>14</td>
<td>0.7</td>
<td>0.4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion striae visible at 01-5x</td>
<td>X</td>
<td>50</td>
<td>16.7</td>
<td>33.3</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL(9)</td>
<td></td>
<td>5</td>
<td>4</td>
<td>382.1</td>
<td>340.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>average difference when proportion was &gt;</td>
<td></td>
<td></td>
<td></td>
<td>15.28</td>
<td>8.68</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biface Endscrapers</th>
<th>Microwear Data Category</th>
<th>more utilized: proportion</th>
<th>more utilized: proportion</th>
<th>difference</th>
<th>Chi-Square</th>
<th>Value</th>
<th>p=</th>
<th>df=</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ring 2</td>
<td>Ring 1</td>
<td>Ring 2</td>
<td>Ring 1</td>
<td>Ring 2</td>
<td>Ring 1</td>
<td></td>
</tr>
<tr>
<td>Proportion resharpened</td>
<td>x</td>
<td></td>
<td></td>
<td>100</td>
<td>90.48</td>
<td>9.52</td>
<td>INVALID</td>
<td></td>
</tr>
<tr>
<td>Proportion scar initiations obscured by wear</td>
<td>x</td>
<td>40</td>
<td>23.81</td>
<td>16.19</td>
<td>2.65</td>
<td>0.1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion scar orientation obscured by wear</td>
<td>x</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion rounding visible at 0-15x mag</td>
<td>x</td>
<td>60</td>
<td>76.19</td>
<td>17.19</td>
<td>1.36</td>
<td>0.24</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion polish visible at 0-15x mag</td>
<td>x</td>
<td>56</td>
<td>42.85</td>
<td>13.15</td>
<td>0.79</td>
<td>0.37</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion exhibiting bit stacking</td>
<td>x</td>
<td>76</td>
<td>80.95</td>
<td>4.95</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion polish on bit stack visible at 15x mag</td>
<td>x</td>
<td>48</td>
<td>57.14</td>
<td>9.14</td>
<td>0.38</td>
<td>0.54</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion exhibiting striae</td>
<td>x</td>
<td>40</td>
<td>47.62</td>
<td>7.62</td>
<td>0.27</td>
<td>0.6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Proportion striae visible at 01-5x</td>
<td>x</td>
<td>30</td>
<td>0</td>
<td>30</td>
<td>INVALID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL(9)</td>
<td></td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>average difference when proportion was &gt;</td>
<td></td>
<td></td>
<td></td>
<td>14.57</td>
<td>9.73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 10-7: Results of Measure #2: Tool Utilization Intensity measures based on metric attributes.

<table>
<thead>
<tr>
<th>Metric Data Category</th>
<th>Location of production intensity</th>
<th>Value of measure</th>
<th>T-TEST</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle or retouch/working edge*</td>
<td>x</td>
<td>62.17</td>
<td>1.27</td>
<td>&gt;0.2     58</td>
</tr>
<tr>
<td>Estimated Reduction Percentage (ERP)</td>
<td>x</td>
<td>0.236</td>
<td>0.27</td>
<td>&gt;0.5     58</td>
</tr>
<tr>
<td>Index of Reduction (IR) Average</td>
<td>x</td>
<td>0.716</td>
<td>0.58</td>
<td>&gt;0.5     62</td>
</tr>
<tr>
<td>Max Length X Width/Thickness</td>
<td>x</td>
<td>85.30</td>
<td>-0.26</td>
<td>&gt;0.5     56</td>
</tr>
<tr>
<td>TOTAL(4)</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Uniface Endscrapers

<table>
<thead>
<tr>
<th>Metric Data Category</th>
<th>Ring 2</th>
<th>Ring 1</th>
<th>Ring 2</th>
<th>Ring 1</th>
<th>Value</th>
<th>p</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle or retouch/working edge*</td>
<td>59.13</td>
<td>54.33</td>
<td>1.81</td>
<td>1.81</td>
<td>1.81</td>
<td>&gt;0.05</td>
<td>87</td>
</tr>
<tr>
<td>Estimated Reduction Percentage (ERP)</td>
<td>0.217</td>
<td>0.229</td>
<td>-0.34</td>
<td>-0.34</td>
<td>-0.34</td>
<td>&gt;0.5</td>
<td>77</td>
</tr>
<tr>
<td>Index of Reduction (IR) Average</td>
<td>0.645</td>
<td>0.632</td>
<td>0.230</td>
<td>0.230</td>
<td>0.23</td>
<td>&gt;0.5</td>
<td>63</td>
</tr>
<tr>
<td>Max Length X Width/Thickness</td>
<td>81.47</td>
<td>77.74</td>
<td>0.237</td>
<td>0.237</td>
<td>0.24</td>
<td>&gt;0.5</td>
<td>64</td>
</tr>
<tr>
<td>TOTAL(4)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Biface Endscrapers
Figure 10-1: Distribution of all bone beamers recovered from 1939 and 2013 excavations. Showing functional zones and level 1 (solid outline) and level 2 (dashed outline) structures (see Chapter 4 for definitions).
Figure 10-2: Distribution of all uniface endscrapers recovered from 1939 and 2013 excavations. Showing functional zones and level 1 (solid outline) and level 2 (dashed outline) structures (see Chapter XII for definitions).
Figure 10-3: Distribution of all bifacial endscrapers recovered from 1939 and 2013 excavations. Showing functional zones and level 1 (solid outline) and level 2 (dashed outline) structures (see Chapter XII for definitions).
Figure 10-4: Distribution of all shell scrapers recovered from 1939 and 2013 excavations. Showing functional zones and level 1 (solid outline) and level 2 (dashed outline) structures (see Chapter 4 for definitions).
Figure 10-5: Distribution of hematite and sherds with red ochre residue recovered from 1939 and 2013 excavations. Showing functional zones and level 1 (solid outline) and level 2 (dashed outline) structures (see Chapter XII for definitions).
Figure 10-6: Detail of Activity Area 1 (on left). Adapted from WPA archive maps, William S. Webb Museum of Anthropology.

Location of AA-1 in Ring 2.

KEY

- Thermal Feature
- Pit Feature
- Burial
- Shell Scraper

FEA.186 (cobb pit) below thermal feature

FEA.167 19 shell scrapers

627
Figure 10-7: The location of burials associated with only hide processing tools (empty diamond) and with both hide processing tools and marine shell (filled diamond).
Table 10-8: Burials in Rings 1 and 2 associated with hide processing tools, sorted by sex and age category*.

<table>
<thead>
<tr>
<th></th>
<th>ADULTS</th>
<th></th>
<th>SUBADULT</th>
<th># ALL INDIVIDUALS</th>
<th># ALL CONTEXTS</th>
<th>ALL *** BURIALS</th>
<th>% ALL BURIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
<td>UID**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RING 1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>17</td>
<td>12</td>
<td>70</td>
</tr>
<tr>
<td>RING 2</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>11</td>
<td>10</td>
<td>107</td>
</tr>
</tbody>
</table>

*sex and age categories (adult, subadult) based on Audrey Adkins Garten 1997.
**UID = unidentified; sex not determined due to insufficient data.
***includes only extended and semi-flexed burials. Flexed, disarticulated, and disturbed burials of other types not included. This was done to avoid inclusion of burials from Fort Ancient components predating the Late Fort Ancient Period. In the future, a more comprehensive study of the grave goods including an attempt to date each burial using diagnostic material culture will refine this data.
Figure 10-8: The location of burials in Rings 1 and 2 associated with marine shell only, metal only, marine shell and metal, and marine shell and hide processing tools.

*When the symbols for marine shell only and metal only overlap it means the scale of the map is too large to show their separation.
Table 10-9: Burials in Rings 1 and 2 associated with marine shell and or metal trade goods. Showing also the location of individuals associated with hide processing artifacts and marine shell.

<table>
<thead>
<tr>
<th></th>
<th>adult</th>
<th></th>
<th>subadult</th>
<th></th>
<th>All</th>
<th></th>
<th>All Burials*</th>
<th>% all burials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>male</td>
<td>female</td>
<td>uid</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Ring 1</td>
<td>marine shell</td>
<td>1</td>
<td>7.7</td>
<td>4</td>
<td>30.8</td>
<td>1</td>
<td>7.7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>metal</td>
<td>1</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>metal/shell</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Ring 2</td>
<td>marine shell</td>
<td>4</td>
<td>12.5</td>
<td>2</td>
<td>6.3</td>
<td>2</td>
<td>6.3</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>metal</td>
<td>1</td>
<td>14.3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>14.3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>metal/shell</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>25</td>
<td>4</td>
</tr>
</tbody>
</table>

*includes only extended and semi-flexed burials. Flexed, disarticulated, and disturbed burials of other types not included. This was done to avoid inclusion of burials from Fort Ancient components predating the Late Fort Ancient Period. In the future, a more comprehensive study of the grave goods including an attempt to date each burial using diagnostic material culture will refine this data.
Table 10-10: Burials in Rings 1 and 2 associated with both hide processing tools and marine shell, sorted by sex and age.*

<table>
<thead>
<tr>
<th></th>
<th>ADULT</th>
<th>SUBADULT</th>
<th># INDIVIDUALS</th>
<th># CONTEXTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
<td>UID**</td>
<td></td>
</tr>
<tr>
<td>RING 2</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>RING 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*sex and age categories (adult, subadult) based on Audrey Adkins Garten 1997.  
**UID = unidentified; sex not determined due to insufficient data.
Chapter 11

Conclusions

General Observations

This study examined the hypothesis that the Fort Ancient Hardin community intensified hide production to take advantage of an “insatiable demand” for animal hides emanating from early European colonial centers (Kardulias 1990:41). This demand was generated by the intensification of an export market of skins and furs, and by tanneries that produced hide-based clothing and other goods consumed by residents of early colonial centers (Gill 1990[1966]:6; Kardulias 1990). The presence of marine shell and European-made items at Fort Ancient communities dating to this time indicates they participated in the same regional exchange sphere(s) that funneled hides into the colonies, so they were likely aware of this activity and may have taken advantage of it.

A central issue of this study is the question of whether Fort Ancient people acted on colonial demand for hides as has been documented for many Native groups, some of whom were in direct contact with Fort Ancient peoples (e.g., Iroquois, Coosa). In addition, several historians have recently emphasized an important “pull” factor in Shawnee migration from their (Fort Ancient) homeland was to live among their Native allies who had closer ties to colonial markets (Drooker 2002:128-133; Lakomaki 2014:26; Warren 2014:25-82). Were early Shawnee entrepreneurship and mobility rooted in a 16th-17th century Fort Ancient precedents? Despite the impressive body of circumstantial evidence produced in recent decades, direct archaeological evidence of Fort Ancient production for exchange remains quite limited.
The presence of non-local trade goods originating in colonized regions, large quantities of hide processing tools and the position of the Hardin community at a cross-road of several trade corridors make it an ideal setting to evaluate the above model. The majority of production indicators examined by this study suggest hide production intensified over time; but the paucity of statistically significant differences between the two components examined makes this case very weak. Despite these ambiguous results, the craft production model used in this study was very productive. The Hardin datasets provide new baseline information regarding the organization and technology of hide production that builds on recent research elsewhere (Lapham 2005).

Several contributions in particular should be highlighted. Perhaps the single most significant is the observation of a functional difference between uniface and biface endscrapers. There is evidence of some overlap in use, but the broad pattern of metric and usewear attributes indicate uniface and biface endscrapers had distinct primary functions; uniface endscrapers were used to work soft materials (likely hides) and biface endscrapers were used to work harder materials (likely hard wood and/or bone). An important caveat to this finding is that the sample sizes were lower than I would have liked and so it should be warned that the strength of this functional interpretation is only as great as the sample size. At the same time, the potential weakness of a small sample size is offset by the fact that micro-wear and metric data independently support these interpretations.

A notable secondary observation about technology is the suggestion that biface endscrapers were used in the manufacture of beamers. This suggestion is based on at least three independent observations. First, the microwear analysis indicated biface
endscrapers were used to work hard materials, likely bone or hard wood. Morphological attributes such as profile shape, with/thickness ratio and edge angle are consistent with working harder materials. Second, the use-wear study of several beamers indicates they manufactured with a stone tool. Finally, the proportion of beamers and biface scrapers co-varied in each ring with more of both in Ring 1, less of both in Ring 2. While these observations make for an interesting circumstantial case, it should be considered a hypothesis that requires evaluation. This hypothesis is definitely worth pursuing because if a link can be demonstrated, it is implied that biface endscrapers and beamers represent a technological package devised by Fort Ancient people for hide processing.

Finally, in the course of parsing out the spatial and chronological relationship between Ring 1 and Ring 2 a great deal of new information was documented about the Hardin Site. This includes reporting new data for large samples of diagnostic lithic, ceramic, marine shell, and metal artifacts. This study also documented a great deal of information about the internal organization of two Late Fort Ancient components, including information about possible residential areas, burial patterns, and possible structures associated with burials.

Much of this current analysis would not have been possible without new field work that documented the current location of the back-filled 1939 excavation areas to a modern site grid that can be expanded on in the future. With this information, research in the future could potentially expand from any of the 1939 excavation blocks to build on the collections from previously excavated areas. A prime example of this in the present study was the documentation of two post hole patterns that appear to be unexcavated portions of structures partially exposed in 1939. Information from the newly
documented portions will magnify the research potential of museum collections by providing data not retained from the 1939 project (e.g., botanical and faunal remains).

**Hide Processing and Regional Exchange**

To conclude, we can bring the findings of this study to bear on broader questions of anthropological interest outlined in Chapter 1: the degree to which the frontiers of colonized regions such as the mid-Ohio Valley participated in regional exchange spheres, and the local consequences of this interaction. A central tenet of World Systems Theory is that participation in large scale exchange spheres has the power to reshape internal social relations. This study examined both residues of hide production and evidence for a link between hide processing and consumption of nonlocal trade goods. Evidence for a change in production at the Hardin Site was very weak. This was surprising given the strong circumstantial evidence of this industry for Fort Ancient in general, and for the Hardin Site in particular. Several possible scenarios are proposed to examine this finding, any of which could provide a useful means of further pursuing this research.

The first possible reason evidence for production intensification was weak may relate to a lack of temporal separation between Ring 1 and Ring 2. Based on currently available data, we cannot rule out the possibility there is very little chronological separation (i.e., no occupation hiatus) between the occupation of Ring 1 and Ring 2. If the community gradually moved north from Ring 1 to Ring 2 with no occupation hiatus, or there was only a very short occupation hiatus (<100 years), it may not be possible to fully resolve the temporal relationship of the rings with the chronological measures currently available. A related scenario is the possibility that spatial overlap
of Ring 1 and Ring 2 has biased the samples of chronologically sensitive materials from both rings, which has made the relatively earlier Ring 1 appear closer in time to the relatively later Ring 2 than it actually is. This scenario was suggested by 15th century radiocarbon dates from Ring 1, despite the presence of 16th-17th century diagnostic artifacts. This hypothesis should be evaluated with a larger sample of radiocarbon dates.

A second possible scenario is that the data used to examine production intensification under-represents what actually happened. In this scenario the appropriate data were not used or the right questions were not asked of the data. An important dataset that would add immensely to this model would be to examine deer mortality profiles and butchery marks. Lapham’s (2005) study found clear diachronic patterns related to deer harvesting and butchering that are suggestive of “hunting for hides”.

Finally, since the hide trade really started to intensify during the 1620s and 1630s (Axtell 1992:130-131), it is possible that European demand for furs and skins did not effectively penetrate the mid-continent until after the last occupation of the Hardin Site.

Another unresolved issue is that even if hide production intensified, this could have occurred for reasons other than exchange. Neutral Iroquois appear to have intensified hide production in the 15th century, which Fitzgerald relates to the onset of the Little Ice Age (2001; see also Abel 2015). Fluctuations in precipitation and temperature characteristic of this climatic episode would have had a serious impact on Native lifeways during the 15th to early 16th centuries (e.g., McCullough 1997; Nolan and Cook 2010), and on those of Natives and Europeans during the late 16th and 17th centuries (e.g., Kelso 2006). Fitzgerald (2001:44-47), for example indicates that changes in Neutral hunting practices originated in the 15th century relate to a shift toward
game exploitation to subsidize crop shortfalls related to climate change. The increased reliance on game would have provided extra clothing needed for a generally colder period. Following this logic, the adoption of formal uniface endscrapers in the Fort Ancient region in the 15th century could potentially also have been a technological response to processing a greater number of hides needed for warmer clothing.

In the Fort Ancient region, the onset of the Little Ice Age also corresponded to change in the settlement system that included a shift in village size and location and greater use of seasonal settlements focused on game and wild resource exploitation (Graybill 1981; McCullough 1997:81-84). If this is true, it is possible most game were caught away from villages and evidence of hide processing therefore could be relatively concentrated at seasonal settlements. Given that this was a strategy used by protohistoric and historic Natives to intensify hide production (e.g., Waselkov and Smith 2000:247), this model is very plausible. To evaluate this idea, hide processing should be examined at seasonal settlements. It could be difficult to parse out the difference between intensification for prehistoric/climatic or historic/economic reasons.

**Hide Processing and Society**

It is important to recognize that even if this study had found strong evidence of production intensification, this does not tell us why. It is often assumed intensification would have been geared toward the acquisition of European trade goods and marine shell, but this is difficult to measure directly. Many historic accounts of early contact period Native groups indicate exchanges may have been geared toward alliance building, intermarriage, and other social functions that have less obvious material markers, so
Fort Ancient production intensification need not be related directly to the acquisition of non-local goods. In fact, weak evidence of intensification at Hardin - despite the presence of nonlocal goods from a variety of sources - may be an indication nonlocal goods were material markers of social transactions. As Galloway recently described for 18th century Choctaw (2009), personal adornments, rank badges and other prestige items equivalent to the non-local goods found at Hardin were acquired from specific people in transactions that had an important social function. Among Fort Ancient people, we simply do not know if skins or furs would have been an appropriate medium for the types of transactions that produced personal adornments of non-local materials.

European trade goods are almost entirely absent from graves containing evidence of hide processing. Marine shell on the other hand was a trade material long available to Fort Ancient people, and it co-occurs with several burials that also contained hide processing tools. Of course, as indicated above, there need not be a relationship specifically between hide production and marine shell just because an individual was buried with both. It is impossible to know whether burial associations represent possessions of the dead or gifts related to mortuary ceremony. However, it is plausible the significance of hides among Protohistoric Fort Ancient people imbued a particular type of social status on those who processed hides (females) – one materialized or symbolized by marine shell but not metal trade goods (see also Holmes 1994:154). This can be suggested based on the fact that four of six adults from Ring 2 associated with marine shell also had hide processing tools. Conversely, when it was associated with adults, metal occurred only males, who were unlikely to be associated with marine shell and hide processing tools. Holmes also observed a male association with metal
This could potentially suggest metal is a marker of male identity, though its rarity with adults of any kind make this case weak.

The unambiguous association of both marine shell and metal with children, on the other hand, is even more difficult to interpret because we cannot assume their mortuary associations represent some aspect of social identity gathered in life as we can for the adults. Several studies have suggested a relationship between infant mortality and interring large quantities of trade goods with subadults (see last chapter). Since bioarchaeological data have not been analyzed by ring location, the issue of mortality cannot be discussed. However we can say trade goods were increasingly concentrated with subadults from Ring 1 to Ring 2 at the expense of adults, specifically women in the case of marine shell. But what does this mean? Clearly, further analysis of the mortuary program is needed. In particular, grave associations need to be reassessed for the entire population, with age categories for subadults broken down to provide greater resolution to patterns observed here.

**Final Thoughts**

This study has attempted to “fit” the project findings into a World Systems Theory framework but neither strong evidence for intensification nor a connection between production and the acquisition of European trade goods were found. What we are left with is a settlement whose connection to the broader interaction sphere was perhaps not strong enough to be influenced by the historically-documented European demand for hides. Of course, it is important to recognize this study only assessed one craft production industry, and only in a preliminary way since many aspects of the
industry could not be examined.

Assuming the results of this study withstand scrutiny in the future, a more suitable model should be sought to examine how Fort Ancient people engaged with the regional interaction sphere during the 15th – 17th centuries. The structure of World Systems Theory does not easily accommodate interaction that produces no perceivable shifts in relations of production. It would be very productive to re-examine these findings using alternative interaction models such as cultural entanglement (Alexander 1998) or Ethridge’s Mississippian shatter zone (2009). Because a comprehensive effort can not be made here, I conclude by attempting to situate the Hardin Site within broader regional historical flows, employing the terminology of both the shatter zone model (after Ethridge 2009) and World Systems Theory in a cursory way.

Like other societies on the distant periphery of the shatterzone, this study found little strong evidence for a “ripple effect” from the periphery of the emerging world system represented by directly colonized areas of the Atlantic and Gulf Coasts. However, by the end of the occupation of Ring 2 at the Hardin Site, the ripples of the shatterzone produced direct consequences for many of the Native groups who had been contacts of Fort Ancient people. The Iroquois, with whom Fort Ancient had only recently established trade relations, were making their way to the Ohio Valley as they dismembered the social fabric of Algonkian-speaking groups of the southern Great Lakes in search of hunting territories and slaves (Bowne 2005). The Coosa Chiefdom that had probably been one of several southern Appalachian groups who linked Fort Ancient people to the southeast for generations abandoned their homeland in search of better prospects elsewhere (Ethridge 2010:60-68). Both of these groups, once linked to
Fort Ancient people, were coalescent communities of multiple groups who had been impacted by disease, slaving and other disruptions before Hardin was abandoned in the 1630s. The turmoil that surrounded Fort Ancient people during the final occupation of the Hardin Site contrasts sharply with the fact the site appears in many respects to exhibit continuity in patterns of spatial organization, material culture, diet, and mortuary patterns. Some potential changes are noted throughout this document, but none were clear enough with currently available data to insist on them.

Given the lack of strong evidence for intensification, or for a link specifically between European trade goods and hide processing, one interpretation of the presence of European-made trade goods at the Hardin site is that they represent a fortuitous consequence of the fact that Fort Ancient communities were linked to coastal areas by trade long before they were colonized. Moreover, items of European manufacture were consumed as part of mortuary rituals like other non-local goods – mostly interred with subadults. However, we should take pause and contextualize the evidence at Hardin in the longer term flow of Fort Ancient history. This and previous research discussed above indicate the Hardin site was connected abroad to Oneota, the southern Great Lakes, New York Iroquois, Susquehannock, Monongahela, and various parts of southern Appalachia. Even if trade goods from these regions were consumed in old ways, they also tell us that this community continued to pursue connections with a range of long-distance contacts that were part of a rapidly changing regional interaction sphere.

If Stephen Warren’s recently published account of an Algonkian-speaking slave in Iroquoian bondage is correct in placing Iroquois slave raids in the Ohio Valley in the
late 17th century, the last residents of the Hardin Site were only a generation away from the disruption they watched their trade partners endure. More importantly, since there can be little doubt occupants of the Hardin Site were aware of the events devastating their neighbors, we can be sure they were using interaction networks to forge new relationships that would help them adapt to changes gradually encroaching on the Ohio Valley. I argue the presence at Hardin of a variety of European metal types (brass, tin brass, copper) and forms (coils, clips, bracelets) indicative of different European sources, as well as early 17th century Native artifact types from places across eastern North America, represents an effort by the community to reach out and position itself favorably in the tumult of the 17th century interaction sphere.

There are some indications of change at components probably post-dating Hardin, but the continuation of many other aspects of Fort Ancient life (e.g., ceramic and lithic technologies, foodways) suggests that Fort Ancient people were undergoing transformation as they rode the shockwaves of the shatterzone by negotiating new partnerships abroad and reorganizing spatial and probably social relationships in the homeland. One example of change may be evident at several 17th century Fort Ancient components that appear to lack a circular community plan (e.g., Larkin, Howard, Orchard). At the Howard Site, the only well-documented Fort Ancient component to produce gunflints, many hide processing tools and Native and European trade goods were also recovered (Pollack and Schlarb 2009:34-35,123-124).

As discussed in Chapter 2, ceramic, pipestone, and other artifacts of possible Fort Ancient origin have been recovered from Seneca, Susquehannock, Shawnee, Quapaw, and Illinois-affiliated sites dating to the mid-to-late 17th century. These
possible trade links strongly suggest Fort Ancient people actively fostered old and new relationships abroad, while also maintaining a presence in the homeland (see also Warren 2014: Chapters 2-5).

Assuming the Fort Ancient-Shawnee ethnogenesis model is correct, the wide geographic distribution of the very earliest Shawnee settlements (i.e., pre-18th century), and temporal overlap of these with the very latest Fort Ancient settlements, indicate that Fort Ancient communities like Hardin successfully reached out to their contacts abroad to find a new home before the shockwaves of the shatter zone resonated beyond their control. At the start of the 18th century, there is no strong evidence for permanent villages in the mid-Ohio Valley, but by this time Fort Ancient people - now known as the Shawnee - had already established themselves as important players in the colonial trade in skins and slaves (Warren 2014). Some of the people living in early Shawnee communities scattered widely across eastern North America may have had distant but fond memories of the banks of the Ohio at the Hardin Village.
APPENDIX A
Geophysics Processing Images
Figure A-1. Stitched and gridded from magnetic gradiometer survey. This data has not been processed.
Figure A-2. Magnetic gradient data after one round of processing with Oasis Montaj. The parameters used: Butterworth Filter (parameters: Cutoff WL:2, Filter Order:8, High-pass) and Directional Cosine Filter  (parameters: Centre Dir:0, Deg of Cos:0.5).
Figure A-3. Noise removed from magnetic gradient data after one round of processing. The parameters used: Butterworth Filter (parameters: Cutoff WL: 2, Filter Order: 8, High-pass) and Directional Cosine Filter (parameters: Centre Dir: 0, Deg of Cos: 0.5).
Figure A-4. Images of plow scars that appear to have generated noise in the magnetic gradient data in the form of directional striping. This noise was removed from final images of the magnetic data using methods described in Chapter 3. Top image is of Units 3-4 (1x2 meters), bottom image is of Unit 11 (2x2 meters). In both images the plow scars have been excavated.
APPENDIX B
Images of WPA Excavation Areas
Documented by 2013 Field Work
Figure B-1. Plan view east end of Unit 5 and southeast and of Unit 6 at base of plowzone (Stratum I). Showing area backfilled by WPA excavations in 1939 thought to represent a portion of expansion Area A.
Figure B-2. Plan view east end of center of Unit 18 at base of plowzone (Stratum I). Showing area backfilled by WPA excavations in 1939 thought to represent an area excavated deeper to expose the north wall of House 2.
Figure A-3. Plan view of Unit 19 at base of plowzone (Stratum I). Showing edge of one area backfilled by WPA excavations in 1939.
APPENDIX C
2012-2013 Excavation Unit Plan Views
Figure C-1: Units 1-2 final plan view.
Showing possible post holes (PP) and features.
Figure C-2: Units 3-4 final plan view. Showing possible post holes (PP*) and features.

15Gp22 HARDIN SITE
UNITS 3-4 ZONE II
DEPTH: 40-45cm bel. surface

*NOTE: The first possible post labeled is 6. PP1-PP5 were designated for Units 1-2. Also, the nomenclature system for possible post holes was changed after Unit 4. For Units 5-22, possible posts have their own sequence in each unit. See Unit 5-6 planview
Figure C-3: Units 3-4 final plan view. Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNITS 5-6 TOP ZONE II
DEPTH: 35cm below surface

NORTH
Figure C-4: Units 3-4 final plan view. Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNIT 7 TOP ZONE II
DEPTH: 35cm below surface

NORTH

0cm  50  100

PP7-1
PP7-6

PP7-2
PP7-7

PP7-3

PP7-4

PP7-1

PP7-5

PP7-6

ZONE II

(FEATURE)
Figure C-5: Units 3-4 final plan view. Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNIT 8  TOP FEATURE 3
DEPTH: 45cm below surface

NORTH
Figure C-6: Unit 9 & Unit 15 plan view. Showing features and zones in Stratum III.

15Gp22 HARDIN SITE
UNIT 9 & UNIT 15
TOP OF STRATUM III
DEPTH: 40-45cm below datum
Figure C-7: Unit 9 final plan view showing possible post holes or features originating in Stratum V at 50-55cm below datum.
Figure C-8: Units 15 and 16 final plan view.
Showing possible post holes (PP) features and zones.

15Gp22 HARDIN SITE
UNITS 15 AND 16
BASE OF STRATUM I
DEPTH:
30-35cm below surface

UNIT 15
PP16-1
STRATUM III
ZONE B
STRATUM III
ZONE A
PP15-1 PP
FEA. 7

UNIT 16
PP 16-2
STRATUM III
ZONE B
PP 15-2

STRATUM IVA
Figure C-9: Unit 13 final plan view. Showing possible post holes (PP).
Figure C-10: Unit 14 final plan view. Showing south boundary WPA expansion Area B.
Figure C-11: Unit 17 final plan view. Showing portion of unit where 1939 WPA backfill was excavated to its terminus.

15Gp22 HARDIN SITE
UNIT 17
BASE OF STRATUM I
DEPTH: 35/50cm below surface

NORTH

STRATUM IIC
(NOT RE-EXCAVATED)
Figure C-12: Unit 18 final plan view. Showing possible post holes and features.
Figure C-13: Unit 19 final plan view. Showing possible post hole and areas excavated by the WPA in 1939.
Figure C-14: Unit 10 plan view at top of Stratum II.
Showing possible post holes (PP) and features.
Figure C-15: Unit 12 plan view at top of Stratum II.
   Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNIT 12 TOP STRATUM II
DEPTH: 32cm below datum

NORTH

FEATURE 4

STRATUM II

PP12-2

PP12-1

PP12-3
Figure C-16: Unit 10 plan view at top of Stratum III/IV. Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNIT 10 TOP STRATUM III/IV
DEPTH: 55cm below datum

unexcavated possible post holes originating at base of Stratum III. They originated below Feature 14.

NOTE: Stratum III & Features 14 and 15 are in a shallow basin excavated into Stratum IV.
Figure C-17: Unit 12 plan view at top of Stratum III/IV.
Showing possible post holes (PP) and features.

15Gp22 HARDIN SITE
UNIT 12  TOP STRATUM III/IV
DEPTH: 55cm below datum

post hole originating at 55cmbd

NOTE: Stratum III & FEA 14
are in a shallow basin
excavated into Stratum IV.
Figure C-18: Unit 11 plan view of Stratum II, middle of Level 1. Showing top of Feature 5.

15Gp22 HARDIN SITE
UNIT 11 STRATUM II
MIDDLE OF LEVEL 1
DEPTH: 35cm below datum

NORTH
Figure C-19: Unit 11 plan view of Stratum II at bottom of Level 2. Showing top of Feature 8 (Burial #1).

**PIECE-PLOTTED (PP) ARTIFACTS**
- PP23-25: mussel shell scrapers (positioned above pelvis)
- PP27: human tibia, proximal fragment
- PP28: small mammal skull
- PP29: turtle carapace/plastron & mammal scapula
- PP31-33: shell tempered sherd concentration
- PP102: biface endscraper (resting directly on right ribs)

15Gp22 HARDIN SITE
UNIT 11  STRATUM II
BOTTOM OF LEVEL 2
DEPTH: 50cm below datum

NORTH
Figure C-20: Unit 20 plan view of Stratum II at bottom of Level 1. Showing features and possible post holes.

15Gp22 HARDIN SITE
UNIT 20 STRATUM II
BOTTOM OF LEVEL 1
DEPTH: 40cm below datum

NORTH

ROCK

FEATURE 12
PP20-5 PP20-6

FEATURE 9 (Burial #2)

ZONE 1

FEA 10 ZONE 1

FEATURE 10 (Burial #3)

PP20-4

FEATURE 10 ZONE 2

PP 20-3

PP20-2

PP20-1

STRATUM II

FEA 9 ZONE 2

FEA 9 ZONE 1

FEATURE 9 (Burial #2)
Figure C-21: Unit 20 plan view at top of Stratum IV. Showing possible post holes.
Figure C-22: Unit 21 final plan view. Showing possible post holes (PP) and zones in Stratum II.

15Gp22 HARDIN SITE
UNIT 21 ZONE II
DEPTH: 36cm below datum

unevaluated possible post in rodent-disturbed area (Zone 2)

post hole Confirmed by excavation
Figure C-23: Unit 22 final plan view. Showing feature and soil zones.
APPENDIX D
2012-2013 EXCAVATION UNIT PROFILES
Figure D-1: Units 1-2 north wall profile showing strata and features. Same scale for width and depth.

15Gp22 HARDIN SITE
UNITS 1-2
NORTH WALL PROFILE

Stratum I/II transition based on plan views and excavation notes, it was not distinguishable in profile.

base of excavation

FEATURE 1

III (unexcavated)

unexcavated
Figure D-2: Units 3-4 north wall profile showing strata and features. Same scale for width and depth.

15Gp22 HARDIN SITE
UNITS 3-4
NORTH WALL PROFILE
Figure D-3: Unit 7 south wall profile showing strata and features. Same scale for width and depth.

15Gp22 HARDIN SITE
UNIT 7
SOUTH WALL PROFILE
Figure D-4: Unit 8 east wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.
Figure D-5: Unit 9 south wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.

15Gp22 HARDIN SITE
UNIT 9
SOUTH WALL PROFILE

NOTE: Stratum IIA was visible in the south wall profile but it did not clearly extend this far south in plan view during excavation.
15Gp22 HARDIN SITE
UNIT 8
EAST WALL PROFILE

Figure D-6: Unit 8 east wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.
Figure D-7: Unit 15 and Unit 16 (south 1x1m) south wall profile. Vertical tick marks represent 10cm depth increments.

15Gp22 HARDIN SITE
UNIT 15 and Unit 16 (south 1x1m)
SOUTH WALL PROFILE
Figure D-8: Unit 17 and Unit 18 south wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.

UNIT 17 (north 1.5m) and Unit 18 (south 1m)

15Gp22 HARDIN SITE
SOUTH WALL PROFILE

UNIT 17 (north 1.5m)

UNIT 18 (south 1 meter)

0cm 50 100
Figure D-9: Unit 10 south wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.

*lower portion of Stratum II contains redeposited fragments of Feature 14

(uncatalogued)
Figure D-10: Unit 12 south wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.

15Gp22 HARDIN SITE
UNIT 12
SOUTH WALL PROFILE

*lower portion of Stratum II contains re-deposited fragments of Feature 14

FEATURE 14
Figure D-11: Unit 12 south wall profile showing strata and features. Vertical tick marks represent 10cm depth increments.
APPENDIX E
STRATIGRAPHY DESCRIPTIONS FOR 2012-2013 EXCAVATION UNITS
<table>
<thead>
<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th># LEVELS</th>
<th>STRATUM (VERTICAL)</th>
<th>ZONE (HORIZONTAL)</th>
<th>FEATURE</th>
<th>POSSIBLE POST HOLES</th>
<th>DEPTH ORIGIN CMBS</th>
<th>FINAL DEPTH CMBS</th>
<th>MOISTURE</th>
<th>TEXTURE</th>
<th>MUNSELL</th>
<th>COLOR</th>
<th>COMPACT-NESS</th>
<th>MOISTURE</th>
<th>MOISTURE</th>
<th>COLOR</th>
<th>TEXTURE</th>
<th>MOISTURE</th>
<th>MUNSELL</th>
<th>COLOR</th>
<th>COMPACT-NESS</th>
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<td>II</td>
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<td>&gt;55</td>
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<td>normal</td>
<td>brown</td>
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<td>possible post hole</td>
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<td>III</td>
<td>III</td>
<td>3</td>
<td></td>
<td></td>
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<td>normal</td>
<td>dry</td>
<td>normal</td>
<td>brown</td>
<td>normal</td>
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<td>normal</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>possible post hole</td>
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<td>III</td>
<td>III</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>normal</td>
<td>dry</td>
<td>normal</td>
<td>brown</td>
<td>normal</td>
<td>normal</td>
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<td>normal</td>
<td>normal</td>
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<td></td>
</tr>
</tbody>
</table>

Table E-1: Deposits recorded in Units 1-2 including strata, zones, features, and possible post holes.
Table E-1 (continued)

Notes for Table A1-1:
1. Deposit excavated in 5cm levels.

2. Deposit excavated in 5cm levels.

3. Post 2 is a possible rodent run.

4. Excavated in SW corner of unit, did not reach bottom, looks like good feature, but not sure what type without further work.
Table E-2: Deposits recorded in Units 3-4 including strata, zones, features, and possible post holes.

<table>
<thead>
<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th># LEVELS</th>
<th>FEATURE (HORIZONTAL)</th>
<th>POSSIBLE POST HOLES</th>
<th>FINAL DEPTH CMBS</th>
<th>MUNSELL COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>MICRO-ARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
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<td>3-4</td>
<td>modern plowzone</td>
<td>I</td>
<td>1</td>
<td></td>
<td></td>
<td>0</td>
<td>v. dark brown</td>
<td>clay</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>none</td>
<td></td>
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<tr>
<td>3-4</td>
<td>plow scar removal / mixed</td>
<td>I/II</td>
<td>1</td>
<td></td>
<td></td>
<td>22</td>
<td>25</td>
<td>v. dark brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>none</td>
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<td>3</td>
<td>disturbed context</td>
<td>II</td>
<td>4</td>
<td>A</td>
<td></td>
<td>25</td>
<td>45</td>
<td>v. dark brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>many</td>
</tr>
<tr>
<td>3</td>
<td>probable looted human burial</td>
<td>II</td>
<td>8</td>
<td>B</td>
<td>2</td>
<td>22</td>
<td>&gt;80</td>
<td>dark yellowish brown</td>
<td>silty clay loam</td>
<td>normal</td>
<td>normal</td>
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<td>sparse</td>
</tr>
<tr>
<td>3-4</td>
<td>midden</td>
<td>II</td>
<td>4</td>
<td>C</td>
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<td>25</td>
<td>45</td>
<td>dark gray brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
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<tr>
<td>4</td>
<td>possible post hole</td>
<td>II</td>
<td>C</td>
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<td>25</td>
<td>44</td>
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<td>II</td>
<td>C</td>
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<td>2</td>
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</table>
Table E-2 (continued)

Notes for Table A1-2:
1. At beginning of level east 1/2 unit was already at 25; this level was to get plow scars out and even unit to 25 cmbd so the contents are mixed pz and top of STRII from w 1/2 only.

2. Possible post holes #s1-5 were assigned to Units 1-2.

3. Rock and clay chinked.

4. Later determined to be a shovel divot on the eastern edge of Zone A.
<table>
<thead>
<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th>ZONE (HORIZONTAL)</th>
<th>LEVELS</th>
<th>DEPTH ORIGIN CMBS</th>
<th>DEPTH CMBS</th>
<th>FINAL DEPTH CMBS</th>
<th>CHARCOAL</th>
<th>MOISTURE</th>
<th>COMPACTNESS</th>
<th>TEXTURE</th>
<th>COLOR</th>
<th>MUNSELL</th>
<th>MOISTURE</th>
<th>TEXTURE</th>
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<td>modern plowzone</td>
<td>II</td>
<td>Zone 1</td>
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<td>32</td>
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<td>some sparse</td>
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<td>5-6</td>
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<td>II</td>
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<td>silt loam</td>
<td>dark yellowish brown</td>
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<td>normal</td>
<td>normal</td>
<td>some</td>
<td>some sparse</td>
<td>some sparse</td>
<td>some</td>
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<td>sparse</td>
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<tr>
<td>6-7</td>
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<td>normal</td>
<td>silt loam</td>
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</tr>
</tbody>
</table>
Notes for Table E-3:
1. A thin, sparse midden with high clay content and much small rocky inclusions in Unit 5 and Unit 6, not mentioned on Unit 7 plan but that was the last unit and may simply have overlooked it. Not on plan because difference between nature of STRII in Unit 7 (and possibly Unit 6) vs Unit 5 was not observed until reading over excavation notes.

2. A thin possible midden deposit definitely in Unit 7, notes for Unit 6 suggest it may have been present here as well. May represent "inside structure, while unit 5 and south 1/2 unit 6 could represent more of the outside of the structure. Note that the small fcr in Zone 1 is present in Zone 2 as well.

3. PP6-5 is rock chinked.
Table E-4: Deposits recorded in Unit 8 including strata, zones, features, and possible post holes.

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<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th># LEVELS</th>
<th>FEATURE ZONE (HORIZONTAL)</th>
<th>POSSIBLE POST HOLES</th>
<th>FINAL DEPTH CMBD</th>
<th>MUNSELL COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>MICRO-ARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
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Table E-5 (continued)
Notes for Table E-5:
1. not excavated separately from Stratum IVB because they were first distinguished in profile after excavation.
2. only around posts north of basin containing Stratum III Zone A.
4. Possible features and post holes previously excavated by WPA.
5. Not excavated separately from Stratum III Zone A because they were first distinguished in profile after excavation.
6. Possible post and pit outlines, one underlying a portion of Feature 6.
Table E-6: Deposits recorded in Units 10 & 12 including strata, zones, features, and possible post holes.

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<th>ZONE (HORIZONTAL)</th>
<th>POSSIBLE POST HOLES</th>
<th>DEPTH ORIGIN CMBD</th>
<th>FINAL DEPTH CMBD</th>
<th>TEXTURE</th>
<th>COLOR</th>
<th>MOISTURE</th>
<th>COMPACTNESS</th>
<th>NOTES</th>
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<th>POSSIBLE POST HOLES</th>
<th>DEPTH ORIGIN CMBD</th>
<th>FINAL DEPTH CMBD</th>
<th>TEXTURE</th>
<th>COLOR</th>
<th>MOISTURE</th>
<th>COMPACTNESS</th>
<th>NOTES</th>
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</table>
Notes for Table E-6:
1. Large clayey inclusions and color suggest looter pit.
2. Feature identified only in south unit wall, unable to evaluate.
3. Called STRII Area B at base of unit 10 lvl 35-45cmbd form; two different observers (SF LVL 45-55 form, MD STRIII lvl 55-60 form) noted large charcoal flecks and chunks in this zone between 45-55cmbd.
4. Dimensions: 55 x ?? cm.
5. Dimensions: 60 x 140cm.
6. Dimensions: 45 x 65cm.
7. Base of midden running northwest-southeast; mostly in unit 10.
8. Excavated and need depths from flotation bags.
9. Excavated only East 1/2 in Unit 10; final shots of Fea14 in unit 12 are at 60cmbd.
10. Not excavated.
Table E-7: Deposits recorded in Unit 11 including strata, zones, features, and possible post holes.

<table>
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<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th>ZONE (HORIZONTAL)</th>
<th># LEVELS</th>
<th>FEATURE</th>
<th>POSSIBLE POSTHOLES</th>
<th>FINAL DEPTH CMBD</th>
<th>DEPTH ORIGIN CMBD</th>
<th>MUNSELL COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>MICRO-ARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>modern plowzone</td>
<td>I</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>10YR 3/2</td>
<td>v. dark gray brown</td>
<td>silty loam</td>
<td>normal</td>
<td>wet</td>
<td>many</td>
<td>none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>midden</td>
<td>II</td>
<td>2</td>
<td>30</td>
<td>0</td>
<td>50</td>
<td>10YR 4/3</td>
<td>brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>much</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>thermal feature</td>
<td>II</td>
<td>Zone 1</td>
<td>5</td>
<td>35</td>
<td>47</td>
<td>2.5Y 5/6</td>
<td>red</td>
<td>silty loam</td>
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<td>normal</td>
<td>none</td>
<td>sparse</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>thermal feature</td>
<td>II</td>
<td>Zone 2</td>
<td>5</td>
<td>37</td>
<td>58</td>
<td>10YR 4/3</td>
<td>brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>few</td>
<td>sparse</td>
<td>3</td>
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<td>11</td>
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<td>II</td>
<td>8</td>
<td>48</td>
<td>0</td>
<td>63</td>
<td>10YR 3/1</td>
<td>very dark gray</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>sparse</td>
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<tr>
<td>11</td>
<td>possible post hole</td>
<td>II</td>
<td>1 unassigned</td>
<td>30</td>
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</table>
Table E-7 (continued)

Notes for Table A1-7:
1. Only excavated STRII LVL1 (30-40) and LVL2(40-50); excavation of FEAs 5 and 8 indicated the midden extends down to about 60cmbd indicating one more level (LVL3) was possible but not excavated.

2. Dimensions: 30 x 100cm.

3. Dimensions: 75 x 114cm.

4. Dimensions: 70 x 190cm; Visual inspection conducted by Greenup County Kentucky coroner, who determined the remains were prehistoric. Partially exposed and then reburied in place without moving.

5. Ambiguous during excavation since it was in the unit corner, but examination of profiles and plans indicate a feature of some type was present, probably a post.

6. Concentration of large animal bones, stacked sherds; may be associated with Feature 8, or unassigned feature in southeast corner of unit. Dimensions: 40 x 50cm.
Table E-8: Deposits recorded in Unit 20 including strata, zones, features, and possible post holes.

<table>
<thead>
<tr>
<th>UNIT</th>
<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th># LEVELS</th>
<th>FEATURE</th>
<th>POSSIBLE POST HOLES</th>
<th>DEPTH ORIGIN CMBD</th>
<th>DEPTH FINAL CMBD</th>
<th>MUNSELL</th>
<th>COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>ARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
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<td>I 1</td>
<td>0</td>
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<td>10YR 3/2</td>
<td>v. dark gray brown</td>
<td>silty loam</td>
<td>normal</td>
<td>wet</td>
<td>many</td>
<td>none</td>
<td>sparse</td>
<td>notes</td>
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<tr>
<td>20</td>
<td>midden</td>
<td>II 2</td>
<td>30</td>
<td>50</td>
<td>10YR 3/3</td>
<td>dark brown</td>
<td>sandy loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>sparse</td>
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<td>II PP20-6</td>
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<td>POSSIBLE POST HOLES</td>
<td>FEATURE</td>
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<td>10</td>
<td>70</td>
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<td>IV</td>
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<td>10</td>
<td>10</td>
<td>70</td>
<td>possible post hole</td>
<td>PP20-IV-3</td>
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**Table E-8 (continued)**

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<th>COLOR</th>
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<td>5</td>
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</table>

**NOTES**
- CHARCOAL: many
- MOISTURE: normal
- COMPACTNESS: silty
- TEXTURE: loam
- COLOR: dark yellow brown
- MUNSELL: 10YR 4/4
- FINAL DEPTH CMBD: <40
- DEPTH ORIGIN CMBD: 58
- POSSIBLE POST HOLES: 20
- FEATURE: Zone 2
- ZONE (HORIZONTAL): 9
- # LEVELS: 10
- STRATUM (VERTICAL): II
- DESCRIPTION OF DEPOSIT: undisturbed human burial

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Table E-8 (continued)

Notes for Table A1-8:
1. Not excavated.

2. Visual inspection conducted by Greenup County Kentucky coroner, who determined the remains were prehistoric. Partially exposed and then reburied in place without moving.

3. Visual inspection conducted by Greenup County Kentucky coroner, who determined the remains were prehistoric. Partially exposed and then reburied in place without moving.

4. Screened a sample and found no artifacts.

5. Recognized at top of STRIV along with PP20-3, but not excavated.
Table E-9: Deposits recorded in Unit 21 including strata, zones, features, and possible post holes.

<table>
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<th>DESCRIPTION OF DEPOSIT</th>
<th>STRATUM (VERTICAL)</th>
<th># LEVELS</th>
<th>FEATURE</th>
<th>ZONE (HORIZONTAL)</th>
<th>POSSIBLE POST HOLES</th>
<th># LEVELS</th>
<th>DEPTH ORIGIN (CMBD)</th>
<th>FINAL DEPTH (CMBD)</th>
<th>MUNSELL COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>MICROARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
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<td>21</td>
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<td>30</td>
<td>10YR 3/2</td>
<td>v. dark gray brown</td>
<td>silty loam</td>
<td>normal</td>
<td>wet</td>
<td>many</td>
<td>none</td>
</tr>
<tr>
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<td>II</td>
<td>1</td>
<td>Zone</td>
<td>Zone 1</td>
<td></td>
<td></td>
<td>31</td>
<td>36</td>
<td>10YR 3/3</td>
<td>dark brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many</td>
<td>sparse</td>
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<td>looter hole</td>
<td>II</td>
<td>1</td>
<td>Zone</td>
<td>Zone 2</td>
<td></td>
<td></td>
<td>36</td>
<td>40</td>
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<tr>
<td>21</td>
<td>rodent disturbance</td>
<td>II</td>
<td>1</td>
<td>Zone</td>
<td>Zone 3</td>
<td></td>
<td></td>
<td>36</td>
<td>70</td>
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<td></td>
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</tr>
<tr>
<td>21</td>
<td>possible post hole</td>
<td>II</td>
<td>1</td>
<td>PP21-1 to PP21-8</td>
<td>36</td>
<td>42/56</td>
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Notes for Table A1-9:
1. Only PP21-1 to PP21-5 determined by excavation to be actual post holes.
Table E-10: Deposits recorded in Unit 22 including strata, zones, features, and possible post holes.

<table>
<thead>
<tr>
<th>UNIT</th>
<th>DESCRIPTION</th>
<th>STRATUM (VERTICAL)</th>
<th># LEVELS</th>
<th>ZONE (HORIZONTAL)</th>
<th>FEATURE</th>
<th>POSSIBLE POST HOLES</th>
<th>DEPTH CMBD</th>
<th>FINAL CMBD</th>
<th>MUNSELL</th>
<th>COLOR</th>
<th>TEXTURE</th>
<th>COMPACTNESS</th>
<th>MOISTURE</th>
<th>ARTIFACTS</th>
<th>CHARCOAL</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>modern plowzone</td>
<td>I 1</td>
<td>0</td>
<td>Zone 3</td>
<td>22</td>
<td>&gt;52</td>
<td>10YR 3/2</td>
<td>v. dark gray brown</td>
<td>silty loam</td>
<td>normal</td>
<td>wet</td>
<td>many</td>
<td>none</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>midden</td>
<td>II 3</td>
<td>22</td>
<td>Zone 6</td>
<td>32</td>
<td>&gt;42</td>
<td>10YR 3/3</td>
<td>dark brown</td>
<td>silty loam</td>
<td>normal</td>
<td>normal</td>
<td>many sparse</td>
<td>2</td>
<td></td>
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<td></td>
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<td>22</td>
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<td>32</td>
<td>Zone 6A</td>
<td>32</td>
<td>&gt;42</td>
<td>10YR 3/3</td>
<td>dark brown</td>
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<td>normal</td>
<td>many much</td>
<td>3</td>
<td></td>
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<td>22</td>
<td>pit feature</td>
<td>II 5</td>
<td>22</td>
<td></td>
<td>75</td>
<td>10YR 3/3</td>
<td>dark brown</td>
<td>sandy loam</td>
<td>normal</td>
<td>normal</td>
<td>normal</td>
<td>many sparse</td>
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</table>

Notes for Table A1-10:
1. Referred to as "II" in STRII LVL1 planview; referred to as This is the primary matrix of Stratum II; it is referred to as "III" in 32cmbd and 42cmbd planviews; also referred to as "II" in DRC east wall profile, and "III" in MD; covers entire unit at 22cmbd; occurs only in south 1x1.25 at 32cmbd; appears again in northeast corner of unit at 42cmbd below Zone 6.

2. Zone 6 is referred to as "VI" on 32cmbd planview of unit in N 1x50-60cm of unit. Note that when the north 1x0.5m of the unit was taken down from 32-42 zone 6 no longer covers the entire area; Zone 3 (the primary matrix of STRII) shows up along the west wall and NW corner indicating that Zone 6 is a sub-stratum within Zone 3; its contraction might suggest it is a feature not unlike FEA16. Soil probe in this part of unit indicates deposit to at least 50cems.

3. Zone VIA on 32cmbd planview in NE 25x25cm area; this was sampled as one float because it had an artifact concentration.
APPENDIX F
Ceramic Artifact Photos
Figure F-1. Examples of Madisonville Series jar attributes. Top shows jar with plain neck and rim, cordmarked body, and parallel-sided strap handle. Rim orientation is slightly flared. Same vessel shown reconstructed in Hanson 1966:Figure 28. Bottom shows two jar fragments with plain rim, cordmarked-smoothed neck and very flared rim orientation. Bottom left is a triangular strap handle. All from Ring 2, Burial 77 excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-2. Examples of grooved-paddle impressed Madisonville Series sherds exhibiting square/rectangular cross-sections (top row), and examples of “basket” impressed Madisonville Series sherds (bottom row). From various contexts in Ring 1, Ring 2, and overlap area excavated in 1939. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-3. Two examples of Type 1 cylindrical ceramic objects. From various contexts, recovered by 1939 excavations. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-4. Example of Type 2 cylindrical ceramic object. From overlap area between Ring 1 and Ring 2, midden context, recovered by 1939 excavations. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-5. Example of Type 2 cylindrical ceramic object. From Ring 1, midden context, recovered by 1939 excavations. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-6. Examples of cut-out (bifurcated) shell tempered strap handles excavated in 1939. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-7. Madionsville Series ceramic object fragment. Probably representing the portion of a conjoined or compound vessel where the two vessels are molded together. Top image has sherd oriented to show the conjoined area from the top of the vessel looking down. The bottom images have the sherd oriented to show the profile of the vessel. Sherd from Ring 1, midden context, excavated in 1939. Image courtesy of William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure F-8. Examples of trailing on Madisonville Series ceramics from various contexts in Ring 2 excavated in 2013.
Figure F-9. Examples of incising on Madisonville Series ceramics from various contexts in Ring 2 excavated in 2013. The top image represents a rim, neck and body section that refits forming a rectilinear guilloche pattern.
Figure F-10. Examples of Todd Plain, Var. Augusta ceramics from various contexts in Ring 1 and Ring 2 excavated in 2013.
Figure F-11. Examples of Todd Plain, Var. Fox Farm ceramics from various contexts in Ring 1 and Ring 2 excavated in 2013.
APPENDIX G
Chert Artifacts
Figure G1. Uniface endscrapers from Ring 1 excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-2  Uniface endscrapers from Ring 2 excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-3. Biface endscrapers from Ring 1 excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-4. Biface endscrapers from Ring 2 excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-5. Type 2 (top row) and Type 5 (bottom row) fine triangular projectile points. From various contexts throughout the site, excavated in 1939. Note the slight notch from the center of the base on three of the Type 2’s. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-6. Type 6 fine triangular projectile points excavated in 1939. From various contexts throughout the site. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-7. Type 9 fine triangular projectile points from contexts throughout site excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-8. Proposed Type 11 fine triangular projectile points. From various contexts throughout the site excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-9. Proposed Type 12 fine triangular projectile points. From various contexts throughout the site excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure G-10. Proposed Type 13 fine triangular projectile points. From various contexts throughout the site excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
APPENDIX H
Marine Shell Artifacts
Figure H-1. Engraved marine shell ornament fragments recovered by 2013 excavations. Top from Ring 2, Unit 3 plowzone above looted burial context (2013-Feature 2). Bottom from Ring 1, Unit 22, plowzone. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-2. Rattlesnake Genre, Carter’s Quarter Style marine shell gorget. From Ring 1, Burial 107. From 1939 excavations. To increase detail, the image was enlarged and rotated. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-3. Rattlesnake Genre, Citico Style marine shell gorget. From Ring 2, Burial 310. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-4. Fragment of Rattlesnake Genre marine shell gorget from Ring 2, general midden context. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-5. Fragment of Rattlesnake Genre (style?) marine shell gorget from Ring 2, general midden context and illustration by Dorothy Bohannon of a marine shell gorget from a private collection reportedly from the site. An annotation on Bohannon’s drawing reads: “fragment of conch shell (tracing) from Gp22, now in possession of Frank Hardin, Siloam, KY. 12/28/38”. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-6. Mask Genre Buffalo Style gorget made of marine shell. From Ring 2, Burial 290. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-7. Mask Genre, Buffalo Style marine shell gorget. From Burial 227 in overlap area between Rings 1 and 2. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-8. Mask Genre, Buffalo Style marine shell gorget. From Ring 2, Burial 264. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-9. Mask Genre, Chicamauga Style marine shell gorget. From Ring 1, Burial 111. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-10. Mask Genre, McBee Style marine shell gorget. From Ring 1, Burial 133. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-11. Possible Cruciform Genre gorget motif on interior of marine shell (top image). Note two sets of suspension holes and engraving on back (bottom image) indicate recycling. From Ring 2, Burial 264. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure H-12. Untyped “Duck / Crane” marine shell gorget. From Ring 2, Burial 225. Note two sets of suspension holes and possible engraving on back (not shown) indicate recycling. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
APPENDIX I
Metal Artifacts
Figure I-1. Fragments of a sheet copper plate from behind cranium of Burial 18, Ring 1. Excavated in 1939. Note that rolled lip is on opposite side of that which is shown. This item was identified by chemical analysis as a European copper alloy. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure I-2. Top row shows metal cone from Ring 1, Burial 18. Bottom row shows metal sheet (bead blank?) from midden contexts, Ring 1. This was identified chemically as a European copper alloy. Both items excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Table I-1 Top row shows metal cone from Ring 1, Burial 18. Bottom row shows metal sheet (bead blank?) from midden contexts, Ring 1. This was identified chemically as a European copper alloy. Both items excavated in 1939.

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*Since there are only 40 catalogue numbers in the Hardin Site WPA database it is uncertain what these catalogue numbers refer to.
Figure J-1. Top image: Bison element associated with Burial 225 from Ring 2. Excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission. Bottom image: fragments of two bone beamers from various contexts in Ring 1 and Ring 2. Excavated in 2013.
APPENDIX K
Mussel Shell Scrapers
Figure K-1. Type 1 mussel shell scrapers from Ring 2, Feature 167, excavated in 1939. Top shows dorsal aspect, bottom shows ventral aspect. Though it is not easily observed in plan view, wear (red brackets) is concentrated on the dorsal margin. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure K-2. Type 1 mussel shell scrapers from Ring 2, Burial 77, excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure K-3. Type 1 mussel shell scraper from Ring 2, Feature 158, a thermal feature excavated in 1939. Note that part of shell was cut out of top picture. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure K-4. Type 1 mussel shell scraper from Ring 2, midden context adjacent to Feature 158 (thermal feature), excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure K-5. Two examples of Type 2 mussel shell scrapers from Ring 1. Both from midden contexts excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
APPENDIX L
Hematite Artifacts
Figure L-1. Hematite pebbles from various contexts throughout the site. From 1939 excavations. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure L-2. Ground / faceted hematite pebbles from various contexts throughout the site. Top row and middle row left item from rom 2013 excavations. Middle row (right) and bottom row from 1939 excavations. Images of 1939 artifacts courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure L-3. Two Celt/adze-shaped implements made of hematite. Top from Ring 2 midden. Bottom from Burial 119 in Ring 1. Both excavated in 1939. Image courtesy William S. Webb Museum of Anthropology, University of Kentucky, used with permission.
Figure L-4. Sandstone slab used to process hematite. From Ring 1, Unit 8, Feature 3, 2013 excavations.
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Downers Grove, Illinois

Education
M.A.  The University of Kentucky
2010  Anthropology

B.A.  The University of Illinois, Urbana-Champaign, IL
2005  Anthropology

Grants and Awards
2014  University of Kentucky Graduate Student Travel Award
2013  Kentucky Academy of Sciences Marcia Athey Grant
2013  University of Kentucky Graduate Student Travel Award
2012  University of Kentucky Graduate Student Travel Award
2010  University of Kentucky Graduate Student Travel Award
2009  University of Kentucky Graduate Student Travel Award
2008  University of Kentucky Latin American Studies Travel Award
2005  University of Illinois Study Abroad Scholarship, May 2005

Employment
2014-present  Archaeological Technician, Red River Gorge, Daniel Boone National Forest
2013  Archaeological Technician, McCullough Archaeological Services, Inc.
2012-13  Field Supervisor, Webb Museum of Anthropology Fort Boonesborough Project
2010-11  GIS Technician, the Kentucky Archaeological Survey
2010-11  Teaching Assistant, Fox Farm (15Ms1) University of Kentucky Field School
2007-08, 10-11  Research Assistant, the Kentucky Archaeological Survey
2007  Computer Graphics Artist, University of Kentucky Department of Anthropology
2005  Field Technician, Northern Illinois University Contract Archaeology Program

Field Experience
2014-present  Archaeological site monitoring, Red River Gorge, Daniel Boone National Forest
2012-13  Hardin Site (15Gp22) magnetic and electromagnetic geophysical survey
2011-13  Hardin Site (15Gp22) site survey, mapping, and excavations
2009  Uci 2009 Site Survey, Yucatan, Mexico
2007 Yaxuna 2007 Site Survey, Yucatan, Mexico
2006 Archaeological Field School, Program for Belize Archaeology Project

**Laboratory Analytical Experience**

2015 Soil sample flotation processing, Hardin Site (15Gp22), KY
2015 Prehistoric lithic processing and analysis, Hardin Site (15Gp22), KY
2014 Prehistoric ceramic processing and analysis, Hardin Site (15Gp22), KY
2012 Soil sample flotation processing, Fort Boonesborough, KY
2009 Prehistoric lithic analysis, Frazer Farm (15Hr42), KY
2009 Prehistoric lithic analysis, Camp Dick Robinson (15Gd87), KY
2009 Prehistoric lithic analysis, Twin Knobs Rockshelter (15Cn50), KY
2008-09 Prehistoric ceramic analysis, Kentuckiana Farm (15Se183)
2007-08 Prehistoric ceramic analysis, Canton Site, KY
2006-08 Prehistoric ceramic analysis, Projecto Arquelogico de Tres Zapotes

**Teaching Experience**

2013 Co-Director, 2013 Archaeological Field School, Hardin Site (15Gp22)
University of Indianapolis Dept of Physics & Earth-Space Sciences
2012 Instructor, University of Kentucky (as graduate student)
2009-11 Teaching Assistant, University of Kentucky

**Publications/Reports**

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Work Presented at Professional Meetings

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